Received via email on October 11, 2016
From: Shalene McNeill, The Beef Checkoff

Comments: Dear Dr. Lunn:

The Beef Checkoff appreciates the opportunity to submit scientific evidence to the Office of the Report on Carcinogens (RoC) in response to its September 9, 2016, Federal Register (80 FR 62513-14) request for information regarding the possible evaluation of consumption of red meat, processed meat, and meat cooked at high temperatures for future editions of the Report on Cancer (RoC).

In response to the request for recently published, ongoing, or planned studies related to evaluating cancer outcomes, we submit the following non-exhaustive list of relevant scientific literature published within the past 5 years, and ongoing and planned studies:

*Ongoing and planned studies funded by the Beef Checkoff
Title: Development and validation of gas chromatography mass spectrometry methodologies for the assessment of polycyclic aromatic hydrocarbons and heterocyclic amines in beef. As described by the researchers (Legako, J. and co-workers), the objective of this project is to validate methodologies for measurement of polycyclic aromatic hydrocarbons (PAH) and heterocyclic amines (HCA) in beef. The researchers propose the use of gas chromatography mass spectrometry (GC-MS) due to its relatively cheaper operation costs and greater availability to other researchers.

Title: Beef as a Component of a Healthy Dietary Pattern in Cancer Survivors. As hypothesized by the researchers (Clinton, S. and co-workers), overweight and nutritionally stressed cancer survivors who actively participate in a 6-month intensive intervention comparing a DGA /AICR approach or a DGA / AICR based diet plus beef will both show improved body composition and successfully maintain a healthy dietary pattern and physical activity effort over time and that regular consumption of lean beef may favorably impact specific nutritional outcomes.

Title: Heme and mechanisms of carcinogenicity. The researchers (Kruger, C. et al.) will conduct a weight of evidence, systematic review studies investigating proposed mechanisms of dietary heme ingestion on initiating or promoting colorectal cancer. Mechanisms to be reviewed will include genotoxicity, catalytic formation of N-nitroso compounds and cytotoxicity due to lipid peroxidation end-products, as outlined by the investigators.

Title: Evaluation of the relative risks due to consumption of red meat compared to other common food items. The investigators (Zagmutt, F. and Costard, S.) aim to determine preliminary, baseline estimates of relative exposure to hypothesized carcinogenics through consumption of selected food items (including red meat); 2) Identify other important potential health risks caused by red meat substitutes; 3) Identify data sources and knowledge gaps. This will also include a broad overview of data and corresponding gaps that would be necessary to perform a traditional dose-response assessment of HCAs & PAHs.

Title: Association between Red Meat Consumption and Colon Cancer: A Systematic Review of Experimental Results Turner, N and Lloyd, S. are completing a systematic review of the available evidence to determine the availability of plausible mechanistic data linking red and processed meat consumption to CRC risk. Turner and Lloyd have found fifty-nine studies using animal models or cell cultures that met specified inclusion criteria, most of which were designed to examine the role of heme iron or heterocyclic amines (HCAs) in relation to colon carcinogenesis. Turner and Lloyd note that most studies used greatly elevated levels of meat or meat components as compared to those found in human diets. Turner and Lloyd note that, although many of the experiments used semi-purified diets designed to mimic the nutrient loads in current westernized diets, most did not include potential biologically active protective compounds present in whole foods. Tuner and Lloyd note that, because of these limitations in the existing literature, there is currently insufficient evidence to confirm a mechanistic link between the intake of red meat as part of a healthy dietary pattern and CRC risk.

*Recent Publications Related to Exposure Assessment Complications for Red Meat, Processed Meat and Meat Cooked at High Temperatures:

Alaejos, M. S., Afonso, A. M. (2011). Factors that affect the content of heterocyclic aromatic amines in foods. Comprehensive Reviews in Food Science and Food Safety. 10(2):52-108.

Alomiraha, H., Al-Zenkia, S., Al-Hootia, S., Zaghloula, S., Sawayaa, W., Ahmedb, N., Kannan, K. (2011). Concentrations and dietary exposure to polycyclic aromatic hydrocarbons (PAHs) from grilled and smoked foods. Food Control. 22:2028-2035.

Archer E, et al. Validity of U.S. Nutritional Surveillance: National Health and Nutrition Examination Survey Caloric Energy Intake Data, 1971–2010. PLoS ONE 2013;8(10):e76632.

Archer E, et al. The Inadmissibility of What We Eat in America and NHANES Dietary Data in Nutrition and Obesity Research and the Scientific Formulation of National Dietary Guidelines. Mayo Clinic Proceedings 2015;90(7):911-26.

Daniel CR, et al. Trends in meat consumption in the USA. Public Health Nutr 2011;14(4):575-83

Dietary Guidelines Advisory Committee (DGAC). 2015. Scientific report of the 2015 Dietary Guidelines Advisory Committee. Washington DC: Department of Health and Human Services and USDA.

Fehrenbach KS, et al. A critical examination of the available data sources for estimating meat and protein consumption in the USA. Public Health Nutr 2016;19(8):1358-67.

Forsberg, N.D., Stone, D., Harding, A., et al. (2012). Effect of Native American fish smoking methods on dietary exposure to polycyclic aromatic hydrocarbons and possible risks to human health. J Agric Food Chem, 60:6899-6906.

Gibis, M. (2016). Heterocyclic aromatic amines in cooked meat products: causes, formation, occurrence, and risk assessment. Comprehensive Reviews in Food Science and Safety. 15:269-302.

Hallström E, Börjesson P. Meat-consumption statistics: reliability and discrepancy. Sustainability: Science, Practice, & Policy 2013;9(2):37-47.

Jørgensen, R. B., Strandberg, B., Sjaastad, A. K., Johansen, A., Svendsen, K. (2013). Simulated restaurant cook exposure to emissions of PAHs, mutagenic aldehydes, and particles from frying bacon. Journal of Occupational and Environmental Hygiene. 10:122–131.

Kitts, D. D., Chen, X. M., Broda, P. (2012). Polyaromatic hydrocarbons of smoked cured muscle foods prepared by Canadian Tl'azt'en and Llheidli T'enneh first nation communities. Journal of Toxicology and Environmental Health. 75:1249–1252.

Klurfeld DM. Research gaps in evaluating the relationship of meat and health. Meat Sci 2015;109:86-95.

Lee JG, Kim SY, Moon JS, Kim SH, Kang DH, Yoon HJ. Effects of grilling procedures on levels of polycyclic aromatic hydrocarbons in grilled meats. Food Chem 2016;199:632-638.

McNeill SH, et al. The evolution of lean beef: Identifying lean beef in today's US marketplace. Meat science 2012;90(1):1-8.

McNeill SH, Van Elswyk ME. 2016. “Meat: Role in the Diet” in Encyclopedia of Food and Health, 1st ed.

Mitka M. Do Flawed Data on Caloric Intake From NHANES Present Problems for Researchers and Policy Makers? JAMA 2013;310(20):2137-2138.

Meurillon M and Engel E (2016). Mitigation strategies to reduce the impact of heterocyclic aromatic amines in proteinaceous foods. Trends in Food Science & Technology. 50:70-84.

Mohammadi, A., Ghasemzadeh-Mohammadi, V., Haratian, P., Khaksar, R., Chaichi, M. (2013). Determination of polycyclic aromatic hydrocarbons in smoked fish samples by a new microextraction technique and method optimisation using response surface methodology. Food Chemistry. 141:2459-2465.

National Food Institute, Technical University of Denmark. (2016). The role of meat in the diet. ISBN:978-87-93109-74-2. Available at www.food.dtu.dk

Olatunji, O. S., Fatoki, O. S., Opeolu, B. O., Ximba, B. J. (2015). Benzo[a]pyrene and benzo[k]fluoranthene in some processed fish and fish products. International Journal of Environmental Research and Public Health. 12:940-951.

Oostindjer M, et al. The role of red and processed meat in colorectal cancer development: a perspective. Meat Sci 2014;97(4):583-96.

Puangsombat, K., Gadgil, P., Houser, T. A., Hunt, M. C., and Smith, J. S. (2012). Occurrence of heterocyclic amines in cooked meat products. Meat Science. 90:739-746.

Singh, L., Varshney, J.G., and Agarwal, T. (2016). Polycyclic aromatic hydrocarbons' formation and occurrence in processed food. Food Chemistry, 199:768-781.

Tapsell, L.C., Neale, E., Satja, A., and Hu, F.B. (2016). Foods, nutrients, and dietary patterns: interconnections and implications for Dietary Guidelines. Advances in Nutrition, 7:445-54.

Viegas, O., Novo, P., Pinto, E., Pinho, O., Ferreira, I. M. P. L. V. O. (2012). Effect of charcoal types and grilling conditions on formation of heterocyclic 3 aromatic amines (HAs) and polycyclic aromatic hydrocarbons (PAHs) in grilled muscle foods. Food and Chemical Toxicology. http://dx.doi.org/10.1016/j.fct.2012.03.051.

Viegas, O., Moreira, P. S., and Ferreira, I. M. P. L. V. O. (2015). Influence of beer marinades on the reduction of carcinogenic heterocyclic aromatic amines in charcoal-grilled pork meat. Food Additives and Contaminants: Part A. 32(3):315–323.

Yao, Z., Li, J., Wu, B., Hao, X., Yin, Y., Jiang, X. (2015). Characteristics of PAHs from deep-frying and frying cooking fumes. Environmental Science and Pollution Research International. doi: 10.1007/s11356-015-4837-4. Epub.

*Critical Reviews Debating Proposed Mechanisms for Meat and Cancer Risk Andersen, V., Christensen, J., Overvad, K., Tjonneland, A., and Vogel, U. (2011). Heme oxygenase-1 polymorphism is not associated with risk of colorectal cancer: A Danish prospective study. European Journal of Gastroenterology and Hepatology, 23(3), 282-285.

DeMeyer, D., Mertens, B., De Smet, S., Ulens, M. (2016). Mechanisms linking colorectal cancer to the consumption of (processed) red meat: a review. Critical Reviews in Food Science and Nutrition. 56:2747-66.

EFSA NDA Panel. (2015). Scientific opinion on dietary reference values for iron. EFSA Journal, 13:4254-4369.

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National Food Institute, Technical University of Denmark. (2016).

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Wu, K., Spiegelman, D., Hou, T., et al. (2016). Associations between unprocessed red and processed meat, poultry, seafood and egg intake and the risk of prostate cancer: a pooled analysis of 15 prospective cohort studies. Int J Cancer, 138:2368-82.

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