The Challenges of Being a Meat Scientist in the 21st Century

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Those in every profession have challenges; it is part of the deal. Most are in the near term—today, tomorrow, next week; we deal with challenges as they occur or by adding them to our five-year-plan. But what about the challenges meat scientists will face in the next 90 years? Very honestly, we cannot even imagine the changes that will occur in meat science—much less the challenges to which we must respond. Nevertheless, I will try.

MEAT AND THE MEDIA

Print media, broadcast media, and pseudojournalism (purveyed on Twitter, Facebook, YouTube, and blogs) keep sensationalism, hyperbole, and misinformation circulating at light speed. In my lifetime, meat has gone from "Center of the Plate" to "Center of Far Too Many Controversies." Fifty years ago, if I told someone I was a meat scientist, he or she might have said, "Oh boy, you can tell me how to pick out a perfect steak." Today, people ask me about factory farms, animal welfare, hormonal or antimicrobial growth promotants, preservatives, sustainability, global warming, meat-borne pathogens, or meat consumption and human disease. Why? I believe it is the result of carpet bombing and piling on by the media and on the Internet. Upton Sinclair wrote *The Jungle* in 1906, and we had 65 years of respite until 1971 when Frances Moore Lappé wrote *Diet for a Small Planet*. What followed was a torrent of pulp fiction about animal agriculture by journalists such as John Robbins, Jeremy Rifkin, Eric Schlosser, and Michael Pollan. Pejorative terms such as "factory farms" and "industrialized farming" are used by newspaper reporters (e.g., Nina Planck, Michael Moss), in movies (e.g., *Fast Food Nation*; *Food, Inc.*), in magazine articles (e.g., Bryan Walsh, *Time*; Liz Vaccariello, *Prevention*), on television (e.g., Katie Couric on CBS; Brian Ross on ABC), and in reports (e.g., Livestock's Long Shadow, FAO-UN; Putting Meat on the Table, Pew Commission). For the most part, those who write about agriculture are armed, without the facts, and dangerous, because readers believe what they write (Greg Henderson; Drovers; April, 2009). When consumers go online to look for information about meat, they have trouble differentiating factual reporting from blogging. v-Fluence Interactive (July, 2009) reported that 70% of what consumers see about beef production on the Internet comes from producers of organic or grass-fed beef, much of the rest comes from animal-rights advocates, and both are critical of traditional beef production. Most bloggers with negative views of meat production and consumption simply parrot back opinions of journalists, vegetarians, or animal-rights advocates with very negative views of the meat industry, its practices, and its products. It is not likely that this will end. Expect instead to entertain questions and to engage in serious discourse about our field of study—in increasing frequency and with greater fervor—for the rest of your career.

DEFENSE OF YOUR LIVELIHOOD

The meat industry is an easy target unless those in it adopt new strategies to respond. When something is published or presented about the meat industry that is negative, biased, or wrong, groups and individuals respond. Both the American Veterinary Medical Association and the Federation of Animal Science Societies issued press releases identifying significant flaws in "Putting Meat on the Table" by the Pew Commission. Representatives of commodity groups (e.g., National Pork Producers Council, National Chicken Council) or associations (e.g., American Meat Institute, National Meat Association) speak on radio and television, hold briefings for members of the US Congress, and commission scientists to develop position papers to counter claims, attack inaccuracies, and correct misstatements in publications such as *Diet for a New America* by John Robbins and *Beyond Beef* by Jeremy Rifkin. Scientifically substantiated findings in position papers are used by academia, industry associations, government officials, and media representatives to counter erroneous statements and opinions. A pork industry coalition sent a letter to the president of CBS News containing rebuttals of claims made by Katie Couric on antibiotic

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use in the livestock industry; National Meat Association issued a press release to counter claims of Michael Moss (*New York Times*) about use of technology by the beef industry. Trade magazines (e.g., *Pork*, *National Provisioner*, *Meatingplace*) offer articles on such issues, providing information that those in industry can use in defense of what they do. Livestock producers and meat packers and processors send letters to the editor and blog responses and opinions on the Internet. Producers are encouraged to tell their story via social media (e.g., Masters of Beef Advocacy program; MBA@BEEF.ORG; April, 2009), and growers, feeders, and packers are encouraged to open the door and show people what they are actually doing. Tom Nagle (*Food Technology*; February, 2010) said, "To win back consumer trust we need to take our industries out of crisis mode and into a proactive mode of effective consumer marketing by mounting a collective, long-term communications plan to provide value-based positioning of the benefits of our food-production system." I believe the American Meat Science Association should use a dedicated portion of its Web site for a "Meet the Meat Scientists" location where our members plus invited experts present scientific responses to current questions and topical concerns about the food-supply chain.

MEAT'S VALUE PROPOSITIONS

It will take more than just appearance, taste, and price to please new-age consumers; add to that safety, wholesomeness, nutritional value, and sustainability. Rapid distribution (from harvest to retail) and clever packaging have enhanced the appearance of meat at retail. Grain-finishing of animals has made meat palatability highly consistent. Science and technology have contributed greatly to our ability to make meat affordable for US and international consumers. Unfortunately though, not all consumers believe US meat is safe to eat. The meat industry's safety challenges are greater than just pathogen reduction; consumers worry still about pesticide residues and the use of hormones and antibiotics for growth promotion. Wholesomeness is defined as "morally or socially conducive or favorable to sound health or well-being"; consumers question the wholesomeness of meat from farm animals that they perceive to be abused, mistreated, or produced via implementation of genetic engineering. Meat is recognized, by most consumers, for its contribution toward meeting daily needs for iron, zinc, phosphorus, protein, and essential B-vitamins. Poultry cuts and lean cuts of pork, beef, and lamb are excellent choices even when dietary fats must be limited. "Sustainability" refers to the production of clean, fair, and good (for people and the environment) food, by those who are interested in the wholesomeness of the final food product, as well as the survival of independent farmers and ranchers (i.e., product that is green, fair, and ethical). A recent survey of grocery shoppers (www.contextmarketing.com; March, 2010) found that (a) 90% of respondents identified the three main qualities of ethical products as being protects the environment, meets high quality and safety standards, and treats farm animals humanely; (b) 70% of respondents believe "ethically produced food" is better for the environment; (c) 70% say they are willing to pay more for ethically produced food (57% would pay up to a 10% premium); (d) 60% believe it is healthier; and (e) 58% believe it is safer to eat. Whether you practice your meat-science vocation in academia, government service, or industry, you must seek opportunities to conduct outreach to consumers by telling them about the important work that is done, by all of those involved in the meat-supply chain, to meet consumers' end-product expectations.

HALOS TO ASCRIBE TO PROCESSED MEAT

Consumers must find solace in the results of meat scientists' efforts to improve consistency, safety, nutritional value, and shelf life of processed products. "Processed food is not considered 'good,' it doesn't have that halo" (Sylvia Rowe; *Meatingplace*; December, 2009). It began to lose its halo in 1978 when Joan Dye Gussow (*The Feeding Web*) said, "I have watched real food disappear from large areas of the supermarket; taking foods' place on the shelves has been an unending stream of foodlike substitutes, some 17,000 new ones every year—products constructed largely around commerce and hope, supported by frightening little actual knowledge." It continued to 2008 when Michael Pollan (*In Defense of Food*) said, "Don't eat anything your great-grandmother wouldn't recognize as food, and don't eat anything incapable of rotting; avoid food products containing ingredients that are unfamiliar, unpronounceable, more than five in number, or that include high-fructose corn syrup." One of ten food trends expected to emerge (*Food Technology*; January, 2010) is a "sense of simplicity"; "clean" labels are in vogue socially, and increasingly, buyers want food products made with the least amount of ingredients possible. An unmet desire of many consumers is to enjoy affordable, restaurant-style foods at home; this gives food marketers the opportunity to recapture mealtime. Meat scientists can help do this but must accomplish consistency, taste, safety and shelf life while doing so with clean labels. The perception that home-prepared foods are much healthier, a view held by 92% of grocery shoppers (*Food Technology*; January, 2010), and the old adage "writing laws and making sausages—you don't want to see either being made" raise the bar for those who develop new ready-to-eat, comminuted, emulsified, or cured meat products. In addition, dietary and health concerns regarding salt, nitrite, preservatives, and chemical additives generate challenges in formulating processed products that are perceived as more healthful, safe, and shelf stable. Meat scientists may have to reinvent themselves—doing more with less. As they do, they may find that the media is not always helpful. For example, Steven Reinberg (HealthDay; March 9, 2010), describing a Harvard School of Public Health meta-analysis, concluded, "It's eating processed meat—not unprocessed red meat—that increases the risk for heart disease and even diabetes." Yet, in a later sentence they say, "Processed meats contained, on average, four times higher amounts

of sodium and two times higher amounts of nitrate preservatives but similar amounts of saturated fat and cholesterol." Do you suppose that all of the sodium and nitrate they consumed came from processed meat? It is difficult to win a game in which you always play defense.

RESPECT FOR THE VALUES OF INTERNATIONAL CONSUMERS AND CUSTOMERS

The precautionary principle is not always a surrogate for nontariff trade barriers. If an importing country wishes to reduce the amount of product it receives from exporting countries, it can initiate tariffs (i.e., duties—prices or fees—imposed by a government on imported goods). If that does not suffice, the importing country's government can create a nontariff trade barrier by specifying some reason to ban importation of unwanted goods. The offended country can request settlement of the issue by the World Trade Organization (WTO). In 1989, the European Union (EU) banned importation of beef from cattle given hormonal growth promotants, claiming that 17-β estradiol was a known carcinogen. The United States said the 1989 ban was a nontariff trade barrier; the WTO ruled in favor of the United States when the EU could not provide scientific evidence to support their claim. The EU then cited the precautionary principle, saying its consumers were afraid of eating meat that might contain added hormones, but again, the WTO ruled that the ban was unwarranted, allowing the United States to respond with retaliatory tariffs (on products exported from the EU to the USA). The precautionary principle (i.e., "It is better to be safe than sorry") argues for prudence in the face of scientific uncertainty and possible harm to health or the environment. The principle was first used in the 1970s by Germany, has since been incorporated into several international conventions, and is now widely invoked by those seeking to halt the marketing of genetically modified food (Joyce Nettleton; *Food Technology*; September, 1999). US regulatory agencies do not believe the precautionary principle is sufficiently defined, resulting in a regulatory system that lacks consistent science-based outcomes (*Food Technology*; May, 2006). Instead, the United States uses a risk assessment approach—because some risk is inherent to everything in our daily life—and built into that process is the recognition of scientific uncertainty, inadequate data, and the incorporation of safety factors to compensate for uncertainty. As a country, we are learning to accept that there are cases in which the supposed health concerns of the people of other countries are real. Based on conversations I have had with consumers in 25 of the EU countries, many are, in fact, genuinely worried about growth-promotant residues in beef. So, if the customer is always right, our poultry packers' recent decision to no longer use chlorine in harvesting and chilling chickens—in the face of Russia's concerns about potential formation of organochloride compounds on the meat—is appropriate.

MEAT-ANIMAL PRODUCTION PRACTICES AND TECHNOLOGIES

Meat scientists must weigh in on the use of present, new, and proposed production practices and technologies. In the 1970s, Laura Freeman (Covington, KY) and Mel Coleman (Saguache, CO) started selling "natural" beef from animals that had not been given antibiotics or hormonal growth promotants. What followed was a cascade of first natural, and later organic, kinds of meat products. Commodity groups countered by using science to demonstrate that tiny traces of residual antibiotics, hormones, pesticides, preservatives, and additives in fresh and processed meat from conventionally raised animals were inconsequential to human health, and that unquestionably assuaged fears of many consumers. Over time, claims made by marketers of newly conceived kinds of products included animal welfare (free range, cage free) and nutritional superiority (grass fed). Some marketers now trumpet sustainability and in doing so, denigrate all kinds of production systems other than their own. In 2009, *Drovers* received a news release that stated, "Industrial grain-based feedlot operations foul the environment, expose cattle to inhumane conditions, require intensive consumption of fossil fuels and produce higher levels of environmental pollutants. Sustainable ranching management on LaCense Ranch helps keep cattle, air, land and water healthy." *Drovers* took a stand, issuing an editorial that stated, "American beef producers face plenty of challenges from radical animal-rights activists and environmental extremists trying to destroy their livelihoods. They hardly need to hear the same attacks from fellow producers trying to promote their products" (John Maday; *Drovers*; October 2, 2009). Meat scientists should be equally courageous in reacting to conjecture about meat-animal production practices and technologies. We cannot stand idly by when someone says, "Recognize meat for what it really is: the antibiotic- and pesticide-laden corpse and rotting parts of a tortured animal" (attributed to John Harvey Kellogg, MD, by Ingrid Newkirk; *Save the Animals*; 1990), "When we eat factory-farmed meat, we live on tortured flesh" (Jonathan Safran Foer, *Eating Animals*; 2009), or "Meat-heavy diets have been consistently linked to increased risk of cancer, heart disease, obesity, diabetes and osteoporosis, and global livestock production is responsible for about one-fifth of all greenhouses gases—more than transportation" (Tara Mataraza Desmond; *IACP Frontburner*; January, 2010). Be ready to defend appropriate production practices and to explain the need for appropriate technologies in production of meat animals and processing of meat products.

IT'S OKAY TO EAT MEAT

The percentage of US consumers who consider themselves meat eaters has remained reassuringly high, but that may not always be the case. Anthropologists report that after humans began growing crops, 10,000 years ago, they could feed larger populations, but plant-only diets

produced poorer health; the early people who ate mainly plants lacked key vitamins, minerals, and amino acids, which led to higher infant mortality, shorter life spans, more infectious diseases, widespread iron-deficiency anemia, and bone-mineral disorders (Loren.Cordain@ColoState.edu; 2010). Jonathan Safran Foer (*Eating Animals*; 2009) says "we shouldn't eat meat, because we have to invent justifications in order to convince ourselves that eating meat is—well—not murder." Such rhetoric suggests that the meat industry might not have developed a satisfactory answer to, "Should you eat meat?" Humans benefit biologically from meat consumption because, to replenish the human body, we need to consume things that are chemically most like ourselves and because, to most of us, it tastes good (Gary C. Smith; *Angus Journal*; May, 2005). Steve Bjerklie (MEATPOULTRY.com; December 9, 2009) says (a) the nutritional argument is countered by the fact that it is possible to stay healthy without eating any meat at all; (b) the quality-of-life argument—nothing in the world tastes quite like a bite of perfectly prepared meat—is subjective; (c) the other arguments—historical, agricultural, industry-executive, no-worse-than—all have weaknesses due to their nonsubstantive logic, intellectual dishonesty, or lack of resonance with those who support sustainable food production; and (d) the question should be, "Are there consequences to eating meat?", and because those consequences include death as well as life, our ethical and moral imperative is to set and accomplish the highest standards for both. Meat scientists should deliberate upon and prepare to answer that question. Some people do not eat meat or certain kinds of meat because of their religion; vegetarianism; or compassion, conscience, and concern. Survey results indicate that 2 to 7% of Americans regard themselves as vegetarians, but less than 1% completely exclude meat, poultry, fish, and shellfish from their diets (Kathleen Meister; *Vegetarianism*; July 1997). Some longtime vegetarians have shifted to become flexitarians, allowing themselves to enjoy some meat—especially if it is grass fed, organic, or natural (*Newsweek*; January 4, 2010). For meat scientists to effectively engage present or prospective vegetarians, it helps to know more about their rationale. The top five reasons people become vegetarians are personal health, concern for animal welfare, influence of family and friends, concern for the environment, and ethical or spiritual reasons (*Vegetarian Times*, 2000; John Maday, *Drovers*, January 4, 2010). People will continue to eat meat in 2011 and beyond despite attempts by media, animal activists, vegetarians, and others to convince folks otherwise—especially if we help convince them it is okay.

BACK TO THE BOOKS; TURN THE PAGE

Meat science professors must insist that students are prepared for problem solving, critical evaluation and interpretation of information, and understanding the issues they will encounter in the real world. As an instructor at Washington State University in 1961, I taught Farm Meats. The objective of the course (98% art and manipulative skills, 2% science) was to prepare students that would become farmers and ranchers to harvest cattle, sheep, and swine; disassemble the carcasses; and cut, process, preserve, and package the meat—for their own and their family's consumption. In 1981, at Texas A&M University, the catalog description of Meats read "integrated studies of the meat-animal processing sequence regarding the production of meat-type animals and the science and technology of their conversion to human food." This course involved 90% science plus 10% art and manipulative skills. At Colorado State University in 2010, we teach Principles of Meat Science; it is described as "structure, composition and biology of muscle and associated tissues; wholesomeness, nutritive value and palatability of beef, pork and lamb" and involves 95% science and 5% art. Few of our graduates return now to farms and ranches, so there is little need to know how to generate, prepare, and preserve home-grown supplies of meat. Many enter the business world or enroll in graduate school or professional studies. If their ultimate vocation is in the meat industry, abilities to memorize and regurgitate facts and figures or to perform manipulative skills are inadequate predictors of their ultimate success. As meat science professors, we must recognize that today's students can access information instantaneously by use of the Internet, so there is no need to waste brain cells by trying to memorize a mountain of information. Instead, we must restructure our teaching plans to emphasize accessing the necessary information, critical evaluation and interpretation (as well as qualitative assessment) of the information they access, and the process of integrating the information to form plans designed to solve problems. Assuredly, we must have previously exposed them to sufficient details and real-world circumstances to enable them to understand issues relevant to the field; otherwise, they will not be able to qualitatively assess the information they access. I foresee a classroom of the future in which each student has a computer and the professor enters and announces, "The problem today is that the muscles in our cured hams are turning green during storage. You have 50 minutes to design a plan of action for identifying the cause of this anomaly. Turn in your plan by the end of today's class. We will discuss your plans in the next lecture period. Come to class next time with a critique of your own plan." Surely, this is a more likely occurrence in a real-world job circumstance than having your boss come to your desk and ask you to list, in order, the top 10 countries in poultry production. For those of us who work in academia, we must prepare our students—and successors—to compete in a quite different world; otherwise, we should receive a failing grade.

DISCIPLINES IN YOUR RESEARCH TOOLBOX

Success in receiving competitive-grant funding to investigate meat science problems will favor those using biochemical, microbiological, or biotechnological disciplines to identify solutions. When I advanced from instructor to assistant professor, my university appointment

changed from 100% teaching to 70% research and 30% teaching. It was difficult to decide what to research, but I did not have to worry about money. The department head had given me a budget. I just had to convince him that the target was right and that the experimental design was appropriate. If he did not approve my project, I could try to convince a company, contracting organization, or granting agency to fund it, but with no reputation, no connections, and no research track record, that was seldom successful. By the time I served as a department head, experiment station funds were dwindling and researchers were expected to obtain grant and contract funds to support more than half of their research programs. At Colorado State University, I received no research funding from the administration and was expected to attract enough grants and contracts to substantially reward the university with indirect costs. I have observed—during these past 20 years at Colorado State University—that those who, like me, conduct applied meat-science research are having progressively greater difficulty sustaining a viable university research program. Those whose research programs are flourishing conduct basic research with strong emphasis on biochemistry, microbiology, and biotechnology. Thomas Powell (*AMSA Newsletter*; January 8, 2010) described the future of meat science research as consisting of three immediate priorities that cross animal-species boundaries and are of concern around the world; these are (a) the nutritional role of meat in a healthy diet, (b) the ongoing perception and realities of food safety and risk, and (c) the effect of a growing animal rights movement worldwide. To those, I would add a need for research on the sustainability and environmental effects of various systems for producing meat animals and on the palatability, safety, and healthfulness of the resulting meat. I also suggest that university meat scientists conduct further research on all additives and preservatives, used to manufacture processed meat, that are presently described in ingredient statements by use of chemical nomenclature; we need more ammunition to defend the necessity of their use. In addition, although our administrators will complain about the lack of indirect costs from grants and contracts funded by most commodity groups and associations (e.g., National Pork Producers Council, American Meat Institute Foundation), meat scientists must continue to conduct research of immediate importance to the meat-animal industries. I remain convinced, however, that those who expect to conduct research, in a university setting, must have at least one discipline in their toolbox to help them establish and sustain a viable research program.

PARTICIPATION IN THE SECOND GREEN REVOLUTION

In the next 40 years, the world must produce more food than we have in the last 10,000 years; that is a daunting food-security task. Lowell Schake (Food Facts Coalition; April 14, 1992) said, "Had people remained hunters/gatherers, the maximum sustainable human population on planet Earth would have been 30 million." On March 15, 2010, there were 308,873,781 people in the USA and 6,808,697,752 people on Earth; we adequately feed 85% of those (the world's hungry has now reached 1 billion people because of war, drought, political instability, high food prices, and poverty; Alessandra Rizzo; Associated Press; June 20, 2009). By 2050, experts predict that the world's population will be between 9 and 10 billion. Globally, the livestock sector now produces 228 mmt of meat and by 2050 will need to produce 446 mmt (United Nations-FAO; 2010). Norman Borlaug, father of the Green Revolution, said, "The world has the technology to feed, on a sustainable basis, a population of 10 billion people. The more pertinent question is whether farmers and ranchers will be permitted to use this new technology. While the affluent nations can certainly afford to adopt ultra low-risk positions and pay more for foods produced by the so-called 'organic' methods, the one billion chronically undernourished people of the low income, food-deficit nations cannot" (*Drovers*; October 26, 2009). Jacques Diouf (United Nations) said, "Organic farming makes healthy food and boosts farmers' income but it cannot feed the world's billions of hungry people" (Reuters; December 10, 2007). Jeff Simmons observed that "70% of what must be achieved in world food production by 2050 can be achieved through technology but only if we do not allow a vocal minority (5% of the US population) to drive the 'green-push' for organic and natural products, and only if we do not allow a second vocal minority (another 5% of the US population) based on luxury extremism, to restrict food choice and turn their choice into policy" (International Livestock Symposium; January, 2010). Bill Gates, who has infused $1.4 billion into agricultural development in Africa and South Asia, said, "Environmentalists are standing in the way of feeding humanity through their opposition to biotechnology, farm chemicals and nitrogen fertilizer" (Greg Henderson; *Drovers*; January 4, 2010). Agriculture can provide the food we eat, the feed for our livestock and companion animals, fiber for our clothes and homes, flowers for the environment, and the fuel we need—if the countries develop the needed information, knowledge, and technology (CAST Issue Paper 45; January, 2010). An international panel of scientists urged world leaders to dramatically alter their notions about sustainable agriculture (to prevent a major starvation catastrophe), get beyond popular biases against the use of agriculture biotechnology, and base the regulation of genetically modified crops on the best available science (*Science*; February 12, 2010). Meat scientists must defend the use of appropriate technology in the production of both plant and animal foods and help develop the new technology that will be needed to feed a hungry world.