SESSION I: INTERNATIONAL PERSPECTIVES
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Role of Agribusiness in Enhanced Nutrition

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I would like to talk to you today about the role of industry in nutrition. Specifically, I want to shift the discussion and look very specifically at the role of industry in the developed world and how it bleeds over into the lesser-developed world.

The USDA food pyramid has been around for well over 40 years. It was taught to both myself as a child and to countless numbers of generations within both the United States and Europe. Although this pyramid has been the foundation of nutrition for humans, I think we have to admit the traditional role of industry around this pyramid has been twofold.

First, it was our job to provide safe and inexpensive sources for each level of the pyramid; secondly, to provide convenient, flavorful ways to present these foods. In the developed world there is no doubt we have succeeded greatly at every level of the pyramid.

The problem really involves what the new role of industry is in enhancing nutrition. The best estimate is that only nine percent of Americans actually eat the foods as recommended on the food pyramid. Scientifically, after 40 years of attempting to persuade the general population to eat a particular way, we have to be frank – we've been an abject failure. We have not been able to persuade the population that this is the way to eat.

I will maintain today that industry's role is to look at the new type of malnutrition taking place in the developed world. Malnutrition that comes from only nine percent of the population eating the way it should misses many of the micronutrients they should be getting in their normal diet. In the next ten to fifteen years, I think the principal challenge we will face is finding ways of getting micronutrients that are present in the ideal diet into the typical Western diet.

I would like to talk about a case study of one molecule that our company has worked with in regards to this particular problem: lutein. With lutein, we saw the industry's role in three different places:

First, to understand the science of what lutein was and if it was important in human nutrition; secondly, to educate the public about this nutrient. Finally, to provide the nutrient to the public in a low-cost manner that it could be incorporated into diets.

Lutein as a molecule is commonly found in nature. In just a few weeks, we will see lutein occurring in almost all plant species in most parts of the northern hemisphere. Lutein is the molecule that protects plant cells from dangerous wavelengths of sunlight. It is present in all

green plants. When chlorophyll abandons the leaves in the fall, we see the brilliant expression of lutein.

Lutein is also found in humans, and it deposits in a very particular part of the eye called the macula. The macula is the part of the eye responsible for the ability to read, where we do all of our tight focal work. This is actually a picture of a healthy macula coming from a human who is eating essentially from the USDA food pyramid. You can actually see the yellow color naturally present within the macula.

When people do not eat the proper amount of lutein, it's now been conclusively demonstrated that they are much higher at risk for a disease called age-related macular degeneration. This problem is really an oxidation of the proteins found within the macula part of the eye. As you can see in the pictures here, we see the vision in the central part of the eye slowly degrades to the point that we can no longer see or do any tight focal work. It is the leading cause of blindness in the Western developed world, including Japan.

Approximately 25 to 30 million people are currently afflicted with the disease worldwide. As of today, there is no known cure or treatment. It is completely related to a nutritional disease present within the developed world, not the underdeveloped world.

When we conduct studies on what the protection of lutein is for the prevention of macular degeneration, it's a linear relationship. Consumption of at least 6 milligrams of lutein per day is required to be able to significantly lower the incidence of macular degeneration. Cataracts are a similar type of eye disease that involve clouding of the lens, an accumulation of dead cells through the lens. This was once thought as a natural result of aging. It is now the second leading cause of blindness in the United States, behind macular degeneration.

Data has now shown that this also is directly affected by nutrition. Again, there is a linear relationship between the intake of lutein and the prevention of cataracts, so it is suggested that 6 milligrams a day is the ideal dosage to be able to take of this important molecule.

Now we are aware of the data of the requirements of this molecule versus the actual consumption levels of lutein and zeaxanthin. The material is naturally found in some of our favorite vegetables. Any green, leafy vegetable contains lutein and zeaxanthin. Kale, broccoli, spinach and lettuce would normally contain sufficient amounts to allow the prevention of macular degeneration or cataracts to occur.

Yet, when we take a look at lutein intake by age group within the United States, the data is rather startling. It levels across all age groups, consistently at about .8 milligrams. Contrast that amount to the 6 milligrams of what we know is the requirement, and we are obviously in a malnutrition state within the developed world. Understand that the nutritional importance of this molecule was not understood until 1995. So in ten years, we have discovered the nutritional impact and the importance of a trace nutrient that is contained well within the fruits and vegetables that we're consuming.

Where are we able then to harvest lutein to introduce it into the human food supply? Marigold flowers are actually the richest source of lutein known on the planet, and thus large consumption

of the flowers themselves could be sufficient, except the toxic byproducts contained within marigolds.

So this is where the role of industry comes in: to figure out a way to crystallize and purify the material such that it can be introduced into not only foodstuffs but obviously vitamin supplements. This could then be utilized to supplement that part of the human diet short of this critical ingredient.

Whereas in the last ten years our company has been fortunate to discover one such molecule, it is my contention today that there are up to 70 different molecules still locked inside the USDA food pyramid. These molecules are not being consumed within the developed nations, thus impeding our ability to extend our lives through a longer period than it is today.

I want to turn now to the problem we are also faced with at this conference. That, of course, is obesity. Many of the previous speakers have talked about the literal size of this problem. I don't think much more needs to be said about this. But I think too often as nutritionists we have been overcome by the complexity of the hunger response in humans. We know this probably involves over 25 biochemicals that drive our desire to eat and unfortunately our desire to overeat.

Large pharma, as we well know, is spending literally billions of dollars in looking to solutions to be able to control directly some of the biochemistry within our bodies that controls our appetite.

My challenge to you is that industry has a role in this arena as well and that foods in and of themselves can contribute to obesity. Let me point to some interesting data developed in the 1990s.

We all know and have perhaps subjectively experienced the fact that certain foods will “fill us up” faster. This brings on what I call the feeling of “satiety” or “satiation”. The feeling of satiety can be and has been directly quantitated with various different foods.

The work I wanted to point out here shows that particular experiments were done when 150 volunteers were fed 300 calories of various foods. For purposes of this rating, white bread was given 100 points. Participants were asked to rate how full or hungry they were after consuming these various foods. As you can see, some foods such as a croissant, cake, or donuts had a satiety index of less than half of that of white bread. On the other hand, other foods had a far higher satiety index.

I would also like to lead your eyes to the final entry of potatoes. Three hundred calories of potatoes contained three times the satiety of 300 calories of white bread. Thus, foods intrinsically have some things that “fill us up” or make us feel satiated more completely. Interestingly, this seems to bridge what we think about various food components. Potatoes for example are considered to be mostly starch; fish on the other hand, had a rating of 225, considered to be completely protein.

It was an observation like this that led us to the conclusion that there must be something else in potatoes besides the starch that contributes to satiety. It was this basis of research that we did in conjunction with universities that we were able to demonstrate that a particular protein with this following amino acid sequence was the party responsible for making potatoes fill us up faster.

Now, this particular protein is present only in a one-tenth of one percent of the dry weight of potatoes. It still had a dramatic influence on consumption of food.

When protein was directly given to humans in a purified form, it would not only increase the rate of satiety, but in addition would stimulate the increase of a particular hormone called cholecystokinin, (CCK), which is the hormone we generate within our bodies when our stomachs get full. This effect led us to believe that there is a commercial product available that could perhaps allow people to be able to control their appetites better through the use of a product; a protein that would make them feel full before they had necessarily consumed the foods that would lead to an overweight condition.

The role of industry, besides obviously understanding this, was then to design an industrial process that would allow the purification from a field commodity product of a single protein out of potatoes. We have been able to successfully do this and are able to offer it into the market as an additional help for those who are trying to control their weight.

The challenge I believe is that this is really the beginning. We must understand that varieties of foods do impact our appetite. Meanwhile we wait for large pharma to come up with pharmaceutical drugs that affect us when we get to an obese condition. I maintain that as nutritionists within the food industry, it's our responsibility to understand how these foods impact appetite and then to modify foods in ways such that we can help people self-limit their caloric intake.

In conclusion, the ability of industry to impact on human nutrition really lies in three following areas: First, we must find and identify correct nutrients to help malnutrition that is occurring in the developed world; malnutrition that I think we're just beginning to recognize. Secondly, we must ensure we have consumed enough of the correct foods. Finally, we must be sure we do not overconsume foods that cause obesity problems our country and the rest of the developed world is experiencing.