Fifth Anniversary!

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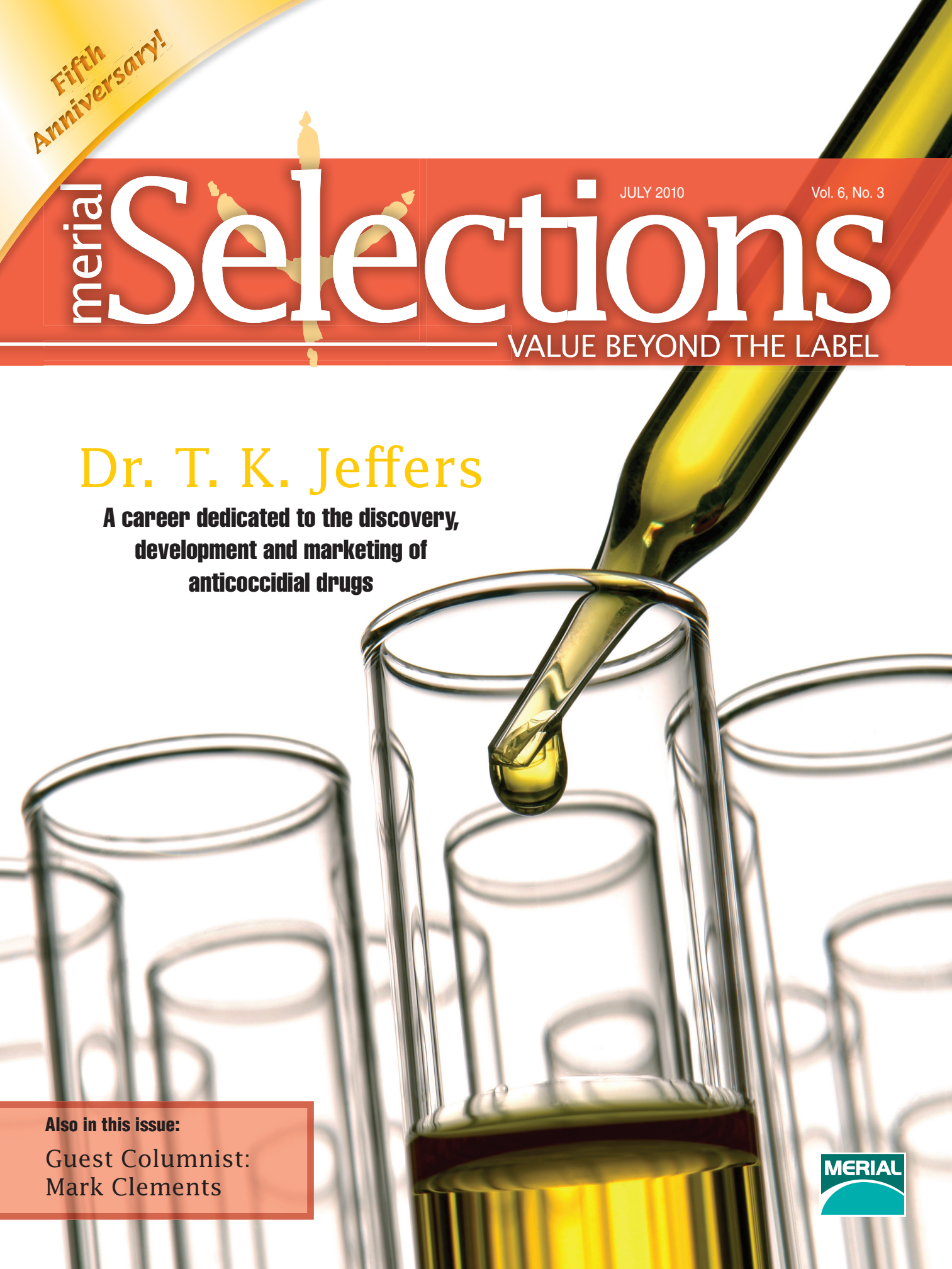

Dr. T. K. Jeffers

A career dedicated to the discovery, development and marketing of anticoccidial drugs

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Guest Columnist:
Mark Clements

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Dr. T. K. Jeffers

A career dedicated to the discovery, development and marketing of anticoccidial drugs

Dr. T.K. (Tom) Jeffers devoted his career to animal health research and research administration, specializing in the discovery, development and marketing of anticoccidial drugs, the study of poultry coccidia and methods for attenuation, and the development of coccidiosis vaccines.

His discovery of precocious lines of coccidia opened the door for the first attenuated anticoccidial vaccine. He co-invented Maxiban (narasin and nicarbazin) and helped obtain FDA approval for Monteban (narasin) and Maxiban as anticoccidial medicines. He has written or co-written more than 50 articles in scientific journals and book chapters.

Looking back over this distinguished career, he credits his work ethic, curiosity, interest in poultry and interest in coccidiosis to his upbringing on his family farm in upstate New York.

Early years

Dr. Jeffers was born in 1941 in Syracuse, New York. That same year, his father, a horticulturist and 1932 Cornell graduate, left his job as a Lake Ontario Park Foreman for the Civilian Conservation Corps and paid $5,000 cash for 100 acres of land outside Auburn, New York, to start a small farm and nursery business.

Jeffers recalls, "We always had animals…to feed the family. There was a vegetable garden in the summer. There was very little purchased outside the home." Living through the Great Depression had changed his parents and they wanted to live a more rural and self-sufficient lifestyle. He explains, "There was always food on the table and you always ate together, and you always had the happiness that went with a close-knit family." Jeffers continues that they were "country people back then. You were poor, but didn't know you were poor."

> "I became what I call a scientific cheerleader, really interested in what the scientists were doing and trying to encourage them."

His first interest in poultry came when he joined 4-H at quite a young age. The local Kiwanis Club was sponsoring a poultry 4-H project and he was able to join for free. His project was to raise 25 straight-run Rhode Island Red chicks to adulthood. There was a big obstacle to overcome at the onset, Jeffers recalls. "One of the requirements, which was pretty challenging for a nine year old, was …that you had to kill and dress a rooster and present that to your sponsor at the Kiwanis meeting." There are complications when a chicken dies, such as the severed body having a mind of its own, and as a 9-year-old, Jeffers thought this was "a little bit disturbing."

Though he was also very involved in Boy Scouts and was a Star Scout by the time he graduated high school, Jeffers remembers his experience at 4-H as doing more for him than any other youth organization. "It gave me responsibility," he explains. "I developed a little neighborhood egg route and that also taught me the first elements of entrepreneurship." He also "learned about commitments to time and how to get in front of people and present your thoughts. And most importantly, how you think on your feet."

At home, his father had tried unsuccessfully to partially supple-

ment the family's income with a flock of about 200 chickens. The birds were kept close together, making transmission of parasites very easy, and there were no medications at the time for diseases in poultry. His father did not think his son's 4-H project was a good one and told his son, "I couldn't raise chickens because of coccidiosis." But young Tom didn't worry. His flock was small, and they were range-reared. They went outside for the summer and only came back in to lay. "They sort of immunized themselves," he reasoned. But what his father said about coccidiosis would have an impact that he did not yet understand.

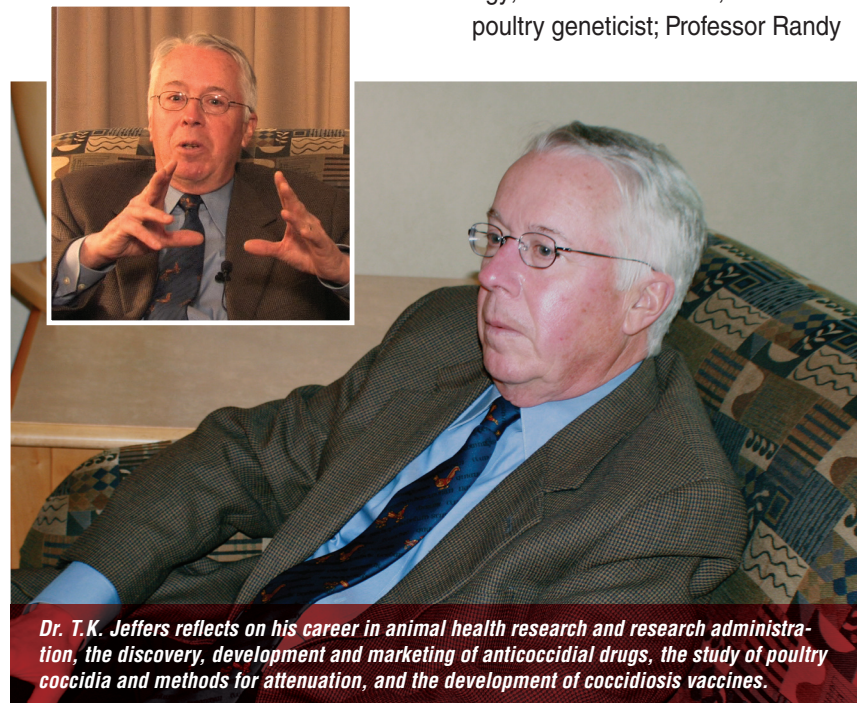
He was active in 4-H through high school and gave many demonstrations on how to get a rooster or hen ready to show at an exhibition. They had to be conditioned, cleaned and trained to be docile for the judges. He remembers one hen fondly. "She was a well-trained actress. She would do anything I asked her to do."

During his high school years, Jeffers was given a spot on the 4-H state poultry judging team. He and the other three members, along with the 4-H State Coordinator, Professor Edward Schano from Cornell University, traveled to other states for competitions, which he recalls as a "fantastic experience." His "first time in the big city" was a trip to the Boston Poultry Show. To this day, he remembers a dinner at the city's still-famous Durgin-Park restaurant, where the prime rib was so big it spilled "right over the edge of the plate."

Academic Life

When it was time to decide what to do after high school, Jeffers says, "I thought, if I have this interest in poultry, maybe I could pursue it at the collegiate level." Both of his parents were Cornell University graduates, and the school had a good Poultry Science program. He could attend at less cost being a state resident and, Jeffers jokes, "As a legacy, I probably got in with less scrutiny." So, in 1959, Jeffers became one of four Poultry Science Majors in the College of Agriculture at Cornell University in upstate New York.

"The Poultry Science Department doesn't exist as a stand alone department any longer," Jeffers laments, "because a number of years ago, it was incorporated into the Animal Science Department." He continues,



Dr. T.K. Jeffers reflects on his career in animal health research and research administration, the discovery, development and marketing of anticoccidial drugs, the study of poultry coccidia and methods for attenuation, and the development of coccidiosis vaccines.

"There are relatively few stand-alone poultry science departments now, which is regrettable." He explains that the egg industry, as a large supporter of poultry research, has been a driving factor in the consolidation of the programs across the country.

The College of Agriculture had a farm practice test requirement for incoming students, in order to confirm a general knowledge of current agricultural practices. Jeffers still gets a chuckle about the city boys there who had never been on a farm being asked to back up a manure spreader and distinguish a rooster from a hen. He, of course, passing the exam with flying colors, while those who did not pass the test were required to "intern" on a farm during their summer vacation in order to continue their enrollment into their sophomore year.

At the time, Cornell had many distinguished and well-known faculty members devoted to various aspects of avian research: the Romanoffs, pillars of avian embryology; Professor F.B. Hutt, a famous poultry geneticist; Professor Randy Cole, an expert in the genetics of disease resistance; and Dr. P.P. Levine, a renowned "coccidiologist", just to name a few. He felt honored to learn from these wonderful educators and leaders in their fields.

While getting his undergraduate degree, Jeffers was on Cornell's poultry judging team, coached by Professor Dean Marble. They traveled to other colleges in the East, judging poultry based on breed identification,

standards of perfection, and carcass quality. It was more advanced and competitive than his judging with 4-H, but also a lot of fun competing with students from other universities. Jeffers admits, "I had a good time at Cornell. Such a good time, that around my junior year, Professor Cole pulled me aside and said, "What do you want to do? Are you preparing to be a poultry farmer?" I told him that I hadn't thought much about it, and he said "you better start thinking about it pretty seriously."

Jeffers credits Professor Cole with changing his academic life and preparing him for his eventual professional career. Cole set up a senior research project for him studying the genetics of incomplete albinism, a sex linked trait in chickens. The project resulted in a paper being published in the journal *Nature* in 1963 (Cole, R.K. & Jeffers, T.K. 1963. Allelism of Silver, Gold, and Imperfect Albinism in the Fowl. *Nature*. 200, 1238 – 1239.). "I've never had anything I've been prouder of than that," says Jeffers. It inspired his serious interest in science, and he decided to apply to graduate school.

When he thought about what he wanted to study, he thought back to his father's concerns about coccidiosis shutting down his interest in raising poultry in the 1940's. He was accepted into the coccidiosis program at the University of Wisconsin in 1963. He arrived on Labor Day weekend and was immediately given an extensive reading assignment by his major professor. He had to read two papers by E.E. Tyzzer (Tyzzer, E. E. Coccidiosis in gallinaceous birds. *American Journal of Hygiene*. 10:269–384.1929 and Tyzzer, E. E., H. Theiler, and E. E. Jones. Coccidiosis in gallinaceous birds. *Am. J. Hyg*. 15:319–393.1932.) and, having read these two classics in coccidiosis research, decide what he wanted to concentrate on in his own graduate research. These papers inspired him then and he treasures them as bound volumes in his rare book collection today. He dedicated his studies to the genetic basis for resistance to coccidiosis in chickens and committed to a five-year PhD program combining two majors, Zoology (parasitology research) and Poultry Science.

While working on his PhD, Jeffers met Gretchen, an undergraduate majoring in Journalism. To pay some of his school expenses, he had a job as House Fellow for the Alpha Gamma Rho fraternity on campus. It was a rule that the undergraduates had to introduce their dates to the House Fellow. When she came to a dance as the date of an undergrad, they were introduced. But, Jeffers says, "She didn't remember my name a week later when I saw her on campus." He re-introduced himself and they started dating and eventually married in 1967.

The T. K. Jeffers 60 year plan

With appreciation to Liberty Hyde Bailey

1941	Father left Civilian Conservation Corps to become small farm & nursery businessman
1950	Raised 25 Rhode Island Red chicks to adulthood as Kiwanis sponsored 4-H project
1959	Attended Cornell University, New York as Poultry Science Major, Cornell poultry judging team
1963	Published Allelism of Silver, Gold, and Imperfect Albinism in the Fowl, in the journal *Nature*
1963	Attended University of Wisconsin for coccidiosis program
1967	Married sweetheart Gretchen
1969	Head of Parasitology at Hess and CLark
1970	Daughter Andrea born
1971	Elanco Animal Health introduces Coban, first ionophore for use in livestock
1973	Son Gregory born

Career

After school, "it was time to get a real job, as my Dad used to say," jokes Jeffers. He went to work for the Canadian Department of Agriculture as a Research Scientist in Ottawa, Canada, because of their interest in the genetics of disease resistance in poultry. However, their focus was on resistance to Marek's disease, not coccidiosis, so when he was offered a position with Hess and Clark, a manufacturer of animal health products in Ashland, Ohio, with a dedicated coccidiosis research program, he accepted. He was their Head of the Parasitology Section from 1969 to 1974.

His "big breakthrough" came in 1974 with his discovery of precocious-

Hear the interview
http://www.WATTAgNet.com/Merial12.aspx

ness in coccidia, which led to the development of the first attenuated anticoccidial vaccine. He had been largely "on his own" as a scientist at Hess and Clark and decided to revisit Tyzzer's papers for inspiration and direction. "Serendipity still plays a role in science," he explains. He decided to work on Tyzzer's unfinished experiment comparing a rapid and slow-

vaccines, or in the use of this method to produce their own vaccine" so, in 1974, Dr. Jeffers was invited to join Eli Lilly and Company in Greenfield, Indiana, and accepted a position as Research Scientist. He was presented with the P.P. Levine Research Award at the annual meeting of the American Association of Avian Pathologists (AAAP) in Anaheim,

quickly about commercial production concerns. "Whenever you have an anticoccidial chemically related to one already on the market," he explains, "you're always concerned about its resistance and the whole

1974	Discovered precociousnes in coccidia, leading to first attenuated anticoccidial vaccine, joined Eli Lilly and Company as Research Scientist
1975	Received P.P. Levine Research Award, published 'Attenuation of *Eimeria tenella* through selection for precociousness' in *Journal of Parasitology*
1976	Published 'Genetic recombination of precociousness and anticoccidial drug resistance 'in *Eimeria tenella. Z. Parasitenk.*
1980s	Researched combinations of anticoccidials leading to Maxiban
2001	Retired
2003	Awarded Cornell University's outstanding Alumni Award
Present	Collaborates to complete Tyzzer's early contributions to the current understanding of the biology of coccidia, serves as Courtesy Professor of Animal Science at Cornell and Affiliate Professor of Poultry Science at Auburn with YourEncore

developing line of coccidia, but would use the *Eimeria tenella* species, which was less easily contaminated than the *E. necatrix* species which Tyzzer used in his experiments some 50 years earlier. "The practical importance of the discovery was two-fold: 1) every species of coccidia can be attenuated by selection for precociousness and 2) these strains are genetically stable and are thus useful in the development of attenuated coccidia vaccines.

While at Hess and Clark, Dr. Jeffers and Gretchen had two rather significant personal blessings as well: a daughter, Andrea, born in 1970 and a son, Gregory, born in 1973.

Hess and Clark was "in the business of anticoccidial medications, and therefore not interested in applying for a patent for the use of this method for producing attenuated coccidia

California, on July 15, 1975 and, in December that year, he published his citation classic (Jeffers, T.K. 1975. Attenuation of *Eimeria tenella* through selection for precociousness. *Journal of Parasitology.* 61: 1083-1090).

He published a follow-up manuscript (Jeffers, T.K. 1976. Genetic recombination of precociousness and anticoccidial drug resistance in *Eimeria tenella. Z. Parasitenk*. 50: 252-255), which established that precociousness is a genetic trait in coccidia, just as is anticoccidial drug resistance.

In 1971, Elanco Animal Health, a division of Eli Lilly and Company, introduced Coban, the first ionophore for use in livestock. By the time Jeffers began research for Lilly, Coban had captured the majority of the market share among anticoccidials approved for use in broiler chickens. He learned

concept of product positioning with other products in your portfolio."

Jeffers was the first Team Leader for the development of a second ionophore, Monteban (narasin) for use as an anticoccidial in broilers. He also worked on the FDA approval for monensin as an anticoccidial for turkeys. In the early 1980s, his team at Lilly began researching combinations of anticoccidials. As a result, he is a co-inventor of Maxiban, the trademark for Elanco's brand of narasin and nicarbazin.

"That was the formal end of my participation in research at the bench level," Jeffers says. He was asked to head up the entire Parasitology Research program in the Animal Health Research Department and then was promoted to Director of Animal Science Discovery and Development Research Department for Elanco

So the chicken came first, not the egg?

By Mark Clements, Editor *Poultry International* magazine

A partial answer may now be available to the age old question "What came first, the chicken or the egg?" The question is vexing, the answer complicated, but the process elegant, it would appear.

Researchers at the Universities of Warwick and Sheffield in the UK have found that "chicken", or at least a particular chicken protein, came first in the context. There is, however, a further twist in that this particular chicken protein turns out to come both first and last. The trick that it performs offers new insights into the control of crystal growth, which is key to egg shell production.

Researchers had long known that a chicken egg shell protein called ovocledidin-17 (OC-17) must play some role in egg shell formation. The protein is found only in the mineral region of the egg and laboratory bench results have shown that it appeared to influence the transformation of (CaCo3) into calcite crystals. However, it remained unclear how this process could be used for forming the eggshell.

The research teams have now created simulations that show exactly how the protein binds to the amorphous calcium carbonate surface using two clusters of "arginine residues", located on two loops of the protein and creating a lateral chemical "clamp" to nano sized particles of calcium carbonate.

While clamped in this way, the OC-17 encourages the nanoparticles of calcium carbonates to transform into "calcite crystallites" that form the tiny nucleus of crystals that can continue to grow on their own. But they also noticed that sometimes this chemical clamp did not work. The OC-17 seemed to detach from the nanoparticle.

The researchers had, therefore, uncovered an incredibly elegant process allowing highly efficient recycling of the OC-17 protein. Effectively, it acts as a catalyst, clamping on to the calcium carbonate particles to kickstart crystal formation and then dropping off when the crystal nucleus is sufficiently large to grow under its own steam. This frees up the OC-17 to promote more and more crystallisation, facilitating the speedy, literally overnight creation of an egg shell.

So without the chicken protein, there can be no egg formation. I think that answers the question, but if you are still unsure, visit the website of either the University of Sheffield or the University of Warwick.

Animal Health. "I became what I call a scientific cheerleader, really interested in what the scientists were doing and trying to encourage them."

Jeffers views each of his professional accomplishments as a privilege. He explains, "If you have the good fortune of having participated in the discovery, development and registration of a new anticoccidial, you'd feel like that was quite something. They don't always come along that often, and you're not always given the opportunity to be part of such a gratifying team effort, and I cannot understate that the progression of a new animal health product from discovery to product registration requires a monumental team effort."

Retirement and Family

"My father always said that you work until you can't physically work any longer, but I retired in April 2001 anyway." He remembers being told that Liberty Hyde Bailey, famous horticulturist and the first Dean of Cornell University's College of Agriculture and Life Sciences, reportedly had a life plan whereby, first 26 years would be spent on his formal education, his next 26 would be spent on his professional career, and the remainder would be spent on whatever he wanted to do. So, in appreciation of Dr. Bailey, Jeffers grins, "I came up with my own life plan." He would spend his first thirty years getting his education (actually beating that time by a couple of years), the next thirty in his occupation, and, at age 60, he would retire.

He and Gretchen moved to Skaneateles, New York, near Syracuse in the Finger Lakes, to spend more quality time with his parents, who were in a nursing home together. "We wanted to live out their lives with them at the time," Jeffers explains.

Still inspired by E.E. Tyzzer's research in 1929 and 1932, he has been collaborating with Dr. Ray Williams to more completely document Tyzzer's early contributions to our current understanding of the biology of coccidia. "I used to always laugh at older scientists, who once they retired, got interested in looking in the rear view mirror," he laughs. But now that he is one of them, he finds himself more interested in the history of science and learning how people lived and accomplished what they did.

Jeffers is very proud of his children. His son, Gregory, earned a

Master's in Food Science from Cornell University and now works for Gorton's in Gloucester, Massachusetts. His daughter, Andrea, earned her undergraduate degree in Communications from Cornell and her Master's in Agricultural Economics and Marketing from Michigan State University. She and her three children live nearby in Zionsville, Indiana, and she works out of her home for a market research corporation in Cincinnati, Ohio. Dr. Jeffers and his wife, now married for 43 years, moved to Zionsville after his parents' passing to be closer to their grandchildren. They recently acquired a summer home back in Skaneateles, NY and he and his brother keep busy each summer tending a vegetable and ornamental garden on the original family home place nearby.

Actively interested in the industry, Jeffers corresponds frequently with colleagues. He currently serves as Courtesy Professor of Animal Science at Cornell, Affiliate Professor of Poultry Science at Auburn University and Scientific Advisor with YourEncore, an organization matching scientists and experts with member companies on innovative projects. In 2003, he was awarded Cornell University's outstanding Alumni Award. He has always been involved with church, enjoys gardening and is an avid reader. He also does some not-for-profit volunteering and fundraising.

But "the smartest thing that I did in retirement is get myself a dog," Jeffers jokes. Their now 7-year-old Labradoodle named Madison enjoys her trips with Dad to play with her friends at Doggie Daycare, but especially loves her daily walks with him. They have an undeniable bond. "If I don't walk her, she nudges me until I do," Jeffers says. "My wife loves the dog, too, of course, but I'm the alpha."

He is concerned about the future of coccidia research programs, with changing priorities in research funding. When these programs fail to continue, he asks, "What goes by the wayside, too, are the different strains of coccidia that people have worked for years to isolate and characterize?"

Looking back at his distinguished career, Jeffers says there is one lesson he would pass to new and future scientists: "Don't assume somebody else has discovered something. Don't avoid trying something just because you think somebody else has tried something and it hasn't worked."

From his experience working on the management side of science, he has learned that money and recognition are not the keys to success. "The driving force for discovery is curiosity. Then, the key to taking that innovation and doing something with it," he affirms, "is applying the discovery to something that actually benefits mankind." **ms**

> "Don't assume somebody else has discovered something. Don't avoid trying something just because you think somebody else has tried something and it hasn't worked."

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