MR. CARLIN: Dr. Waldroup, University of Arkansas.

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MR. WALDROUP: Right. My name is Park Waldroup. I'm a professor at the University of Arkansas. I've been involved in poultry research now for about 47 years and I think this background is on my side because poultry and poultry nutrition has become an international situation. The feeding that we do here in the United States is reflected in Brazil, it's reflected in China, it's reflected in Thailand and virtually everywhere around the world.

We like to think that we know more about the nutrient requirements in chickens than almost any other animal including man and there's a number of reasons for this. A small animal is easy to handle. It grows fast. We can get a lot of turnaround. Now, you can say the same thing about the white rat, but the big difference here, of course, is that there's a great commercial application.

The poultry industry, although it's very large is a very small community, actually, of researchers and nutritionists and we know each other and we do a lot of collaboration and there's a very quick application of the research that we do, which is commercial practice. And this has been

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brought about, of course, not only through genetic research but also the nutrition to allow us to produce chickens at a very economical rate and to provide a very high quality protein at a very low cost to the consumer.

Feeding poultry or formulating poultry is really a very simple step just like almost any manufacturing process. There are several steps that we go through. First of all, of course, is trying to establish what nutrient requirements that we want to meet; that is, what sort of nutrients do we want to provide to the bird.

Next, we have to see what materials are available. The poultry industry, just as Mr. Carlin in the dairy industry, works off of byproducts. There aren't too many things that are grown -- people don't kill cows just to make meat and bone meal for chickens. So we have to see what do we have available. In looking at those ingredients we have to make some decisions, is there limitation on the quantity available? Up until now, for

example, we've been able to buy just about all the corn that we wanted. We're running into situations now where that may not be the case.

And certain other ingredients, there are

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certain limitations on how much we can purchase. There are certain physical limitations. For example, in some areas molasses might be a good buy, but there's some physical limitations to how much you can add. There are some ingredients that actually have some toxic factors if fed at very high levels. Cottonseed meal is a prime example.

And taking all these into account then we can blend these together to come up with a mixture that gives us the requirements at the most economical price. This may change from day to day. It may change from hour to hour. It certainly changes from week to week.

Very few companies have a very fixed formula. It changes literally almost from day to day. These are the 40 known nutrients that are required by the chicken, the pig, the man or any other animal and we'd like to think that we have a pretty good handle on all of these 40 nutrients as to what a young chick needs. And it looks pretty formidable, but when we start breaking it down we look first and see that we typically add a vitamin premix that supplies all of the known vitamins in more than adequate quantities so that we don't see all the nutrient deficiencies that were once very

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common in the animal industry.

We also add a trace mineral mix so that we can provide the quantities of these because depending upon different parts of the country and where the grain is grown and so forth they may not have enough iron or zinc or selenium, so we provide these in a trace mineral mixture.

All the nutrients that I showed here in yellow are almost always going to be in additive quantities no matter what type of ingredient that you use. So really we wind up actually looking at about ten key nutrients when we start to formulate a diet. We have to provide energy, of course, and this is the primary cost of producing a poultry diet. About 70 percent of the cost of producing a poultry feed goes to make up the energy and this is where I'll address this a little bit later.

Please go back, please. There are about six critical amino acids that are needed and about

three minerals that we have to consider when we start to formulate a feed. Who sets the standards for what goes into a poultry feed? If you go to almost every country outside the U.S., there's usually some governmental agency that says a starter chicken feed has to have X amount of

protein. The dairy feed has to have Y amount of calcium and so forth. Typically when you talk to government officials, they say, well, we want to protect the farmer, we want to make sure that the chicken or the pig has enough protein. Typically in doing this the nutrients are usually far in excess of what are needed and simply in an effort to "protect the farmer."

Virtually all the poultry produced in the U.S. is under the integrated system in which the feed company itself sets its own standards in terms of nutrient standards. The company may decide to produce a chicken at a very high rate of gain. It may decide to because of -- usually these decisions are based on the types of ingredients that are available locally.

In one area you might have plentiful supplies of grain, in others they might be less plentiful and so decisions are made. For example, this is a survey of 160 different poultry complexes and just looking at the energy, the crude protein and a couple of the critical amino acids. You can see there was as much as a ten percent difference from the lowest to the highest in terms of what energy level that they chose to use probably

because -- and all of these were probably because of the types of ingredients that were available to them. As much as 20 percent difference in the protein content.

Basically when we start putting a diet together, we have to look at several critical ingredients. And I have listed these in basically the order of their importance. First, we have to have a good high quality protein source. We are growing animals and this is a protein driven factor.

We have to have grains or grain byproducts for energy. We use supplemental fats and oils. We need a source of phosphorus. Phosphorus is the key ingredient for growing bones. We have to have other essential minerals, principally calcium and sodium and, of course, the

essential vitamins.

We also -- if we start looking at where we're getting the grains from, corn, I'm showing here the relative energy bag of some of the common grains and corn, of course, is by far the highest in energy followed closely by sorghum. You've all read a lot recently about the ethanol industry and the potential byproduct from distillery grains.

Notice that it's way down the list in terms of its potential energy value.

If we start looking at volume, of course, there's no question here. This is why we're using a lot of corn. If we look at the next one, we see the fact that's really disturbing me is that a tremendously increasing amount of corn is being used for ethanol production and this is leading to some critical situations.

Among the protein sources, soybean meal is the primary one that's used and if you look at the next slide that's showing the volume produced. You can see this is why we're driven largely by using corn and soybean meal for our primary ingredients.

We also, of course, have been a big user of inedible fats from the restaurants and fast food industry and we make a lot of use of supplemental pure amino acid that helps to stretch out and balance our protein.

There's no such thing as an average, but this would be a typical diet that would be found in virtually every poultry grower diet. As you can see, it's a very simple mixture consisting of a lot of byproducts feed, but well supplemented with

vitamins, minerals and amino acids.

The poultry industry, of course, has become very conscious about the environment. That is characterized by having a lot of chickens in very concentrated areas and most of these areas, of course, are located in areas where poor economic -- poor agronomic productions. I grew up in the poor rural south and many of you are aware of the fact that there wasn't a whole lot to do until people started to build chicken houses but this, of course, causes problems.

This is a map showing the excess phosphorus not only from chickens but other animals and the poultry industry, of course, is addressing this. We have started using phytase

enzymes to help improve the phosphorous in there. I ran a survey recently and they're estimating that 80-85 percent of the grower-producers are now using phytase enzymes. Nitrogen is going to become a problem and we're working on that.

Let me just make one more comment here. Biofuels, this is an area that's really worrying me and a lot of people. As we saw, an increasing amount of corn is going into making ethanol. It leaves us a byproduct, but the byproduct is very

poor in quality. It's much lower in energy, much lower in protein quality. And, in fact, this was in the paper just recently and we started seeing the war between food and fuel starting. People in Mexico cannot afford to buy corn tortillas now, and I'll leave it at that.

MR. CARLIN: Thank you very much. We're obviously looking at issues in a broader sense than what you have shared and you've been working in the poultry industry for a long time. In addition to what you've shared with your presentation, what do you see as the other issues for the poultry industry as we look to the future?

MR. WALDROUP: Well, you know, certainly right now to me the environmental issue is going to be a -- is and will continue to be a critical issue. I think we're addressing that. Some of the other speakers are going to be addressing problems with that. My, at least short-term, concern is just simply this battle between fuel and food because it is really getting to be a critical point if we are going to continue to produce meat for our consumers versus putting alcohol in our cars.

MR. CARLIN: Yes, Dan?

MR. JACKSON: You have a frame in your talking about -- that you didn't mention about feeding arsenic and antibiotics. Could you say a little bit about that?

MR. WALDROUP: Well, the usage of these has dropped precipitously in recent years. Two years ago I would have said 90 percent of the feed contained arsenic in some û an arsenical, let me say an arsenical. I think the figure today -- now, let me emphasize that chart that I showed does not include all of the poultry producers. Not all poultry producers participated in that survey, but today it's about, what, 30 percent. It is a very

useful product. It is useful for animal health. You know, in Europe they have now tried to go antibiotic free and they wind up with a tremendous amount of health problems in their chickens because of that.

MS. WILSON: Could you comment on the environmental fate of the arsenicals?

MR. WALDROUP: I'm not an expert in that area. I just choose not to comment on that.

MR. CARLIN: Thank you very much, sir.