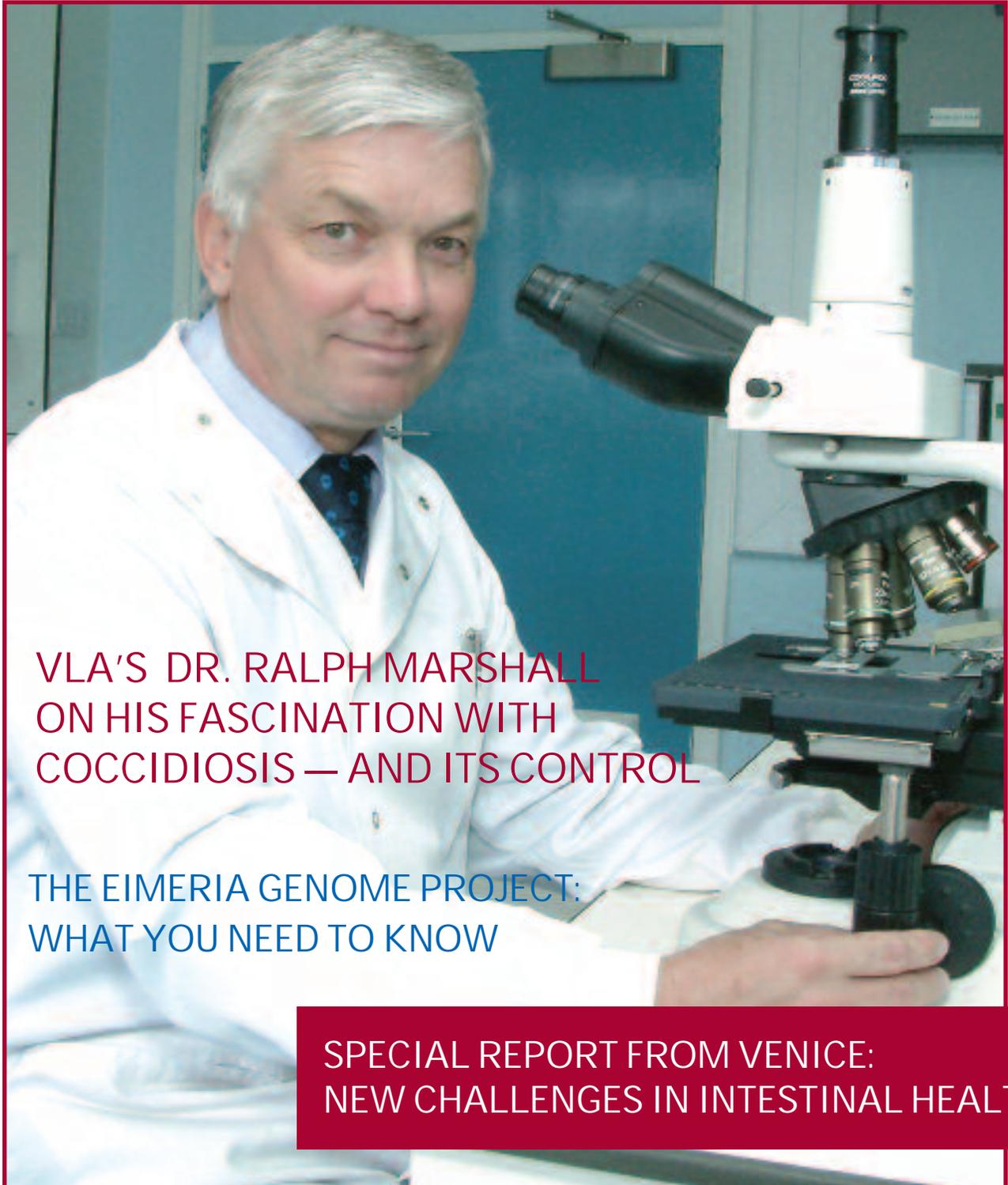


# COCCI FORUM



VLA'S DR. RALPH MARSHALL  
ON HIS FASCINATION WITH  
COCCIDIOSIS — AND ITS CONTROL

THE EIMERIA GENOME PROJECT:  
WHAT YOU NEED TO KNOW

SPECIAL REPORT FROM VENICE:  
NEW CHALLENGES IN INTESTINAL HEALTH

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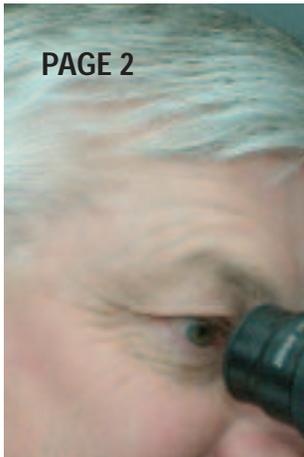
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Asking tough questions



*Cover: Dr. Ralph Marshall of Veterinary Laboratories Agencies, Weybridge, England, finds Eimeria organisms — the ones that cause coccidiosis — attractive, mysterious, clever and challenging. For more on his work and fascination, see page 2. Photo by Joseph Feeks.*

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## IN THE EYE OF THE BEHOLDER

*Eimeria* is the object of Dr. Ralph Marshall's fascination

To an outsider, studying *Eimeria* for a living is a far-from-glamorous job, but parasitologist Dr. Ralph Marshall considers the object of his work attractive, mysterious, clever and challenging.

He even has a favorite coccidial species — *Eimeria tenella*.



Marshall: 'Slowly we realized that these little parasites were winning.'

"Under the microscope, it has the most beautiful shape of all the *Eimeria* oocysts and a beautiful blue halo. It's as simple as that. I just love it," he says.

The scientist heads up coccidiosis research at the Veterinary Laboratories Agencies (VLA), an entity initiated over 100 years ago in a small London office. Today, VLA is located in Weybridge, England, and is an internationally recognized veterinary research center. It is a reference laboratory for many farm animal diseases and conducts

important studies for pharmaceutical companies.

Marshall came to VLA in 1971 and compares his work studying *Eimeria* to his favorite hobby — bird-watching. "There are a lot of analogies between the two," he says. "I love walking out in the field and being able to identify a bird. And I love being able to look down a microscope and identify a parasite. Both have taught me the skill of observation, which is key to parasitology."

Observation has also enabled him to witness an array of interesting developments over the years in the field of coccidial research.

### 'Brave new world'

When anticoccidial chemicals were developed and marketed, it appeared to herald a "brave new world," he says. Then the problem of *Eimeria* resistance to anticoccidials started to develop. Marshall spent several years studying the problem.

"Slowly we realized that these little parasites were winning. It was good fun working out the mechanisms of how the parasites were getting resistant to drugs," he says.

"We managed to develop lots of resistant strains here in the lab. We actually had one that got hooked on an anticoccidial. If we gave this particular *Eimeria* strain to chickens that were fed a particular anticoccidial, the parasites lived. If we withdrew the drug, the parasites died. The drug seemed to keep the parasites alive," Marshall says.

Recalling the advent of ionophores, he says, "The idea behind these drugs was *not* to wipe out the parasites completely."

Around that time, however, Marshall experienced a time warp when he moved to another department within VLA and temporarily lost track of coccidiosis research. He returned to his beloved field in the 1990s to find a newcomer on the scene: the attenuated coccidiosis vaccine Paracox, which has dominated his life for the past decade.

The poultry industry had difficulty adjusting to the notion of vaccinating poultry to control coccidiosis. “There was a total change in mindset from being told you have to get a drug to kill this parasite to then being told that you don’t want to use a drug, you can use a vaccine instead,” he says. “That was a difficult concept for producers to grasp.”

Today, coccidiosis vaccines are widely accepted in the breeder sector and in several countries, their use is growing in other segments of the market, including broilers and free-range laying hens, Marshall says.

### Testing sprayed vaccine

Marshall has also been involved in testing new methods of administering coccidiosis vaccines. About 6 years ago, he headed up VLA’s assessment of Schering-Plough Animal Health’s SprayCox II, a spray cabinet technology for application of Paracox-5 to broilers.

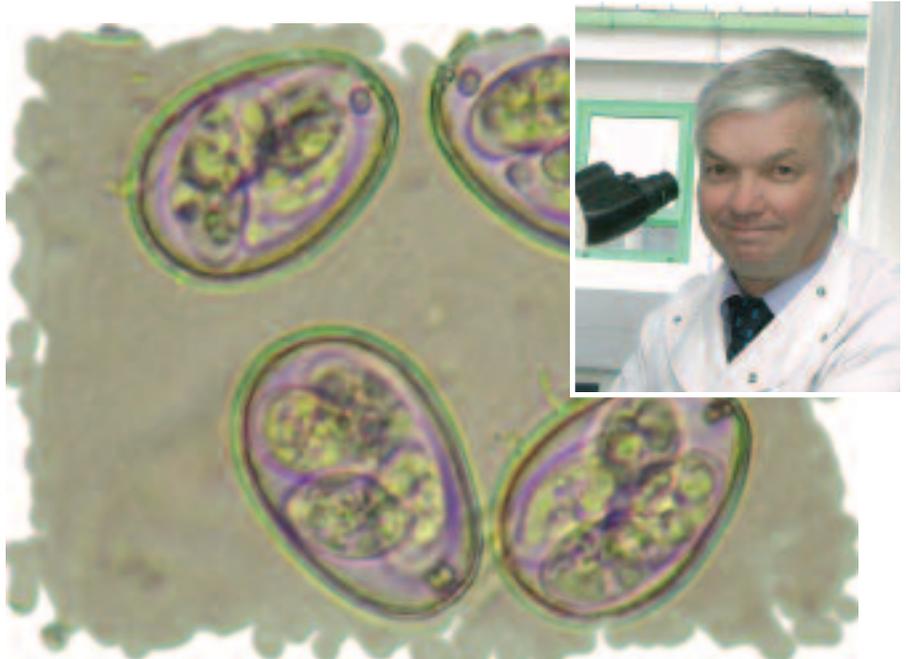
“We set up a cabinet that was like a giant sort of construction kit,” he says. “We had about 700 or 800 birds that were vaccinated in large groups at once. Then we challenged them with field strains of *Eimeria* given at times ranging from about 2 to 7 weeks after vaccination. It was very successful and we published the results.”

More recently, Marshall has been involved in testing the efficacy of the spray cabinet for administration of Paracox-8 for broiler breeders as well as free-range egg layers, a development that would bring added convenience to farmers vaccinating birds in this segment of the market.

For the study, birds were challenged with seven *Eimeria* species. The outcome is being determined by performance results such as weight gain as well as oocyst output and lesion scores. At this writing, the preliminary results looked good, he says.

Another important aspect of Marshall’s work with coccidiosis has been development of an anticoccidial sensitivity test to determine the level of resistance among *Eimeria* parasites recovered from the field. Birds on various anticoccidials are challenged with *Eimeria* field isolates and, again, performance and oocyst output and lesion scores will be used to reveal the sensitivity of each *Eimeria* species to the various anticoccidials tested.

Studies in other countries, he notes, have demonstrated that resistant field strains of *Eimeria* can be replaced with the strains of *Eimeria* in the vaccine, which are still sensitive to anticoccidials. In other words, the vaccine can be used to revitalize a producer’s anticoccidial program or it can replace the



*‘Eimeria tenella ‘has the most beautiful shape of all Eimeria oocysts,’ says Marshall, ‘but it’s also regarded as one of the most difficult strains to manage.’*

*Eimeria photo courtesy of Dr. Ralph Marshall.*

use of anticoccidials, which is especially important for growers raising antibiotic- or drug-free birds.

At this writing, Marshall planned to initiate sensitivity testing soon. Similar testing has been conducted elsewhere in Europe and the United States, but never before in the UK, he says.

“Our studies will demonstrate if the experience in the UK is likely to be the same as it has been elsewhere,” he says.



*Marshall has been involved in testing new methods of administering coccidiosis vaccine, including the SprayCox II spray cabinet.*

### ***Eimeria*'s economic impact**

Throughout the interesting twists and turns that have occurred during his career, Marshall never forgets the economic importance of his work.

*Eimeria* and resulting coccidiosis has been estimated to cost the UK alone £35 million (51.5 million Euros or \$66.2 million) a year considering production losses and the cost of anticoccidial control, he says. “With inflation, it’s probably a lot more since that figure was established. The disease causes a huge, huge cost to poultry distributors.”

*Eimeria*, Marshall points out, is tenacious. If you leave coccidia lying on the

ground in a chicken house, particularly in the UK where it’s often cool and damp, it can survive for weeks and may resist normal cleaning and disinfection processes. With short turnaround times, this can present a problem for subsequent flocks. “It can be a very difficult bug to get rid of. The industry has found ways to contain *Eimeria*, but it comes with a price.

“We’ll never know all there is to know about coccidia. These parasites are just too clever for us,” he says.

There are also hidden costs from coccidiosis that aren’t even readily apparent, Marshall says. Anticoccidial resistance has resulted in a subclinical challenge that knocks the edge off performance. Trials in the UK have shown that when broilers are vaccinated for coccidiosis with Paracox-5 and that challenge from resistant coccidia is eliminated, growth appears to blossom and there’s an increase in live weight. “Considering that we grow 800 million broilers in the UK annually, better control of coccidiosis through vaccination could have a huge impact, but producers here, understandably, want hard data,” he says.

Marshall’s work with vaccines has taken on new importance due to the movement toward drug-free poultry production. The arsenal of anticoccidials is shrinking and, he predicts, ionophore use may be reconsidered in the future.

Producers still using anticoccidials need to make the most of the ones that are still available or they need to find alternatives. If they know they can successfully revitalize or replace their anticoccidial program with vaccination, “that would be great,” Marshall says.

In addition to changes prompted by the drug-free movement, animal welfare trends are also affecting poultry producers. More birds will be free-range and the sizes of cages and the number of birds reared on floors are growing, which could increase the coc-

*continued on page 22*



# CocciForum Venice

## New Challenges in Intestinal Health Management

**G**rowing flocks without in-feed antibiotic growth promoters (AGPs) has had its consequences. One is an adverse impact on intestinal health, which has contributed to the multifactorial disease known as necrotic enteritis (NE). Until their use was discontinued, the contribution of AGPs to the control of NE was not fully appreciated.

The ban on AGPs was implemented due to concern that subtherapeutic antibiotics given in poultry and livestock feed may contribute to antibiotic resistant infections in people, but it has resulted in more infections and, ironically, has increased use of therapeutic antibiotics, underscoring the need to find non-antibiotic alternatives.

The importance of NE cannot be underestimated. As nutritionist Bill Dudley-Cash recently wrote in *Feedstuffs*, an internationally read trade publication, “The successful commercial production of [poultry], in the absence of antibiotics, is dependent on the control of necrotic enteritis.” An increasing number of poultry consumers worldwide are demanding that their broilers be grown without in-feed antibiotics and “understanding, controlling and/or managing necrotic enteritis are the keys to growing chickens without antibiotics,” he said.

Dr. Luciano Gobbi, technical service manager for

Schering-Plough Animal Health in Italy, says that NE can be controlled without routine, subtherapeutic antibiotics, enabling producers to move a huge step toward meeting consumer demand for truly antibiotic-free poultry.

Gobbi points out, however, that NE goes hand-in-hand with another enteric disease — coccidiosis — which damages the intestinal lining, setting the stage for the overgrowth of *Clostridium perfringens* — the cause of NE. “Good control of necrotic enteritis requires good coccidiosis control,” he says.

The quest for antibiotic alternatives for control of necrotic enteritis as well as coccidiosis has focused largely on nutrition, management and vaccination.

To further knowledge in the poultry industry on these topics, Schering-Plough Animal Health recently organized a seminar near Venice. More than 100 representatives of leading poultry companies from Europe, the Middle East and Africa gathered to hear from experts on non-antibiotic control of intestinal disease. Participants also had the opportunity to hear from several producers who are successfully controlling coccidiosis with vaccination and from a marketing expert about how to succeed in today’s climate.

*CocciForum* magazine is pleased to present highlights from the seminar in the articles that follow.

## Future approaches for necrotic enteritis control

Necrotic enteritis has become a leading problem for broiler chicken producers, but control of the disease is possible with a combination of vaccines and microflora modulation, predicted Dr. Steve Davis, president of Colorado Quality Research, Inc., a US-based poultry research company.

*Davis: 'When we talk about necrotic enteritis, we have to talk about coccidiosis control.'*



In recent poultry industry surveys, necrotic enteritis was one of the top five health problems affecting broiler flocks, said Davis. "It's very much a hot topic... and it did not become a problem until we started trying to raise broilers without in-feed antibiotic growth promoters."

### Varies widely

Davis's organization has conducted between 30 and 40 studies of necrotic enteritis and made several interesting observations. One is that the cause of necrotic enteritis — the alpha toxin produced by *Clostridium perfringens* — varies widely.

"There's a real difference in the *C. perfringens* out there," he said. With some isolates, just a little administered in feed will rapidly kill birds. Other *C. perfringens* isolates tend not to cause

mortality, but adversely affect weight gain and feed conversion.

"When we talk about necrotic enteritis, we have to talk about coccidiosis control," he continued. It's much easier to induce necrotic enteritis if birds have coccidiosis, particularly the *Eimeria maxima* variety. Coccidiosis damages the intestines, providing the right environment for *C. perfringens* to proliferate and for NE to develop.

Ionophore anticoccidials such as lasalocid, monensin and salinomycin have antibacterial properties — more than people realize, he added. "We feel very strongly that ionophores have helped prevent necrotic enteritis not by control of coccidiosis, but because they have actual [antibacterial] efficacy against *C. perfringens*," Davis said.

Ionophores, however, are probably on their way out due to public pressure to eliminate the use of all antibiotics in food animals. Chemical anticoccidials have no antibacterial effects and therefore would do little to control NE, said Davis.

Considering the current situation, vaccines are the direction of the future for coccidiosis control and may be used alone or in rotation with any anticoccidial to help prevent drug resistance, he said.

Besides coccidiosis, other factors that appear to predispose flocks to NE are poor chicken quality and uniformity. "We've noticed if chicks are of poor quality, we have more necrotic enteritis mortality and more early mortality," he reported. "The more uneven the birds are, the easier they succumb to a *C. perfringens* challenge. It's always the smallest chicks that end up being the first to die."

In addition, faster growing birds also tend to break with necrotic enteritis sooner than slower-growing birds, he said.

“When you get an ideal flock, it’s very difficult to produce necrotic enteritis,” Davis said, adding that it’s possible that some breeds of birds are more resistant to the disease.

### New toxoid

Control of NE in the future may depend largely on vaccines, partly because the *C. perfringens* bacterium has excellent potential for use as a vaccine antigen, he said.

Schering-Plough Animal Health has developed a *C. perfringens* type A toxoid vaccine for NE that is currently being used in the United States. (See [www.netvaxforpoultry.com](http://www.netvaxforpoultry.com).) In 2008, it is expected to be approved for use in Europe.

Davis pointed out that while the new *C. perfringens* type A toxoid may be new for poultry, the technology is not new among sheep, cattle and swine. Because injecting individual broilers would be impractical and costly, the toxoid is given to breeder hens, which then convey passive immunity to their broiler progeny, he said.

Davis’s company tested the toxoid in broilers that also received a coccidiosis vaccine for coccidiosis control. Birds with passive immunity from hens that had received the NE toxoid had a significant decrease in NE lesions and a numerical decrease in mortality compared to birds not from hens that received the toxoid. (Figure 1.)

“Passive immunity through vaccination definitely shows that it has excellent potential” for control of NE, Davis said.

To further prevent and control the disease, “We have to avoid placing known poor quality chicks on farms that we know have a high *C. perfringens* challenge or repeat necrotic enteritis farms,” he advised.

Improved cleaning and disinfection programs may help control NE if ways can be found to kill *C. perfringens* spores but not the “good bugs” in the house, Davis added.

**Figure 1. Necrotic enteritis mortality — vaccinates vs. challenged and non-challenged controls.**



A = Challenged control

B = Non-challenged control

C = Chicks from hens not given clostridium toxoid and vaccinated day 1 for coccidiosis

D = Chicks from hens given clostridium toxoid and vaccinated day 1 for coccidiosis

Davis has found that diet definitely can influence NE. The more wheat, rye and barley fed to chicks, the greater the toll of NE. High protein levels have been associated with NE outbreaks. Animal byproducts, particularly fishmeal, may be contaminated with clostridium. Consider that successful antibiotic-free poultry producers in the United States tend to use all vegetable diets, he said.

“I’m not saying we have all the answers, but it’s quite obvious that we can play with these diets and create necrotic enteritis,” he said.

Davis has also studied feed additives including enzymes, probiotics and organic acids. “We have not found anything that I would say is a magic bullet.”

Nevertheless, “as we learn more about the natural microflora of the gut, we’re going to get better and better with these types of products. When combined with vaccine technology, we’re going to find that it may be possible to prevent NE without antibiotics,” he said.

## Maximizing intestinal health with nutrition

Nutrition can maximize intestinal health and help prevent enteric disease, but deciding which ingredients to use and finding the right balance of each can require as much finesse as a high wire act.



*ten Doeschate: 'Chicks need to develop a healthy, well-functioning gut early in life.'*

The trend toward growing broilers with fewer or no in-feed antibiotics is forcing producers to consider an array of dietary approaches that may or may not improve intestinal health and prevent “dysbacteriosis” — an overgrowth of “bad” gut bacteria, said Dr. Rob ten Doeschate, a poultry nutritionist with Abnatech Global, Peterborough, England, a consulting and research firm serving the poultry industry.

“We used to have antibiotic growth promoters (AGPs). They’re gone. We’re still using anticoccidials in the feed and one by one the list of available anticoccidials gets shorter, so vaccines will need to be used,” he said.

To help ensure good intestinal health in light of current trends, it’s more important than ever to begin by making sure broiler chicks get off to a good start, ten Doeschate said.

“Chicks need to develop a healthy, well-functioning gut early in life, so for the first week, feed very high nutrient and mineral levels,” he said. The digestible levels of amino acids may be

above breed standards. Sodium is key, “but don’t forget calcium and phosphorous,” he added.

The diet should also have a good physical quality to ensure intake and stimulate gut development. “Nowadays we use good quality fat and oil almost exclusively,” he said. Too much fat, however, is bad because lipid digestion is still underdeveloped.

Young birds need highly digestible protein. “I don’t think that’s soy, so I like to see a bit of fish meal and, if you can’t use fish meal, use some other purified protein to help the bird the first couple of days,” ten Doeschate said.

The nutritionist believes that better intestinal health can be promoted by encouraging gizzard development, which can be accomplished by incorporating some coarse material, such as whole wheat, into the diet.

In the United Kingdom, whole wheat is widely used in broiler feeding. Wheat has been linked to an increased risk for some intestinal problems but, according to ten Doeschate, the key is finding the right amount, which can be challenging.

Feed trials comparing no whole-wheat dilution with medium and high levels of added wheat showed that a high level of wheat resulted in decreased live weight and poor feed conversion, but it also resulted in a lower water intake and fewer hock lesions. Medium amounts of whole wheat addition can be positive, ten Doeschate has found.

Wheat-based diets do result in increased gut viscosity, “and we use NSP (non-starch polysaccharide) enzymes to get over that,” ten Doeschate said.

### ‘Pronutrients’

Besides enzymes, there are several other “pronutrients” or additives to

consider for broilers raised without AGPs, he said.

One option is acid salts or organic acids, which have been used extensively in breeder feeds to eliminate or control salmonella. In broiler chicks, their benefits are not as clear. Trials at Abnatech have shown that birds tend to drink more if there's a lot of acid in the feed, complicating litter management. "In addition, free acids are corrosive and therefore are not popular at feed mills; acid salts are probably less effective and aren't really the product for poultry either," he said.

Plant extracts such as essential oils have been touted as an alternative to antibiotic growth promoters, but questions remain about their active ingredients and quality. "If you get a level in the diet that will work, it might be so high that we can't afford it, so it's not one we've used," ten Doeschate said.

### Prebiotics

Prebiotics are another option and would include complex carbohydrates such as mannan oligosaccharides from yeast cell walls. Yeast products, he said, have performed well in trials. They are not digested by the bird and improve gut health. Mannoproteins prevent attachment of *Escherichia coli* and other bacterium to the gut wall and stimulate the immune response, he said.

The nutritionist is also big on betaine, which is an "osmoprotectant" that helps maintain cell integrity. Studies show that in chickens with coccidiosis, where the ratio between crypt depth and villi length decreases, betaine allows villi to lengthen, resulting in better nutrient absorption. "There's an interaction between the coccidial challenge and betaine in the tissue. Putting more betaine in the diet is positive, he said.

Betaine also prevents dehydration and maintains ionic balance, especially during times of stress such as transport,

high heat or pathogen challenges. It is compatible with enzyme function, protects enzymes and membranes from osmotic inactivation and improves water balance, ten Doeschate said.

*'The trend toward growing broilers with fewer or no in-feed antibiotics is forcing producers to consider an array of dietary approaches that may or may not improve intestinal health'*

"Nutrition," he said in conclusion, "can effect changes in intestinal health that may be positive or negative. Of course, it's important to establish a healthy, good functioning gut during the starter period. There are more pos-



itive actions we can make in feed design. Use the right enzyme. We can minimize changes during the bird's life. Look at food structure — I'm talking about coarse grinding. And then last, but not least, use some pronutrients," he concluded.

## Top producers share first-hand experiences managing coccidiosis with vaccination



**W**hether they are smaller niche-market operations or top industry players, European poultry producers are finding that coccidiosis vaccination is proving to be a problem solver. Vaccination is allowing them to meet market demand for antibiotic-free broilers, combat anticoccidial resistance in conventional flocks, further enhance food safety and simplify flock thinning. Following are success stories from four progressive EU producers.

### Lloyd Maunder Ltd, UK

#### Vaccination 'fundamental' to coccidiosis control



*Tanton: 'Primary disease agents cause a reduction in the birds' immune status.'*

At Lloyd Maunder Ltd, a fully integrated, family-run company that's been producing broilers in England since the 1950s, coccidiosis vaccination has become "fundamental to coccidiosis control," says hatchery manager Mike Tanton.

As a relatively small company, when competition with larger companies in the conventional broiler market became difficult, Lloyd Maunder looked to the

high-value, niche market. In 2000, the company started growing organic, free-range broilers and now produces 80,000 of them weekly, which it sells in 15 company shops and to retail outlets, he said.

As part of its new venture, the company developed its own robust breed of bird, the Devonshire Red, which is reared to 4 weeks of age in brood houses with high standards of biosecurity. These high-health birds are then transferred to mobile houses on the range areas.

Frequently farms have birds of three different age groups at any one time, presenting tough coccidiosis control challenges, Tanton said.

The sole method of managing coccidiosis in its organic chickens is vaccinating with Paracox-5. Chicks are sprayed at the hatchery when they are one day old. Red food dye included in the vaccine not only encourages preening and ingestion of Paracox-5, it marks the chicks, which lets hatchery staff and farmers receiving the chicks know that birds are protected against coccidiosis. "The application is very easy," Tanton said.



*Red food dye added to Paracox-5 encourages preening and marks chicks, making it obvious they have been vaccinated.*

“In round terms we vaccinate with Paracox-5 and the birds don’t get coccidiosis. Performance data backs this up with good levels of production performance” he said.

Lloyd Maunder strives to grow birds slowly and keeps weight to about 2.25 kilograms (4.9 pounds) as dictated by market requirements. Slower growth not only helps produce birds that taste good, it also has reduced mortality, Tanton said. In organic systems often the main causes of loss are as a consequence of the more challenging environment the birds grow in and the effects of predation.

Where coccidiosis is seen it is usually associated with other diseases such as Marek’s disease or Gumboro for example.

“We think that these primary disease agents cause a reduction in the birds’ immune status and coccidiosis occurs as a secondary infection. Suboptimal management can also be a significant factor” Tanton said.

“In our experience on farms with good standards of management, Paracox-5 is highly effective and it does exactly what it says on the box,” he said.

## Amadori Group, Italy



*Toscani: 'Performance results are better than expected.'*

### Both 'green' and standard broilers benefit from coccidiosis vaccination

Paracox-5 has helped one of Italy’s poultry giants, Amadori Group, launch its “green and healthy” Amadori 10+ product, developed in response to growing consumer demand for drug-free products.

Amadori, a fully integrated company that produces about 110 million broilers annually, found that after gaining experience with Paracox-5, it had “very satisfactory technical results” in its green birds and began using the vaccine in standard broilers too, said Dr. Tonino Toscani, director of health and nutrition for Amadori’s poultry business.

In its drug-free birds, use of the vaccine coupled with good management practices enable birds to maintain performance similar to birds receiving traditional in-feed anticoccidials, “which we have demonstrated in many internal trials,” Toscani said.

In standard broilers, the vaccine is used primarily to combat rising coccidial resistance to anticoccidial drugs and chemicals. “We hope to ensure greater choice of effective anticoccidial products for the future by rotating the vaccine with medicated feed,” he said.

Toscani showed data demonstrating that after three cycles of using the same ionophore anticoccidial, the number of resistant *Eimeria* coccidia rises. When Paracox-5 is rotated with anticoccidials, ionophore resist-

ance decreases because the vaccine’s live, attenuated *Eimeria* oocysts replace resistant oocysts.

Isolates of European field coccidia, including some taken from it’s own poultry units, have shown that com-

Figure 1. Number of resistant *Eimeria* strains (red dots) after three cycles of ionophore usage.

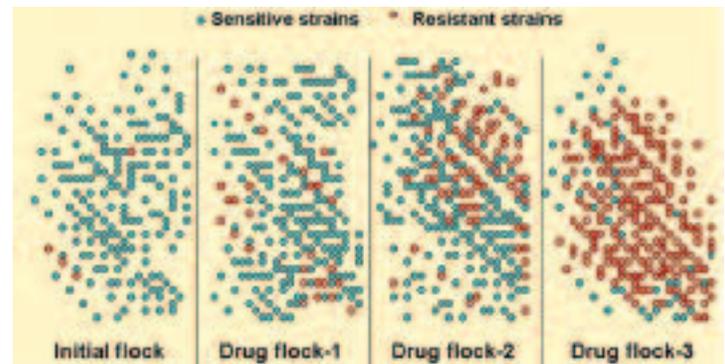
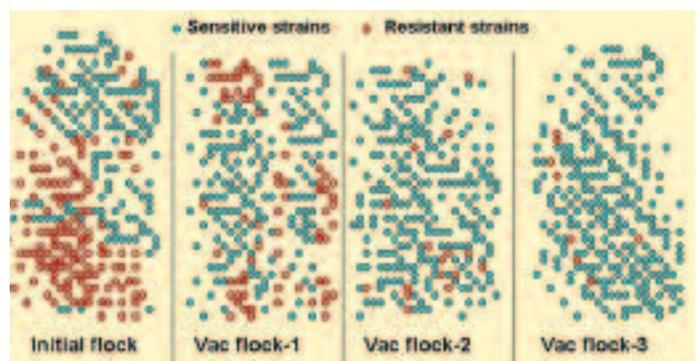


Figure 2. Number of resistant *Eimeria* strains (red dots) after three cycles of Paracox-5 usage.



plete coccidial resistance and reduced sensitivity to the in-feed anticoccidials monensin and diclazuril are widespread on farms that strictly use in-feed anticoccidials for coccidiosis control, Toscani added.

In contrast, “our experience suggests that a rotation program that includes at least two or three consecutive vaccinated flocks followed by two or three medicated flocks on the same premises restores sensitivity to standard anticoccidial drugs,” he said. In standard flocks, Amadori now usually uses in-feed anticoccidials during winter, which helps reduce the impact of wet litter, and the coccidiosis vaccine in late spring and summer.

### No acute disease outbreaks

“Performance results are better than expected,” Toscani said, yielding not only good coccidiosis control with no cases of acute disease, but improved feed conversion.

He attributes some of Amadori’s success with the vaccine to genetic improvement and feed management. Energy and protein in the diets have been reduced to control enteric problems. In the future, enteric disease in birds vaccinated against coccidiosis may require a dedi-

cated control strategy; medication may be occasionally needed in vaccinated birds as well as in those receiving anticoccidials.

Necrotic enteritis control will also require new strategies in brooding management, diet manipulation and vaccination when it becomes available. Bird density and water quality are other factors that need to be considered, Toscani said.

*Note: For more about Amadori’s experiences with coccidiosis vaccination, see CocciForum No. 8 or go to [www.ThePoultrySite.com/CocciForum](http://www.ThePoultrySite.com/CocciForum).*



## Martini Alimentare, Italy

### Coccidiosis vaccination simplifies feed management, saves money



*Longoni: ‘We can’t take the risk of residues.’*

One of the major Italian poultry producers — Martini Alimentare — has found that Paracox-5 significantly simplifies management in flocks that are thinned, a popular practice in Europe.

Martini, an integrated company with six feed mills and three slaughterhouses throughout Italy, produces 15 million broilers annually.

Dr. Corrado Longoni, a poultry field veterinarian with Martini, explained that males and females are placed in the same house but are divided by a fence. Females are usually thinned at ages of 35 to 37 days

because they have less efficient feed conversion rates. Another thinning might be done for heavy females or light males, usually at 44 to 46 days of age.

After each thinning, practiced in accordance with animal welfare regulations, the fence is moved to give more space to a greater number of faster-growing, large-breasted males that are processed at weights of 3.3 or 3.4 kilograms (7.2 or 7.4 pounds) and, sometimes as high as 4.5 or 4.6 kilograms (9.9 or 10.14 pounds), he said.

Thinning makes it possible to send birds from each group for processing at different ages, depending on market demand. Thinning makes it easier to raise very heavy birds throughout the year, especially during summer months when there is heat stress and higher density could be detrimental. In addition, thinning enables producers to capitalize on economies of scale, since house space is used more efficiently and more kilos of meat per square meter can be produced. All players in the production chain benefit from increased profits, Longoni said.

## Medication complicates thinning

The use of in-feed synthetic or ionophore anticoccidials and their required withdrawal time, which is usually 5 days, seriously complicates thinning, he said. (Figure 1.)

Anticoccidials have to be withdrawn from feed soon enough to ensure that meat has no residues, and puts the flock at risk for a coccidiosis outbreak. Keeping anticoccidials in the feed increases the risk that residues could mistakenly end up in meat at a time when consumer concern about residues is at an all time high. Market flexibility is hindered and feed management becomes a logistical nightmare since two or three withdrawal periods would be needed in thinned flocks, he said.

In addition, “feed mill contamination is a real concern,” since Martini makes feed for poultry other than broilers. “We can’t take the risk of residues either in feed for non-target species or in our withdrawal feed for broilers,” Longoni said.

Vaccinating for coccidiosis eliminates these problems. It protects against coccidiosis, makes it easier and safer to thin flocks and enables Martini to be flexible in response to market needs. Feed management is simplified since no withdrawal diet is needed, and there are no headaches about anticoccidial residues in meat or about cross-contamination, he said. (Figure 2.)

## Reduced costs

Parcox-5 has not only improved disease and feed management, it has saved money in several ways, Longoni added. Since it enables thinning to be practiced and house space is used more efficiently, transportation costs for moving day-old chicks and for transporting live birds to slaughterhouses are each down by 20% to 30%.

The cost of transporting feed is reduced by 10% to 20% because there is no need for withdrawal feed or for larger quantities of other feed, although this savings would vary among producers, he said.

Integrators pay farmers based on the kilograms of meat per square meter and flock performance, including the feed conversion ratio, the culling rate and meat quality.

“Increased volume per square meter provides farmers with reduced fixed costs and provides integrators with reduced variable costs,” Longoni said.

*Note: For more about Martini Alimentare’s experiences with coccidiosis vaccination, see CocciForum No. 10 or go to [www.ThePoultrySite.com/CocciForum](http://www.ThePoultrySite.com/CocciForum).*

Figure 1. The required withdrawal of anticoccidials to ensure there are no residues in meat put the thinned flock at risk for a coccidiosis outbreak.

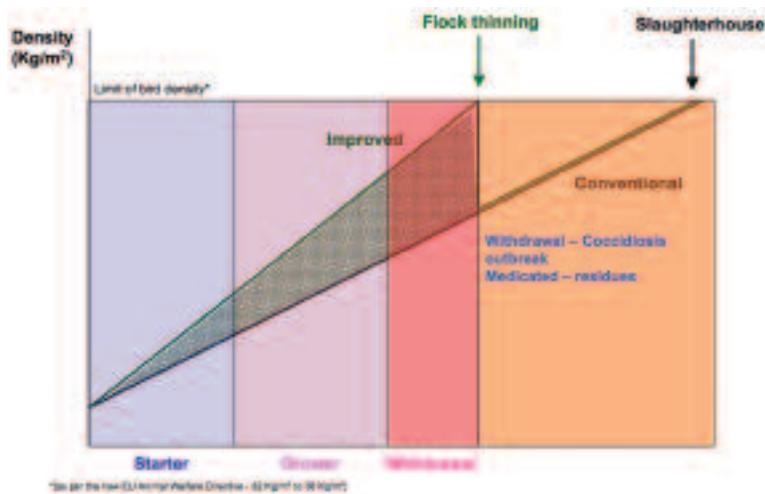
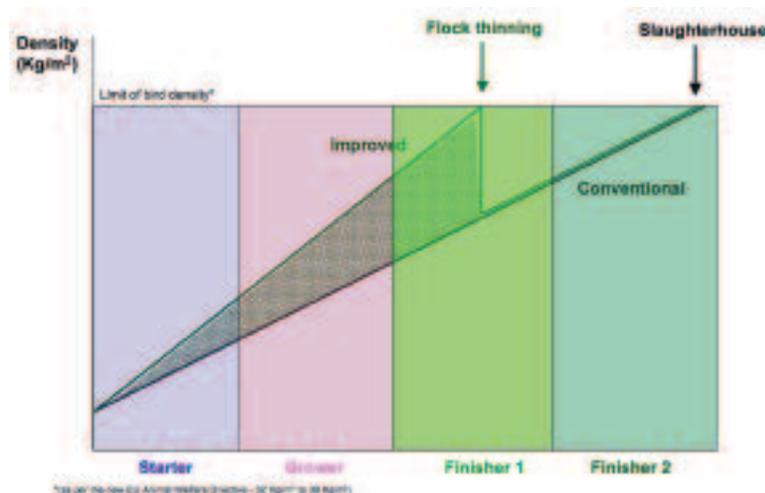


Figure 2. In thinned flocks, Parcox-5 simplifies feed management as well as eliminates concerns about residues in meat.



## SADA, Spain

### Vaccination helps ensure food safety



*Bellés: 'Complements the practice of thinning flocks'*

At Spain's leading poultry producer SADA p.a., a vertically integrated company with nine hatcheries and 10 processing plants, over 3 million chicks are placed with contract farmers weekly.

SADA consumers want poultry meat that is safe to eat from healthy birds raised with the environment and animal welfare in mind, according to integration manager Dr.

Santiago Bellés Medall of SADA, a subsidiary of the Netherlands-based Nutreco, one of the world's leading animal nutrition companies.

Potential hazards in food include biological hazards such as bacteria, viruses and parasites, physical hazards such as bones or plastics, and chemical hazards, which include pesticides, antibiotics and anticoccidial residues. Each risk must be identified and separate measures taken to deal with each one. Consequently, SADA has strict procedures in place to ensure that all potential hazards are controlled and prevented, he said.

SADA has found that one way to prevent the risk of anticoccidial residues in poultry meat is by using Paracox-5, which is administered to about 25% of the company's flocks. Use of the vaccine especially complements the practice of thinning flocks, Bellés said.

Thinning, he explained, is practiced on farms with medium and high density — about 14 and 18 birds per square meter (10.76 square feet), respectively — and is based on live weight, not age. About 20% of its birds are grown to about 1.8 kilograms (3.9 pounds) and the rest to more than 2.5 kilograms (5.5 pounds).

**Figure 1. Vaccination to control coccidiosis eliminates the need for a withdrawal diet.**

Anticoccidials	Withdrawal days
<b>Chemical</b>	
Robenidine	5
Halofuginone	5
Diclazuril	5
<b>Ionophore</b>	
Lasalocid	5
Monensin	3
Narasin	5
Salinomycin	5
Maduramycin	5
<b>Vaccine</b>	
Paracox-5	None

When anticoccidials are used, managing withdrawal diets in flocks that each have their own growth rate requires making several different feeds in small quantities. Logistics at the feed mill become complicated, as does the transport of feed and feed management on the farm because several different feeds have to be juggled, increasing the risk for errors or cross-contamination, he said.

It becomes “nearly impossible” to abide by legal requirements intended to prevent anticoccidial residues, Bellés added.

With coccidiosis vaccination, the need for a withdrawal diet is eliminated, which simplifies feed management and, perhaps best of all, enables SADA to guarantee that its poultry is free of residues from ionophore anticoccidials, he said.



## Future success for EU poultry companies requires focus on consumer trends, quality

Disease-control methods such as vaccination and other tools that reduce antibiotic usage and nurture the consumer's view of poultry meat as a safe, high quality and socially conscious product will contribute to the success of European poultry companies in the future, according to a leading poultry consultant and strategist.

"Today's consumer wants to know *what* he eats, from *where* it came and *how* it was produced. He wants *assurance* that what he eats is *safe* for his *health* and the *environment*, that it is *fair* to the manpower that produced it and that the meat comes from animals that are *well cared for* and *healthy*," said Dr. Osler Desouzart, a Brazil-based food-industry analyst who helps poultry companies with marketing and planning through his company OD Consulting.

Desouzart noted that this trend is particularly gaining strength in Europe. "European producers should concentrate in differentiated quality and new values of the consumer, among which I would say that regional and local values are important. More and more, the issue of 'landen,' 'paeso,' 'terroir,' 'from home' is perceived by the consumer as a value," Desouzart added.

These trends are initiating changes ranging from the use of more "natural" diets in poultry feed to reduced housing density for birds, he added, emphasizing that poultry companies that ignore "His Almighty Excellency, The Consumer" will be doomed to fail.

### Traits of successful companies

During the course of his work, Desouzart has found that the successful poultry companies of today consider quality an intrinsic value of the whole company. They have a permanent improvement system in place and are



*Desouzart: 'European producers should concentrate on differentiated quality and new values.'*

never happy with the status quo. Their strategy reflects where they want to be in 10 years and provides a detailed, quantified and dated plan for the next 3 years. They base decisions on data and facts.

The primary focus of successful poultry companies is on the consumer rather than production. They have "win-win" relationships with their clients and suppliers, he said.

Granted, cutting costs is important, but "creating value is essential," he said. A lower price does not necessarily mean better value. Value goes hand-in-hand with quality, which must start at the beginning.

*'Today's consumer wants to know **what** he eats, from **where** it came and **how** it was produced. He wants **assurance** that what he eats is **safe** for his **health** and the **environment**'*

"A premium chicken sold at a premium price cannot be made... with second-grade feed, with the lots managed

by untrained people and with the ‘cost dictatorship’ determining that the least expensive ingredients should always be used,” he said.

“Quality begins at the beginning, but has to go all the way to the end. There is no ‘partial’ quality, or quality just in parts of the process, by part of the departments and part of the time,” Desouzart said.

“My point is that if European producers try to fight the imports with their unbeatable prices and tailor-made bulletproof productions that resist any quality assurance audit, they shall fail. If they think that they can entrench behind protectionism, they are doomed.”



Desouzart said that marketing “fresh” poultry might be one way to compete, but he warned producers that they should be prepared to fight again in 20 years because it’s only a matter of time before technology makes it possible for foreign suppliers to sell fresh poultry as well.

“The only thing that the invaders cannot obtain is the level of marketing knowledge and understanding that can only come from working in that market,” he said. “Furthermore, foreign producers can’t claim that their product is locally produced.”

### Branding denotes confidence

Another trait common among successful poultry companies is branding. “There are no leaders without a brand,” and to consumers, a brand denotes confidence, assurance, reliability, recognition, comfort, feeling at home and safety, he said.

The basis for branding is “defined and established quality.” Consumers are prepared to pay for this personal reassurance, “provided you do not forget that ‘accessibility’ is a component of quality,” Desouzart continued.

“A French consumer will argue for days that a “poulet de Bresse” is superior to any other broiler in the world, even if you can induce him to error in a blind test,” Desouzart explained. “But why does he pay up to CHF 24,00 per kg for the chicken produced in Bresse? Because of its reputation, which dates back to Louis XIV.

“So sell uniqueness and reputation,” he added, “because wealthy consumers are not buying meat or protein. Above all, they are buying pleasure.”

Desouzart emphasized that while positive connotations of a brand can take decades to build, they can take nanoseconds to be lost. “His Majesty the consumer seldom forgets or forgives,” he quipped.

Desouzart warned mainstream European poultry producers to abandon any notions they may have about feeding the world’s hungry with low-cost meat, which could lead to defeat as underdeveloped countries increasingly supply inexpensive poultry for consumers in their countries. Mainstream producers, Desouzart said, need to stay focused on producing quality meat with added value for local markets.

In fact, “Your local market knowledge, its idiosyncrasies and consumer values may be the best ally that you have to survive,” he said.

## PASSING THE 'SO WHAT?' TEST

Genetic studies of *Eimeria* could lead to big breakthroughs in coccidiosis control

Professor Martin Shirley gets frustrated at times. His research into the genetics and genomes of *Eimeria* could lead to major advances in coccidiosis control. But to anyone outside his field, Shirley's work seems complicated, futuristic and, well — boring to those involved with poultry production. And talk of it often falls upon deaf ears.

"This is not science fiction," Shirley says. "I want producers and veterinarians to understand that this research will pass the 'so what' test. It has huge potential significance for controlling coccidiosis, which remains one of the economically important diseases in poultry."

Shirley is director of the Institute for Animal Health (IAH), the largest research institute focused on livestock diseases in the United Kingdom. In the 1980s, he led the team that developed the world's first attenuated coccidiosis vaccine, which set the stage for what is now known in Europe as the Paracox line.

Today, his focus is nailing down the genetics of *E. tenella*, the most widespread and problematic of the *Eimeria* species affecting poultry. Shirley initiated the project and is working jointly with Fiona Tomley, also of IAH, as well as researchers at the Sanger Institute of the UK, the Malaysia Genome Institute, the University of Sao Paulo, Brazil and the Laboratory for Molecular Biology of the UK Medical Research Council.

### Benefits for poultry producers

Studying the genetics of the ever-evolving *Eimeria*, Shirley predicts, will lead to simpler but more effective methods of protecting poultry from coccidiosis. It's the only way the poultry industry



Shirley and IAH associate Fiona Tomley: "This is not science fiction."

will be able to meet demand, perform up to par and reap better profits, Shirley says.

Consider that *Eimeria* has evolved over tens of thousands of years. It has become adept at subverting the biology of its host — the chicken — to its own advantage, and it's likely to keep evolving. "We're trying to untangle that relationship so we can intervene and come up with new control measures as they are needed. It's a tough challenge," he says.

Toward that goal, the researchers are 'mapping' *E. tenella*'s genome. Genome is another word for genetic information. In short, Shirley and colleagues are deciphering the parasite's genetic makeup.

"When we started the work, the genetic information of *E. tenella* was a bit like having a book that has no chapters, paragraphs, sentences or punctuation and you have to figure out where

each strand of words belongs and fits together,” he says.

Until recently, virtually nothing was known about the chromosomes of *Eimeria*, Shirley says. Chromosomes are the rod-shaped structures in the nucleus, or center, of the cell and they carry the genes which determine the characteristics that an organism inherits from its parents.

*E. tenella* has a sequence of 14 chromosomes. “When we finish our mapping project, we will have 14 sets of information — one set of information for each chromosome. But keep in mind that these 14 chromosomes comprise millions of pieces of data,” Shirley says.



Shirley (right) reviews a report of the *Eimeria* genome project with Schering-Plough's Iain Brown. 'The industry is embracing vaccines.'

### Unique chromosomes

The project to map *E. tenella*'s genetic structure has already proved interesting because the chromosomes of this species are unique compared to most if not all other organisms that have ever been studied. In fact, they are among the most complex organisms in all of veterinary medicine, he says.

Shirley likens the study of *E. tenella*

chromosomes to discovering the patterns along strings with four different colored beads. “Imagine the 14 chromosomes of *E. tenella* as 14 strings *each* containing between 1 million and 14 million of the four differently colored beads,” he says.

Interestingly, a study of the smallest chromosome has revealed that it contains distinct, alternating regions. Looking from left to right, the beads initially appear as though the colors are distributed randomly, then there are distinct and repeating patterns of color, then seemingly random colors again, then the strong and repeating patterns of color and, finally, seemingly random colors again, Shirley says.

“Our mission is to identify similarities in the patterns of these ‘beads’ and then link them to specific traits that will enhance our understanding of the parasite and the best way to control it,” Shirley says.

*E. tenella*'s unique arrangement may explain parasitic mysteries such as why *Eimeria* has become increasingly resistant to drugs. Chromosomes from two *Eimeria* strains are known to come together during sexual reproduction, he says, but that is all the detail known at present.

Although the genomic mapping of *E. tenella* is an enormous undertaking, the project is already about 95% complete, Shirley says. Once done, researchers can “data mine,” producing results that will be freely available to anyone in the world who wants to use the information for research or development of commercially useful products.

The IAH researchers want to discover what it is about the *Eimeria* parasite that causes chickens to develop a protective immune response. They are also looking at a technology known as “transfection,” which enables pieces of DNA to be moved from one parasite into another. The technology might make it possible to develop a “piggy-

back” vaccine with one parasite that would protect against all species of *Eimeria*.

### Flashback

Anyone who questions whether genetic studies of *Eimeria* are too futuristic to lead to something practical need only consider the situation years ago when scientists first grew *Eimeria* parasites in chicken embryos.

At the time, scientists were viewed with skepticism as they tried to discover whether the life cycle of the parasite could be modified, but they found the answer was “yes.” Moreover, the parasites defined by the life cycle changes were attenuated and could be used as live vaccines.” Soon after, the research spawned other, better, approaches to attenuation, which led to the development of the breakthrough coccidiosis vaccine ‘Paracox’, Shirley says.

“When we started collecting precocious *Eimeria* parasites over 20 years ago, we had no idea they were going to become the sort of global standard for control of coccidiosis with a live attenuated vaccine. No idea at all,” he says. “Today, there are a billion doses a year of the vaccine helping poultry producers control coccidiosis in their flocks.”

### Vaccines are the future

Even though the coccidiosis vaccines of today work well, making them requires growing all the different species of *Eimeria* that cause coccidiosis and then harvesting them from chicken fecal matter to make the vaccines. Birds probably are receiving many more gene products than they need.

In the future, it eventually may be possible and more cost effective to identify exactly which gene products are relevant to immunity, then manufacture — perhaps with genetic engineering — single parasite vaccines that protect against all types of *Eimeria*.

New technology for controlling coccidiosis that arises from the genomic

data, Shirley says, is likely to be a vaccine because the continuing use of chemotherapy is under political and other pressures.

“The industry is embracing vaccines and beginning to see that the future of coccidiosis control will depend on vaccines. We’re already facing the prospect in the European Union that drugs may be removed entirely from system because of consumer concerns. We are then left with vaccines and, I believe, as long as there is poultry, there will be a need for *Eimeria* vaccines. That much is very clear now,” he says.

“For poultry to remain the major meat-producing animal in many parts of the world and remain of importance to the UK, the United States and other countries, there will have to be products that effectively control coccidiosis. And these products will not be developed in 5 minutes by somebody having a ‘eureka’ moment. They will come from sophisticated scientific projects such as genome analyses and genomic mapping,” he says.

For now, Shirley hopes that the poultry industry will take note of *E. tenella* genetic research, think about its positive implications for the future and meet the researchers with open ears. “Be prepared to support our work, which the industry will need,” he says. “It may not be for the people farming now, but for their sons and daughters and grandsons and granddaughters.”

In turn, researchers have to do their bit, he freely admits, by communicating to the industry in understandable language. “We can be accused of not expressing ourselves in ways that can be properly understood,” he concedes. “I hope the industry is ready to listen and that it challenges us. We both need to meet halfway. There’s work to be done.”

*More information on the E. tenella genome project can be found at [http://www.sanger.ac.uk/Projects/E\\_tenella](http://www.sanger.ac.uk/Projects/E_tenella).*



*Shirley: ‘I hope the industry is ready to listen’*



## Necrotic enteritis outbreaks in broilers stop after vaccinating hens with clostridium toxoid

Outbreaks of necrotic enteritis in conventional broiler flocks stopped after breeder hens were vaccinated with Netvax, a new clostridium toxoid vaccine, Dr. Neil Ambrose said at the European Poultry Conference held last fall in Verona, Italy.

The initial experience with the vaccine indicates that “passive immunity to *Clostridium perfringens* type A alpha toxin appears to be a viable strategy for the control of necrotic enteritis in broiler chickens,” said Ambrose, director of veterinary services for Sunrise Farms of Surrey, British Columbia, Canada.



Sunrise Farms modified diets to ensure a good start and reduce the necrotic enteritis-causing bacterium in young chicks.

The *Clostridium perfringens* type A toxoid was developed by Schering-Plough Animal Health and is the first product of its kind for poultry, although clostridium toxoids have been used in other species for many years. Two doses of the vaccine are administered to hens, initiating immunity to the alpha toxin produced by *C. perfringens*, which is the most common cause of necrotic

enteritis in chickens. The hens pass on the immunity to their broiler progeny.

Necrotic enteritis, Ambrose said, can be devastating, resulting in high mortality and reduced feed intake, weight gain and flock profitability. The problem is especially difficult to control in birds on wheat-based rations, which are common in Canada.

With a trend in many parts of the world towards the production of broiler chicken meat without the aid of antibiotics, including ionophore anticoccidials, Ambrose started trials for Sunrise Farms by using a live coccidiosis vaccine instead of an in-feed anticoccidial in wheat-fed birds. However, in 2005, the company had six consecutive cycles of about 30,000 birds that experienced necrotic enteritis outbreaks. The birds had received a coccidiosis vaccine, a nonattenuated coccidiosis vaccine based on live *Eimeria* field strains, at day-of-age and the in-feed antibiotic-growth promoter bacitracin and/or virginiamycin. Three of the flocks also received the anticoccidial salinomycin, which was added to stem the necrotic enteritis outbreak, but did not.

For each flock, there were two peaks in mortality attributed to necrotic enteritis, which occurred at about 19 and 27 days of age. Both roughly corresponded to expected peaks in coccidial cycling from the *non-attenuated* vaccine, he said.

“It is likely that the combination of intestinal viscosity associated with the wheat ration and the mucosal disruption caused by the normal cycling of the coccidial vaccine allowed the overgrowth of *C. perfringens*, triggering the necrotic enteritis events,” he said. “There was no evidence of coccidial lesions outside of the normal expected levels for the coccidial vaccine, which appeared to be performing normally, with adequate development of immunity to coccidiosis.”

### Trial flocks

Sunrise Farms wanted to determine if passive immunity provided by the new clostridium vaccine could replace or augment in-feed antibacterial medication given to broilers that are fed a wheat-based diet, which is common in Canada, he said.

The company grew two broiler flocks from hens that had received *Clostridium perfringens* type A toxoid. Both



Ambrose: 'There was no evidence of coccidial lesions outside of the normal expected levels.'

flocks were vaccinated for coccidiosis at day-of-age and the broilers, which totaled about 24,000 in number, received only the growth promoter bacitracin in the starter, grower and finisher rations. No in-feed anti-coccidial was provided (Table 1).

The results with these test birds were compared to the six flocks that had experienced necrotic enteritis outbreaks and were from hens not vaccinated with Netvax.

All the birds had received the same, wheat-based diet.

Among birds in the test group, "there was no evidence of necrotic enteritis in random birds, culls or mortality upon post-mortem examination, which also verified continued cycling of the coccidiosis vaccine at acceptable levels," Ambrose said.

### Better growth after toxoid

Growth performance in the flocks from hens vaccinated with the *Clostridium perfringens* type A toxoid met breed standards and, in fact, surpassed growth in the control group, he said. These results were achieved in the second flock despite severe heat stress at 27 days of age due to unseasonably high environmental temperatures, he said.

"Passive immunity against the *C. perfringens* type A alpha toxin appeared to successfully augment in-feed medication to prevent lesions of necrotic enteritis when a non-attenuated coccidiosis vaccine was used in concert with a wheat-based ration," Ambrose concluded.

Sunrise Farms, he added, was planning further testing to determine whether passive immunity provided by *Clostridium perfringens* type A toxoid could control necrotic enteritis when reduced levels of in-feed medication are given or in the complete absence of in-feed medication.

Table 1. Medication regimens for flocks that did and did not experience necrotic enteritis outbreaks.

Medication regimen	Coccidiosis vaccine at day-of-age	Salinomycin in grower ration	Ration			
			Starter	Grower	Finisher	Withdrawal
<b>Flocks with necrotic enteritis outbreaks that were not from hens receiving the clostridium vaccine</b>						
1	Yes	No	bacitracin	bacitracin	bacitracin	
2	Yes	No	bacitracin	virginiamycin	virginiamycin	virginiamycin
3	Yes	No	virginiamycin	virginiamycin	virginiamycin	virginiamycin
4	Yes	Yes	virginiamycin	virginiamycin/salinomycin	virginiamycin	virginiamycin
5	Yes	Yes	virginiamycin	virginiamycin/salinomycin	virginiamycin	virginiamycin
6	Yes	Yes	virginiamycin	virginiamycin/salinomycin	virginiamycin	virginiamycin
<b>Flocks with no evidence of necrotic enteritis that were from hens that received the clostridium vaccine</b>						
1	Yes	No	bacitracin	bacitracin	bacitracin	bacitracin
1	Yes	No	bacitracin	bacitracin	bacitracin	bacitracin

## Renowned parasitologist Peter Long remembered by poultry industry



Peter Long

Last October, sad news slowly spread throughout the world's poultry industry. Renowned poultry parasitologist Peter Leslie Long had died at age 78 after a short illness.

"Peter Long is a giant in the history of coccidiosis research," says colleague Dr. Martin Shirley, of the Institute for Animal Health, United Kingdom, who was mentored by Long.

According to Long's colleague Dr. Ray B. Williams, Long demonstrated a flair for innovation early on when he served in the Royal Army Medical Corps and suggested using the erythrocyte fragility test as an aid to diagnosing Cooley's anaemia in Maltese families.

After his military service, Long worked in parasitology research at the entity now known as the Agricultural Research Council, a British government body. Despite no formal academic qualifications at the time, he made steady and impressive progress in his career and innumerable contributions to the field of coccidiosis research. Long studied part time and, in 1952, became a member of the Institute of Medical Laboratory Technology by examination and, by 1956 obtained Fellow status.

Long had many other accomplishments too numerous to list here that included a steady stream of publications as well as teaching positions and fellowships around the world. In 1971, he received a PhD from Brunel University for his work on avian coccidia and, in 1977, was awarded a DSc, says Shirley. Long was a recipient of the Tom Newman Medal for Poultry Research from the British Poultry

Breeders and Hatcheries Association and an honorary member of the British Veterinary Poultry Association. He co-edited a book entitled *The Coccidia*, which became the first in a series of volumes that have stood the test of time and continue to be useful reference texts.

In 1979, Long succeeded Prof. W. Malcolm Reid as Professor in the Department of Poultry Science at the University of Georgia. In 1983, Long was awarded the title of D.W. Brooks Distinguished Professor of Poultry Science, which he held until 1990, when he returned to the UK for retirement.

Of Long's many important contributions to the knowledge of coccidia, says Williams, one of the most significant was his demonstration that *Eimeria tenella* can develop in chicken embryos.

Improved approaches to attenuation, such as the use of specific-pathogen-free birds, were initiated by Long, leading to the creation of anticoccidial vaccines through the full attenuation of all remaining poultry *Eimeria*. Long provided tools for other workers to explore the biology and chemotherapy of coccidia.

Adds Shirley: "[Long's] later contributions to coccidiosis research continued to reflect his desire to improve and understand the control of disease and his early work in Georgia was pivotal to the first understandings of the relationship between pathological changes in the intestines and body weight changes of vaccinated or naive chickens after challenge, findings that were to become important considerations in the evaluation of vaccines."

Williams notes that Long was also highly respected for his support and encouragement of younger researchers. His generosity in sharing ideas and authorship of publications was widely acknowledged, and the international scientific community showed its appreciation with a dedication to Long at the Ninth International Coccidiosis Conference in Brazil, 2005.

## Eye of the Beholder *Continued from page 4*

cidial challenge. That's why Marshall says vigilance is needed not only to keep up with coccidiosis disease patterns, but also to find improved control strategies that help producers minimize losses due to *Eimeria*.

Apart from VLA, Marshall plans to be vigilant about traveling with wife Jackie, adding to the list of 40 countries they've visited so far.

His most exciting trip was a safari in Botswana — hands down. "The ani-

mals, birds and ecology are fantastic," he says.

Asked what observation in the bird world compares to the excitement of *E. tenella's* blue halo, though, and Marshall says it was finding a nesting pair of black stilts in New Zealand, probably the rarest shorebird wader in the world.

"There are only about 80 of these birds left in the world, and I observed a breeding pair," he says.

## Updated coccidiosis book addresses value of coccidiosis vaccination

A popular book on coccidiosis has been updated to include a new chapter on anticoccidial drugs and vaccines.

The 165-page book, *Poultry Coccidiosis: Diagnostic and Testing Procedures*, is authored by veterinary parasitologists Donal Conway and M. Elizabeth McKenzie. When it was first released in 1979 and a second edition was published in 1991, the book was found to be very useful for poultry scientists, disease diagnosticians and veterinarians.

The most recent edition reflects substantial progress in knowledge about coccidiosis in poultry and a growing body of critical information, Conway says.

The book includes an introduction to coccidiosis, reviews diagnostic procedures and collection and counting of oocysts. It also contains basic procedures and example protocols for testing anti-coccidial drugs.

There is a tutorial on scoring gross lesions caused by major species of *Eimeria* infecting chickens. The review is based on the Johnson and Reid lesion scoring procedure. For each species, lesions due to infections ranging from light to severe are illustrated by high-quality images.

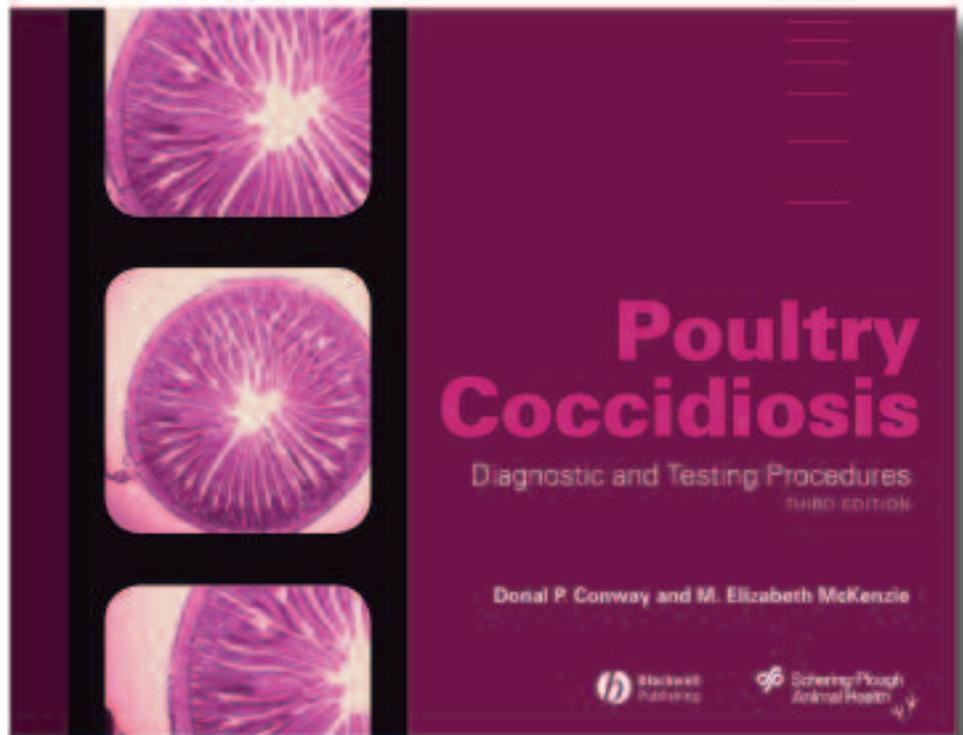
“Over the years, these images have been of significant value in assessing the importance and severity of both controlled and naturally occurring coccidial infections, and it is a special delight to us to review these images once again,” Conway comments.

### *Vaccines minimize resistance*

In a chapter on the epidemiology and control of coccidiosis, Conway and McKenzie state that the use of anticoccidial vaccines in a rotational program with anticoccidial drugs is recommended to minimize the risk of anticoccidial drug tolerance or resistance problems over the long term.

“The use of anticoccidial vaccines in breeders and replacement birds is probably the optimum course in most situations, and the current ability to vaccinate chicks at the hatchery by spray cabinet... has made a big difference in making anticoccidial vaccines a practical option for broiler chickens as well,” say the authors, who also cover important topics such as environmental management and feed quality.

The book’s new chapter on anticoccidial drugs and vaccines reviews various anticoccidials and provides a review of each drug’s chemical structure, safety and efficacy. It contains an interesting history on the development of polyether



ionophorous antibiotics, reviews the advantages of these drugs and includes concerns such as ionophore toxicity.

### *Vaccines a 'practical alternative'*

Vaccines, the authors state, “provide a very practical and important alternative to the exclusive use of anticoccidial drugs for two excellent reasons.”

A number of studies have demonstrated that vaccines give a comparable level of coccidiosis protection to growing broiler chickens compared to anticoccidial drug programs and most live vaccines replace indigenous coccidial populations in the broiler house with coccidia that are susceptible to anticoccidial drugs, extending the usefulness of anticoccidials, they say.

Although initial application of live vaccines was limited to layers and broiler breeders, there is currently a growing use of live anticoccidial vaccines in broiler chickens due in large part to the ability to apply vaccines in an economically effective way at the hatchery, the authors say.

They explain that Paracox vaccines were the first commercially available products of their kind containing attenuated strains of *Eimeria* spp, which are relatively nonpathogenic. The vaccines, Paracox and Paracox-5, have several possible methods of application; hatchery spray at day of age appears to provide substantial benefit in stimulating early immune development in broilers.

The updated book will be available through Blackwell Publishing Professional, 2121 State Avenue, Ames, IA 50014-8300, USA, or through its website: [www.blackwellprofessional.com](http://www.blackwellprofessional.com) or [www.blackwellvet.com](http://www.blackwellvet.com).

## Oocyst-counting method ensures proper administration of Paracox-5

A practical method of counting oocysts after the first shedding in birds vaccinated with Paracox-5 has proved to be an excellent method for assessing the effectiveness of vaccine administration.

The method was developed for birds receiving Paracox-5 via spray cabinet in the hatchery. It is the brainchild of Schering-Plough Animal Health's technical service manager in Italy, Dr. Luciano Gobbi, and his associates in the company as well as poultry field veterinarians.

"We devised the method after discovering that other, similar methods requiring collection of individual droppings were time consuming and difficult to implement on a routine basis," Gobbi explains. "They also resulted in failures monitoring the oocyst count in birds vaccinated with Paracox-5."

The newer method, in use since 2005, indirectly evaluates the accuracy of vaccine hatchery spray by monitoring the first oocyst shedding. "We now have enough experience with this method to conclude that it is effective and useful," he says.

Fecal samples are usually collected by Schering-Plough Animal Health employees, who work with poultry farm managers or their deputies. Diagnostic labs handle fecal sample processing and oocyst counting because they have the necessary facilities and expertise, Gobbi says.

The oocyst-counting method provides data and figures that enable judgments to be made about how effectively the spray cabinet has worked and whether uniform vaccine coverage has occurred. It helps determine whether chicken preening and vaccine swallow are adequate, he says.

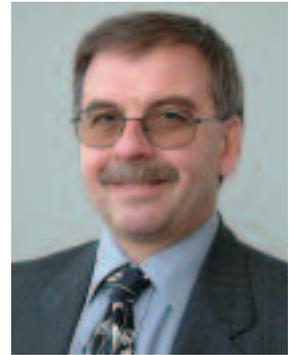
The procedure starts with day-old chickens, when they are released from transport cages and placed on the floor. One

chicken per cage is caught randomly. The selected chickens are confined in one or two wire-floored poultry cages with legs that raise the cages from 40 to 50 centimeters (16 to 20 inches) above the floor. This ensures that birds have no contact with the litter.

Starting at 96 to 97 hours after Paracox-5 vaccination by spray administration and until 148 to 156 hours post-vaccination, stainless steel trays are placed under the poultry cages so that all feces can be collected and pooled every 20 to 24 hours.

This is the time when birds shed only *Eimeria* oocysts from the vaccine. The collection of oocysts and subsequent counting at a lab can demonstrate that a large amount of chickens ingested the vaccine and, above all, that vaccinal oocysts have "multiplied" within the intestine epithelial cells, stimulating immunity, Gobbi says.

Studies have shown, Gobbi adds, that the litter oocyst pattern in birds that receive Paracox-5 for broilers differs from birds that receive Paracox-8, which is designed for layers and breeders. One of several possible reasons could be that Paracox-5 has three fewer *Eimeria* species compared to Paracox-8, which may reduce the number of oocysts produced after vaccination. In addition, Gobbi prefers fecal sample collections be taken after several hours of fecal deposition as opposed to collecting individual droppings at one specific time, as previous methods required.



*Gobbi: 'It is effective and useful'*

## UK flu outbreak in turkeys posed no threat to Paracox vaccine safety

The outbreak of H5N1 avian influenza in February at a farm belonging to Britain's largest poultry producer poses no threat whatsoever to the safety of Paracox vaccines, says Philip Grose, plant director for Schering-Plough Animal Health's manufacturing facilities in the United Kingdom.

Every step of production for Paracox vaccines is carefully controlled under strict biosecurity procedures to ensure the purity of both Paracox-8 for breeders and layers and Paracox-5 for broilers, he says.

For instance, Paracox vaccines are made with specific-pathogen-free (SPF) birds hatched from SPF eggs, which are tested to be doubly certain they are free of any pathogens, including avian influenza. Feed used during production is irradiated and water used for production is purified, he says.

The vaccines are chemically sterilized and, during this procedure, are handled either in a biological safety cabinet or laminar flow hood. The sterilization process has been tested to verify its effectiveness. "Specifically, our sterilization process fully inactivates H5N1 avian influenza (Thailand origin), which has been demonstrated by the Australian Animal Health Laboratory," Grose says.

"In addition to all this, our quality control procedures include testing of finished products to confirm the vaccines are sterile and free of extraneous agents," he adds.

Biosecurity procedures for manufacture of Paracox vaccines include strict control of production facilities, he continues. Positive pressure cascades are used to prevent entry of extraneous agents into the facilities. Air is filtered and production areas and equipment are routinely sanitized. The production facilities have pressurized airlocks for the transfer of materials; raw materials and equipment are passed through the airlocks and are sanitized using approved disinfectants.

During the secondary manufacturing stage, clean rooms are used and employees handling antigens before packaging wear full, sterile gowns. All materials in the clean rooms are autoclaved, Grose says.

Employees and contractors are screened before entering the plant to make sure they pose no risk. If they have been anywhere that non-SPF birds are held or visit facilities where infectious avian agents are handled, they are forbidden from entering Paracox vaccine manufacturing facilities for three days.

"Both Paracox-8 and Paracox-5 customers can rest assured that our vaccines are completely safe for use," he says.

## Asking tough questions

How should European poultry producers fight growing competition from inexpensive frozen imports? Should producers seek more protectionist policies? Or should they rethink their strategies to become more competitive?

What is the best way for European poultry companies to deal with this new competition? Do they simply need to become bigger and more efficient? Or should they steer consumers toward value-added, locally produced, branded products that command a premium price?

And how will *your* company meet these challenges? What does your operation do exceptionally well? What could it do better? What opportunities have you ignored? Where will your operation be 10, 20 or even 50 years from now? What roadblocks stand in your way of progress?

These are among the many questions facing poultry producers in and around Europe today. And they are not easy to answer. No one poultry operation is the same in terms of management, facilities, marketing or long-term goals. We do know, however, that change is essential if we want to remain competitive.

As poultry industry trend-watcher Osler Desouzart tells us in the article beginning on page 15, “Today’s consumer wants to know *what* he eats, from *where* it came and *how* it was produced. He wants *assurance* that what he eats is *safe* for his *health* and the *environment*, that it is *fair* to the manpower that produced it and that the meat comes from animals that are *well cared for* and *healthy*.”

Desouzart also warns against mistaking economy for progress: “A premium chicken sold at a premium price cannot be made... with second-grade feed, with the lots

managed by untrained people and with the ‘cost dictatorship’ determining that the least expensive ingredients should always be used. Quality begins at the beginning, but has to go all the way to the end. There is no ‘partial’ quality, or quality just in parts of the process, by part of the departments and part of the time.”

At Schering-Plough Animal Health, we are making efforts to partner with poultry producers to meet these challenges. A good example of this effort is the recent meeting we hosted near Venice (see the Special Report beginning on page 5) to help producers focus on intestinal health and ways to produce wholesome, value-added, yet competitive poultry while meeting the growing consumer demand for birds without in-feed antibiotics.

It is our hope that this special issue of *CocciForum* — the first one published specifically for Europe and the Middle East — will provide inspiration and ideas for meeting the many challenges presented above.

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# **Innovative Solutions** *in Poultry Health*

**Today's poultry industry demands innovative approaches to emerging diseases.** To remain profitable, poultry producers evaluate options carefully and choose what works best for them. We have always strived to offer products and services that make a difference, even taking the unconventional path to bring the best tools for improved performance and profitability.

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