Don't Underestimate This Public Health Enemy: 'Prion Pathology'

Colin Lowry, cell biologist and Associate Editor of 21st Century Science & Technology *magazine, was interviewed on Feb. 12 on the danger of bovine spongiform encephalopathy—BSE, or mad cow disease—and the little-known science of prions. The interview, excerpted here, was conducted by Economics Editor Marcia Merry Baker and Science Editor Marjorie Mazel Hecht. The full interview will appear in* 21st Century Science and Technology.

EIR: We have had two cases of BSE in North America over the past nine months, and from a scientific point of view, you have said that the Federal food and agriculture safety policy is outrageous. What is the danger?

Lowry: The Federal standards are totally inadequate. There's very little testing at all to identify cows that are slaughtered that might have BSE. There is absolutely no testing before an animal is slaughtered, which is a real problem, because if you find a BSE cow, you can't identify where it came from. And the only way to find new cases is to catch them at slaughter by chance.

The USDA is also misleading the public on where the prion pathogen, or BSE, is found in cattle. The press reports, and statements by Ann Veneman and others from the U.S. Department of Agriculture, are either the result of complete stupidity, or lying. BSE is *not found only in the brain and spinal cord.* In an animal that actually is symptomatic or infected, it will be in all nervous tissue, in the lymph nodes, in the blood, small amounts in the muscle, in the spleen, in the gut—just about everywhere. So, to think that you're protecting yourself by not eating brain and spinal cord, or somehow not recycling those parts into other animal feed, is just ridiculous—and potentially a lie, because they should know better.

EIR: What is the pathology of the "prion" and where does this name come from?

Lowry: The prion is a protein, sub-cellular in size, folded into a dominant conformation that is somehow infectious, in that it causes incredibly horrible neurological complications, and can spread through the blood, person to person.

Prions themselves were recognized as such in the mid-1970s, originally by Carleton Gajdusek, and later by Stanley Prusiner and his research group. Gajdusek first found what came to be called prions in tribes in New Guinea, some of which were cannibals, others of which were not, but they had rather unusual rituals, which involved communing with the dead, and being exposed to their brains. And he saw neurodegenerative disease in very young people, which you would never expect to see.

This disease is called kuru, and is endemic in New Guinea, and probably a few other places. It is a neuro-degenerative disease, a prion disease. Basically, it causes massive cell death of neurons throughout the central nervous system. It has a long incubation time, on the order of years. It might take up to 6-10 years, to actually have someone die of it.

Its behavior is very similar to what we see in the inherited Creutzfeldt-Jacob Disease (CJD) and in the animal-to-human transmitted variant Creutzfeldt-Jacob Disease (vCJD), and how the disease progresses.

EIR: Was CJD known earlier?

Lowry: No. Prions were identified in the late 1970s. At that time, the prion was a really revolutionary idea that was resisted by most scientists. No one believed that anything except a virus or bacteria could be infectious or transmissible. Prions were just a protein, in a very dominant shape or conformation that was resistant to high heat, protease digestion, enzymes, chemicals—nothing could kill it, so to speak.

EIR: Did they actually take samples of the kuru, the prions?

Lowry: Yes, this is exactly what they did. At the time, they did not know what it was. The first assumption—which was a good assumption—is that it was some kind of rare virus. So they then used techniques that would obviously destroy viruses—autoclaving (sterilizing), high heat, chemicals, filtering, you name it. And they found that there was almost nothing they could do to the protein fraction of the extracts; it was always infectious, even when they used things that would destroy nucleic acids, RNAse, DNAse, so that there would be no nucleic acids left, or available for this thing to reproduce.

So they determined at that point, that this must be some kind of protein that's infectious.

EIR: Why was it named "prion?"
Lowry: I think, because we had virions, and we had proteins, and they wanted to make it an infectious protein. I don't know actually, who gave the name—whether it was Gajdusek, or Prusiner. It acquired the name in the late 1970s.

EIR: Is it known how much of the infectious protein it takes to infect another animal or person?
Lowry: No. That's part of the problem. The threshold is probably very low. There's no way to quantify that directly. But it will depend on three factors: whether the prions are bound to a metal, whether they are in solution, and what the genetics of the person are.

In the first case, if the prion is bound to a surface, such as steel, or any other metal, there is an *extremely low threshold* required to infect another animal. The experimental work was done on this by the French, and also by the British. One of the unfortunate transmissions of the variant Creutzfeldt-Jacob Disease (vCJD) occurred in France, the result of instruments that had been sterilized in the standard way, which did not do anything to defeat the infectivity of the prions; the prions bound tightly to the stainless steel.

What happened was that two other people on whom these instruments were later used in brain surgery, became infected.

EIR: So instruments, used on someone who had the disease, were sterilized and they still passed on the disease to the next patient?
Lowry: Yes, at the time they did not know that the original patient had Creutzfeldt-Jacob Disease.

EIR: Was this resilience to sterilization known before BSE transmission to humans came along; that is, at the time of the first knowledge of Creuzfeldt-Jacob Disease?
Lowry: Well, there had been other experiments, modelling this exact scenario in mice. These were much more precise, because they were laboratory-controlled. What they did is, to take a transgenic mouse, which is able to be infected with the same prion that causes BSE in cows. They took a stainless steel wire and passed it through a small hole into the infected mouse's brain. They then took this wire, dipped it in 10% formaldehyde, autoclaved it, did everything you would normally do to sterilize an instrument, and then put it into the brain of another mouse, that did not have any infection at all. They found that you can do this in series, and end up infecting maybe eight out of ten mice in a row.

EIR: So you sterilize it ten times—and it's still causing infection, from the very first case?
Lowry: Yes, potentially. In other words, it is not 100%, but eight out of ten, in this case. What they find is that the prion protein is absolutely resistant, when it is bound to a steel surface. The only way to beat it in this case, is incineration.

The prion binds tightly to stainless steel, and is absolutely resistant to destruction by heat, chemicals, and other standard sterilization techniques.

EIR: Is this any steel surface, like a knife used in slaughter?
Lowry: Yes. Anything: slaughterhouse equipment, surgical instruments, wire, whatever is metal. The prion, in its normal form, binds to copper and other metal ions very tightly. And they found out, the hard way, that it binds to stainless steel *incredibly tightly,* and is absolutely resistant to treatment by chemicals, proteases, heat, whatever you want.

EIR: Irradiation?
Lowry: Even irradiation. The prion could care less.

EIR: Please discuss the other two factors regarding this low infectivity threshold.
Lowry: Factor two is whether the prions are in solution or not. We are talking here about a fluid, like blood—and this is the other large fear about human-to-human transmission, in cases in the United Kingdom and in France. There are documented cases occurring in Scotland, of a person who gave blood and later was diagnosed as having variant Creutzfeldt-Jacob Disease, which means that the person was actually exposed to BSE, and was infected from the original cow form of the prion, which then adapted into human form. And before the person was symptomatic, he was a blood donor, and this blood was then given to someone else.

Now, the person who got this blood—and I think there are two cases documented—these people then became infected with variant Creutzfeldt-Jacob themselves, through the blood. This is not a surprise because, since the late 1970s, we've known that, in the case of scrapie (which is the prion in the sheep), blood from one scrapie-infected sheep transfused into another healthy sheep, will cause that second sheep also to

get scrapie. The period of incubation could range from one year to three years in the sheep.

In the human cases, from what we've seen in the British cases, incubation time might be between three to six years, maybe as long as ten.

EIR: And the third factor of the threshold?

Lowry: The third factor, which is really unknown, has to do with the genetics of the host animal or person that is being infected. This means that because a prion is a protein—it's not a virus, it's not a bacteria—it does not infect in a classical sense. It actually binds to what we'll call the prion-precursor.

The normal form of this protein is found on the surface of the cell. It is basically stuck through the cell membrane, with its tail going back into the rest of the cytoplasm. So, what happens is that the prion—or the infectious form—actually binds to the native precursor, and then transforms this precursor through a series of events inside the cell, many of which are not understood at all.

Then it causes that cell to produce *only* the prion-infectious form of the protein, to stick that onto the exterior of the cell, and then to infect other cells. But, what happens is, that the genetic variation in the prion protein itself will determine the susceptibility of the host to infection.

So, let's say, if I had a large variety of mice of different strains and backgrounds, and infected 100 mice with a particular prion, I may find a group of maybe 10 to 15 mice that are resistant to it, because my infectious prion, of a certain type, cannot bind or cause the prion natural precursor of these mice, to transform into the prion type. So, in the human population, we always expect that a small percentage of the population will be resistant to a given prion, and a small percentage will be very easily infected by it.

In the middle range, it's very hard to tell. Basically, we don't know the genetic determinants, especially in human beings, that would cause us to be able to judge, whether one person will become infected, or another, not. We don't really know the answer to that yet.

EIR: Start back in the 1970s again, with the sheep form of what is now known to be a transmissible spongiform encephalopathy. Hasn't the sheep form of illness been observed for ages?

Lowry: Yes, this is scrapie, the name of the disease in sheep, which has been around for at least 100 years. In the late 1970s, scientists realized that sheep scrapie was a prion disease as well, and they determined that it was. Of course, sheep scrapie is endemic in Great Britain. There were a huge amount of sheep scrapie cases in the 1970s—probably in the hundreds of thousands in sheep at that point. And of course, at that time, there were very few rules about slaughterhouse excesses—what kinds of bonemeal and fats could be recycled from slaughtered sheep, and then rendered back into animal feed.

And so this was done—sheep parts got into the cattle feed.

BSE is believed to have originated with the prion disease known as sheep scrapie, which underwent a species-jump into cattle in Britain. Lowry points out that there are other possible prion diseases yet to come.

And this was thought to be the original source of BSE: a species-jump from sheep scrapie into cattle. It is not fully understood exactly how this happened. But there has been a lot of good research, especially concentrating on, whether BSE could jump to human beings. And the answer so far, is a definitive, yes. This has already occurred.

EIR: Where did it show up?

Lowry: The British experience is the best thing we have to go by, although, it is important to keep in mind, that this is one particular prion we're talking about, which doesn't mean that another epidemic couldn't occur from a different source.

The British epidemic is believed to be a single-source epidemic, from most available research. This means that scrapie is the original prion, which then passed into the cattle and became BSE. What happens is, that the prion must adapt to its host to be able to "reproduce."

It's not reproducing in the way a virus or bacteria does. What it is doing, is causing the cell to create only the prion form of the protein. Now, this has no genetic changes whatsoever; there are no genetic changes in the infected animal. The only change is in what we call the *post-translational processing of the protein.. . .*

EIR: Can we go back to the British epidemic, and how it occurred?

Lowry: The British epidemic, as I said, was a single-source epidemic. When Margaret Thatcher became Prime Minister, deregulation of all the agricultural policies was introduced, along with cost-cutting measures. What used to be done in the United Kingdom before Thatcher (it was done less here), was that they would recycle from the slaughter house, mostly bone meal, brain, and every other fat and piece of garbage they could get off the floor. This was from cows, sheep, any-

thing that was slaughtered, all animals. They would then sell this to a rendering plant that would use high heat and organic solvents, to remove some of the fat, and to kill off viruses, immediately. The high heat will also kill off bacteria. So it was a relatively sane idea at the time, although with some risks.

Now, when Thatcher came in, the government said, "Well, we're not going to have them adhere to these standards. They're going to do whatever they want"—deregulation. And with the pressures on cost-cutting, the rendering plants started lowering the temperatures they were using, and most of them—in fact, from the British reports I've seen, all but two plants in Britain that did bonemeal and reprocessing—cut the use of organic solvents entirely.

And this was probably what doomed them. Because, the prion is a transmembrane protein, and it loves to be associated with lipids. And by not using organic solvents, lipids and fats are untouched.

So, researchers in Britain have gone back through the records and determined that the transfer of sheep scrapie to cattle—when it really took off—is probably about 1981. Now this change in the law was made starting, I believe in 1979, but not everybody went for it immediately. So what happened in 1981-82: There was some event, where the sheep scrapie basically came in contact with enough cattle, so that a small percentage of cattle in the population was infected by the sheep variety. Other cattle were resistant at that point.

But once the scrapie was in the cattle, it adapted to the cattle, and then it could go to almost any cow. At that time, the British were also recycling cattle parts into cattle feed. This is a key thing to keep in mind, because at that point, that's what really burned them. If it had only been the sheep parts that were being recycled, there would have been only a small number of cattle that were susceptible to that species-jump, so to speak.

That's not what happened. There were 189,000 cases documented of Mad Cow in Great Britain, by, I believe, about 1990.

Margaret Thatcher, as depicted in a 1996 French article, "A Mad Cow Called Maggie," that blamed her deregulation policies for the spread of BSE.

EIR: So they were taking dead cow parts from the slaughterhouse to be rendered into animal feed.
Lowry: They didn't discriminate: cows, sheep, pig, anything.

EIR: And after they stopped using sheep, they were still using cows and other animals?
Lowry: Yes, until 1989, when they did wise up, after the scientists screamed at them for ten years. It's the early 1980s that really killed them. Because in the early 1980s, they were using recycled cow, sheep, pig, whatever, back to the cows via animal feed. The sheep were the initial event. But the problem was recycling the cattle parts, because the adapted BSE prion could wipe out potentially 80-90% of the cattle coming into contact with it.

Whereas, before, with the sheep scrapie, maybe only a very low percentage—2-5% could do this. That's the estimate they made. So then, what happened is, that the British realized that they had obviously exposed—at the lowest estimate—at least 2 million people to infected beef during this period. It's probably higher, but let's just go with that figure for a moment.

They got that figure by extrapolating the 189,000 infected cattle, and the ones that probably were slaughtered that were not recalled and went to market. It's statistical; it's not really scientific, but probably somewhat accurate. So the problem then is, that in about 1994, I think, they first recognized, they were seeing a variant Creutzfeldt-Jacob Disease in humans.

Now, let me clarify this. There is an original Creutzfeldt-Jacob Disease. This is a genetically inheritable disease, and this mutation is a mutation of the prion precursor protein itself. In other words, these people with the original CJD are born with a different set of amino acids in their prion protein, the normal protein. The bad news is, that the mutation they have changes the surface potential of their protein, changes

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its binding characteristic, and therefore, totally changes its function.

Unfortunately for these people, this kicks off the spongiform encephalopathy that basically is a time bomb. These people usually get the disease in their 40s, sometimes in their 30s. But what the British started seeing was what they thought was Creutzfeldt-Jacob in people as young as teenagers, and very old people. But a very old person could never survive with original Creutzfeldt-Jacob. So, they reasoned, this thing must be BSE in human beings. And testing it later, and with genetic analysis, they realized, yes, it is.

The way to confirm this was done secondarily in France, and there was some work in the United States as well. What they did, is take BSE—the original BSE prion, and infect primates—macaques, and other non-human primates—and they showed that these animals could easily be infected by BSE. And once BSE passes through the first primate, if you then take the blood of the primate who is infected—and the prion doesn't have to change much; just a slight alteration to adapt to the macaques—you can then infect 80-90% of the other primates that you inject.

EIR: Through blood transfusion?

Lowry: Yes. So this is the *real fear in Britain.* And this, of course, has come true in the two cases that we've seen, and there are probably many more that are not reported.

France is also worried about the same thing. They've seen a few of the variant Creutzfeldt-Jacob Disease cases themselves, so the blood transfusion question is definitely very important to them. And it will be here in this country, since we have absolutely none of the safeguards that they have.

Let's go back to one aspect of the British experience, the first documented case of the variant CJD from a blood transfusion. Now, the thing that has freaked out the British blood bank nationally—and they've written about this—is that, as a result of the lack of any good way to test the blood for prions, they have to track the cases individually.

And here's the bad news. Even if you assume that the British have the best epidemiology in the world—which they don't—and assume that they can find half of the actual cases, and we have 150-some-odd documented cases, that means that we missed 150-some-odd cases. So, if any of those infected people gave blood, we'll never know it, until we start seeing secondary transmission through the blood banks to other people.

The other bad news is that once we have the variant Creutzfeldt-Jacob adapted in this form, the susceptibility is extremely high. In other words, the likelihood is that probably 90% or more, of the population will be susceptible to the human-adapted prion in the blood form.

Now, the original fear, of course, was, this transmission from the cows to the human beings. Eating infected beef, researchers thought, would have a relatively high transmission level, even 40%. By this measure they would have seen thousands of cases in the early 1990s, and they didn't. So, there was a false sense of security—which is being used in the U.S. press to say, "Well, the British had only 150 cases, and maybe 2 million people were exposed."

Ah, but they were exposed to the BSE agent through eating beef. What if you took those people and you exposed them to the new variant Creutzfeldt-Jacob, then you would have *90% efficiency* of transmission. The problem is, they can't test, because there is no way to test the blood. We don't have a test sensitive enough for that. But if that's now in the blood banks in the United Kingdom, they could be sitting on a time bomb!

EIR: How long do they keep blood?

Lowry: It wouldn't matter. In other words, that exposure of the people went on for years. So you could have someone, even from five years ago, who may have been exposed, who isn't going to show symptoms of the disease until ten years later. So this is a very serious concern.

Obviously, replaying the same situation in the United States is a time bomb. *We have absolutely no testing.* We have no idea. So without even having the tests, if we say okay, what if we start seeing variant Creutzfeldt-Jacob in the United States, we have no way to backtrack it. We have no way to test it. We can't say the blood supply is safe at all.

The second point I want to make is that all disease models are based on the spread of the scrapie-BSE-to-humans in Britain. In the United States we have mule deer prions, we have white-tail deer prions, and we have scrapie itself. Well, people eat a lot of white-tail deer. If we see a different prion protein jump into humans from a different source, there is no way to model it, based on the British experience. You don't know what it's going to do. You don't know how infective it will be, from human to human. How efficient, right now, is the

white-tail deer prion—can it infect humans just as BSE did? We don't know.

Does anyone want to do a study to find out? No. So how can we model it? We can't. We can only model it in non-human primates, and I've never seen any of this work being done. I'm sure it's going to start being done. But, the assumptions being thrown around in the press about, "Oh, don't worry, the risk is very low," are based on assumptions that just may not be true at all.

And we're not talking about the flu, where you may or may not die. This is a 100% fatal disease. "Oh, if you catch it, maybe you'll be okay." No, you're not going to be okay. It's a 100% fatal disease. So, if you then start telling the people who die of it, "Oh, too bad. That was your risk," that just doesn't go over very well. "It's 100% fatal, but it's a small risk"—that's ridiculous. That's no way to run public health policy.

EIR: So we really need a very large program of research, monitoring, testing, education, a very broad program.
Lowry: We need a huge research program on prions themselves, and also, we need to be able to try to get an understanding of how species jumps do occur, and what could happen—because we have two other sources that it could jump from. We only know of one, in the British experience, from sheep to cow to human, that has occurred. But there is the opportunity for that to happen from other sources. And no one has a model of that, or any idea of what the impact of that could be. And we have to do that research.

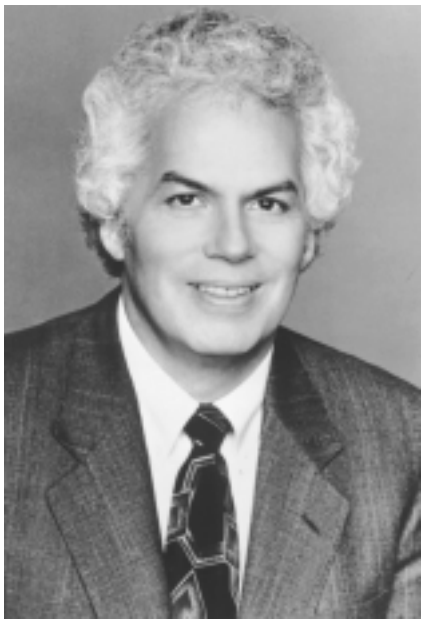
And there's a ton that would have to be done on treatment interventions, because there is *no* good treatment at all right now. That's going to take the longest. And that's really the scariest.

It's under way, but a relatively small group of scientists are doing it. Because again, from the funding perspective, they would say, "Well, the risk is so low, why do you want to study that?"

EIR: Are there still people who say that prions don't exist?
Lowry: There are. There is still some resistance against it. People say, "Well, the prion exists, but it actually must be harboring a nucleic acid, and you just can't see it." I find this ridiculous at this point. And I think that, especially Prusiner's work in moving the prion associations in the cell, that is the final nail in the coffin.

EIR: In France they test routinely, 3 million cattle out of 6 million slaughtered.
Lowry: And the Japanese test all their slaughtered cattle. We test very little; about 30,000 cattle a year, I believe, and this is after slaughter.

We do not have a rapid test, which the Europeans have. I mean, we have it, but the USDA just doesn't use it. So, it might be eight or ten days after a cow is slaughtered, and the meat from it is already packed up and sent to seven states, that you would then—if you found infected cattle—have to recall it, which is obviously very difficult. And it's going to cost a hell of a lot of money. Then you would have to decontaminate the slaughterhouse, and no one is even talking about that from the USDA.



In pursuit of prions: Stanley M. Prusiner, M.D. is professor of neurology and biochemistry at the University of California at San Francisco, and directs the Institute for Neurodegenerative Diseases.

The rapid test is currently in use in Britain, even though it's designed by American companies, which is rather ironic. It is an immune-based test, using antibodies to look for the presence of the prion protein in its infectious form. You can probably do it in a day or two. You could do it in the same day, if you actually had a lab set up to do it. This is what they also use in France, and probably Germany and elsewhere.

EIR: Is this done with a dead animal or a live one?
Lowry: This is with a dead animal. This is with samples of brain tissue or other such things.

EIR: The province of Alberta in Canada announced this February, that it will implement the French rapid test technique.
Lowry: France has a decent testing system; at least they use a rapid test, with results in one or two days. And they do it at the slaughterhouse, *before the meat is sent out,* which is smart. Now, they've not instituted a test on live animals because that is still being worked on. It certainly could be done.

Here in the United States, we also have to deal with prions in other animals besides cattle. We have mule deer, in the Western U.S., and we also have white-tail deer, which have become infected with the prion originally from the mule deer. This really is a challenge to the current science, because there is no model of the spread that fits this. The mule deer, a different species of deer in the Western United States, which co-exists with the white-tails in Colorado and elsewhere, has had a natural mule deer prion, probably for hundreds of years.

In the United States, we have to deal with prions in other animals besides cattle. The white-tail deer became infected in a species-jump from a prion originally in the mule deer. But how, since no one is recycling feed to deer? Nobody really knows.

But now we have seen it jump to white-tail deer.

Now the problem is, white-tail deer don't eat mule deer. And no one is recycling feed to deer. So the infected feed theory is moot. The question is, how did this happen? The researchers that look at this have some ideas. These deer in the West do live in the same habitat. They eat a lot of the same things. There could be feces contamination; there could be urine. Nobody has a definitive answer. . . .

EIR: Over decades, or a hundred years or so, is there occasionally subsidence of the scrapie?
Lowry: Not quite. What has happened in these cases are, either a lot of the scrapie-infected sheep die off, and so do their offspring. And they also, even in the old days, before anybody knew what these were, they would likely have culled these sheep out.

The problem is that scrapie is in the sheep; it can be genetic, in that it can just occur naturally, with a higher frequency than that of Creutzfeldt-Jacob. In a population like that of the United States, you might only see fewer than 100 CJD cases in a year. But if you look at a sheep population, the instance of scrapie is much higher.

There are also a lot of questions about how scrapie spreads in sheep, that are not fully known. We know it will spread obviously from mother sheep, through the milk, to its offspring. But again, sheep don't eat other sheep, so there are still some unanswered questions about how it really can spread. We do know the following about the sheep, though. In an animal that is symptomatic, or even just pre-symptomatic, the lymph nodes, and therefore the lymph system, and the tonsils, are loaded with an extremely high level of prions. So, it is potentially possible, that if they are eating from the same sources—and the salivary glands are loaded with prions—that they may be able to somehow spread the disease through their own salivation, onto the food the other sheep eat. We don't know.

Now, also in the United States, the same researchers from Colorado Fish and Wildlife, who are working on mule deer, and white-tail deer prions, have developed a way to do a needle-biopsy of the tonsils of the mule deer, without killing the animal. They take that material, and do an immune-based test, and they can do that in a day or two.

It's not perfected; it has not been used in cattle yet that I know of; but the same technique certainly could be applied. Because we do know, yes, in cattle, the disease is very similar, in that the lymph nodes, and the tonsils become loaded with prion—even in an animal that doesn't show symptoms. And obviously when it does show symptoms it's very easy to test for. So this could be rapidly developed in less than a year, with no question. And it would be the best kind of surveillance test to use for herds.

EIR: You've recommended what you call a "two-tier system" for testing.
Lowry: Yes. The way you would do it, is that if you develop the test for the live animals—because obviously the cattle farmers would not appreciate you killing off the herd to test it—you could just test a certain number of animals in a herd, regularly, to see if there is any BSE coming into this herd. If there is, you quarantine that herd, and test the rest of them.

And obviously, the second level would be, at the slaughterhouse, where you have to test a much, much greater number of animals.

EIR: How about all of them?
Lowry: Maybe. I don't know, because the amount of cattle slaughtered in the United States is on the order of 30 million a year. That might be a little difficult to do.

EIR: Of course, now there is hardly even a pretense of checking.
Lowry: Yes. It's less than a half percent. If you had a properly devised system of checking, if you could actually see it out in the field, so to speak—if you see it, then you would increase your testing at the slaughterhouse.

EIR: You could have animals slaughtered who had some prion that would be passed on through their meat.
Lowry: That is possible. But as I said, doing a live test, you would catch even pre-clinical animals. It all depends on how good the test is. That is still to be developed. If we could do a test of the blood—in this case, a pre-clinical animal would have thousands of times less prion in the blood, than an animal that is actually showing signs of the disease. This is a definite challenge that we're going to have to solve. At the moment, we couldn't do that kind of test.

EIR: But if you combine what you are describing, with what was announced in February, by Federal officials; that is, if

you had a true nationwide system of tagging-and-tracking, so that you know where the animals are, along with your testing systems, then you could go for containment.
Lowry: Exactly, classical containment.

EIR: But the USDA Veterinary head, W. Ron DeHaven, said, well, we're going to stop tracing the connections of the December 2003 BSE cow, and we are going to forget about the others in the breeding herd that we can't find.

If, instead, you had complete tracing and tracking and really good surveillance, then you could go for containment.
Lowry: Absolutely, because the current system is ridiculous. They can't even trace the other animals. They can't do it, even if they wanted to test the other herds, where these animals might have been. If you had the tracing system, plus the two-tiered testing, I think that would be adequate, depending on how sensitive your tests really are.

EIR: On a global scale, in terms of trade and regionalization, we've had 30 years or 40 years of dispersement, with the ethic being, "We want to be open-ended, not much testing, self-policing," and a lot of movement of animals, as opposed to local and regional-based livestock raising and slaughtering. So, we are in trouble.
Lowry: We know exactly where that will go. It will be the elimination of the entire beef industry in the United States. Because we can't afford to reproduce the British experience, and what if our case is worse than theirs? They had to slaughter 2 million cattle, and they basically annihilated the British beef industry in the 1990s, which is now barely coming back.

If you do that to the American beef supply, not only the United States is going to start starving, but the rest of the world depends on it as well.

EIR: And there are problems of scale at work. Britain has many more sheep as compared with numbers of cattle. In North America, we have many more cattle as compared with numbers of sheep. They may be widely dispersed, but given enough time, and no testing, it's inevitable.
Lowry: Yes, because there is so much transfer of animals around the world.

EIR: It's ironic, that their justification for not doing this, is to protect the cattle industry.
Lowry: Yes, but not taking these precautions will destroy the cattle industry.

EIR: They say they are saving money. That's called, the "markets speak."
Lowry: I think the smarter cattlemen realize that this is going to be suicide for them. None of the countries that actually do testing is going to lift the ban on the U.S. cattle, until the United States can do its own testing and prove that the meat is actually safe.

EIR: We've talked about public health, animal health and all. Now, what about the gear-up that we ought to be having at the level of science—laboratories and research collaboration?
Lowry: The problem with the prion diseases is that, because there is so much unknown, and because there are so many different disciplines involved, even within biology, there really isn't enough collaboration.

To deal with it at the cell level, you need experts from immunology, experts at looking at how the cell produces proteins and traffics them in the cell. And then, to go into the whole animal models of the disease, you need to know veterinary experts, pathologists, neurologists. And if you are eventually going to do interventions, you are going to have to have people in drug design. And if vaccines are ever an option, of course, you need people to be able to do that. And at the protein level, you need biophysicists, and molecular biologists. And there's not one of those scientific disciplines that can answer the question of how we can actually handle or control prions. All of them will have to work together.

In the United States and Europe, science is so cut up among the disciplines in little boxes of their own, without understanding what the others are doing, that there is no way to collaborate effectively to solve the problem. That's a big barrier.

EIR: Well, you're really quite unique in this, because no one else is saying this. Your training is double-barreled in that you have the biological training, but also you have a public health perspective and a political outlook that probably is not shared by very many.
Lowry: Not many. But I think some of the top scientists who deal with prions, would share the same or a similar view.

EIR: Are they afraid to speak out?
Lowry: They're not going to speak out, especially with the political repercussions in science.

EIR: Ann Veneman has fired more than one person in the last two years.
Lowry: Yes. The same thing occurred in Britain in the 1980s. There were many British scientists who were told to shut up by the Thatcher government, and later by the Major government as well, because this was a complete bombshell.

EIR: And then you also had big funding of the effort of the so-called friends-of-the-animals, to say, that prion disease is "revenge" on meat-eaters. . . . In Britain, they just cancelled the building of a new research lab, because of the animal rights people protesting, that they didn't want testing on animals. And yet, who is going to get hurt from this?
Lowry: The first casualty of prion diseases are animals.

EIR: Besides the Prusiner group, who else is working on this in depth?

And we're not talking about the flu, where you may or may not die. This is a 100% fatal disease. "Oh, if you catch it, maybe you'll be okay." No, you're not going to be okay. It's a 100% fatal disease. So, if you then start telling the people who die of it, "Oh, too bad. That was your risk. . . . "It's 100% fatal, but it's a small risk"—that's ridiculous. That's no way to run public health policy.

Lowry: There are large groups in France, of various types. Some from the national research center, people around the Pasteur Institute, and in Lyon. I would have to go look up where everybody is. In the United States, there is a huge group at the University of California at San Francisco—led by Prusiner, but there are many others. There is a large group in Colorado, which deals with mule deer and other wildlife; a fairly significant group at the National Institutes of Health, specifically within NINDS—that's National Institute of Neurological Disorders and Stroke. And there are other people spread out looking at different aspects of it—some in the pure biochemical work, looking at the X-ray crystallography of the protein itself. There is a very wide array of researchers.

EIR: On the engineering side, wouldn't you want industrial engineers, and others, to be working on the sterilization question? We've heard something about a plasma-furnace crematorium technology developed in Germany. This is a big challenge, for public health, How do you dispose of infected animals? What did they do in England? What is reliable?
Lowry: Decontamination is a serious question. At first, the British were mostly burning and burying carcasses, which works pretty well, as long as none of that actually gets back in the food chain. Designated dump areas are certainly not as good, nor as fool-proof as the German idea of high-pressure, high-temperature incineration is. . . .

EIR: On the veterinary side, and not strictly just the food chain, are there certain animals where efforts have focussed?
Lowry: There has been a pretty wide survey of animals that are used for human consumption. There is an interesting anomaly with regard to pigs. Pigs do have a prion disease. However, the spread of the pig disease is completely unique in that it cannot be spread by the oral route, or introduced through the gut. We don't know why we cannot introduce infection from pig to pig through the gut.

This is also again, lucky for us, because if this were not the case, we would have another source of prions in a major food source.

Now, this is very startling, in one sense. Because even among mammals, a pig is closer to a human, than a cow or sheep, because the latter are ruminants, and we're not. So, it's very strange. This shows you how detailed this work is.

If we take a pig that is infected with pig prion, and we take an extract from its lymph node, or from the brain, and *infect* it into another pig's brain, yes, that pig's going to get prion disease. But if we were to somehow, hack up the infected pig, and feed it to another pig, it's not going to be infected. We don't know why. There's a difference in the gut processing of the antigen in the pig that is affecting the prion, and we have no idea what's going on, at this point.

I want to get into another aspect of this, which is the prion theory of neural invasion, from the oral—or basically, the feed-contamination idea—and how this could work in human beings.

We do now have a better understanding of this phenomenon, although there is still a lot unknown. So, what is presumed to have happened—there used to be an old saying, well the immune system doesn't react to the prions at all, because the prion is just too much like your native normal prion precursor, so how could it differentiate between the infectious form? And that's not entirely true.

Yes, human beings do not have an effective immune response against prions. But there is a special situation in the human gut regarding any foreign antigens. You have a very high degree of tolerance in the gut, because you must. Otherwise, anything you eat from foreign proteins of meat, could not be recognized as it normally would.

If I took a piece of meat and cut it up and injected it into your skin, you would have a hell of a rash, and a large inflammation response. But if you eat that meat, the lining of your gut does not become inflamed, and you don't have an immune response, or you'd be dead if the immune system had this problem. So the gut has a special tolerance.

The gut uses a separate class of immunoglobulins, which are the major surface receptor, that the immune system uses to communicate. The gut has a special one, known as immunoglobulin A (IGA). It will basically tag with IGA, antigens that it wants to process. We're looking at all these antigens coming in. We know that many of them are foreign. We'd like to know if any of these antigens could potentially be dangerous, infectious, or from something we could be concerned about, like a bacteria or virus.

EIR: Like a referral system.
Lowry: Yes, a referral system. So what happens is that, we

coat them with IGA, and we send them to the spleen, or we send to the lymph nodes. But the primary lymph nodes that deal with the gut are first, along the small intestine itself—known as Peyer's patches. And there is some processing done there. But the main processing is done in the spleen. Now, the lymph nodes in the spleen are very important, because they have the most contact with the sympathetic nervous system of the spleenic nerves—direct contact, for good reason.

In the spleenic lymph nodes, a large quantity of very special immune cells live here, called dendritic cells—not to be confused with neuronal cells. These are immune cells that are special because they can speak to both branches of the immune system at the same time. This means I can look at antigens that can be presented on the surface of the cell, such as from a virus, and I can look for loose stuff, that is around in fluids and in blood, and create antibodies to them if necessary. The first is cellular immunity, and the second is humoral immunity, or antibody-based immunity.

The dendritic cell could speak to both arms, and present the same antigen to both at the same time. It's in charge of processing these kinds of antigens. So, what happens in the case of the prion from the gut, is that it is presented to the follicular dendritic cell in the spleen and lymph nodes, and unfortunately, the dendritic cell has no choice but to pick it up. Once it does, since it, itself, has prion precursor, it is one of the first cells to become infected. It then transfers the infection to other cells of the immune system.

So what they have shown in animal models, is that the first place where the prion from the oral contamination route, shows up, is in the lymph nodes in the spleen. Then, because these lymph nodes are in direct contact with spleenic nerves, it is through the spleenic nerves, that the prion gains access into the nervous system. And this is why you have a long incubation period in the animals. It's not so easy for the prions to do this, to gain enough infected cells to actually get the ball rolling from the prion's point of view, in the nervous system, to actually cause massive replication of the prion, and then eventually damage. This takes years.

EIR: So, the times are what you already said: 1-2 years in sheep; 3-6 years in humans—

Lowry: Yes. It can be quicker. Then again, there are lots of experiments looking at hamsters and mice and incubation times. The other thing that is very interesting, is that there are different strains of prions. We could have BSE, and have different strains, or variations of that. And each has different incubation times in different species. It's very complicated.

Let's say, in the transgenic mice model, what we've done to study BSE directly is to give the mouse the prion precursor from cattle. We make a mouse, basically; from the prion's point of view, it's binding to cattle; however, the cellular machinery is mouse. So it still has to adapt to the mouse to a certain degree, because it's got to be able to turn on the mouse machinery to create BSE prion.

So what they found, is that there are varying incubation times, depending on what strain of prion we're talking about, and this varies from hundreds of days, to potentially years.

Selected References

E. Flechsig, C. Weissman et al., "Transmission of scrapie by steel-surface-bound prions," *Mol. Med.*, Vol. 7, No. 10 (October 2001), pp. 679-84.

K. Kaneko, S. Prusiner et al., "COOH-terminal sequence of the cellular prion protein directs subcellular trafficking and controls conversion into the scrapie isoform," *Proc. Natl. Acad. Sci.* (U.S.A.), Vol. 94 (March 1997), pp. 2333-2338.

C. Lasmezas, J. Fournier, J. Deslys et al., "Adaptation of the bovine spongiform encephalopathy agent to primates and comparison with Creutzfeldt Jakob disease: Implications for human health," *Proc. Natl. Acad. Sci.* (U.S.A.), Vol. 27, No. 98 (March 2001), pp. 4142-4147.

N. Nathanson, J. Wilesmith, and C. Griot, "BSE: Causes and consequences of a common source epidemic," *Am. J. Epidemiol.*, Vol. 145, No. 11 (June 1, 1997), pp. 959-69.

D. Peretz, S. Prusiner et al., "Antibodies inhibit prion propagation and clear cell cultures of prion infectivity," *Nature*, Vol. 16, No. 412 (6848) (Aug. 16, 2001), pp. 739-43.

S. Prusiner, P. Bosque, et al., "Prions in Skeletal Muscle," *Proc. Natl. Acad. Sci.* (U.S.A.), Vol. 99, No. 6, (March 19, 2002), pp. 3812-17.

M. Wild, T. Spraker et al., "Preclinical diagnosis of chronic wasting disease in captive mule deer and white tailed deer using tonsillar biopsy," *J. Gen. Virol.*, Vol. 83 (pt. 10) (October 2002), pp. 2629-34.

J. Wilesmith, J. Ryan, and M. Atkinson, "Bovine Spongiform Encephalopathy: Epidemiological studies on the origin," *Vet. Rec.*, Vol. 128, No. 9 (March 2, 1991), pp. 199-203.