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106 – Omega-3 for Concussions and Brain Trauma

Transcript

Interview with Dr. Michael Lewis

BrainHealthEducation.org

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Steve Lankford: Hello, and welcome back to Health Quest Podcast. I'm your host, Steve Lankford. Thanks for joining me. I'm glad you're here. I have an interesting interview for you today. I'm going to be talking to Dr. Michael Lewis. He's been our guest once before when he was starting his Brain Health Education and Research Institute. This is an organization that studies omega-3s and brain health, brain trauma, brain injury, concussions ... very important research. But it's been a couple years since we talked to Dr. Lewis and I imagine a lot has occurred in those two years. Certainly, research is ongoing.

His particular efforts have been ongoing, so it's in that capacity I'm pleased to introduce to you once again Dr. Michael Lewis. Dr. Lewis, welcome back.

Dr. Michael Lewis: Thank you, Steve. It's certainly my pleasure to join you today.

Steve Lankford: I've been so intrigued by what you've done. Our first interview was so interesting because of your emphasis on omega-3 and brain trauma. That's a little different than what most people are aware of. They know that maybe omega-3s are good for the brain and they're good for maybe memory or things like that, but I don't know that they really have thought about it in terms of things like brain trauma, posttraumatic stress syndrome, even concussions. Before we get into our topic, give our listeners a short review of your history.

Dr. Michael Lewis: Basically, my short review of my history is I graduated from the US Military Academy, West Point, and spent all together about 31-1/2 years in the military. Along the way, I went to medical school at Tulane University after having spent some time in Infantry Divisions. Then after medical school, did my postgraduate training at Walter Reed Army Medical Center, at Johns Hopkins University, and Walter Reed Army Institute of Research. As I was getting ready to retire, I was working as a professor at the Uniformed Services University, also known as basically the military's medical school.

The idea of what could I do to help with the problem that the military was having in the Afghan and Iraqi wars with traumatic brain injury, and I just had some ideas pop into my head from things that were happening around me. I went to the head of research at Walter Reed, basically, and asked, "Is anybody looking at the use of omega-3s to help with the recovery from traumatic brain injury?" and the answer was, "No, why don't you?" Subsequently, about five, maybe six years ago now, I got involved in how omega-3s may be able to help with traumatic brain injury.

- Steve Lankford: You recently had started the Brain Health Education and Research Institute prior to our previous interview. Tell us a little bit about that mission.
- Dr. Michael Lewis: That was basically my way of wanting to continue the work that I had started in the military before I retired. I felt that there was a bigger need. While traumatic brain injury and concussion is obviously a serious problem, with Iraq and Afghanistan veterans there's roughly 20,000 or so traumatic brain injuries that we know of from those two wars.
- On a completely different scale in the sporting world, sports concussions, and car accidents, and so on, there's an estimated 1.7 to 3.4 million traumatic brain injuries and concussions every single year in the United States between young and elderly people who are more susceptible to having an injury from falls, but also the sports community and the collision sports such as football, hockey, lacrosse, soccer, and even basketball. I wanted a way to be able to reach out to the general public with my ideas of how omega-3s can help prevent and help people recover better following a concussion or a traumatic brain injury.
- The forum that I chose was a nonprofit foundation or institute that I started which is called Brain Health Education and Research Institute. More information can be found on our website, www.BrainHealthEducation.org. It was basically designed just to do that, as a nonprofit model to educate the public, educate what I call the three P's ... the patients, the parents, and the providers ... on the value of providing omega-3 nutrition around brain health. But also what I hoped to do down the line is get more funding to be able to sponsor research and do more research to get into the scientific literature as well.
- Steve Lankford: I suppose that's a daunting task also because of the nature of your research and trying to find the funding. Research is not cheap. We all know that. I think if anything is going to bring this to a wide audience, it is this idea of concussions in sports. Certainly, currently, that's a fairly big topic.
- It seems like often I'm hearing news reports on concussions in professional sports, now even concussions amongst our youth athletes ... girls' soccer, boys' football, you mentioned basketball ... so these problems really start in the lives of our children and then carry on through accidents and through the soldiers and the men and women in the military who are facing these very difficult circumstances and subject themselves to these very powerful kinds of forces. Do you find that there's more interest in it now because of this expanding awareness of concussions?
- Dr. Michael Lewis: It's rather interesting. I think in general there's more awareness, but yet when I get down to the level of talking to the stereotypical or euphemistic soccer mom ... that suburban mom who's got a child or a teenager who's playing, say, high school football or recreational soccer or so on, and just when I think we're getting the word out, people aren't thinking of it down at that level. It's certainly become much more of a public issue with the NFL and professional sports, but I think people just don't actually really contemplate how much of a problem it is down at the teenager, or even below, level ...

eight-year-old girls playing soccer and having problems or kids that have falls on the playground at school.

It's really pervasive throughout society and I think it's been underappreciated and still the awareness is not nearly what I think it would be. Interesting fact that I've learned is there's approximately 44 million kids that play organized sports in this country every year, and there's an estimated at least a half a million concussions or head injuries that are seen by healthcare providers for a concussion. That doesn't even include the ones that have a problem and basically go home and shake it off or try to recover on their own.

Steve Lankford: We have had a tendency to minimize the impact that we think these concussions have had. It's "shake it off," "get back out on the field," but we're discovering that there are perhaps some long-term implications from these kinds of injuries. Describe for us what happens when the brain has a concussion or a trauma. What goes wrong?

Dr. Michael Lewis: There's a number of things, and the best way to describe it is there's a primary injury and a secondary injury, and the primary injury is that mechanical force that causes the problem in the first place. That may be an acceleration or deceleration injury from a car accident, hitting a windshield, falling backwards on a volleyball court or a basketball court and hitting your head, colliding heads going up to do a header with soccer where two players run into each other, or, of course, the helmet-to-helmet collisions that we see all the time in football. So what happens is it gets back to a really simple concept that a mass in motion will stay in motion until acted upon by outside forces, and so basic physics.

That brain continues to move forward even after the helmet has stopped, and now you've got the brain that continues to move forward inside the skull and can hit the front of the skull, reverberate back and hit the back of the skull, for example, or opposite if it's a fall backwards, but one of the other things that's not so well-appreciated is something we call diffuse axonal injury. That comes a lot, as we understand, from the different densities of the different layers of the brain. If you have a sudden force that acts on the brain, the different layers of the brain are going to move at different rates ... force equals mass times acceleration.

There can be shearing that is caused throughout the brain if it's a severe enough injury like in a car accident or very subtly in a sports type of concussion. There's four areas that are impacted after an injury. There can be cerebral ischemia, a lack of blood flow to the brain, and that can happen even in something as a stroke or a heart attack where there's not enough blood flow to the brain, but also it can be a vasospasm within the brain where certain areas of the brain, the blood vessels go into spasm and then not enough blood flow gets to that area.

There's axonal injuries as I described. There's an inflammatory processes that happen and then there can be cerebral edema that happens within the cells, not just around the cells. They can cause all kinds of neurometabolic cascades. That secondary injury, which is really coming into play more and more as we understand it, is a lot of times responsible. There's going to be the damage from the primary injury, but that secondary

response is an inflammatory or a metabolic cascade. Once an injury occurs and you've got the primary and the secondary injury that has happened, the thing that I really like about omega-3s is it really can impact on three different areas.

It can have an impact on neuroprotection to keep cells from dying during that secondary inflammatory phase. The other area that it can have a major impact is it can help modulate or right-size the neuroinflammation. Any time you have an injury, you have to have some inflammation, but the problem is sometimes it gets out of control, and so omega-3s are really good about modulating and right-sizing that neuroinflammation. One of the most important areas where omega-3s can have a major effect is it can help with neuroregeneration.

It can help those brain cells maintain not only staying alive, but then also increasing their ability to reach out to other brain cells, create new synapses, and literally, become regenerative as a way to help recover from a brain injury. One of the problems we have with pharmaceutical targets and one of the reasons why to-date all clinical trials have failed is because the pharmaceutical targets in traumatic brain injury are only looking at one of those three main areas: neuroprotection, neuroinflammation, or neuroregeneration, whereas omega-3s affect all three of those areas.

Pharmaceutical targets tend to be looking way down in the weeds at an enzymatic process and stop that process. Whereas omega-3s potentiate the good side of the equation and help with those three areas.

Steve Lankford: When we first spoke a couple of years ago, omega-3 was the foundation of your research. Are you still focusing mostly on omega-3s or have you expanded into any other types of nutrients?

Dr. Michael Lewis: I would like to be able to expand into other types of nutrients, but there's so much work to be done on omega-3s. One of the biggest problems that we have is that we don't have any good clinical trials. While we have good preclinical evidence in animal models that show all these things are very much proven to be effective where omega-3s can affect the neuroinflammatory cascades and neuroregeneration and so on, we have never had a good clinical trial to prove that this is effective.

That would be very expensive and very difficult to do, so what we have to rely on to-date is the preclinical studies. But also we are starting to accumulate more and more clinical evidence based on the work of just a few of us in the field where we're starting to publish case reports where the only thing that was different in that case report ... and I'm aware of three of them now published ... is the use of omega-3s. That was the thing that really made a difference in the recovery of a person after a traumatic brain injury.

Steve Lankford: We're still very much in the early stages of this kind of research and, in some cases, it's observational and now we have some case studies where it's been applied. It's not necessarily the same as a scientific study, but certainly, we have certain expectations when we see brain injury. And we know what has happened in the past and we can at least compare to that, so tell us a little bit about these observational studies and what kinds of things have you seen?

Dr. Michael Lewis: I will make a correction that observational studies are very valid scientific studies. People like to dismiss that and say the only scientific studies are randomized clinical trials. If that were the case, we'd have so little published in the literature. In fact, it's the observational clinical studies that really are the foundation for most of medicine. They're incredibly powerful and incredibly important. But one of the things that they need to lead to in most cases, but not always, is, in fact, a clinical trial where you have a placebo control. And that's the most powerful, but certainly not the only type of scientific study that's important.

What have we seen? I'll tell you about several different things and then I'll go into one study that hasn't been published yet where we're looking at a little bit more objective evidence. I'll give you one example to start with is the Sago mine accident in January 2006. That miner that survived, while it was not a traumatic brain injury ... it was an anoxic brain injury where he was deprived of oxygen, exposed to heavy amounts of methane gas and carbon monoxide. When they corrected the deficiencies from the carbon monoxide through dialysis and hyperbaric oxygen, and the things that we need to, the brain still was not functioning anywhere where it should be, and he was still in a coma.

They added high doses of omega-3s and feel that that was the thing that made the difference. We don't know because it was not a controlled clinical trial. It's an observation and many other things were tried, but fast forward a couple years, and myself, knowing about that Sago mine accident, I applied that same thinking of omega-3s to a severe car accident when the family reached out to me. In this particular case, it was a traumatic brain injury and the only thing that was done differently in addition to the standard care was the addition of high doses of omega-3s.

The short of the story is that this 18-year-old boy came out of a coma and, while he was not expected to ever even live or have any kind of function, attended his high school graduation three months after the car accident. He's still not completely back to normal. He still struggles with the issues of that severe traumatic brain injury, but I was fortunate enough to have both the Sago mine and this case of Bobby who was featured on CNN on the Sanjay Gupta Show. And that has just exploded the amount of information and the reach to people.

It brings on a third case that was rather interesting. It was an eight-year-old girl in Rochester, New York who was a drowning accident and so she had an anoxic injury. But the parents had seen the Sanjay Gupta Show and suggested to the pediatrician, "Would this work for our eight-year-old daughter?" About two weeks after the initiation of high-dose omega-3s, this little girl came out of a coma. And then we'll fast forward to one that hasn't been published yet, is there was a 16-year-old boy who was a hit-and-run victim as a pedestrian and he was in the same situation. The parents were told, "The kid will not survive. You need to let him go," but the parents didn't give up.

They reached out through CNN to a couple of us and we suggested the use of omega-3s. And that boy has had a remarkable recovery, and it was just featured on CNN, actually, just last weekend in the middle of January 2014. I'm aware of a number of other cases

where people have reached out and given me feedback of how high-dose omega-3s have really helped.

Steve Lankford: How powerful that is and how rewarding it must be. Because when it's slow to get research dollars, at least you know the work that you've done is leading to a positive and powerful impact, at least in these few families. Thankfully, CNN is seeing some value in that, in that they're reporting on this as well. Hopefully, this is the beginning of a groundswell because maybe it begins with the consumer or the average person who has nowhere else to go. When you're told that there is no other option, there is no other hope, it turns out, well maybe there is.

Dr. Michael Lewis: It's certainly not a scientific study that's been done to prove it, but one of the problems is that we as an American public want a silver bullet cure. I will always go on record as saying, "It will never be a cure for traumatic brain injury. We can only hope to optimize the function of the person following the injury." I think people's expectations are probably too high. So that is one of the issues and one of the criticisms is it doesn't work in everyone. It's not a hundred percent cure, but what we hope to do is provide that nutritional foundation to help the brain heal itself if it will heal itself, and that's not the case a hundred percent of the time. So one of the things I'm trying to do is get some research started.

Let me just tell you one quick bit where I worked with a person who is a clinician outside of Camp Lejeune, North Carolina where there's a large Marine base. He's involved with a company that does EEG brain mapping, so it looks at the electrical activities of the brain and measures it through an EEG. What I coordinated with him was to do an EEG brain map on a couple of patients and then try five weeks of high-dose omega-3s for patients that were continuing to have problems with post-concussive symptoms months after their injuries, and then do a second brain map following the five weeks, and see what the difference is. The results are amazing.

They're outstanding how the omega-3s, which is the only thing used as an intervention, the difference between the pre- and the post-brain map is phenomenal. We hope to have that published in the next couple of months.

Steve Lankford: That would be very interesting and I will look forward to hearing more about that when it's published. When we first talked last time, you suggested that part of your thinking was that because the brain is made up of DHA, one of the omega-3 fatty acids, that this is part of the reason why it's so beneficial ... simply giving the brain what it needs, the brain will do what it needs to do with it or what it can do with it. Is that still a simplistic, but prevailing idea?

Dr. Michael Lewis: It basically is still the main idea. It is rather simplistic and I understand that, and without going into all the great details of the science, that basically still holds true. DHA is an important part of the neuron cell wall. If the neuron cell wall is made up of more arachidonic acid or an omega-6 versus the DHA, an omega-3, that arachidonic acid has been released through enzymatic mechanisms and through damage, and the downstream effects of the arachidonic acid released from that neuron cell wall are very

proinflammatory. They just wreak all kinds of havoc in neuroinflammatory cascades and so on.

Historically, mankind has had an even match between omega-6s and omega-3s. When you have some inflammation, it's countered by the anti-inflammatory effects of the omega-3s, but the problem with the typical Western diet and the typical person, instead of having a 1:1 ratio of omega-6s to omega-3s today, it's not uncommon to have ratios of 15:1 and 20:1. We've even measured in the US military, 25:1 ratio of omega-6 to omega-3 and that's reflected in the cell wall of the neuron and the downstream effects of what happens after an injury.

Steve Lankford: Is it possible that when we have somebody who lives on the average American diet, has low omega-3 and high omega-6, what you're saying is this is the fatty acid that inhabits the brain tissue? It is possible, then, when this inflammatory process starts, that because the average person doesn't have sufficient omega-3, that the body can't really provide the benefits then that it needs and it's kind of stuck with the inflammatory omega-3s, and does that lead to ongoing problems? Is that a contributing factor?

Dr. Michael Lewis: It gets back to that secondary cascade or secondary injury where we need something that's going to have neuroprotection to keep the cells alive and omega-3s can do that, whereas omega-6s potentiate the death of neurons when that cascade begins and is ongoing.

It also affects the neuroinflammation, as I mentioned. Sixes potentiate the neuroinflammation and the omega-3s help modulate and right-size that inflammation. It's only the omega-3s, and particularly DHA, that potentiate the ability for a neuroregeneration through biochemical cascades, through the eicosanoid series and the docosanoid series, resolvins and neuroprotectins which basically come as downstream effects from DHA and EPA, which are the important longer chain omega-3s.

Steve Lankford: Those terms that you used, resolvins and protectins, are these factors do you think in the benefits that omega-3s provide for the brain?

Dr. Michael Lewis: Absolutely. They are the main factors in the downstream effects when the omega-3s are activated, either released from the cell wall through enzymatic or traumatic processes, or circulating in the bloodstream. And so these resolvins and protectins, these downstream biochemical pathways, are absolutely essential in order to protect the brain, keep too much of the brain cells from dying, but also to help the brain heal once the immediate danger is over.

Steve Lankford: Has most of your research been on looking at the effects of omega-3s after-the-fact, or has there been any look at what happens if a person has been well-nourished with omega-3s, if they suffer a similar type of injury? Is there any way to compare one person like that with another who doesn't have that?

Dr. Michael Lewis: It would be a great study to do. There's certainly some good anecdotal evidence that I could certainly point out and tell a few anecdotes of people that I'm aware of that were well-nourished in omega-3s and seem to be very well-protected. So doing a study would

be incredibly difficult, long, and expensive, and very difficult to even measure the outcome. In that case, it's sometimes better to turn towards animal models where you can control how things are. There's a few good studies in stroke model and traumatic brain injury model in animals that show that that's in fact the case. When you pre-load the experimental animal with omega-3s, it becomes very neuroprotective.

We don't know if it decreases the damage that occurs to the brain or is it that we already have the omega-3s on board in such a level that it promotes that neuroregeneration right away, but it's certainly, from a clinical and a pathologic standpoint, it's incredibly effective and incredibly powerful. A number of these studies have been published in the literature and certainly some of the work that I've done at the Walter Reed Army Institute of Research on some omega-3 products have shown that we've been able to duplicate those type of studies— that it is very neuroprotective when on board before the injury.

Steve Lankford: I believe on your site ... and I didn't actually look at this yet ... but I believe that you have some protocols for the use of omega-3s. Is that correct?

Dr. Michael Lewis: That is correct, Steve. One of the things that I wanted to do is it doesn't do any good to keep this science to myself or to just the scientific community, so my hope is to be able to reach the general public by making this information freely available on my website. I publish on the website two different protocols. One is for severe TBI where the patient is unconscious and you have to be giving liquid omega-3s down the feeding tube.

The other is basically a general brain health type of protocol. So whether it's post-concussive symptoms after a concussion or after a stroke or whether it may be some other brain pathology, there's a basic brain health protocol that I have found to be very effective with patients. That's my intent is to make that information freely available to the widest audience. It appears that we are doing okay with that. We average over 600 hits on our website every single day.

When something happens, when CNN is publishing some work, or other media outlets are producing some information or news about omega-3s, we will get up to 2000 or more hits every single day on our website, so I know the word is getting out there.

Steve Lankford: Are there any warnings or contraindications for people at home who might want to try this?

Dr. Michael Lewis: The biggest concern with most people when they take fish oil is that they get a little bit of indigestion and might taste a fishy taste after taking a fish oil. But a wise scientist once told me that if you ever taste the fish oil, it was either manufactured poorly or it's spoiled ... it's become rancid. A good quality fish oil should never repeat on you. You should never taste it, but the other concern particularly with higher doses is that it does affect the pathways that are involved in clotting of the platelets much like aspirin does. There is a susceptibility to bruising a little bit easier, and certainly the higher doses can cause the potential to bruise.

People will often talk about it thins the blood and makes you more susceptible to bleeding, but that's actually never been an issue in any of the 9000 clinical trials reported in the literature. But I would liken it to the effect as if you were taking an aspirin a day, you may get some bleeding or your clotting times may become a little bit longer.

Steve Lankford: You mentioned DHA being this fatty acid. The omega-3s as we're familiar with them in fish oil have EPA and DHA. Do you recommend a balance of those two or do you focus a lot more on the DHA because of its presence in the brain particularly?

Dr. Michael Lewis: It depends on what you're trying to achieve. EPA is thought to be more important in mental health and depression-like problems and DHA appears to be more important in traumatic brain injury or anoxic brain injury. I'm actually not an advocate of either one. I'm an advocate of both. EPA has a tremendous effect on the nitric oxide pathways in the bloodstream and the arterial walls and has a significant effect in the eicosanoid series resolvins and the different biochemical pathways, so it's very important in the inflammation realm of any injury or any situation.

DHA is the one that is found inside the brain, in the cell walls of the neurons, whereas EPA is not thought to cross the blood-brain barrier. So DHA is more important to the structural component of the brain and has similar biochemical effects that it is anti-inflammatory, but it also adds in the resolvins type of pathways and the neuroprotectin type of pathways that EPA doesn't. To me, both are very important. In a way, it's an even amount of both, but it's kind of hard to say one is more important than the other because they're both important to me.

Steve Lankford: They both have their benefits and they both have their role to play, therefore, you might as well be able to get them both. I just wasn't sure whether somebody should focus on the DHA, but in this case, it sounds like they can get a common blend of EPA, DHA found in fish oil, and get one that's good. Nordic Naturals is one I know you've been associated with. They have a reputation for purity, quality, good tasting oils.

You mentioned children that in some cases are dealing with the sports injuries. Does that suggest that omega-3s in fish oil would be generally recognized as safe for children?

Dr. Michael Lewis: Absolutely, although the FDA ... I'm not aware that they have ever come out with levels of intake specifically for children ... I think they only come out with one level basically saying up to 3000 mg of EPA and DHA per day are generally recognized as safe. Interestingly enough, the European Union recognizes up to 5000 mg of EPA and DHA as generally recognized as safe, and I'll just throw one other thing in. I'm aware that the FDA has approved up to 9000 mg for experimental studies, recognizing the safety of EPA and DHA, but they've never, as far as I'm aware, have ever come out with any guidelines in particular for children.

Steve Lankford: Dr. Lewis, we're very near the end of our time. It's so interesting. There's so much to talk about when it comes to omega-3s and especially the importance of brain health and brain trauma and the things that you are directly dealing with, but I'd like to give you

the last word. Is there anything that you want to make sure that our listeners hear today that we didn't cover already?

Dr. Michael Lewis: I would only say, Steve, that the medical system as we know it has not come up with any solutions to traumatic brain injury and concussion. What we're told after a concussion, if you go to the CDC website or any other important websites, what we're told is absolutely very important. And I'll just pick on sports injuries is that the player should be removed from the game to rest the brain, not allow a second injury to occur on top of the first one, and that's all incredibly, incredibly important, but what's not addressed is what is going on with the brain itself.

Who is helping the brain? The standard medical answer is there is nothing. Only rest and time will allow the brain to heal itself. I'm taking a more proactive approach, and that I believe omega-3s will help potentiate, help provide that nutritional foundation to help the brain heal itself faster, more completely, through its wide variety of mechanisms. Whereas our Western system of medicine basically says only time will heal the brain. I don't believe that that's true. I think we can help the brain. I think we can help the time process.

Steve Lankford: We're starting to see examples of that through the episodes that you referred to. Certainly, we expect the science to continue to emerge. I know this is a challenging area, but it's always been my opinion that a body that's well-nourished is likely to do better than one that isn't. So with that as just a foundation, we're not guaranteeing any results other than if you give the body what it needs, it stands a better chance of repairing and fixing some of those things that might be wrong. Your research is so important and I want to thank you so much for giving of your time for this effort and for being my guest on Health Quest Podcast.

As always, it's most interesting, tremendously important. Thank you so much.

Dr. Michael Lewis: Steve, it's always my pleasure. I agree with your last statement. Omega-3s are an important tool, but they're just that. They're one tool of many that could or should be used for TBI, traumatic brain injury, and concussion, but it's just one tool. It's not a cure. It's not a drug and it's not an answer, but it's a foundation on which to help the brain heal itself. I appreciate you helping me get that word out, and I look forward to giving you more updates as we go along.

Steve Lankford: Yes, I do, too. Before we end, does your website have information, research references, or something that the average person can go and get more knowledge about this topic?

Dr. Michael Lewis: I post some basic information. I published the protocols that we discussed, but one of the things that I am very proud of is that I'm constantly looking at the literature and I'm pulling out and I put it under my latest news section. Every single day, I'm looking at what's the latest news in traumatic brain injury and omega-3s. I'm putting links up and maybe the first sentence or first paragraph or two of the story and links to those news bits. And I screen those myself personally and look for the scientifically rigorous and relevant news articles and put that out for public education.

- Steve Lankford: If somebody is in a situation that they need help, can they reach out to you through your website?
- Dr. Michael Lewis: The short answer is yes and they often do. I've received over the last year or so hundreds of emails from people asking for advice. I do put all the basic advice up on the website. People, if they still have questions, will contact me through the website, and we've got means available through the website to reach out to me.
- Steve Lankford: It's such an important mission. I know it's what drives your passion, and I wish you the best success. I'm so happy to be able to report on your work and to support your efforts. Anything that we can do to lead people to better health and to your types of research, we're happy to do that. Once again, Dr. Michael Lewis, the Brain Health Education and Research Institute ... thank you, once again.
- Dr. Michael Lewis: Thank you, Steve.
- Steve Lankford: Take care. Bye.
- Dr. Michael Lewis: Bye.