

WORLD FOOD PRIZE SYMPOSIUM October 2001

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Good afternoon, ladies and gentlemen. And thank you very much, Floyd, for those very kind words. We are long-term friends and do meet annually to exchange our goals and our opportunities as seems fit at the time. And could I also say a word of thanks to the World Food Prize for the invitation to me to contribute to this conference. The program is a very interesting one and particularly for someone like myself who comes from the nutritional arena, when I at one time or other actually did some science.

Regrettably, perhaps, the subject of the conference could hardly be more topical than it is. It's also, I might say, a pleasure for me to come back to Iowa. I was trying to count whether this was the fourth or the fifth time I've been to Iowa. And I always like to see how other people's agriculture is being conducted. And as we flew into Des Moines, I could see that some harvesting was visually in progress.

But as I think you all know, and you've heard a bit about it today already, the United Kingdom has had to contend with two major animal disease epidemics in the last 15 years or so. I was grateful to Peter Chalk for introducing my talk this morning. I was a bit concerned at one point that he wasn't going to leave me anything to say, but perhaps I will be able to draw out a few more detailed points.

One of those epidemics was concerned with a new disease of cattle, and you should always be aware that new diseases do arise. The new disease was BSE or Mad Cow disease and started in the mid-1980s. In 1996 it was concluded that it was transmissible to man, and of course that brought a completely different dimension to the disease. So it was not only an animal health problem but very quickly became a human health problem. The other, Foot-and-Mouth disease, is an ancient scourge of the livestock industry around the world, and the first case in the United Kingdom occurred in February. And I had hoped to be able to say that we were at the end of the epidemic, but I understand since I left the UK, we've had another case. We hadn't had any cases in October, and I was hoping we might have seen the end of it. But perhaps not unexpectedly, there may yet be a few cases to stamp out.

In contrast to BSE, Foot-and-Mouth disease does not hold any hazards for human and is primarily of animal welfare and economic importance. And that became quite an important issue in the minds of the UK public. I might say that the epidemics have been a major source of disappointment to a country that prided itself in having high animal health status in its livestock and indeed thought it had a well-developed surveillance system to detect such diseases.

But what I'd like to do is to describe rather briefly the main features of these epidemics in the UK and then try to draw out some of the issues that are, I think, of global importance. I should say I will probably set out rather more problems than answers, but I hope in so doing it may stimulate you to think about the problems and what the answers might be.

First then if I could turn to Foot-and-Mouth disease. This first slide shows the recent history of Foot-and-Mouth disease in the UK, and we had a very long break, thankfully, since the last major epidemic. One of the repercussions of not having had disease for a long time were a large number of people who had never actually seen Foot-and-Mouth disease, which may actually have contributed to its failure to be diagnosed at an early stage. And certainly one of the lessons, if you like, is that we will try to keep people rather better informed what some of these diseases look like, even if we haven't had them for a long time.

It is Type O Pan-Asiatic strain, which I think has been around in various parts of the world but is heavily focused in sheep, which was, I think, probably quite a new thing for Foot-and-Mouth disease but certainly a new feature for the UK and created quite a lot of difficulties in diagnosing the disease. There was considerable delay in the first diagnosis of the disease, and I'll talk a little bit about that in a moment. But because of that, it was equivalent to a multi-primary case outbreak, in other words, an outbreak that appeared to arise at a whole host of places very widely spread... moment. And I should say, the government was ill-prepared for that type of outbreak; it was not something it expected. It expected perhaps a single-focus outbreak with a range of farms around it, as indeed we'd had in 1967.

This is a slightly complicated map. I don't want to focus too much on it but just to say that the disease was initially diagnosed in the bottom righthand corner of the slide, in Essex at _____. But actually the index case had come from near the top of the country, near the top of England anyway, in North _____. And the origins of the disease and the transmission of the disease were very much from that point. And the disease, before it was diagnosed in Essex, had already been spread quite widely in the region of the farm in the north of the country, firstly by wind in a viral plume within about a five-mile radius of the initial farm.

And then predominantly it was spread by markets, and the key markets were the ones at Hexon and the other Longton market. And if you see the arrow, it's pointing out from the Longton market; it's the one on sort of the left of the country as you look at it. And that shows the rapid distribution of the disease around the country. Within ten days the disease had been distributed around the country; and of course those ten days had already mainly taken place before the disease was actually identified.

That brings out a number of points. Perhaps one interesting statistic was that about 80% of the epidemic can be attributed to 16 sheep that were taken to Longton market on a particular day. One wonders if the farmer hadn't bothered to take his sheep that day if we might have avoided most of the epidemic. But those 16 sheep that were infected going through Longton market that day and the subsequent market were responsible for 80% of the epidemic that did occur.

Of course, some of the features were: the modern, motorway network allows animals to be move quite long distances, modern transport, vacuoles and so forth, vacuoles that seem to be never stopping – they're picking up sheep in one area, dropping them in another – an ideal mechanism, maybe modern animal transport, but an ideal mechanism for spreading a disease if every you had one. I comment that sheep are much-traveled animals in the UK.

This is just a picture of the epidemic. It showed the cases peaking in March or April with about 50 cases a day. It's been rather a long tale. The basic strategy in trying to control the disease was to cull out the infected premises and to cull out any, what we call, dangerous contacts around those premises. And it's quite a complex business, together with the law and actually compensating farmers for their stock and to decide which farms are going to be killed out. And of course the other feature was that we did encourage high biosecurity in those farms. The graph starts at February and tails out towards the end of September, a fairly classical epidemic picture, I think, of a disease.

I've alluded to some of the causes for the large epidemic; they're set out here: The delay in identifying the disease. It raises questions about how often veterinarians, vets are on farms these days. And I suppose going back some years, vets were frequently called out to treat animals, but with modern medicine and the cost of that versus the value of animals, I suspect there are many farms that don't actually see a vet from one month's end to the next and maybe even one year's end to the next. So if you're going to actually detect diseases and have your veterinarian professions have a tight control on it, it does actually suggest you have to have a mechanism that allows vets to get onto farms at least at some points in time.

The sheep population is another serious issue. It's about 60% greater than it was in 1967, and there are questions about whether there were too many sheep around and whether that made things even more difficult. I said that the sheep were well-traveled, and there are obviously marketing features associated with that but also husbandry features. A lot of sheep in the UK are overwintered on dairy farms, so they spend part of their life on the sheep farm and part of their life on the dairy farm. And that again causes difficulties when trying to control the disease. And finally, perhaps, the husbandry aspects of sheep – clipping, dipping – bring farmers and sheep together and bring neighboring farmers together and again provide another mechanism by which the disease can be transferred.

The next slide just shows some statistics, a large number of vets mobilized in relation to the normal three or four times... We were very grateful to vets from other countries who helped and came and helped with the epidemic, particularly the United States but many other countries supplied veterinarians to help with the effort. We did have a large... of the army involved at one point.

And then coming on to the number of animals slaughtered – and these actually are the numbers excluding welfare slaughter – I think we now have slaughtered something like 5.5 million animals to try and contain this epidemic, both those that were directly concerned with the disease but also ones that were suffering because of welfare considerations. Because of the movement restrictions, they were on a farm where there was limited grass, and hence those sorts of cases had to be dealt with. Additionally, we did have at one time a large market for light lambs going into the rest of Europe. And since there is no market for light lambs coming off the hills, we've also had to implement a scheme to remove those animals from the market.

The next slide talks about the repercussions from Foot-and-Mouth 2001, as we call it. Just a few points. Perhaps disposal was a major problem of the slaughter policy. And as you all

have seen from your television pictures, we started out by burning quite a lot of the animals. That proved environmentally and esthetically very unsatisfactory. We then invoked burial and buried a lot of the animals. But again the difficulties with burial are rather not much different with large sites. These took many weeks, three weeks, to prepare, even with army excavators and all that sort of stuff, and to prepare them so that they would meet environmental requirements was quite a major issue. And, of course, thrown in, as I'm going to come on to talk a little bit about, we had BSE in the background. So people were concerned about burying animals that might be carrying BSE on these sites.

Another issue that came up very quickly was the issue of tourism and the importance, the relative importance of tourism versus farming. And we had a large debate about that. And vaccination another big issue and should we have used it, what should its role have been in control. And the discussion is unfinished on that. I suspect that we'll have to do a serious amount of discussion of that issue, if we had a further outbreak and what role we would put for vaccination in that.

And finally perhaps the ethical discussion – I think the public came to think that slaughtering animals as a means of disease control for a disease that was of economic importance only, not a disease that was affecting humans. And the ethical issue of whether it is fair and reasonable to slaughter animals for that purpose is another issue that's ongoing.

Lastly, with Foot-and-Mouth disease, just to say a little bit about the global aspects. It is somewhat surprising – I think something quite difficult for the public in the UK to understand was: Here's a disease that perhaps can be controlled by a vaccine, doesn't constitute any hazard to humans – why are the measures that have been taken against it so severe? Well, I think anyone who's been involved with agriculture knows that this is a very traditional way in which Foot-and-Mouth disease has been viewed. But whether it's the way it should always be viewed, and particularly if we could get rather better vaccines I think is another issue that does require more debate.

Obviously, we didn't have the disease before February. It came in somewhere. It came in in the human food supply and was then passed on through animals. But obviously, things about what sort of import control policy we should have is quite a big issue. I should say it's magnified a bit in Europe with very free movement of people and goods and so on and again with modern, motorways, and products can be from the south of Europe to the north of Europe in a very short timespan with very little intervention in between as to what's in the containers; and they're not always labeled as you might expect, in other words meat traveling in containers have also got vegetables and other things in them.

Tourism and tourists coming back to the country with parcels of meat from other countries is another dangerous route of bringing disease into the country. Things like the fate of domestic waste. This particular outbreak was associated with swill feeding and with clearly inadequate treatment of swill, but, I mean, that has been stopped. But there are other sorts of issues. We look increasingly to composting household waste as a means of disposal, and there are all sorts of issues about the safety of composting. Composting is one of the means by which

we are going to meet our environmental target. But nevertheless there are quite a lot of issues around that.

The disposal of carcasses, as I said, is an increasingly difficult question and the role of vaccination. It seemed to us that this is a global issue because it was mainly not employed in the UK because of the global food impact. The global companies would not guarantee to take products from animals that had been vaccinated. And that was probably the one thing that stopped vaccination being used. And I think, again, it is an issue that needs to be discussed in an international context.

If I could move on quickly then to BSE. This shows the picture of the epidemic in the UK. These are cattle cases per month. And I was interested to think, going back to 1986, which seemed to me to be the beginning of the Food Prize. So we've been wrestling with BSE since 1986. And we're still not free in 2001. We hope to be free in a year or two, and the epidemic is declining rapidly.

Just one point perhaps from this and one point that makes BSE a very difficult disease. The point is its long incubation period. The average incubation period of BSE is five years in cattle, so that by the time the first case had been identified in the UK, all the cases up to 1991 were already incubating. So 40% of the epidemic was incubating before the first case was seen. That's an average sort of figure, but that's the reality of it. And that makes it a very difficult disease to live with.

I did say that in 1996 we decided that there was an associated variant of the human disease CJD associated with BSE. And this chart shows the total CJD. This is people per year, deaths per year from CJD. And the solid line is the total cases; the dotted line – I'm not sure if everyone can see in the bottom righthand corner – is the cases of variant CJD, which we would ascribe as associated with BSE.

Rather interestingly, the CJD incidents increased in the early part of the nineties. The normal rate around the world is something like one case per million per year, a bit under one case per million per year. And that figure seems to apply in countries that have Scrapie (?) or TSE diseases in livestock. The numbers seemed to increase in the early nineties, which I think was attributed to better ascertainment and looking for the disease. And then, of course, the rise after 1995 is due to the variant CJD figures on top of the others. What's rather interesting is that the total figure does seem to be coming down, which is a bit difficult to explain. But the variant CJD as a proportion of those cases is going up.

The next few slides talk about the control measures. I think mostly to point out the extent of the control that has had to be introduced with BSE. Firstly, on the animal side, BSE was quickly traced to the use of meat in bone meal. And one of the control measures is the strict exclusion of meat in bone meal from all animal feeds. We then diagnosed any cases that arise in recent years of slaughtered-out relatives. In other words, if we find a cow, we slaughter out the calves and any relatives around that case so that we can perhaps try to remove the case.

I should say it's a common fallacy that this was a disease in beef cattle. It was actually a disease in dairy cows. I think 85% of the cases are in dairy cows and a rather small proportion in beef cattle. Nevertheless, all the public concern was in relation to beef, and we never did manage to correct that misunderstanding.

The next slide shows the measures to protect the human population from introduction through animals. A very severe measure is that all the cattle over 30 months of age are excluded from the food chain and are simply rendered and incinerated. We also still remove the infected tissues, brain, spinal cord, and a number of other tissues from the carcasses. And these two control measures leaves the meat supply in the UK amongst the safest in Europe. And of course things like vaccines have to be sourced from non-UK materials lest they would become contaminated.

And just extend that then to human-to-human control, there's clearly quite a lot of concern about blood transfusions. These are not carefully monitored, and the blood is all liquid-depleted to remove any potential for transmission through that route. And disposable instruments are used for some surgery, and things like some eye operations and then various other techniques where neuro tissue might be involved. And hospitals have had to introduce stricter disinfectant routines to ensure that there's no transmission of the disease from one person to another.

Just then very briefly to update the current situation. The eradication of BSE, I think, is well underway. We hope we're moving rapidly towards eradication perhaps by 2005 for some such time, though still I think veterinarians are always concerned about the tail of an epidemic and how easy it is to kill off the tail of an epidemic.

As far as Scrapie is concerned, the disease of sheep, we're embarking to eradicate it from the UK sheep population. It's been made a notifiable disease. We're using genotyping to bring TSE-resistant flocks of sheep and to breed from resistant types only. And of course, the third measure is to try and get some measure of whether the UK human population is infected with variant CJD. And we're doing a large program of screening of stored human tissues to see whether there are, what the incidence might be in the population. I should say the picture is still hampered by the lack of diagnostic tests in the live animal, which would make life a lot easier.

Finally, in just this context of updating the current situation, the concerns we currently have are primarily to do with BSE in sheep, and did BSE get into the sheep flock in the early 1990s. If yes, is there still BSE in the sheep flock now? We've done some monitoring. It's quite a tedious process to be able separate Scrapie and BSE. We've not found any animals that have BSE, but it is obviously a continuing concern. And the other concern, I suppose, is having embarked on breeding-resistant types, the question is whether resistant types themselves might be carriers of the disease. In other words, they're resistant, but they're not actually free of the disease. So there is a question around that. We are maintaining a large research program on the TSEs, and indeed a number of other countries now have very substantial programs addressing all the issues around them.

The next slide tries to update the situation in Europe. And the UK and Switzerland... Well, the UK was by far where the biggest epidemic occurred. But Switzerland also had a significant epidemic, and those epidemics are coming down very dramatically. Ireland is still trickling along with numbers. And a range of other European countries are listed here; their numbers are increasing. And I think perhaps Portugal is the country of greatest concern. But then you question what about Spain over the border from it. And I think these are small, but they are rising numbers of cases, which is always a matter of some concern, given that you have a five-year incubation period. The primary cause of this is inadequate control of meat in bone meal, and that caused the continuing spread.

Just very briefly on theories on the origin of BSE, this is a very important topic concerned with the long-term use of meat in bone meal. Because, depending on where the BSE came from, means that either feeding meat in bone meal is a long-term risk strategy or whether it isn't. The three thoughts of where it might be coming from was a rare bovine TSE that's simply been multiplied up by the recycling of animal materials through animal feeding systems. The other two are mutation of a sheep's Scrapie strain and selection of a rare sheep's Scrapie strain, and again multiplication up through the meat in bone meal system. Obviously, if it's a mutation of a sheep's strain, then the mutation could occur again; so you could never really feed meat in bone meal safely unless you can be sure that you've totally denatured any TSEs that might be present in the meal.

And just turning finally to important features of TSEs from a global viewpoint: The first one is that a very small dose of material is required to infect an animal, and it's certainly less than 1 gram of infected grain and probably more like .1 gram. One gram, by the time you've produced meat in bone meal, is no bigger than about two peppercorns of material. So if you're going to have it excluded from feeds, you need to have a very tight exclusion system to prevent even that small ... getting into the system. And if it's .1 gram, then you're down to a very small amount of material.

The long incubation period means that the disease can be incubating for a long time before you detect any cases at all. And then, of course, you have those cases appearing. One of the difficulties is there is no obvious immune response, so most of the normal techniques that are used to detect disease can't be used and it generally can't be detected until a very advanced stage in the disease itself, in other words; until the prions build up in the animal, you can't actually detect the disease.

Further important points, of course, is the link between BSE and variant CJD. While I think most people believe there is a clear link between the two, the root by which the transmission takes place is unclear. It's generally been assumed to do with consuming food products – and I think that's by far the most obvious one – but there's very little proof of that, and in fact there is no difference between those who've got the disease and those who didn't; there's no apparent difference in their diet.

So as I say, the origin of BSE is unclear. And perhaps at the bottom of the slide, Scrapian sheep and chronic Western disease in deer, both transmit naturally, which provides yet a further dimension. And I think certainly there are many in Europe who are a bit concerned

about CWD in the USA. I don't know how concerned the USA is, but I suspect quite concerned. But there are many in Europe who wonder about the risk and the dangers that are run with CWD.

Finally, perhaps in this context, BSE I think has been a fairly genuine nightmare in the UK. And I wonder just how much of a nightmare, how much greater of a nightmare, it might have been in a developing country that would not have been able perhaps to take the sort of expensive control measures that have been needed in the UK to deal with this disease.

I hope then, in conclusion, that this has given you a feel for some of the issues, perhaps modern issues, around these two epidemics. Perhaps the moral is that animal health problems continue to visit those who think they have sophisticated animal protection systems, and these systems are as vulnerable as ever. And perhaps we should be very well prepared and expect the unexpected.

Thank you very much.

Q My name is Sharon Paget, and I'm a high school teacher from Ottumwa, Iowa, and I teach genetics and microbiology and... physiology. And my question to you is: Has there been a significant change that you know of in your educational system, I mean, as far as curriculum, informing students and so on? Have there been any changes like that that you know of?

A Yes, that's a good question. My wife is a food technology teacher. And I suspect we don't do a good enough job in putting the real perspective across to schools. They certainly get a lot of material from people like Green Peace and those who don't present a conventional view of the world, but I suspect we don't do a good enough job in informing young people of the true nature of these diseases and the science around them.

Q Margaret.. Carlson... David, that was a very lucid and very good explanation of some very complex data. You used especially careful language when you were talking about what the UK government decided to do about vaccination, and it sounded to me like the language of somebody who personally already crossed the fence toward policy change but was defending a government which had not crossed that particular line, but I will leave you to confirm that or otherwise by my next question, which is: What has to happen for this global dialog on the benefits of immunization to take place? You said it would be good if this happened. I was in the UK a couple of times during the worst of the epidemic, and there was more than one person saying that the only way you could provoke that dialog was to take some of the infected material, move it very quickly to the United States and Australia, and you would very quickly have a dialog on the actual merits of proceeding to having a global herd that was immunized. I mean, do we have to wait for that kind of outbreak before we actually get into the discussion about the merits of vaccination for commercial benefits, vis-à-vis, continuing our current policy – and the benefits of either for human health would be the same – but what we're talking about is strictly commercial benefits.

A I think the discussion will probably take place fairly naturally. A lot of people have obviously observed the difficulties we've had to confront and I suspect have thought, "And supposing this was our country." I mean, Foot-and-Mouth disease could come into anyone's country. And they've thought, "What would we do?" So I think certainly there's a very ready discussion in Europe about what the European Union's policy is going to be. But the vaccine issue is not an easy one. We did, we came very close to using vaccine at one point, these cattle in Cambria. No one ever thinks of vaccinating pigs because they threw up so much virus that I don't think anyone would think of vaccinating pigs. With sheep, there are a lot of them, and it's quite difficult. We... 39 million. They're not numbered, so you'd have to round them up... Perhaps I've gone just a few more points. But in the middle of the epidemic, to have rounded up sheep would perhaps have created a major focus for transferring the disease. In fact, the best place for sheep is up in the hills, well away from man and other sheep, if you see what I mean. So they're all... such questions. Certainly, in the middle of an epidemic it's quite difficult to use vaccine.

The key point I said was that the major global food manufacturers would not promise to take milk or meat products from animals that had been vaccinated. They were concerned about their consumers in other countries, that they might be resistant. And we did some surveys. There was some resistance to vaccination in the UK as well, from a consumer viewpoint.

So, while there are a lot of arguments around vaccination, I think the debate will take place, and certainly we will want to foster that debate if we can. Thank you.