Canadian Meat Science Association
CMSA ASCV
Association scientifique canadienne de la viande

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CMSA Newsletter

The Newsletter Committee would like to hear from you. If you have any information you would like to share with the CMSA membership, please contact a member of the Newsletter Committee and we will include your contribution.

President's Message

I would like to welcome back ongoing members and welcome new members. I hope that this is going to be a very productive year for the Canadian Meat Science Association. Thank you to Scott McQuay for all the time and effort he contributed last year as President. Thank you also to the Executive and members of our committees who have all spent significant time for the success of the CMSA. I believe our efforts are making a difference and look forward to working with you over the next year.

We have a great opportunity to have some impact within the Canadian meat sector. Specifically, as identified by Scott McQuay, our Past President, there is a void in Canada with the disappearance of the Canadian Agri-Food Research Council. At the CMSA Annual General Meeting a small committee was established to explore how the CMSA might play a role in coordinating the development of national research and development priorities for the meat industry and researchers. Also, the CMSA is organizing the 2012 International Congress of Meat Science and Technology which will be held in Montréal. This is a huge undertaking and will require participation of many members of our community. This meeting was held in Calgary in 1993 and was very successful. We have big shoes to fill!

There will be some changes to the 2008 CMSA/CMC Symposium with the changes

the CMC is making to its annual meeting. As described in this newsletter's report from Linda Saucier on the 2007 Symposium, the Symposium will now be a part of the CMC Annual Meeting and will be held on Thursday, May 8th in Niagara Falls. Hopefully this change will result in increased participation in the Symposium and also increased interaction among the scientific and technical community and industry leaders.

As always, the CMSA is looking for new members and it is not only the Promotion Committee members' responsibility to find them. All members should actively promote the Association and encourage membership in it. Please do your part. We have had stable membership for several years but it is important, if we are to move forward, to increase our membership. We would particularly like to see more student participation.

In closing, I look forward to a busy and productive year. I am eager to see this Association realize its full potential and will do my best to help. If you have any ideas or suggestions about how we can move our Association forward, please let me know.

Until next time,

Frances Nattress
nattressf@agr.gc.ca

Message de la présidente

Je désire souhaiter la bienvenue aux nouveaux membres ainsi qu'un bon retour aux membres permanents. J'espère que cette année s'avérera très fructueuse pour l'Association scientifique canadienne de la viande (ASCV). Merci à Scott McQuay pour tout le temps qu'il a consacré et les efforts qu'il a fournis l'an dernier en tant que président. Merci également aux membres de l'exécutif et aux membres de nos comités qui ont tous donné de leur temps, ce qui a contribué au succès de l'ASCV. Je suis convaincue que nos efforts changent vraiment les choses et je me réjouis à l'idée de collaborer avec vous cette année.

Nous avons une occasion incroyable d'exercer une certaine influence au sein du secteur canadien des viandes. Car, comme notre ancien président Scott McQuay l'a expressément mentionné, la disparition du Conseil de recherches agro-alimentaires du Canada crée un vide à l'échelle du pays. Lors de l'assemblée générale annuelle de l'ASCV, un petit comité a été formé afin de voir quel rôle notre Association pourrait jouer dans la coordination de l'établissement de

recherches nationales et des priorités enmatière de développement pour les chercheurs et dans l'industrie des viandes. En outre, l'ASCV organise l'International Congress of Meat Science and Technology de 2012 qui aura lieu à Montréal. Il s'agit d'un énorme projet qui nécessitera la participation de nombreux membres de notre milieu. En 1993, cette rencontre a eu lieu à Calgary et a connu un vif succès. Nous avons donc du pain sur la planche!

Certains changements seront apportés au symposium de l'ASCV et du Conseil des viandes du Canada de 2008, soit les modifications de l'assemblée générale annuelle effectuées par le Conseil des viandes du Canada. Comme le décrit Linda Saucier dans son rapport sur le symposium de 2007 dans le présent bulletin, le symposium fera dorénavant partie de l'assemblée générale annuelle du Conseil des viandes du Canada et aura lieu le jeudi 8 mai à Niagara Falls. Avec un peu de chance, cette modification se traduira par une participation massive et entraînera également une interaction plus marquée entre les communautés scientifique et technique et les chefs de file de l'industrie.

Comme toujours, l'ASCV est à la recherche de nouveaux membres; ce n'est pas seulement aux membres du comité promotion et recrutement de s'en occuper. Tous les membres doivent faire activement la promotion de l'Association et encourager le recrutement. Nous vous invitons fortement à y participer vous aussi. Le nombre de membres de notre Association a été stable pendant plusieurs années, mais, si nous voulons progresser, il est important d'être en augmentation, plus particulièrement en ce qui touche la participation des étudiants.

Pour conclure, disons que je m'attends à une année bien remplie et fructueuse. Je suis impatiente de voir cette Association donner toute sa mesure et je ferai de mon mieux pour y contribuer. Si vous avez des idées ou des suggestions quant à la façon

À la prochaine,

Frances Nattress
nattressf@agr.gc.ca

2007 CMSA Corporate Members

Canadian Beef Grading Agency
Cindy Delaloye

Canadian Centre for Swine Improvement, Inc.
Pramond Mathur

Centre du développement du porc du Québec Inc.
Pierre Falardeau

Cargill Foods
John Lines

M & M Meat Shops Ltd.
Coleen Stevens

Maple Leaf Fresh Foods
Nather Aziz

Monsanto Choice Genetics
John Eggert

Olymel
Sylvain Fournaise

PIC Canada Ltd.
Serge Pommier

CMSA Committees 2007

Executive

President	Frances Nattress, AAFC
Past President	Scott McQuay, Naturin Canada
President Elect	Nather Aziz, Maple Leaf Fresh Foods
Secretary/Treasurer	Cindy Delaloye, Canadian Beef Grading Agency
Director Ontario	Ken Darley, Griffith Laboratories
Director West	Dave Old, Alberta Pork
Director Quebec	Linda Saucier, Université Laval
Director at Large	Serhiy Hlamazda, Cargill Meat Solutions

Newsletter

Dave Old, Alberta Pork — Chair
Tineke Jones, AAFC

Promotions

Serhiy Hlamazda, Cargill Better Beef — Chair

Education

Ken Darley, Griffith Laboratories — Chair

Nominations and Election

Scott McQuay, Naturin Canada — Chair

Website

Nather Aziz, Maple Leaf Fresh Foods — Chair
Bethany Uttaro, AAFC
Wayne Robertson, AAFC

Symposium

Linda Saucier, Université Laval — Chair
John Farlinger, OMAFRA
Lynn McMullen, University of Alberta
Yemi Ogunrinola, Vantage Foods
Shannon Scott, AAFC
Mueen Aslam, AAFC
Parthi Mathukumarasamy, CMC
Margo Ladouceur, CMC

CMSA Activities

Highlights of the February 7, 2007 CMSA Annual General Meeting

The Annual General Meeting of the Canadian Meat Science Association was held in Vancouver on February 7, 2007. Thirty-three members were in attendance. Major agenda items included: membership, relocation of CMSA office to the University of Alberta, 2012 International Congress of Meat Science and Technology in Canada, the role of CMSA as a replacement for the CARC Expert Committee on Meat and Poultry Products and as a voice for the meat science community in Canada, nomination of new members for the Executive and constitutional review.

Unfortunately the CMSA continues to lose members. We need to understand why we lost 11 members over 2005 numbers and how we can get them back. Will industry consolidation continue to affect the viability of the CMSA? What steps can the CMSA take to protect ourselves from this problem?

Transfer of the CMSA office from the CMC to the University of Alberta is complete. Cindy Rowles (cindy.rowles@ualberta.ca) is the contact person for the CMSA at the University.

The International Congress of Meat Science and Technology will be held in Canada in 2012. In 2006 a committee was struck to suggest options for location of this meeting. Montréal has been selected as the best location and it has been suggested that, if IUFoST has its annual meeting in Montréal that year (decision to be made in September 2007), ICoMST could be held in conjunction with that meeting at the Palais des congrès de Montréal. A motion to nominate Linda Saucier and Phyllis Shand as co-chairs of the ICoMST organizing committee was carried and Frances Nattress was to contact Phyllis to ask if she would accept this nomination. Phyllis did not accept but has agreed to co-chair the Technical Program Committee.

With the discontinuation of the Canadian Agri-Food Research Council and the associated Expert Committee on Meat and Poultry Products, there is a gap in identifying and discussing meat research priorities for Canada. The CMSA has an opportunity to fill this gap. A small committee was formed to explore this potential and to develop and implement an action plan.

Three positions on the CMSA Executive were open for nominations. Dave Old is the new Director West. Ken Darley agreed to serve another term as Director Ontario. Nather Aziz is President Elect.

The next CMSA Annual General Meeting will be held in conjunction with the CMC Annual Meeting in Niagara Falls in early May, 2008.

CMSA Activities and Events (cont'd)

2007 Technical Symposium
Focus on the consumer: What science can do for you
Vancouver, February

A total of 107 participants gathered together at the Hyatt Regency in Vancouver for our Annual Technical Symposium held concomitantly with the Canadian Meat Council Annual Convention. The selection of the topic, *Focus on the consumer: what science can do for you*, was done after a thorough review of last year's evaluation form but also after consulting with various groups on the research/science priorities notably Agriculture and Agri-Food Canada, Canadian Council of Grocery Distributors, Canadian Pork Council to name only a few. It soon became clear that the consumer was a priority. The proceedings are posted on the CMSA Website in the section for members only but here is a quick overview of the program:

An event such as this would not be successful without the contribution of many. I had the pleasure to work with a wonderful team of volunteers: Mrs. Cathy Acker from OMAFRA, Dr. Luigi Faucitano from AAFC-Lennoxville, Dr. Sylvain Fournaise from Olymel s.e.c., Dr. Parthiban Muthukumarasamy from the Canadian Meat Council and Dr. Yemi Ogunrinola from Vantage Foods Inc. Thank you also to Prof. Lynn McMullen from the University of Alberta, Mr. Serhiy Hlamazda from Cargill and Mr. Martin Michaud from Olymel s.e.c. for their help with tickets and greeting guests, and Mr. Doug Brown from Freybe Gourmet Foods who took care of the speakers' gifts. The poster session was kindly organized again this year by Mr. Wayne Robertson from AAFC-Lacombe with the help of Dr. Fadia Naim from AAFC-St-Hyacinthe; 13 posters were presented during the day. The logistic of the event was under the leadership of the CMC office. Mrs. Carla Abbatemarco, Margo Ladouceur and Anne Bard made sure every thing went smoothly and it did! The

The Science Behind Consumer Preferences

Key note speaker: Prof. Ellen Goddard, University of Alberta, Economics and Adding Value to Meat
Dr. Tania M. Ngapo, AAFC-St-Hyacinthe, Consumer Studies in Meat Science
Dr. Priya S. Mir, AAFC-Lethbridge, Nutraceuticals, Functional Foods, Value Added Meat; what else is on the menu?
Dr. Randy Huffman, American Meat Institute Foundation,Customer and Consumer Expectations of Meat Products: The U.S. Perspective

Consumer Health and Protection

Key note speaker: Prof. P. Michael Davidson, University of Tennessee at Knoxville, The Antimicrobial Preservative Conundrum
Mrs. Lorraine McIntyre, BC Centre for Disease Control, Case Studies - The "CSI" of Food Poisoning Investigations
Ms. Shendra Brisdon, Fraser Health Authority,Tracking, Tracing & Recall - Why and How Should We Prepare?
Mr. Ken Clark, Overwaitea Food Group, Meat Challenges Today: a Retailer's Perspective

lunch was sponsored by Maple Leaf Foods Inc. who provided premium meat for the sandwich buffet. The Associate Members of the Canadian Meat Council made a generous contribution of $1200 on top of their regular contribution for the student scholarship; our organisation is extremely fortunate to benefit from their ongoing support. And finally, this year again we were overwhelmed with the response we got with our request for door prizes. A warm thank you to all our sponsors!

Before I close my update, I would like to take this opportunity to invite you to share your thoughts with respect to our annual symposium especially for topics of interest to you for our next meeting in Niagara Falls May 8th 2008. A new format is expected to arise for next year's meeting and we would like to get your suggestions to make the best out of our symposium.

SHERATON FALLSVIEW
NIAGARA FALLS

See you in Niagara Falls!

Linda Saucier
Technical Symposium Chair
linda.saucier@san.ulaval.ca

Highlights of the March 5, 2007 CMSA Executive Meeting

The CMSA Executive met by conference call on March 5, 2007. Major agenda items included the 2012 International Congress of Meat Science and Technology which is to be held in Canada, identification of 2007 committee chairs and the effects the change in the format of the Canadian Meat Council will have on the Technical Symposium and the term of the CMSA Executive.

2007 Committee Chairs are listed within the Newsletter. The Chairs are putting together their committees and complete committee membership will be in the next Newsletter.

The Canadian Meat Council has decided to shorten its annual meeting activities. As a result, the Annual Symposium will be held on Thursday, May 8 and will be one of the concurrent sessions of the CMC Annual Meeting. Although the Executive thinks this may be positive, it agreed to consider 2008 a test year and the format of the Symposium will be discussed again after the 2008 meeting. Moving the CMC Annual General Meeting to May affects the term of the CMSA Executive if the annual face to face CMSA Executive meeting and the Annual General Meeting are to remain associated with the CMC meeting. The Executive agreed that this is a one time adjustment and should not be a problem.

The next meeting will be held in late April.

Countdown to ICoMST

The International Congress of Meat Science and Technology, the premier world meat science conference, will be held in Canada in 2012. The CMSA will be the host organization for this conference and will lead the organization of it. Members have already been active identifying appropriate venues for the event. The conference was held in 1993 in Calgary and was held in Baltimore in 2005. Experience from these two events will greatly assist the organizing group.

Organization of this conference is a huge undertaking and is going to require the involvement of many CMSA members as well as other members of the meat science community.

Currently we are awaiting a decision by the International Union of Food Science and Technology on the location of its 2012 World Congress of Food Science and Technology. Montréal is in the running to host this conference and a decision will be made in late September. Linda Saucier has been working with the Palais des congrès in Montréal which is a likely location for the congress if there is an opportunity to link with the 2012 World Congress of Food Science and Technology. The CMSA has asked Phyllis Shand to co-chair the Technical Program Committee. Researchers at Agriculture and Agri-Food Canada have offered to work on the Technical Program and a co-chair will be suggested. Yvon Bertrand will be the Secretary/Treasurer of the Organizing Committee.

There will be several other committees required to handle hospitality, finances and tours, for example, and the CMSA is looking

for people who would be interested in assisting.

An overall chair for the organization of this conference has not yet been identified. However, this individual must have national and international recognition as a leader in the field of meat science with academia, government and industry. He or she will be a key figure and the executive welcomes nominations and suggestions to recruit this high profile individual.

Industry participation in this initiative will be particularly important and we would encourage you to get involved.

Linda Saucier & Frances Nattress

A few words about the Percy Gitelman Memorial Scholarship…

The Percy Gitelman Memorial Scholarship was established in memory of a Canadian food industry pioneer, entrepreneur, leader and former President of the Canadian Meat Science Association. In 1975, Mr. Gitelman founded UFL Foods Inc in Edmonton, Alberta. The company started as a supplier of spice blends to the meat industry and under Mr. Gitelman's guidance, the company evolved to be one of Canada's leading food industry suppliers of food ingredients, innovation and technology.

Percy's passion for food technology resulted in the development of thousands of new ideas and products through his unending support of research and development. He fostered collaboration with the most creative and brightest minds in food science at Universities, government organizations and within his own company.

One of his many achievements was the development of deheated mustard for use in meat products, condiments, salad dressings, cheese spreads and sauces – still in use in products in over 50 countries worldwide.

Mr. Gitelman's commitment to advancing knowledge of food science was evident in his involvement in many professional organizations, including the CMSA, the Canadian Institute of Food Science and Technology and the Institute of Food Technologists. Mr. Gitelman was a visionary leader in the Canadian food industry and provided creativity and guidance to Canada's agriculture and food processing industry. The Percy Gitelman Memorial Scholarship is given to the brightest young meat scientists in Canada to recognize their scientific achievements in the hopes that they will continue to pursue careers in meat science and make their own impact on the field.

CMSA/Percy Gitelman Memorial Scholarship 2007

Eveline Plamondon

Eveline is originally from Shawinigan in Québec . She obtained a dual DEC (college) in Music and Health Science in 2001. She got her bachelor's degree in Microbiology in 2004 from Université Laval in Québec City. During her B.Sc., she also completed a microbiology program in Food Safety and Quality from the Department of Food Science and Nutrition.

She started in research as a summer student in molecular biology in Prof. F. Belzile's laboratory in Plant Science. She then enrolled in graduate studies in the Department of Animal Science at Université Laval in the summer of 2004 under the supervision of Prof. Linda Saucier.

Eveline is currently in the second year of her M.Sc. degree and she should complete her experimental work in the next few months. Eveline presented her initial results at the poster session of the 2006 CMSA Technical Symposium. She also presented a poster at the 4th edition of the Conference on Research and Innovation in Québec's Agriculture and Agri-Food (CRIQAA) in March 2006.

The aim of her project is to determine the level of thermo-resistance of *Mycobacterium avium* subsp. *paratuberculosis* (MAP) in a meat matrix. Some scientists have suggested that MAP may be the etiologic agent of Crohn's disease. This has raised public health concerns although the link between the two remains to be established. Ultimately, Eveline's work will provide valuable information with respect to the control of MAP and on the efficacy of heat treatments currently used in the industry. Hence, some industrial interventions, like temperature and time of carcass pasteurization, might have to be revisited in order to ensure the control of MAP should an accidental contamination of the meat occur.

Poster

Plamondon, E., Marcotte, M., Naim, F., Saucier, L. 2006. D and z values in meat extract: the quest to understanding heat resistance in meat. Annual Technical Symposium CMSA, March 2006.

CMC Associate Members Scholarship 2007

R.C. Michitsch

Rob Michitsch was born and raised in Niagara Falls, Ontario. He attended the University of Guelph, Ontario, attaining his B.Sc. in Environmental Sciences while actively partaking in athletic, coaching and extra-curricular academic pursuits. Rob was fortunate to receive a Board of Governor's Scholarship for these efforts.

Deciding to concentrate on waste management issues, Rob remained at the University of Guelph to attain his M.Sc. in Soil Science and Waste Management under NSERC funding. Working under the supervision of Drs. Calvin Chong and Paul Voroney, Rob successfully re-used a wastewater by-product as a plant nutritive supplement in field, pot and hydroponic applications. The wastewater was produced through the anaerobic digestion of municipal organic waste. During this time, Rob received several additional scholarships, continuing activity in athletic and academic extra-curricular pursuits. As well, this research allowed Rob to present at several conferences and publish final results. Following his graduate experience in Guelph, Rob accepted a Research Associate position with the Nova Scotia Department of Agriculture, working on several climate change and waste management projects.

One such project was to actively biopile slaughterhouse-residual materials on commercial slaughterhouse facilities in Nova Scotia. Observing the need for further research due to pending disposal regulations for specified risk materials, Mr. Michitsch began his doctoral studies and research at Dalhousie University in Halifax, Nova Scotia, in this area.

Specifically, Rob seeks to determine the persistence and transport characteristics of select bacterial and viral pathogenic indicator micro-organisms, both spatially and temporally, during the biopile active phase of similar residual materials. Various media (e.g. soil, effluent) are analyzed as a measure of potential for off-site pathogen migration, and differing management techniques (e.g. aeration) versus these pathogenic characteristics are simultaneously being evaluated.

Due to the emergence of BSE in Canada, inclusion and enumeration of a surrogate prion is actively being pursued. Mr. Michitsch was fortunate to receive NSERC PGSD and other funding to undertake this research, and has presented his initial findings at the ASA-CSSA-SSSA meetings and the Carcass Disposal Symposium in late 2006.

Rob continues extra-curricular involvement in many areas and is a member of several international societies. Mr. Michitsch desires to be active in the discovery, advancement and promotion of technologies to mitigate and re-use wastes, while fostering environmental awareness and sustainability through policy involvement and education.

Activities and Events

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

1907-2007 100 Lacombe Research Centre / Centre de recherche de Lacombe

Please join the Lacombe Research Centre for its Centennial celebration on July 21, 2007

Lacombe Research Centre Celebrates 100 Years of Discovery

"History is the version of past events that people have decided to agree upon," wrote French General Napoleon Bonaparte. As Agriculture and Agri-Food Canada's Lacombe Research Centre approaches its 100th birthday few people would disagree that the Centre has played an important role in shaping the agricultural industry in Canada.

Meat research has been an integral part of the work done at the Lacombe Research Centre and continues to be a key focus for the future.

In the early years, animal breeding and genetics were important to the farming community and were reflected in the mandate of the initial animal science program. There were many important discoveries made in this area over the years, but the most recognized was the development of the Lacombe Hog in 1957. It was the first breed of livestock developed in Canada and the product of 10 years of swine breeding research by Dr. Howard Fredeen and the late Dr. J.G. Stothart.

By 1952, the relevance of carcass merit was recognized and early carcass research was undertaken. Innovative, non-destructive, electronic and physiological techniques were developed at the Centre to estimate carcass lean and fat in live animals. Recognizing the need for carcass dissection data, Dr. Howard Fredeen and Mr. Archie Martin collaborated with industry to collect information which led to the development of a new hog carcass grading system in 1968 and a new national beef carcass grading system in 1972.

By 1978, a meat research section was established and five scientists were employed with competency in animal physiology, muscle biochemistry, carcass and meat quality, microbiology, and sensory evaluation. Although the Centre did have its own swine and beef herds, research had some limitations because researchers had to rely on commercial processors for the slaughter and dressing of meat animals. To address this need, an onsite federally-inspected slaughter and processing facility was built at the Centre in 1984. To this day, Lacombe remains the only federal research centre to have such a facility.

During the 1980's meat research was expanded to encompass not only swine and beef, but alternative species such as lamb, ostrich, emu, elk, deer, bison, and musk ox. Over several decades the program has continued to expand and additional scientists have been recruited with experience in molecular genetics, lipid biochemistry, and microbiology. National and international collaboration with other governments, academia and industry (Alberta Agriculture and Food, Public Health Agency of Canada, Canadian Food Inspection Agency, Health Canada, University of Alberta, University of Saskatchewan, University of Manitoba, McGill University, to name a few) have enhanced research capabilities and

Activities and Events (cont'd)

expertise. Agriculture and Agri-Food Canada is a member of the Institute for Food and Agricultural Sciences, Alberta and researchers at Lacombe are an integral part of their Value-Added Meat Program. Similarly research on improvement of animal welfare and sustainable production efficiencies is integrated within the Alberta Canada Livestock Welfare Research Partnership.

Today research on the fundamental and applied aspects of meat science continues to thrive at the Lacombe Research Centre. A meat virology program has just been established and construction of a new virology laboratory is complete. The program, with its unique resources, retains its ability to undertake meat research using a value-chain approach. A complement of knowledgeable staff continues to design and conduct relevant meat research that has a significant impact on agriculture in Canada and throughout the world.

Canada

Activities and Events (cont'd)

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Lacombe Research Centre
Centre de recherche de Lacombe

Veuillez venir célébrer le 100e anniversaire du Centre de recherches de Lacombe avec nous, le 21 juillet, 2007.

Le Centre de recherches de Lacombe fête 100 ans de découverte

« L'histoire est un mensonge que personne ne conteste », a écrit l'empereur français Napoléon Bonaparte. À la veille du 100e anniversaire du Centre de recherches de Lacombe d'Agriculture et Agroalimentaire Canada, peu de gens disputeraient le fait que le Centre a joué un rôle de premier plan dans l'évolution de l'industrie agricole au Canada.

La recherche sur les viandes a fait partie intégrante des efforts déployés au Centre de recherches de Lacombe et continue d'être une dominante pour l'avenir.

À l'origine, la sélection et amélioration des animaux et la génétique comptaient pour beaucoup au sein de la collectivité agricole et trouvaient leur expression dans le mandat du programme scientifique initial de science animale. Plusieurs découvertes importantes ont été faites dans ce domaine au fil des ans, mais la découverte la plus éclatante a été la création du porc de Lacombe en 1957. Il s'agit de la première race d'un animal d'élevage créée au Canada et le produit de 10 années de recherche sur l'élevage du porc menées par le Dr Howard Fredeen et le regretté J.G. Stothart.

En 1952, la valeur intrinsèque de la carcasse était mise en lumière et les premières recherches sur la carcasse étaient entreprises. Les chercheurs du Centre se sont attachés à mettre au point des techniques novatrices, non destructrices, électroniques et physiologiques de calcul du rapport muscle/graisse des animaux vivants. Conscients de la nécessité d'en savoir plus sur la dissection de la carcasse, le Dr Howard Fredeen et M. Archie Martin ont uni leurs efforts à ceux de leurs homologues de l'industrie en vue de recueillir des données qui ont donné lieu à la mise au point d'un nouveau système de classification des carcasses de porc en 1968 et d'un nouveau système national de classification des carcasses de bœuf en 1972.

On a assisté, en 1978, à la création d'une section de recherche sur les viandes et à l'embauche de cinq scientifiques spécialistes de la physiologie animale, de la biochimie des muscles, de la qualité des carcasses et de la viande, de la microbiologie et de l'analyse sensorielle. Bien que le Centre disposait de ses propres troupeaux de porcs et de bœufs, la recherche était limitée parce que les chercheurs devaient compter sur les entreprises de transformation commerciale pour l'abattage et l'habillage des animaux de boucherie. En 1984, afin de combler ce besoin, une installation d'abattage et de transformation sur place, sous réglementation fédérale, était construite au Centre. À ce jour, Lacombe demeure le seul centre de recherches fédéral doté d'une telle installation.

Au cours des années 1980, la recherche sur les viandes a été élargie pour englober

non seulement le porc et le bœuf, mais aussi d'autres espèces, telles que l'agneau, l'autruche, l'émeu, le wapiti, le cerf, le bison et le bœuf musqué. Avec le temps, le programme n'a cessé de prendre de l'ampleur et d'autres scientifiques, avec de l'expérience en génétique moléculaire, en biochimie des lipides et en microbiologie, ont été recrutés. Les échanges, au plan national et international avec d'autres gouvernements, le milieu universitaire et l'industrie (le ministère de l'Agriculture de l'Alberta, l'Agence de santé publique du Canada, l'Agence canadienne d'inspection des aliments, Santé Canada, l'Université de l'Alberta, l'Université de la Saskatchewan, l'Université du Manitoba, l'Université McGill, notamment) ont permis d'améliorer les capacités et l'expertise en recherche. AAC est un membre de l'Institut des sciences alimentaires et agricoles de l'Alberta, et les chercheurs de Lacombe font partie intégrante de son Programme des viandes à valeur ajoutée. De la même façon, la recherche sur l'amélioration du bienêtre des animaux et sur les économies de la production durable est intégrée dans le cadre du AlbertaCanada Livestock Welfare Research Partnership (Partenariat entre l'Alberta et le Canada pour la recherche sur le bienêtre du bétail).

Aujourd'hui, la recherche sur les aspects fondamentaux et appliqués de la science des viandes continue de prospérer au Centre de recherches de Lacombe. Un programme de virologie des viandes vient tout juste d'être mis sur pied et la construction d'un nouveau laboratoire de virologie vient de se terminer. Le programme, et ses ressources à nulles autres pareilles, est toujours apte à effectuer des recherches sur les viandes grâce à une approche axée sur la chaîne de valeurs. Un personnel aguerri continue de concevoir et de mener des recherches pertinentes sur les viandes qui ont une incidence importante sur l'agriculture au Canada et partout dans le monde.

Canada

IFASA Value-Added Meat Program Update

Meat Solutions for Tomorrow - Consumer and Market Place Insights, February 16 , 2007, Edmonton, Alberta

The challenge of taking information such as market trends and building a consumer desired product is routinely faced by processors and food service. It rsises many questions such as: How do large companies do it? Will the consumer pay for health, traceability or other product attributes within these products? and What role can market and meat researchers play in assisting the companies? The Meat Solutions for Tomorrow conference addressed these questions. The Conference was sponsored by Rural Economy Department of the University of Alberta, Alberta Agriculture and Food and the IFASA Value-added Meat Program. An underlying objeective was to facilitate a networking opportunity for researchers and companies.

Rob Hand at Robert.Hand@gov.ab.ca

Scientific Contributions

Can ultimate pH of the longissimus muscle help differentiate borderline dark-cutting beef carcasses from slow-blooming carcasses?

Wayne Robertson[1], Tom Veale[2], Howard Kirbyson[3], Stan Landry[1] and Jennifer Aalhus[1]

[1]Agriculture & Agri-Food Canada, Lacombe Research Centre
[2]Canadian Food Inspection Agency, Saskatoon, SK
[3]Canadian Beef Grading Agency, Duchess, AB

Following exsanguination, muscle glycogen is converted to lactic acid lowering the initial pH of H"7.0 to an ultimate pH of H"5.5 assuming an adequate concentration of glycogen in the muscles at time of slaughter. This change normally requires 24 to 48 h in cattle (Warriss, 1990). If muscle glycogen stores are depleted before slaughter then the decline in pH of the muscle is limited. Ultimate pH (pH_u) e" 6.0 has been associated with dark-cutting in beef muscles (Tarrant & Sherington, 1980; MacDougall and Jones, 1981; Brown *et al*., 1990; Warriss, 1990). Various researchers have defined dark-cutting beef as having a pH_u in excess of 5.8, 5.9, 6.0, 6.1 or 6.2 measured at 24 or 48 h *post mortem* (Murray, 1989; Abril *et al*., 2001). Muscle that is cut soon after an animal has been slaughtered is translucent and sticky to the touch. If sufficient glycogen was present initially, the muscle becomes progressively more opaque until pH_u is reached. The transition from translucent to semi-opaque is detectable at pH 5.9 (MacDougall and Jones, 1981). In dark-cutting meat the transition from translucent to opaque does not occur. Page *et al*. (2001) conducted a survey of muscle color and pH in 1000 beef carcasses in three US beef packing plants. They reported a longissimus muscle pH of 5.87 was the approximate cut-off between normal and dark-cutting carcasses. Of carcasses that had muscle pH e" 5.87, 22 of 24 (91.7%) were classified as dark cutters according to USDA grading standards. Of the carcasses with muscle pH < 5.87, 6 of 976 (0.6%) were classified as dark cutters.

A study was conducted at the Lacombe Research Centre in 2004 to examine the impact of chill duration (24 h, 48 h, 20 d aged) and bloom time (0 to 90 min) on color development in the longissimus muscle of beef carcasses (reported at AAFC Meat Research Informational Meeting, Gatineau, QC, February 1, 2005). The goal was to evaluate the impact on retail appearance after an aging period of 20 d on longissimus muscle obtained from carcasses exhibiting borderline dark color at grading time. Of 63 animals managed in the pre-slaughter period to reduce glycogen reserves in the muscle, 23 produced carcasses which were identified as slow-blooming. Slow bloomers were identified as still having a Japanese Meat Grading Association (JMGA) beef color score e"6.5 after a 20 min bloom following 24 h of chilling at 1°C. Carcasses in the study were not high voltage electrically stimulated since the objective was to produce carcasses with borderline color characteristics and HVES is known to improve the brightness of beef compared to non-stimulated carcasses in the early *post mortem* period (Lawrie, 1998a). Of the 23 slow bloomers, all but two bloomed adequately after a 30 min bloom following the aging period. Muscle pH_u was measured in the face of the longissimus muscle at the 12th rib at 48 h *post mortem*. The two muscle samples which did not bloom adequately following aging were clearly distinguished by their higher pH_u (5.85, 5.87) in comparison to the samples which did bloom (<5.70). The results of this study indicated that pH_u might well provide a means of differentiating borderline dark-cutting carcasses which are really slow bloomers from true dark-cutting carcasses

that will never bloom to provide the bright, cherry red color desired by the retailer and consumer.

The mechanism for improvement in muscle color with aging has been elucidated by several authors (Madhavi & Carpenter, 1993; Min *et al*., 2002; Boakye & Mittal, 1996; Trater & Hunt, 2003; Young *et al*., 1999; James & James, 2002; Lawrie, 1998b). Enzymes in the cytochrome are generally capable of utilizing oxygen for long periods *post mortem*, competing for oxygen required to form oxymyoglobin, the pigment responsible for the bright red color of bloomed meat. Since there is no oxygen present in the depths of the muscle itself, the degree of blooming depends on the rate of oxygen diffusion from the exposed meat surface and the balance in uptake by the cytochrome enzymes and by myoglobin. Oxygen-utilizing enzymes in the deeper tissues become progressively inactivated with ageing time with the result there is increased retention and penetration of oxygen in the outer layers of freshly cut meat providing a deeper oxymyoglobin layer and intensifying the oxymyoglobin color.

Post mortem treatments such as electrical stimulation of the carcass, carcass chilling temperatures, duration of chilling, and blooming times and temperatures all impact the development of muscle color. Therefore it is important to resist extrapolating results obtained in the research coolers in the Lacombe Research Centre abattoir to the commercial situation. Thus it was proposed in this study to survey pH_u of borderline dark-cutting carcasses in three commercial beef abattoirs and then to evaluate development of meat color of muscle samples derived from selected carcasses with varying pH_u values through typical wet-ageing processes. The goal of the study was to determine whether a pH_u cut-off value could assist in differentiating dark-cutters from slow bloomers.

Procedures

The study was conducted at three large commercial beef plants in the fall and early winter of 2006. Ultimate pH and temperature of the rib eye (longissimus thoracis) muscle was measured in the exposed face of the 12th rib of dark-cutting carcasses. Prior to measurement of pH, an expert team made up of the National Livestock Grade Standards specialist and a Regional Grade Standards Supervisor made a determination of the color relative to the Canadian dark-cutting standard for each carcass. Notations were made when the color of the rib eye of evaluated carcasses was close to the standard, and when they were very dark or extremely dark. An experienced rater also assessed the color using the Japanese Meat Grading Association (JMGA) beef color standards (resin models with 1=palest, 7 = darkest, 8 = darker than last model). Minolta CR-200 readings (illuminant C, 2^{o} standard observer) were recorded, taking into account the areas of the muscle which contributed to the grading assessment, i.e. if the muscle color was not uniform across the rib eye, color was measured on the area of dark-cutting that caused the carcass to remain downgraded.

Carcasses were identified which fell into four pH ranges: <5.70, 5.70 – 5.79, 5.80 – 5.89, 5.90 – 5.99. Boneless ribs with carcass identification intact were collected, packaged and shipped to Lacombe Research Centre from carcasses in each pH range at each of the participating plants. The ribs were held at -1 to 2^{o}C in vacuum to provide an aging period after which steaks were fabricated for evaluation of color after bloom times of 20, 30 and 60 min. Subjective color scores were recorded in reference to the Canadian dark-cutting standard by the same expert team. Subjective scores were also assessed using the JMGA standards and Minolta CR-200 readings were repeated after each bloom time. Finally, muscle pH measurements were repeated.

Scientific Contributions Cont'd..

Results and Discussion

Rib eye muscle pH

Ultimate pH of the rib eye muscle of 352 Canada B4 carcasses evaluated at three large commercial plants ranged from 5.48 to 7.05. Twenty-five percent of the dark carcasses had pH values less than 5.8 while 44% had pH values less than 6.0 (Table 1). Samples for re-evaluation following an aging period were readily obtained in all the desired pH ranges (Table 2).

Murray (1989) obtained similar results after measuring rib eye pH in 285 beef carcasses which were rated as being darker than the Agriculture Canada standard card. Only 13% of the carcasses had rib eye muscle pH greater than 6.0, while fully 50% had pH less than 5.8. The pH measurements were obtained 15 to 22 h post-slaughter (much earlier than in the current study) and Murray's contention was that the majority of the dark beef found was probably normal meat which had not yet had time to reach its final potential with respect to pH and color development.

In contrast to our findings, Page *et al*. (2001) were able to conclude that a longissimus muscle pH of 5.87 was the approximate cut-off between normal and dark-cutting carcasses in a survey of 1000 carcasses at three U.S. plants. While their sample contained only 28 carcasses classed as dark cutters, 22 of these were in the sub-sample of 24 carcasses having a longissimus pH e" 5.87 and 6 dark cutters were in the much larger sub-sample of 976 carcasses with lower muscle pH. That stills means, however, that more than 20% of their dark-cutting carcasses had pH less than 5.87. In our study 31.5% of carcasses identified as dark-cutting had longissimus muscle pH less than 5.87. The higher percentage in our study is likely due in part to the fact we were primarily concentrating on borderline dark-cutting carcasses and did not evaluate all of the very dark cutting carcasses that passed through the plant. Therefore the results between the two studies are not that divergent, but the conclusions the investigators reached are very different.

Color of aged product

The anticipated improvement in meat color of samples with pH less than 5.80 was not realized. In fact, subjective evaluations (JMGA beef color score) and objective color measurements both indicate the aged product, measured at the 12th rib, was darker than when the rib eye muscle was evaluated on the carcass (Table 3). Minolta color measurements, which are not only objective in nature but also provide the advantage of a consistent light source, support the subjective assessments (Table 4). Thirteen of the samples collected were noted as being equal to the Canada color standard card or just darker than the card. Although most of these samples had pH_u less than 5.80 they also failed to improve in color with aging. Additionally, five samples were identified and harvested which on re-assessment of the carcass were deemed brighter, but just brighter, than the Canada color standard card. Interestingly, these samples were also rated darker (at the identical 12th rib site) after aging and objective color measurements supported the subjective assessments. All five samples were rated darker than the Canada standard, and as much as a 3-unit difference in JMGA scores towards the darker end of the scale was observed in individual samples. In summary, eighteen samples which were truly borderline calls unexpectedly did not benefit from aging.

Normal beef will brighten with aging in part because structural changes to the contractile proteins that occur with aging increase light scatter (MacDougall, 1980) and greater penetration of oxygen deeper into the meat as well as the inactivation of cytochrome enzymes which compete for oxygen (Boakye & Mittal, 1996). The present results, where aged product was actually darker than muscle measured on the carcass, were unexpected. This may be explained in part at least by the

differences in bloom times which had elapsed before the assessments were made. Aged product was allowed to bloom for d" 1 h while the carcass assessments were completed after a wide range in time of exposure to air (up to 3 d). In plant C where study personnel made assessments relatively soon after the carcasses had passed through the grading chain, objective color measurements of unaged and aged muscles were more similar, but like the other samples no improvement in color with aging was observed.

The results of this study are in marked contrast to the 2004 results obtained in the research abattoir at the Lacombe Research Centre. Differences in saturation are often greater than differences in lightness between dark cutting and normal meat (MacDougall, 1982), with dark cutting meat being less saturated (lower chroma values) and reflecting less light (lower L*). In the 2004 slow-blooming study, mean values of both chroma and L* increased by nearly 2.5 and 3 units respectively with 20 days of aging in comparison to the values obtained at 48 h *post mortem* (Table 4). Differences of this magnitude are large and are visually readily detectable. In contrast, chroma and L* values in the current study decreased with aging by 1.5 to 2 units on average and these differences were reflected in the JMGA scores. Different Minolta instruments were used in the two studies: the CR-300 was used in the 2004 study while the more portable CR-200 was used in the current study. Both instruments were set to the same illuminant (C, north sky daylight) and 2° standard observer. While the use of different instruments between the two studies makes direct comparisons of values obtained less precise, the comparisons are still valid and the markedly higher values obtained for aged product at the same bloom time in the earlier study compared to the current study reported in Table 4 are real and very substantially different.

The very different results obtained between these two studies illustrate the potential danger of blindly extrapolating results to commercial situations or indeed to any situation where differences in study animals and carcass treatments exist. Relevant differences between the two studies include:

1. Management of the animals in the pre-slaughter phase, e.g. pen size, transport duration, time off feed prior to slaughter; and environmental conditions, e.g. temperature, temperature fluctuations.
2. Animals used in the 2004 slow-blooming study had not been implanted. Depending on the implant regime employed, length of time between the last implant and slaughter, and sex of the animal aggressive implant strategies especially seem to increase the manifestation of stress and subsequently the incidence of dark cutting (Scanga *et al*., 1998).
3. High-voltage electrical stimulation of the carcasses was deliberately not employed in the slow-blooming study. In normal beef electrical stimulation of the carcass lowers muscle pH more rapidly, hastens the onset of *rigor mortis* and the development of meat color. In *ante mortem* stressed beef where much of the muscle glycogen is depleted prior to slaughter, electrical stimulation of the carcass has no effect on muscle color or ultimate pH and the resultant ultimate pH is very high e.g. 6.5 (Dutson *et al*, 1982). Presumably in border-line dark cutting carcasses muscle glycogen has not nearly been depleted and therefore there is potential for pH decline to fit somewhere in between these extremes. The earlier onset of *rigor mortis* and earlier attainment of ultimate pH in electrically stimulated carcasses may lessen the difference seen in color of bloomed meat between early *post mortem* muscle and aged product.
4. Other differences in carcass treatments including muscle cooling rates also factor into the equation. Faster cooling rates retard *post mortem* pH decline and onset of *rigor mortis* and development of color.

5. In the Lacombe study, slow bloomers were identified as still being dark after a 24 h chill and 20 min bloom period. Comparisons were then made to 48 h chilled carcasses and 20 day aged product. In the current study, initial assessments and selection of samples occurred approximately 36 h to 4 d *post mortem*.

pH of the Psoas major

The pH of the tenderloin muscle (Psoas major) was measured on 284 B4 carcasses at the same time as pH was recorded for the rib eye muscle. The frequency of carcasses with a high tenderloin pH (e" 6.0) was much lower than those having a high rib eye pH (8.5% compared to 57%, Table 5). Of the 162 carcasses which had a rib eye pH e" 6.0, only 21 (13%) had a tenderloin pH which exceeded this limit. Tarrant and Sherington (1980) undertook a survey of pH_u values in steer and heifer carcasses in a Irish beef slaughter plant over a three year period, accumulating data on 8720 carcasses. They examined pH of thirteen muscles of 'dark-cutting' carcasses, defined as carcasses having a longissimus pH e" 6.0. The longissimus and four large muscles of the hind quarter (semitendinosus, semimembranosus, adductor and gluteus medius) were most frequently affected by increased pH while the other muscles examined showed only slight increases in pH compared to normal pH carcasses. The mean longissimus pH of the high pH_u carcasses was 6.32 while the mean pH of the psoas major was 5.65. Similarly, in the current study the mean pH of carcasses having a rib eye muscle pH e" 6.00 was 6.37 while the mean pH of the psoas was 5.71. The authors hypothesized that the beef muscles most affected with high pH values were selectively active before slaughter with the subsequent depletion of muscle glycogen. This would come about as a result of transport and the effort required in maintaining balance, mixing and milling about in strange pens at the abattoir, etc. Differences in the proportions of muscle fiber types between muscles adapted to different functions would also impact physiological processes in the *ante mortem* period as well as *post mortem* metabolism thus affecting the rate and extent of pH decline, pigment concentration, and content of cytochrome enzymes which compete for oxygen in the post slaughter period – factors impacting the oxygenation of myoglobin and light scattering properties of the muscle.

Conclusions

1. All carcasses evaluated in the study failed to produce brighter meat on aging of the rib eye irrespective of the ultimate pH of the longissimus muscle. Therefore it is abundantly clear that pH_u measurements of the rib eye muscle are not useful in differentiating dark-cutting carcasses with borderline color from slow-blooming carcasses which will bloom satisfactorily following aging.

2. The premise of the current study was that muscles from borderline dark-cutting carcasses with normal ultimate pH may bloom brightly following aging, in which case the carcasses would have been down-graded unfairly at considerable expense to both producer and packer. In as much as none of the samples collected, including eighteen samples which were very near the dark-cutting breakpoint, responded to aging with respect to improvement in color, the study does show that subjective assessments conducted by qualified personnel are working well.

3. While color of the tenderloin muscle was not measured, the study demonstrated that the psoas major is affected by increased pH far less frequently than the rib eye muscle (longissimus) of dark-cutting carcasses.

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Table 1. Frequency of Canada B4 carcasses evaluated by pH category and JMGA score[1]

JMGA Score	pH_u Category (longissimus muscle)						Total
	< 5.60	5.60–5.69	5.70–5.79	5.80–5.89	5.90–5.99	>5.99	
5					1	2	3
5.5		3	2	2			7
6	1	2	3	6	6	6	24
6.5	2	9	7	4	4	12	38
7	6	9	15	11	9	38	88
8	6	11	6	9	10	66	108
8–V Dark	3	2	1	2		41	49
8–Black		1			1	33	35
Total	18	37	34	34	31	198	352

[1]Japanese Meat Grading Association beef color score (resin models): 1 = palest, 7 = darkest, 8 = darker than last model.

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Table 2. Samples collected by pH category – Carcass measurements

JMGA Score	pH_u Category (longissimus muscle)						Total
	< 5.60	5.60–5.69	5.70–5.79	5.80–5.89	5.90–5.99	>5.99	
5						1	1
5.5		3	2	1		1	7
6			2	5	2		9
6.5	1	5	6	3	2	2	19
7	3	6	10	6	4		29
8	4	8	6	7	5	1	31
8–V. Dark	3	2		1			6
8–Black		1					1
Total	11	25	26	23	13	5	103

Table 3. Changes in JMGA score with aging*

JMGA Score	Carcass	Aged product – 12th rib
5	1	
5.5	7	
6	9	4
6.5	19	5
7	29	22
8	31	58
8 – Very Dark	6	4
8 – Black	1	10
Total	103	103

* Carcass bloom times varied widely, aged product rated after 40 min bloom.

Table 4. Change in Minolta color measurements with aging[1]

	Current pH Study[2]		2004 Slow-blooming Beef Study[2,3]	
Color parameter	Carcass, 12th rib	Aged product, 12th rib	Carcass, 48 h Chill	20 d Aged Product
L*, lightness	34.3	32.8	34.8	37.6
a*[4]	17.9	16.5	20.6	22.5
b*[4]	9.3	7.7	9.2	10.5
Chroma (saturation)	20.2	18.2	22.6	24.9
Hue[5]	27.3	24.8	23.9	25.0

[1]Carcass bloom times of current study varied widely, aged product measured after 30 min bloom.
[2]Grading instruments different (current study = Minolta CR-200, Slow-blooming study = Minolta CR-300)
[3]Slow-blooming study: color measurements of 21 samples which were dark at 24 h and bloomed up after 20 d of aging in vacuum

Table 5. Frequency of pH by category in two muscles: rib eye (longissimus thoracis) and tenderloin (psoas major).

Muscle	pH category					
	< 5.60	5.60 – 5.69	5.70 – 5.79	5.80 – 5.89	5.90 – 5.99	>5.99
Rib eye	34	22	19	23	24	162
Tenderloin	139	70	23	19	9	24

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A glimpse of food virology research at Agriculture and Agri-Food Canada

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Estimates suggest there are approximately 11 million cases of food-borne illness per year in Canada and that the annual costs associated with the treatment of the resulting acute gastro-enteritis could be as high as $3.7 billion when lost paid employment for individuals and caregivers are included (Majowicz et al., 2006). In more than 80% of cases, the causative organism is not identified but viruses are suspected to be responsible for 2/3 of cases (Mead et al., 1999). In response, Agriculture and Agri-Food Canada (AAFC) initiated a food virology program in 2001 under the leadership of Dr. Alain Houde at the Food Research and Development Centre in St. Hyacinthe, QC in collaboration with the Canadian Food Inspection Agency (CFIA). Dr. Julie Brassard joined the food virology research team in St. Hyacinthe in 2004 and Dr. Tineke Jones was appointed to develop a food virology research program under the guidance of Dr. Houde in Lacombe in 2005. Since this is a new research direction for the department and the Lacombe Research Centre, suitable virology laboratories did not exist. Renovations to create a virology research laboratory in Lacombe were completed in March of 2007 and the laboratory is unique in that it is the first AAFC food research laboratory in Canada equipped to work with live viruses.

Food virology research faces many challenges. Existing virus detection methods have been developed for the medical diagnostics area. When someone is suffering from acute gastro-enteritis, they can shed anywhere from 10^8 to 10^{11} viral particles per gram of feces, which allows for easy detection of viruses. In contrast, viruses are typically present in foods in very low numbers, therefore, detection methods must be sensitive enough to detect as few as 10 particles per food sample as the ingestion of as few as 10-100 particles is sufficient to cause disease. Recognized detection methods for most food matrices do not yet exist due to the low numbers present in foods. In addition, it is very difficult to study the behaviour of many of the human enteric viruses because many currently cannot be cultivated using tissue culture techniques. Viruses are parasites and require host cells for multiplication, which is an advantage because unlike bacteria, they cannot grow in the food environment. However, the lack of cultivation methods makes it very difficult to study their characteristics and survival. With the advancement of molecular detection methods, much of the research currently focuses on the presence of viral genes. Unfortunately the presence of a viral gene does not indicate if the virus particle is still infectious and this will become another important aspect of food virology research.

Until recently, it was thought that food-borne enteric viruses could only originate from humans and therefore their transmission was limited to contaminated food-handlers, cross-contamination of foods, and contamination by water. However, there are increasing concerns about zoonotic transmission of animal viruses through foods as some animal viruses are genetically closely related to human strains. There is no documented evidence on the ability of many of these viruses to cause gastroenteritis in humans or animals. In the past, food safety research has typically been funded in reaction to food-safety issues but the department aims to look ahead to the future to acquire new knowledge to protect the Canadian consumers and promote and support an internationally competitive agri-food industry. In response, the AAFC food virology programs have received AAFC funding through the peer review process

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for the next four years to carry out pro-active public good research activities on emerging and zoonotic viral pathogens to investigate potential animal sources and to determine the risks of food-borne viruses to humans by tracking their transmission and survival throughout the food chain.

Human caliciviruses have emerged as the major cause of acute nonbacterial gastroenteritis and have been implicated in many food and water associated outbreaks (Mead et al., 1999). *Norovirus* and *Sapporovirus* are the two genera of the *Caliciviridae* family that cause acute gastroenteritis in humans and some strains are genetically similar to those found in swine and cattle (Dastjerdi et al., 1999; Liu et al., 1999; Van der Poel et al., 2000). Norovirus infections appear to be common in swine and the existence of animal noroviruses that are closely related to human strains raises the question about the potential for zoonotic transmission (Farkas et al., 2005; Wang et al., 2005). Similarly, swine hepatitis E virus (HEV) is widespread in herds and strains are genetically related to human HEV (Huang et al., 2002). The zoonotic transmission of HEV from wild boar and deer has been demonstrated (Matsuda et al., 2003; Tei et al., 2003) and it has been suggested that undercooked pork liver or pork products contaminated with fecal matter could be a vehicle for transmission of HEV (Yazaki et al., 2003). Many human pathogenic enteric and hepatic viruses such as Norovirus and hepatitis A and E can not be cultured and their detection is therefore limited to molecular techniques. This lack of culturability poses a potential problem because the presence of viral nucleic acid does not necessarily represent an infectious virus, which has important implications for food-safety, particularly when inactivation treatments are employed. Therefore, it would be desirable to use a model or surrogate for enteric and hepatic viruses which can be cultured so that the relationship between presence and infectivity can be determined. This will be one of the research activities that will be targeted over the coming years.

Enteric bacteriophages such as F-RNA coliphage MS2 have been suggested as an appropriate model or surrogate for the behaviour of norovirus because they are of similar size, have similar survival characteristics and can be readily, rapidly, and economically cultured (Havelaar et al., 1984; Dawson et al., 2005). F-RNA phage plaque assays are routinely used as indicators of contamination with enteric viruses in determinations of water quality and have been suggested as a potential viral indicator for shell-fish (Doré et al., 2000; ISO, 1995). F-RNA coliphages use the F-pili of gram-negative bacteria as receptors, which are produced by the bacterial cells during the logarithmic phase of growth at temperatures above 30°C. Therefore, F-RNA phages cannot attach and multiply once they are shed from the intestinal tract into the environment, making F-RNA phages an ideal model for enteric viruses (Grabow, 2001). F-RNA phages are readily excreted by swine and poultry but detected with less frequency and in lower numbers from cattle (Havelaar et al., 1990).

There is little information on the presence of F-RNA phages on carcasses. Therefore, to assess the potential for F-RNA phages as a surrogate for enteric viruses in foods of animal origin, the numbers and frequency of F-RNA phage recovered from fecal samples and from anal or random sites from the same pig carcasses slaughtered at a research abattoir were determined. Fecal samples were obtained from the large intestine of 96 pigs at the time of slaughter. A 1 g portion of fecal matter was suspended in 9 ml NaCl (0.85%) peptone and decimal dilution series were prepared to 10^{-5}. Swab samples (200 cm^2) from random or anal carcass sites obtained at various stages of the dressing process were diluted in 20 ml NaCl peptone and decimal dilution series were prepared to 10^{-2}. In duplicate, a 1 ml aliquot of diluted sample mixed with 2.5 ml molten semi-solid Tryptone Yeast Extract Glucose Agar (TYGA) containing 250 ug of nalidixic acid and 1 ml of a log phase culture of *Salmonella*

typhimurium WG49 was poured over the surface of a TYGA plate (ISO, 1995). After solidification, the TYGA plates were incubated at 37°C for 18h and plaques were counted, picked and exposed to RNase to distinguish F-RNA from F-DNA phages using standard procedures (ISO, 1995). The preliminary results indicate that F-RNA coliphages can be readily recovered from fecal samples (Fig. 1) and carcasses during all stages of the dressing process (Figs 2 and 3). Furthermore, pasteurization or washing of carcasses did not substantially decrease the frequency (Fig. 2) and levels of recovery of F-RNA coliphage (Fig. 3). These preliminary results also appear to indicate that carcass handling and washing could result in a redistribution of F-RNA coliphages on carcasses. The findings of this initial study suggest that larger scale studies of carcass contamination with F-RNA coliphages are warranted to evaluate their potential as virus surrogates and/or indicators of fecal contamination. Knowledge that is obtained from future studies on the behaviour and survival of F-RNA phages, using both cultivation and molecular assays, can be extended to methods of detection and survival of pathogenic enteric and hepatic viruses from animal reservoirs and will be important in evaluations of enteric virus control strategies.

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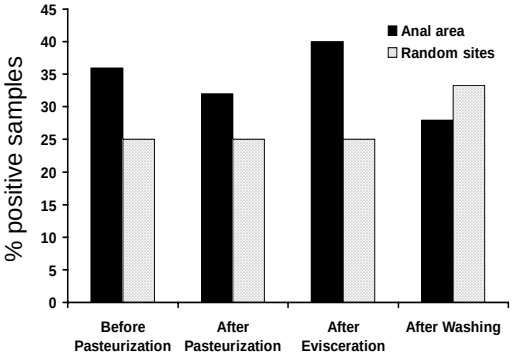

Figure 2. Frequency of recovery of F-RNA coliphages from carcasses at different stages of the dressing process, N=24

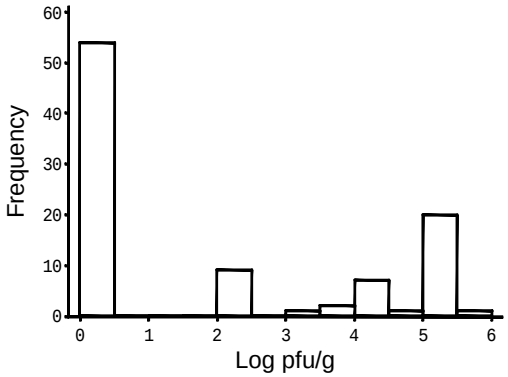

Figure 1. Distribution of F-RNA coliphages in fecal samples, N=96

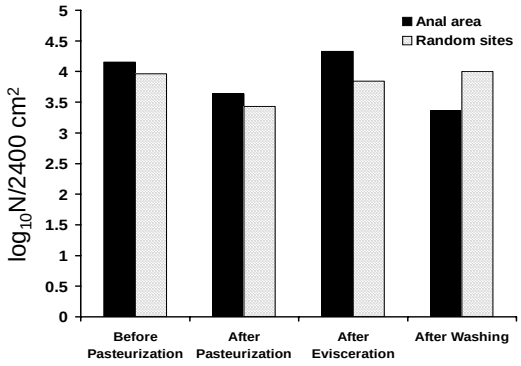

Figure 3. Total number ($log_{10}N/2400\ cm^2$) of F-RNA coliphages recovered at different stages of the dressing process, N=24

Events Calendar

June 17-20, 2007
The 60th Reciprocal Meat Conference
Brookings, South Dakota. Come and enjoy four days packed with the best technical programming and networking opportunities. http://www.meatscience.org/rmc/

June 18-21, 2007
The Annual Meeting of the Canadian Society of Animal Science
Will be held in Winnipeg, MB. This is the first time that CSAS will meet together with the Canadian Section of the American Oil Chemists' Society (CAOCS) and the Canadian Society for Nutritional Sciences (CSNS) at the Canadian Nutrition Congress 2007 (CNC2007). Information on this congress, including the program, registration and abstract submission, can be found at the following web site: http://umanitoba.ca/outreach/conferences/cnc2007 or Jim House at j_house@umanitoba.ca or 204-474-9523 or
Kees Plaizier at plaizier@ms.umanitoba.ca or at 204-474-9500

July 8-10, 2007
94th Annual Meeting of the International Association of Food Protection
IAFP 2007, Disney's Contemporary Resort, Lake Buena Vista, Florida
http://www.foodprotection.org/meetingsEducation/2007ammain.asp

August 5–10, 2007
53rd International Congress of Meat Science and Technology, Beijing, China
The theme of the Congress is "Chance, Innovation and Challenge".
http://www.icomstchina53.org.cn/Themeet/invitation.jsp

September 13–14, 2007
A Symposium on Advances in Intervention Strategies for Quality Control of Meat and Poultry Products
Presented by the Canadian Meat Council, Sheraton Gateway, Toronto Airport. For more information contact Parthi Muthukumarasamy email: _parthim@cmc-cvc.com or ph: 613-729-3911 ext. 23.

May 6–11, 2008
88th Annual Conference, Canadian Meat Council
Sheraton Fallsview, Niagara Falls, ON. http://www.cmc-cvc.com/english/publications_e.asp

Contact the Chair, CMSA Neswletter for Information/Submissions

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In the News...

Taken from FSNet, AnimalNET, FoodNavigator USA, MeatingPlace and Meat News

Projects unveil customer perceptions to boost Canada's beef success

Jan. 30, 2007

Canadian Cattlemen's Association, Calgary, AB

A wealth of knowledge to drive marketing strategies for Canadian beef has been unveiled by two international perception studies funded by the National Beef Industry Development Fund (NBIDF). "The task of knowing the customer has never been more complex or important for Canada's beef industry," says Dave Plett, NBIDF Chair. "This is particularly true with the changes we face in the post-BSE world." To deliver this knowledge, NBIDF funded two major projects to audit the opinions of influential global meat experts and consumers in top export markets for Canadian beef.

In the first project, the Canada Beef Export Federation undertook a Beef Quality Perception Audit (BQPA) in Japan, South Korea, Taiwan, Hong Kong/Macau and Mexico, to understand how the qualities of Canadian beef are regarded among close to 1,000 meat experts in those markets. This project built on a similar audit of U.S. meat experts conducted in 2004 by the Beef Information Centre. The meat experts participating in the information audit included top meat company directors, beef importers and distributors, and meat purveyors who have the dollars and powerful market influence to drive demand. "These people are the movers and shakers - collectively, they represent millions of dollars in trade," says Michael Young, vice president of international programs for Canada Beef Export Federation. "They are in the business of buying what sells, and they can buy beef from anywhere in the world. How they perceive beef quality and Canadian beef has a huge impact on our future success and prosperity in the export marketplace."

The findings confirmed Canadian beef grading standards are doing a good job of addressing the demands of these meat experts, since all the preferences indicated are ones Canada already delivers as standards for its beef grades. However more work is needed to help these experts identify Canada's association with these advantages. "The results showed that Canadian beef has a strong opportunity for success in these markets, as long as we continue to communicate and reinforce our strengths," says Young.

At a consumer level, NBIDF also funded a consumer perception study, to gauge attitudes related to beef food safety in four primary markets for Canadian beef. This project was used as a basis to propose supply chain management strategies to enhance beef demand.

A team led by Dr. Ted Schroeder, an agricultural economist at Kansas State University, conducted extensive surveys focusing on consumer perceptions and attitudes about beef food safety. Surveys were conducted during 2006, with approximately 1,000 consumers in each of the primary markets of Canada, the U.S., Japan, and Mexico.

Combined results of the surveys showed that 80 percent or more of consumers in Canada and the U.S. considered beef a safe product, whereas only 48 percent of Japanese and 60 percent of Mexican respondents felt beef is a safe product. Compared to four years ago, consumers in all four countries indicated they had reduced their beef consumption because of food safety concerns. Canadians and Americans reduced beef consumption by 20 percent, Mexicans by 30 percent and Japanese by 55 percent.

"This finding is particularly challenging for Canada as a beef exporter, because lost consumer confidence in beef can occur regardless of what the Canadian beef industry alone does to ensure food safety," says Schroeder. "It's clear that beef food safety is a global issue."

More information on results of the two projects is available in two new feature articles, available on the NBIDF Web site, www.cattle.ca/NBIDF

New consumer research to be released at annual meat conference: Nearly 90 percent of shoppers compare meat prices before purchasing

Jan. 30, 2007

American Meat Institute, Washington, D.C.

New research highlighting consumer meat product and promotion preferences, shopping behavior and the growth of the natural and organic market will all be presented at the 2007 Annual Meat Conference, Feb. 18-20, 2007 at the Caribe Royale Orlando All-Suites Resort and Convention Center in Orlando, Fla.

Information presented at the session is based on a joint consumer study by the American Meat Institute (AMI) and the Food Marketing Institute (FMI) and will be presented by Anne-Marie Roerink, director of research at FMI.

Highlights from the study include:

· In-store sales promotions and signs have the highest impact on the quantity of meat purchased.

· Over one-third of shoppers compare meat prices at different stories before shopping and half compare prices of different meat and poultry products within the store.

· Over half of shoppers keep ready-to-heat products in stock at home.

· One-fifth of shoppers stated that better customer assistance would prompt increased meat purchases.

Results from the study will be released during the session and presented in an actionable format for immediate applicability within any organization.

Co-sponsored by AMI and FMI, the conference has become the industry's premier meat marketing and operations educational program, designed to bring

together every segment of the retail meat and poultry supply chain. Associate sponsors include the American Lamb Board, Canadian Meat Council, National Chicken Council, National Pork Board, The Beef Check-off and National Turkey Federation.
www.meatconference.com.

Mad cow study points to virus, not proteins

Jan. 30, 2007
Washington Post
http://www.washingtonpost.com/wp-dyn/content/article/2007/01/29/AR2007012901991.html
Researchers have found more evidence that a virus may cause mad cow disease and a related brain disorder in humans, threatening to overturn 25 years of research focusing on malformed proteins called prions.
Laura Manuelidis, a neuropathologist at Yale Medical School, was cited as saying that serve cells infected with the human form of mad cow disease contained a virus-size particle that doesn't appear in uninfected cells. Cells infected with scrapie, a related sheep disorder, contained the same germ.
The findings challenge the idea that the diseases are spread by prions, abnormal proteins that have also been detected in the brains of infected humans and animals. Stanley Prusiner won the Nobel Prize in 1997 for research identifying prions as the infectious agent.
But questions have arisen because people and animals are thought to catch the disease by eating infected meat, and some researchers argue that the stomach and intestines would quickly break down any protein before it reached the blood or brain.

US meat inspection changes to begin in April

Feb. 22, 2007
Associated Press
WASHINGTON — Richard Raymond, the U.S. Agriculture Department's top food safety official, was cited as saying that stepped-up inspections at some meat and poultry plants are set to begin in April.
The story explains that the new policy, which was to be announced Thursday, is designed to increase scrutiny of processing plants where the threat of *E. coli* and other germs is high or where past visits have found unsafe practices. Plants with fewer risks and better food-handling records will be inspected less often.
Raymond was quoted as saying, "We will do this for a long time in these locations until we've had a chance to evaluate how well it's going, where the bumps in the road might be, what we might need to do differently and how training needs to change. "Raymond told The Associated Press late Wednesday that as many as 1,200 plants might be part of the new system by Jan. 1.

Maple Leaf to close Saskatchewan hog facility

by Tom Johnston on Mar. 6, 2007 for **Meatingplace.com**
Maple Leaf Foods Inc. will close its Saskatoon, Saskatchewan-based hog slaughtering plant on June 1, ahead of the company's original schedule.

The announcement came much sooner than hog producers expected, but Maple Leaf has offered them long-term contracts to ship their animals to the firm's Brandon, Manitoba, plant. The contracts will include premiums to offset hiked transportation costs, Norm Sabapathy, the company's vice president of labor, told reporters. Company officials said in October they would close the aging plant within three years as part of a plan to double-shift its Brandon slaughter facility. In November, though, Maple Leaf said the Saskatoon plant would close within 12 to 18 months.
The Saskatchewan government and local hog producer associations have been studying ways to offset the closing of the Saskatoon plant. With its closure, most local hog producers will have to deliver to Maple Leaf's Brandon facility or to an Olymel plant in Red Deer, Alberta.

Canadian consumers increasingly concerned about environmental issues related to agriculture

by Bruce Cochrane Mar. 5, 2007 for **Farmscape** (Episode 2417)
The latest "Canadian Consumer Attitudes Towards Pork Production Survey" shows the environment has emerged as the second most import issue on the minds of Canadians, topped only by concerns related to food safety.
Since 1999 Ispsos Reid has tracked the attitudes of non-farming Canadians toward
agriculture, primarily hog farming.
The latest survey, conducted last July, questioned just over 21 hundred consumers about issues related to food safety, the environmental impact of hog farming, the care and treatment of hogs and genetic modification of hogs.
Vice president agribusiness, food and animal health Dr. Susan Jones says the most dramatic finding over the years has been the emergence of environmental concerns related to hog farming.
The difference that we in 2006 is environmental issues are far more top of mind than they used to be and I don't think this is necessarily specific to the hog industry.
We all know that, for a variety of reasons, people are thinking and talking more about the environment and we saw this very clearly in our study.
A majority of Canadians believe that hog farming fundamentally is somewhat unfriendly to the environment.
They're more aware of and more concerned about environmental issues in general.
In 2006 we saw a growth of people that were unsure whether the environmental impact of hog farming is positive or negative and what that tells

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us is when people are unsure you can be pushed either way.
So I think the important thing for our industry is now is not the time to let up in terms of communications about the hog industry, about environmental regulations and about environmental safeguards because people are highly aware and there's a lot of people that just aren't knowledgeable or aren't sure about the impact of the hog industry.
Dr. Jones notes the survey, which was conducted on behalf of pork producers in Ontario, Manitoba, Saskatchewan and Alberta, will be used primarily in developing communications strategies directed toward non-farming Canadians.

New Research and Development Center for Tyson Foods Inc.

by Tom Johnston on March 6, 2007
for **Meatingplace.com**
SPRINGDALE, Ark. - Tyson Foods Inc. President and CEO Dick Bond said that the new state of the art research and development center unveiled here today will help the company improve its lagging beef segment.
The $45 million 100,000-sq.-ft. Discovery Center certainly will help Tyson remain the No. 1 chicken processor by creating new products and more diverse flavor profiles with 19 research kitchens, a USDA inspected multi-species pilot production plant and a staff of food science and culinary experts. But it also will aid the protein giant in adding value through more focused innovation among its red meat products.
Bond told Meatingplace.com that closed foreign markets and a harsh winter's impact on domestic producers have affected Tyson's beef performance, and the Discovery Cener won't change that overnight. "It won't be as important in the next week, the next month or even the next six months as it will be in the longer term as we try to add more value to more and more beef products," Bond said.
Tyson rolled out about 460 new products last year.
Craig Bacon, Tyson's vice president of research and development, told **Meatingplace.com** that new scrutiny of processing plants where the threat of *E. coli* and other germs is high or where past visits have found unsafe practices. Plants with fewer risks and better food-handling records will be inspected less often.
Raymond was quoted as saying, "We will do this for a long time in these locations until we've had a chance to evaluate how well it's going, where the bumps in the road might be, what we might need to do differently and how training needs to change. "Raymond told The Associated Press late Wednesday that as many as 1,200 plants might be part of the new system by Jan. 1.

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Tyson rolled out about 460 new products last year. Craig Bacon, Tyson's vice president of research and development, told **Meatingplace.com** that new product development will continue at the same pace this year, but it will have increased focus on beef products. "In the past three to four years, the majority of our new protein products were chicken," Bacon said. "We're going to see that flip. We're going to see more beef and pork and less chicken."

Hormel Foods expans its Natural Choice line

by Ann Baagel Storck on Mar. 6, 2007

for **Meatingplace.com**
Hormel Foods on Tuesday announced the expansion of its Natural Choice line of 100 percent natural meats to include roast beef, chicken strips, Canadian bacon and uncured bacon.
The additions join the deli sandwich meats and dinner ham that are already part of the line. All of Hormel's Natural Choice meat products are low in fat and have no preservatives, no artificial colors or flavors, no added nitrites or nitrates, no trans fat and no gluten. They also feature recycalable outer packaging in brown and green earth tones.
The new Natural Choice products will be available in supermarkets nationwide starting this month.

Canada a 'controlled risk' for mad cow

Mar. 10, 2007
by Sarnia Observer (ON)
Canada has, according to this story, won recognition from a review panel of the World Organization for Animal Health for taking the proper measures to control the risk of mad cow disease and is recommending Canada be among the first small group of countries classed in the "controlled risk' category for the brain-wasting disease.
The story says that the United States is also known to be among the first group, although the list of recommended countries has not been publicly released.
The classification is expected to help further open world markets to Canadian beef exports, and should provide scientific weight to Canada's legal arguments against countries that remain closed. The world panel made its recommendation last month, triggering a 60-day response period from the 168 member countries in the organization. They will formally decide whether to ratify the recommendation at their annual general session in May.
Dr. Brian Evans, head of the Canadian Food Inspection Agency, was cited as saying Friday the designation is based on an exhaustive set of criteria that improves on the old international system which ranked a country's risk of bovine spongiform encephalopathy, or BSE, from zero to high, stating, "It speaks to Canadians that the international community has respect for the mitigation measures that Canada has not only adopted, but also the degree to which they've been implement and enforced. … By achieving this designation it allows Canada then to make its case . . . that we have a legitimate opportunity at the international level for those countries to expand trade."

Minimal risk rule important step to normalized trade with Canada, American Meat Institute says

Mar. 12, 2007
American Meat Institute
http://www.meatami.com/Template.cfm?Section=Press_Statements&template=PresReleaseDisplay.cfm&PressReleaseID=3236
USDA's proposed rule to allow additional imports from Canada "is one more step toward returning to normal cattle and beef trade between the United States and Canada," according to comments

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submitted to USDA's Animal and Plant Health Inspection Service (APHIS) by AMI Foundation President James H. Hodges. The comments were submitted in response to the proposed rule that would restore the importation of live bovines from Canada born after March 1, 1999.

Hodges pointed out that the disruption of cattle and beef trade between the U.S. and Canada that has followed the diagnosis of the first case of BSE in Canada has resulted in substantial economic hardship for U.S. beef processors. "Fully restoring cattle and beef trade in North America is a critical step to preventing further equity losses in the industry, enhancing our competitiveness in an increasingly global market, and protecting jobs in the U.S.," he noted.

AMI urged USDA to amend the proposed rule and allow cattle of any age to be imported if they were going directly to slaughter, noting that doing so is consistent with World Organization for Animal Health (OIE) guidelines and poses no health risk to the cattle population. "The extensive array of risk mitigation measures implemented in both Canada and the United States over the past three decades dictates an expansion of the proposal," he said, adding that a "statistically based testing and surveillance program in both countries provides a high degree of confidence that animal health is protected."

Hodges pointed out that imposing a birth date for cattle moving directly to slaughter is not consistent with the treatment APHIS afforded beef and beef products in its final rule published in the Federal Register on Jan. 4, 2005, which provides for the importation of beef derived from cattle of any age if requirements for the removal of specified risk material (SRM) are met. "Allowing the import of cattle of all ages for slaughter does not increase the likelihood of BSE occurring in U.S. cattle because a ban on feeding ruminant proteins to ruminants effectively protects the U.S. cattle herd," he said, noting that oral ingestion of feed contaminated with the BSE agent is the only documented route of field transmission of BSE.

OIE guidelines permit trade in all beef and beef products from which SRM have been hygienically removed. Because SRM would be removed from any beef or beef product derived from imported Canadian cattle that are sent directly to slaughter in the U.S., it would be inconsistent to impose a birth date on such animals when no such limitation applies to the imported beef.

Hodges applauded the agency for publishing the rule, but again urged their consideration of an amendment that would permit the importation of cattle of all ages for slaughter. "No food safety or animal health reasons exist to exclude the importation of Canadian cattle born before March 1, 1999 for slaughter," he added.

Manitoba Pork Producers launch public education campaign

Mar. 12, 2007 for **Farmscape** (Episode 2423) by Bruce Cochrane

Manitoba's pork producers have launched a multimedia public education campaign designed to inform the public about the benefits of hog production and what hog producers are doing to protect the environment.

Earlier this month the Manitoba Pork Council kicked off a radio, television and newspaper campaign aimed at dispelling some of the negative myths currently circulating about the province's hog industry.

Public affairs and marketing manager Tracey Bryksa says research has shown the general public knows very little about the hog industry in Manitoba and, with the Manitoba Clean Environment Commission undertaking a review of the environmental sustainability of the hog industry, it was felt that this was a critical time to get out more information.

We are doing quick hits on TV so there are three 15 second commercial spots that will run. Each one comes up with a quick message about the industry. The same idea for radio, with four different radio spots and again they're 15 second spots as well, quick hits of information.

The newspaper is a little bit more detailed. There was a large four page insert that ran in the Winnipeg Free Press on the weekend on March 3rd and 4th and it kind of laid out a picture of the industry, what the hog industry and hog farmers do for the environment, when it comes to food quality, job creation, money going back into the economy, things like that. It was kind of a quick education on the hog industry.

Further to that we will be running ads in the paper. Each one will be focused on a specific area, whether it's the economy, job creation, food safety, environmental contributions.

Bryksa says, in addition to highlighting the good work that hog farmers are doing to protect the environment, the campaign will touch on the economic benefits of hog production.

She points out the hog industry has created over 15 thousand jobs and adds over a billion dollars to the provincial economy each year which are significant benefits to the province that people should know about.

Study finds antibiotic resistance in poultry even when antibiotics were not used

Mar. 8, 2007 by Alicia Karapetian for **Meatingplace.com**

A surprising finding by a team of University of Georgia scientists suggests that curbing the use of antibiotics on poultry farms will do little, if anything, to reduce rates of antibiotic-resistant bacteria that have the potential to threaten human health.

Dr. Margie Lee, professor in the UGA College of Veterinary Medicine, and her colleagues have found

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that chickens raised on antibiotic-free farms, and even those raised under pristine laboratory conditions, have high levels of bacteria that are resistant to common antibiotics. Her findings, published in the March issue of the journal Applied and Environmental Microbiology, suggest that poultry come to the farm g resistant bacteria, possibly acquired as they were developing in their eggs.

The resistances don't necessarily come from antibiotic use in the birds that we eat," Lee said, "so banning antibiotic use on the farm isn't going to help. You have to put in some work before that."

Lee and her team sampled droppings from more than 140,000 birds under four different conditions:

1. commercial flocks that had been given antibiotics;
2. commercial flocks that had not been given antibiotics;
3. flocks raised in a lab that had been given antibiotics.
4. flocks raised in a lab that had not been given antibiotics.

The researchers examined levels of antibiotic resistance in normal intestinal bacteria that do not cause human illness and, in a companion study published in May in the same journal, also examined levels of drug-resistant campylobacter bacteria, a common foodborne cause of diarrhea, cramping and abdominal pain.