Pitch perfect

In his new role as director of UW-Madison's Meat Science & Animal Biologics Discovery program, **Steven Ricke** aims to strike a balance among traditional, applied and blue sky meat science.

by **Julie Larson Bricher, science and technology editor**

Steven Ricke is in the zone as he strides through the halls of the state-of-the-art Meat Science and Animal Biologics Discovery (MSABD) facility at University of Wisconsin-Madison. He's talking with his signature enthusiasm about his role as MSABD director, his vision for the program, his career in meat science — and being a baseball fan.

"The MSABD program and this facility is a whole new ballgame," Ricke smiles, pointing out the building's modern features like a batter gesturing at the stands where the home run hit will land. "You know, it's a real 'build it, they will come' scenario for meat and poultry industry partners, research collaborators across campus and other institutions, and students and faculty. I think that this really is a field of dreams for meat science and discovery."

Ricke comes by the baseball metaphors honestly. He developed a love of America's pastime at a young age as he passed the time listening to St. Louis Cardinals day games on a transistor radio while milking on the family farm in south central Illinois.

Previous to joining UW-Madison, Ricke served as the Wray Endowed Chair in Food Safety at the University of Arkansas, where he was also the director of the Center for Food Safety. His research program in the division's Arkansas Agriculture Experiment Station was primarily focused on salmonella, with projects spanning more than 15 years.

The award-winning microbiologist and poultry researcher even likens his internationally recognized work in food safety to baseball.

"People in baseball, just like in science, are constantly trying to model," Ricke explains. "And food safety's probably not a bad parallel with baseball, because people are always trying to model and make it predictable. And, as I've always argued, the pathogens don't always get that memo."

Photography by Tom Grimm

> **Problem solving** *is one of the really exciting and rewarding aspects of what I do.*

Meatingplace had the opportunity to chat with Ricke to find out more about how the MSABD program is swinging for the fences in advancing traditional, applied and blue sky meat science, and how meat and poultry processors can improve their RBI stats when it comes to scientific innovation.

Meatingplace: How did you get into meat science and the meat industry as a career, and what do you like most about it?

RICKE: I started out in ruminant nutrition at the University of Illinois, working with beef cattle and cannulated sheep. In the process, I became interested in rumen microbiology, and moved to the University of Wisconsin to start my Ph.D. program as a double major in bacteriology and animal science under Dan Schaefer. While at Wisconsin, I got to know the poultry scientist Dr. Mark Cook, and collaborated with him on some poultry research. After completing a post-doc at North Carolina State to gain a molecular background, I came across a faculty position in the poultry science department at Texas A&M University to do food safety work with salmonella. This was pretty much the start of my work in food safety and poultry meat microbiology.

In general, what I like most is the opportunity to apply science to solve issues in the meat industry. Problem solving is one of the really exciting and rewarding aspects of what I do. More specifically, the opportunity to apply the most advanced microbiological techniques to the science of meat microbial ecology really intrigues me. This remains a fairly unexplored area, and there is considerable need for this in the meat industry. How to make it applicable to the meat industry is the challenge, [and] that excites me!

Meatingplace: Tell us a little about your new role with University of Wisconsin's Meat Science and Animal Biology Discovery (MSABD) program.

RICKE: In general, my job is two-fold. First, it's to apply leadership on what this program's unique blend of traditional meat processing, food safety and biologics will look like. The building and facilities are designed to make them interconnected. The challenge is to simultaneously conduct independent research projects in all three areas under the same roof, but look for ways to merge and blend these concepts into multidisciplinary-oriented projects.

Second, biologics remains a fairly unfamiliar concept to traditional animal sciences, even though it is, in reality, a natural direction for further meat processing. What we've got to do is come up with a practical way for industry to implement it. It's one thing to say you ought to be harvesting tissues for specialized enzymes, but how do you work that into a traditional processing line? So, that's part of my role, too. We need to listen to industry, identify their problems — and in the case of biologics, their opportunities — and really be leaders on solutions.

Meatingplace: What is the vision for the new MSABD program?

RICKE: Our overall mission at MSABD is to be a place to discover, learn and advance meat science for students of all ages and companies of all sizes. My personal vision is to accomplish this is in the three areas I just described: meat processing, food safety and biologics. For meat processing, we have brand new world-class facilities that accommodate whatever we wish to pursue. Consequently, we can do anything from live animal; to ready-to-eat meat products in USDA-inspected facility by doing research for testing ideas; providing instruction, hands-on experience; as well as extension-based workshops.

Read more about MSABD at meatm.ag/msabd

For food safety, the vision at MSABD is to be the place where microbiologists and meat scientists work to keep consumers safe by ensuring safe food. We have the capabilities to accomplish this with Biosafety Level-2 containment, meat processing functions, microbiology lab, equipment sanitation evaluation, and pathogen-inoculated animal harvest capability.

For biologics, we plan to embrace Mark Cook's initial vision. He famously said, 'All of those molecules in the gut pile are used to keep the animal alive. There should be some useful molecules there.' Biologics are essentially molecules or tissues extracted from harvest co-products that could be repurposed for added value related to animal or human health benefits. This means determination of extractability, yield and biological effectiveness, followed by a first draft for path to commercialization. And, part of that vision is answering

SCIENCE CRED

NAME
STEVEN RICKE, PH.D

TITLE
DIRECTOR, MEAT SCIENCE AND ANIMAL BIOLOGICS PROGRAM, DEPARTMENT OF ANIMAL AND DAIRY SCIENCES

ORGANIZATION
UNIVERSITY OF WISCONSIN-MADISON

EXPERIENCE
DONALD "BUDDY" WRAY ENDOWED CHAIR IN FOOD SAFETY AND DIRECTOR OF THE CENTER FOR FOOD SAFETY, UNIVERSITY OF ARKANSAS; PROFESSOR, POULTRY SCIENCE DEPARTMENT, TEXAS A&M UNIVERSITY

RECENT HONORS
NATIONAL CHICKEN COUNCIL BROILER RESEARCH AWARD (2020); POULTRY SCIENCE ASSOCIATION EVONIK AWARD FOR ACHIEVEMENT IN POULTRY SCIENCE (2019); INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION FELLOW AWARD (2019); UNIVERSITY OF WISCONSIN COLLEGE OF AGRICULTURAL AND LIFE SCIENCES DISTINGUISHED ALUMNI (2019); WILLIAM C. FRAZIER LECTURE MEMORIAL LECTURESHIP IN FOOD MICROBIOLOGY, UW FOOD RESEARCH INSTITUTE (2017)

NOTABLE
CO-FOUNDER AND FORMER PRESIDENT, ARKANSAS ASSOCIATION OF FOOD PROTECTION; AMERICAN SOCIETY FOR MICROBIOLOGY DISTINGUISHED LECTURER (2015-2017)

AFFILIATIONS
POULTRY SCIENCE ASSOCIATION; INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION; AMERICAN SOCIETY FOR MICROBIOLOGY

EDUCATION
B.S., M.S., RUMINANT NUTRITION, UNIVERSITY OF ILLINOIS AT CHAMPAIGN-URBANA; PH.D., BACTERIOLOGY AND ANIMAL SCIENCE, UNIVERSITY OF WISCONSIN-MADISON

FAVORITE QUOTE
EVERY CALLING IS GREAT WHEN GREATLY PURSUED. (OLIVER WENDALL HOLMES, JR.)

a question posed by our MSABD Advisory Committee: "Could the value of the non-meat portion of the animal exceed the value of the meat?"

And so vision-wise, that's what is exciting for me. It is a huge challenge, figuring out how to blend those three pieces and come up with a coherent message. I think they are interconnected, and part of the job is figuring out how they're interconnected. That's part of the fun and challenge, and with the faculty we have and the graduate students coming in, the new facilities and so on, I think we're in a great position to meet that challenge.

Meatingplace: What do you think are the top scientific advances made in recent years in meat and poultry processing?

RICKE: I think there's a few. First, whole genome sequencing has become a game changer in terms of identifying and tracking foodborne pathogens through the supply chain. We can now pinpoint precisely the serovar and strain of a particular foodborne pathogen such as salmonella. This is important, as there are over 2,500 serovars of salmonella, and it does matter which a particular isolate is in terms of potential to cause disease and therefore, the highest risk. This, in turn, has led to a better and wider range of molecular-based detection tools with more genetic precision. This is also leading to advancements in quantitation.

Second, I would say, is the introduction of microbiome sequencing into preharvest gut microbiology. This has really helped us understand gut microbial ecology as it develops during the lifetime of the animal, and how certain feed additives impact that ecology and the pathogens' ability to colonize in their presence. Gut microbiome characterization has led to potential applications for monitoring gut health and animal performance among others. This is exciting, because this helps to approach animal production research and applications at a systems level.

> *We need better detection tools that not only detect but quantify pathogens in real time.*

Also, microbiome mapping for meat processing, while not as far along in advances as the preharvest side, is becoming increasingly better. There are numerous opportunities to use this technology to better understand not just the microbial ecology of the meat, but also of the processing plant environment and how those two interact with each other. With the new MSABD BLS-2 facilities, we can do microbiome mapping in the presence of specific pathogen loads to determine such things as which organisms are the best indicators for pathogens.

Meatingplace: How important is the data we're getting today from microbiome research?

RICKE: I think what we're realizing with the microbiome data is that these microbial communities are very interactive. They communicate with each other, and the pathogens communicate and interact with the non-pathogens in the community. I mean, they're in the neighborhood and they're all trying to coexist, and it's highly competitive. It's classic microbial ecology.

Often, the drivers for those interactions are real simple things to a pathogen like salmonella. The trigger might be, 'I'm starving. I need nutrients, and these other organisms are starving me out, so what am I going to do to get them?' And so, the salmonella uses its toolkit to become invasive, such as making toxins to kill the cell or making proteins that allow it to invade the cell to obtain those nutrients. And I think understanding those triggers will help us to better predict under what conditions you're going to make salmonella mad, and it's going to do these things and cause a food safety issue.

So, those are the kinds of answers I think we can get out of microbiome data. It helps us connect the dots and figure out what the microbial ecology triggers are, what's driving things, why organisms are constantly changing, and what risk they pose. And, that will help us predict food safety problems in order to develop better ways to prevent them.

Listen to Ricke on MeatingPod at meatm.ag/ricke

Meatingplace: Speaking of pathogens, during your career, you've focused quite a bit on salmonella and campylobacter, and their impact on poultry operations. What is the state of the science, and what do you think are the continuing challenges for processors in controlling or mitigating this hazard?

RICKE: I think we have developed a much better understanding of the biology of these foodborne pathogens. This understanding has led us to realize how complicated and complex they are both in preharvest and post-harvest animal production. Consequently, the ability to limit or minimize them continues to be difficult to pin down. And, we have encountered some surprises. For example, we are now realizing that both interact with the native nonpathogenic gut microbial populations.

But they are different in how they interact. I think the biggest challenge is coming up with strategies that couple preharvest control with lowering post-harvest levels. To accomplish this, we need better detection tools that not only detect, but quantify pathogens in real time. We also need to develop multiple hurdle strategies for preharvest control of pathogens. This means examining a wide range of feed additives that not only decrease pathogens in the gut, but additives that prevent colonization.

And, I think having rapid quantitative tools is another big challenge. The industry's moving in that direction, and the allied industry is developing tools to do that. We need that, because quantitative risk assessment is very dependent on pathogen numbers. And I think risk assessment is the appropriate way to go. I mean, which is more dangerous — one viable salmonella per chicken carcass, or a million viable salmonella per chicken carcass? They're very different. One is a more minimal risk, one is a more definite risk, and we need that information to evaluate the effectiveness of processing interventions.

I always tell people that the secret to microbiology is knowing your organism.

If you know it well enough, you can predict its vulnerabilities. I think sometimes we ignore that aspect of it, and we try to engineer a solution as opposed to developing an understanding of the problem.

Meatingplace: As a food safety scientist, what excites you most about the advances the industry is making in terms of improving food protection throughout the supply chain?

RICKE: In general, I think there is much more awareness of food safety issues throughout the supply chain, from farm to fork. This is becoming true not just for the food animal industry, but in the fresh produce industry as well. In addition, I think there is much faster adoption of new tools by industry in general as they become available, whether it be better detection methods or new interventions.

Also, I think food safety, in general, is moving into more of what I call a 'mechanistic mentality,' as opposed to a 'We just need to kill the organisms' mindset. Understanding the microbiome and those mechanisms in organisms and their communities is really important, because then you can start to predict risk for a pathogen becoming virulent. And beyond that, there is much more of a prevention mentality about food safety today, rather than the historical reactionary response to an outbreak once it has occurred. In other words, if we know what the mechanisms are, we can look at how to prevent the problem from occurring in the first place.

> ***We'd like home runs, but singles every now and then are just fine. I mean, a single still moves the runner closer to home.***

This proactive approach bodes well for the future of food safety. Prevention is always the more desirable outcome, obviously. And I think those are the tools that the industry needs.

Meatingplace: In your opinion, what is the most significant challenge the meat and poultry industry will face in the next five years?

RICKE: I think one of the biggest challenges is finding and retaining a sufficient labor pool for the meat industry. The pandemic contributed to this, and perhaps accelerated awareness of it as a looming issue. This, in turn, has spurred renewed interest in introducing automation to processing, and there is research being done both at universities and by industry.

The challenge will be how to engage food safety monitoring into these more automated systems. But I think the near-term challenge is how do you get traditional food safety intertwined with automated systems? In other words, how do you get an interface to where it's practical?

I think automation potentially eliminates some food safety issues, because you certainly take the human element out of it in terms of cross-contamination, et cetera. But, you're probably going to have unanticipated problems that emerge from automation, since you also don't have as many eyes on it anymore. And so, you're going to have to balance. This will probably require more research to develop real-time online sensor strategies, because you're going to have to have some way to have eyes on that process.

Let's face it: We'd like home runs, but singles every now and then are just fine. I mean, a single still moves the runner closer to home. I do think that is part of the challenge. I think we try too hard to hit home runs, and we don't realize that it's okay to get to a solution in a stepwise fashion, because that gives you a chance to pivot if you need to. For every advancement, there always is going to be a series of unintended consequences that we haven't thought about. And that's where the singles versus home run analogy comes in, because I think singles buy you time to be able to encounter those unintended consequences before you make a big decision or change.