Anti-Aging Teleclinic
***with* Dr. Ron Rosedale and Dr. Joseph Mercola**

Dr. Mercola: Welcome, everyone! This is Dr. Mercola, and I welcome everyone to our first anti-aging teleclinic. This is going to be an exciting, information-packed series, and we're just honored to have Dr. Ron Rosedale with us today. He's out in Colorado, and really, one of the leading experts in the country in this area. He's studied quite a bit for many years, and attends many of the biochemical, scientific meetings to obtain the latest and the greatest information. So I'm just very excited to be able to pick Dr. Rosedale's brain, so that we can capture some information that could make us happier and healthier and extend our lifespan. So we're really excited about that, and I'm just delighted to have him join us today.

So, Dr. Rosedale, you're on the line now?

Dr. Rosedale: Yes. Thank you.

Dr. Mercola: Okay.

Dr. Rosedale: Thank you for having me, and I'm looking forward to this morning.

Dr. Mercola: So, what we're going to do is, I want to make sure that everyone has their executive summary that was sent out by e-mail. So if you either have had that printed out, hopefully, and if you can gather that from your papers, you'll find the topics that we're going to discuss on the clinic today. And the first topic is going to revolve around skin, and that's such an important area for all of us, the way we look, and of course, there are millions, if not hundreds of millions of dollars spent every year in this country on skincare products and surgical procedures to improve the way we look. So, that's certainly one solution. It's not one that I'm greatly in favor of because it doesn't really address the underlying cause of the problem, and we're all about addressing foundational causes.

So we're going to have Dr. Rosedale enlighten us about some of the simple, inexpensive, basic strategies that you can go about and use to improve the way your skin looks and to maintain the young-looking nature of your skin. He'll explain some

of the biology and the issues associated with one of the reasons why that starts to break down. So, Dr. Rosedale, if you can start addressing that, that'd be great.

Dr. Rosedale: Sure. Your skin, I think, can take us to much deeper issues also. One of the things that I like to do is find commonalities among different diseases. So when skin is aging faster, basically, what you're talking about is more diseased skin. And what I'd like to do is give a little bit of a background first as far as what disease is and what health is, so that we're on some common ground.

One of the things that I noticed when I was working on another book, that I'm still working on, is that in order to tell somebody how to be healthy, I had to actually define what health was, and that's not that simple. It seems like it would be very simple, but it takes you into some very deep realms. As an example, when one talks about skin, one normally is talking about the epithelium, the covering of our body. But skin can also be the endothelium, and that's the "skin" that lines our arteries, and they're essentially the same type of cells that do virtually the same things, that when they're injured, secrete pretty much the same chemicals. You can very much think of damage to the lining of the arteries as your arteries wrinkling, and when the arteries wrinkle, instead of causing the scar tissue, sort of, that we call "wrinkles" on the external skin, we call it "plaque" on the internal skin, or the lining of the arteries. And the same biochemical processes that cause our external skin to wrinkle, cause our internal endothelium, the lining of our arteries, the arterial skin, to wrinkle also.

And what we really want to do is, I think, first, define and examine some of the biochemical processes that occur in our body in all of our tissues; in our skin, in our brain, in our arteries, that cause us to age faster than we ought to. And if we can actually discover some of the commonalities, then there are some simple things that can be done that will not just be good for the external skin, but that will also be good for the lining of the arteries. It will be good for our brain. It will be good for our kidneys, etc.

But first, we have to define what is our goal. What is our actual goal? Is our goal to lose weight, for instance? Is our goal to have glowing external skin? A goal, and my goal for everybody out there really and everybody that I see and talk to, is for them, as you mentioned, Joe, to lead a long, happy, healthy life. But we have to define those

terms a little bit. We have to define our destination. I can't just say, "We're going on a trip", without saying, "Well, we're going on a trip to Sun Valley, Idaho", for instance. What really is our destination?

If I were a cardiologist, for instance, I would say, "Well, our destination is good heart health, and good heart health is equating to low cholesterol". But is that necessarily true? Is low cholesterol really our goal? And I would have to say, no. That's not necessarily our goal. That makes a lot of assumptions. It makes assumptions that low cholesterol is going to lead to a longer, happier, healthier life, and that's never been shown. What has been shown with cholesterol is, there is an *association* between cholesterol, for instance, and a reduction in heart disease. But what if it increases your risk of cancer four times? So is that really a good thing? In other words, if I could snap my fingers and come up with a drug, or even a supplement, that reduced your incidence of heart disease in half – which, there isn't such a thing, but let's make believe, for instance – that.

Dr. Mercola: Well, the drug companies would like us to belief that. They're selling Lipitor at $10 billion a year.

[cross-talk]

Dr. Rosedale: Yeah. **.....**

Dr. Mercola: As a magic bullet. And I think if you go in the PDR, the Physician's Desk Reference, and you look at the actual, very detailed description of the drug, there is no mention in there that it actually has been shown to reduce the risk of heart disease.

Dr. Rosedale: That's correct. And there is a purposeful deception in all of the studies and advertisements about that drug, and that deception is, actually trying to pull the wool over the public's eyes, into believing that an association implies a cause. So that if low cholesterol is associated with a lower risk of heart disease, that high cholesterol is *causing* heart disease. And that's totally wrong. An example would be, for instance, that aging is associated with gray hair. But it doesn't necessarily mean that gray hair is causing you to age. You know, there's an underlying commonality between the two that has to be discovered. So putting hair dye to cover up the gray hair and give a person black hair again doesn't necessarily mean it's going to slow their rate of

aging any more than lowering their cholesterol is going to slow their rate of aging. And that's really what I mean by kind of defining the end point. What really will constitute health? It's not going to be low cholesterol. And if we have a little time, I can use cholesterol as a very good example of what ought not to be focused on and what is not necessarily good health. In fact, the figures that I heard, that I actually saw, Joe, last year, that the drug companies made over $40 billion on cholesterol-lowering drugs.

Dr. Mercola: I was just referring to Lipitor alone, I think.

Dr. Rosedale: Oh, Lipitor alone? Yeah, that could be. That very well could be. And if you add all the other statin drugs.

[cross-talk]

Dr. Mercola: It's another $30 billion.

Dr. Rosedale: **.....** billion. Yeah. So it's just totally ridiculous. But let's get back to what health is, to me, anyway. And that way, then I can tell you the direction and the means by which we can obtain that health.

One of the things that one can look at as far as health is concerned, is life. Let's try and keep things really simple and relatively non-controversial, because there's so much confusion in medicine right now, and that confusion, not just medicine, but in nutrition and health. Where does that confusion come from?

There's a number of reasons that there's so much confusion. Number one, I think, is that the American diet is so bad, that if you make any changes whatsoever, you've improved it. So saying that one diet, is one diet good or is one diet bad, you can't really say that. They're *all* good because they've all made certain changes to the typical American diet, and as I said, if you make any changes at all, you've improved it, and so that's not a great endeavor necessarily; it's not a difficult thing to improve the American diet.

Another reason there is so much confusion is what you kind of mentioned, and what seems obvious to certain people, and that is, that, many of the studies, in fact, most of the studies, are financed by drug companies, and they're not doing a study to discover some new truth and trying to discover what is really healthy. They're spending $50 million on a study as a marketing campaign. They want to publish something to tell you that Lipitor is good for you, and they could do five studies or six

or eight studies, and the only one that they're going to actually publicize, the only one that they're going to publish, is going to be the one that might have come out in their favor. So there could have been eight studies that were done on Lipitor that showed an increase in heart disease or an increase in mortality rate, and the public will never see it, and they'll never hear about it.

Dr. Mercola: You know, Dr. Rosedale, I think I might have gotten us off on a tangent because what we want to do here, we've got seven questions to go over, and I really want to open up the opportunity for people to ask their individual questions. So what I'd like to do is spend about 10,15 minutes going over the specific things, the specific recommendations for each of those issues, and then we'll open it up for questions. I also wanted to mention, just for everyone listening, that we are going to have bathroom breaks every 40 minutes or so, to give you a two-minute rest break, and stand up and stretch and relieve yourself. So if we can maybe get to some of the practical components and the recommendations, and then we can open it up for questions, it'd be great.

Dr. Rosedale: Yeah. The majority of our time will be spent on that.

Dr. Mercola: Okay.

Dr. Rosedale: But I do want to just give a little background as to each of the recommendations for the specifics, how they relate, really, to the entire whole, because they're all connected, as far as, for instance, memory and skin and all these things have some underlying commonalities that I think need to be discussed.

And so anyway, to jump forward. But my definition of health is, communication, that all disease is some sort of deficiency in communication, that we are ten trillion cells that are having to coordinate with one another to create a republic of cells, and that coordination, normally, is so good that we kind of think of ourselves as a single individual. But it's when that communication goes awry that virtually all disease arises, and it is always the communication that has to be corrected, and not as much the individual parts. And that leads you to a lot of interesting conclusions.

For instance, that diabetes is not a disease, necessarily, of blood sugar, but a disease of the instructions given to the glucose. Glucose is listening to orders, and if you fix the instructions, which many people believe come from insulin, although we'll

probably see that it comes from other things too, that the sugar will be fine. So it's always the instructions that you want to deal with ultimately. And we're going to talk about some of the instructions that actually relate to the rate of aging of every system, including skin, including the brain, including the heart. They're all related. They're symptoms of the underlying disease of aging. And we can call aging a disease because we know that, although it's not totally curable, we know that it can be greatly slowed down, it can be reduced, that studies in many different species of animals have shown that you can not only reduce the rate of aging 10% or 20%, but you can go up to 300% and 400% reduction in the rate of aging.

By aging, let's talk about what we're talking about there. We're not just talking about an increase in the number of people who would reach maximal lifespan. We're talking about increasing maximal lifespan. So if we were to snap our fingers and have everybody live to be 120, now that would be a great thing. Don't get me wrong. Everybody would be much healthier. If everybody died at 120 years old, we have not reduced the actual rate of aging, because right now, the maximal lifespan in humans is about 122 years. So what we want to do is, we want to slow down the rate of aging. We want people to be able to live to be 130 and 140, maybe 200 years old. It's hard to say. But they've been doing that in animals now, or the equivalent aging in animals, for well over a decade. They can make animals that normally die in two years, die at six years now. And we know that the way to do this is by mechanisms that have very much to do with nutrition. There are no drugs that anybody has discovered. But via mechanisms that relate to insulin and leptin and nutrition, you can greatly slow down the rate of aging, and therefore, the symptoms of that aging process. And the symptoms of aging are going to be wrinkled skin, heart disease, diabetes, osteoporosis, arthritis; all of these things are related to the rate of aging.

It's like catching a cold. Everybody can breathe the same rhinovirus. Some people will get a cold, some people won't. Some people will get a sinus infection. Some people will get a cough. Some people get a stuffy, runny nose. The same underlying cause, different symptoms. And that's really what you have with aging. We have the same underlying disease, but some people will get osteoporosis, some people will have excessively-aged skin, some people will get brain disease, some people will get diabetes

or obesity. But underneath it all is the same basic process that is causing everybody's problem, and, in general terms, that problem is going to be damage to the communication systems, damage to the mechanisms that are allowing our ten trillion cells to work as a collective whole. And we need to correct those messages, and the most important of those messages relate to metabolism. And metabolism can roughly be defined as the chemistry, the biochemistry, that turns food into life. And when that metabolism is damaged, when that metabolism goes awry, you can't continue to make life out of food, and you become diseased. You'll get heart disease, skin disease, brain disease, kidney disease.

So the metabolism is one of the major things that we need to correct in order to correct any underlying disorder. There's really no exception to that. For instance, now, let's go back to skin. One of the things we know that causes skin to age more rapidly is a process called *glycation*. Glycation is where sugar combines with important molecules in the body. Normally, we think of glycation as sugar combining with proteins, and in skin, that's very important. When glucose combines with collagen in the skin, it causes the collagen, essentially, to become bent and misshapen and to stick together, and that's called *cross-linking*, and we know it as wrinkles. We know that wrinkles are a form of glycation, and glycation, increased glycation, is accelerated by damage to the skin. So, radiation to the skin will increase glycation, will increase damage to the collagen. The collagen molecules will kind of become entangled with one another, and we know it as wrinkling.

One of the ways that you can reduce that wrinkling is, number one, to reduce the radiation damage. Number two, to increase the processes that repair damage. One could look at aging in general as a battle, constantly, between damage and damage control, rate of repair. What ultimately will cause us to age, and finally succumb to that damage, is that the repair mechanisms ultimately become damaged too. So, one of the things that we want to try and do is preserve the repair mechanism. If you can repair damage as fast as it occurs, you'd live forever. Ultimately, however, that doesn't occur. It occurs better early in life. We can control damage better when we're younger than when we're older, and ultimately, that will cause our perception of aging.

One has to understand that aging itself can't really be helped. Aging just means that we're a day older tomorrow than we are today, and that's always going to occur. But what I was talking about, when we think of the aging process, is the damage associated with that being a day older, and we want to reduce the damage, and we want to increase our repair of that damage. And that's done intracellularly. We know, and aging studies have shown, that you can greatly increase the genetic expression of the processes that allow you to repair damage, but it has to come from inside the cell, and that's an important process. So, you can reduce the damage that is occurring outside the cell, but to increase the rate of repair, you have to upregulate the genes that determine how well you're able to repair tissues.

So we have genes, for instance, that will upregulate a mechanism called heat shock proteins, that keep proteins in the proper shape, which determines their function. You have mechanisms that increase the production of antioxidant systems, and there are even DNA-repair enzymes that need to be upregulated, and there are even anti-glycating agents that need to be upregulated. Much of that, in fact, the most powerful mechanisms that we know of to increase the genetic expression of repair mechanisms, are dietary. There are no drugs that can do it. But a change in diet can be so powerful because we know that it changes genetic expression.

So once again, with skin, you want to reduce glycation, and you want to increase the repair of that glycation. One of the easy things you can do to reduce glycation, to reduce the combination of sugar with the proteins in the skin that causes them to kind of stick together, that we know as wrinkles, is to reduce the glucose that's floating around in your blood, and the easiest way to do that is just not to eat it. Nothing Einsteinian here. If you want to reduce glycation and you want to reduce your rate of aging, reduce the amount of sugar that's floating around your blood.

What are the foods that turn into sugar? Joe, you've talked about that for a long time, as have I. You want to reduce the starches that turn into sugar, and the other basic food group that can turn into sugar is protein, and so you don't want to eat necessarily excess proteins, because that excess protein can easily turn into sugar and sugar-like compounds that amount to the same damage.

Unlike carbohydrates, we know that protein is an essential nutrient; 50, 52, depending on your age, up to 54 so-called essential nutrients. These are nutrients that you have to eat because our bodies can't make the components that it needs entirely. We know, for instance, that carbohydrates are a non-essential nutrient. In other words, we can make all of the carbohydrates that our bodies need from other compounds. We can make carbohydrates from protein. We can make a little bit of sugar from fat. So we don't need to take in any carbohydrate. However, protein is a different story. You have to take in protein because we can't make all that we need. But you want that protein to be able to repair your body tissues. You want to be able to incorporate those amino acids into your muscle, into insulin, into leptin, into signaling molecules, into enzymes, so that we can keep functioning. However, you can only incorporate so much in a particular period of time, and if you eat excess of that protein, you're not going to waste it. You don't want to urinate protein away, for instance. If you did, you know your kidneys are in trouble.

So what we do with that extra protein is we make fuel out of it. So we want to use that protein to make body parts, lean body mass. But if you eat excess protein, you're going to make it into fuel, and that fuel is going to be sugar like, and then, you're going to burn sugar.

Dr. Mercola: So one of the keys then is to limit the amount of extra sugars and starches and keep your protein in moderation.

Dr. Rosedale: Exactly.

Dr. Mercola: Are there any other key principles or guidelines you want to advise for minimizing the amount of damage and wrinkles on our skin?

Dr. Rosedale: Sure. We always have sugar, I mean, even if you minimize your dietary sugar and foods that turn into sugar, we have to have some sugar, and the reason we have to have some sugar is to fuel our red blood cells and a couple other tissues; not so much our brain, but our red blood cells have to burn sugar as fuel because you can burn sugar, so called anaerobically. You don't have to use oxygen, and red blood cells don't want to consume their major cargo, which is oxygen. So they want to preserve their oxygen, and they can do that by burning sugar rather than fats. And so everybody has a certain amount of sugar. You know that if your blood sugar

goes down to zero, you're in trouble; you're not going to live very long. And so, sugar is one of those things that's kind of a built-in aging mechanism. You have to have some around to feed some of those cells that require it. But that same sugar is going to cause accelerated aging.

So our body has systems to combat the damage associated with that sugar. So certainly, one of the major ways to reduce glycation is to reduce your sugar intake. The next major way is to reduce the combination of whatever sugar you have with your proteins and your DNA; so, reduce the damage that that sugar is causing, and that can greatly be aide by certain supplements. We know that there are anti-glycating supplements that are, to me, among the most important of all the supplements that people take; things like lipoic acid, we know is a very good anti-glycating agent. There are fat-soluble forms of vitamin B1, the class of compounds called allithiamine, or benfotiamine, is a particular brand that takes that glucose inside cells and converts it into ribose, which can then be made into RNA, or ribonucleic acid. So it takes something bad, extra sugar inside cells, and turns it into something good, and that prevents the internal components of cells from glycating and becoming damaged, and that's an extremely important compound, also.

Carnosine, not to be confused with carnitine, but L-carnosine, or just carnosine, is a dipeptide - it's made up of two amino acids – that is there, apparently, specifically, to reduce glycation, and those tissues that are extremely important have a higher quantity of carnosine. So that's another supplement that can be taken to reduce damage associated with sugar.

Dr. Mercola: Can you review some of the dosages here, or food that might have these nutrients in them?

Dr. Rosedale: Sure. The lipoic acid, for an effective dose, I would say, at least 200 mg, and then it can go up to 600 or 800 mg, depending on your degree of health.

Dr. Mercola: Is that per dose or per day?

Dr. Rosedale: That would be per day, divided up. So alpha lipoic acid 200 mg twice a day would be a typical dose for an average, semi-healthy person. If you've got neuropathy, for instance, then you would want to go to 300 or 400 mg twice a day. Now, lipoic acid, as the name sounds like, is a fairly powerful acid, and so it should be

taken with food. In some people, it can cause some gastric upset because of the powerful acid, but most people can tolerate it extremely well, and it's one of the finest nutrients, I think, out there, for just about everybody.

Carnosine, there is some controversy over how much people need. Your gut, apparently, can break down carnosine pretty easily, and so, some people think you have to exceed what your body would break down, and go up to 500 mg twice a day. Other people think you don't have to quite take that much. My own feeling is that 500 mg, or perhaps even a little bit higher, twice a day, if you've got some disease that you're trying to take care of.

Acetyl L-carnitine is another substance that can ultimately, reduce glycation, and 500 mg twice a day would be a minimal dose, taken on an empty stomach.

L-arginine is a very interesting nutrient that has a lot of uses. One of its major uses, as you know, Joe, is that it can dilate arteries; it's a precursor to nitric oxide, which is kind of a gaseous neurotransmitter. But one of the effects of arginine is to cause the muscles that line your arteries to relax so that they will open up and dilate. And that has a lot of, of course, extremely wonderful uses, not the least of which is, it lowers blood pressure. But it also then delivers more nutrients and more hormones to tissues. In other words, if you take L-arginine, we know that it will deliver more insulin to different tissues, effectively improving insulin sensitivity and reducing insulin resistance, and therefore, reducing diabetes. But another advantage of L-arginine is that it acts as kind of a sacrificial lamb to glucose. Glucose kind of has a preferential affinity for arginine, so that it will glycate the arginine and leave your own tissues alone. So the more arginine you take, the more your own tissues will be spared from glycation, and that's another benefit of taking L-arginine.

Dr. Mercola: So, if you decide to cheat and go off a diet and splurge on some sugar snack, then it would probably be good to take **.....**
[cross-talk]

Dr. Rosedale: Good to take L-arginine. Yeah. That's kind of like one of your morning-after pills. Of course, the best morning-after pill for mistakes in diet is exercise. If you're going to eat something that's going to raise your blood sugar, one of

the major benefits of exercise is that it allows you to burn off that sugar and doesn't leave it around as long to do damage.

Dr. Mercola: If you are going to splurge and have something sweet like that, when would be the best time to do it? Before exercise, during or after?

Dr. Rosedale: You mean after you ate it? The best time to exercise.

[cross-talk]

Dr. Mercola: **.....**

Dr. Rosedale: Yeah. The best time to exercise, if you've splurged on something you know you shouldn't have is immediately afterwards.

Dr. Mercola: Okay. **.....**

[cross-talk]

Dr. Rosedale: **.....** your blood sugar will rise after you eat, let's say, you ate a potato, and that's going to cause your blood sugars to go up. You're better off to burn off that sugar that that potato is going to turn into than to leave that sugar around to glycate and raise your insulin and cause insulin resistance.

Dr. Mercola: Well, that works out really well too, because if you exercise appropriately, that has a very blunting effect on your appetite for the sweets to begin with.

Dr. Rosedale: Right.

Dr. Mercola: So you're going to be craving the sweets before the exercise, and you have them and exercise and that will lower it. Of course, it's best to minimize, or eliminate, your use of the sweets. But if you're going to, that would be a reasonable practice.

Dr. Rosedale: Right. The two major benefits that you just mentioned, of exercise, are, number one, it does reduce your appetite, and number two, it allows you to burn off mistakes in your diet. So, of course, better not to have the mistakes in the first place. But if you do, if it's just stuffing for a Thanksgiving dinner, you know, if you immediately, even do something as simple as go out and walk afterwards, you're going to minimize the damage a great deal. And then, take some supplements. Take supplements that will reduce the damage associated with that meal.

For instance, I treat a lot of diabetics. That's one of the major things that I do. And I can see two diabetics who eat virtually identically, and they can have, let's say, they have even the same blood sugar. Let's say, their blood sugar is slightly elevated to 110 or 120. If one of those two diabetics is taking a cocktail of anti-glycating supplements and you measure their hemoglobin A1c. Hemoglobin A1c is typically called kind of an average sugar of three months. But what it really is measuring the degree of glycation of red blood cells. And the hemoglobin A1c, from the diabetic patient that's taking anti-glycating supplements is often a magnitude lower than the person with the same blood sugar who's not taking the anti-glycating agents. So I might get a 5.9 hemoglobin A1c from that person taking supplements and a 6.6 or a 6.7 from that person not taking anti-glycating supplements. So they can definitely have a very objective effect on glycation, and therefore, the damage associated with sugar. So they're extremely important in diabetics.

But you can kind of think of everybody as having diabetes. I mean, Joe, you and I have diabetes. Everybody has diabetes. It's a matter of degree, because we all have blood sugar. And so far, they've not really shown a lower limit of health benefits of low blood sugar. In other words, you don't want your blood sugar to be too low, but it's kind of what you're used to. But if a person is used to a blood sugar of 60, for instance, that person is going to be healthier than a person with a blood sugar of 70 or 80, which of course, is going to be healthier than a person with a blood sugar of a hundred **.....**

Dr. Mercola: What do you think the ideal fasting blood sugar should be?

Dr. Rosedale: Well, the ideal fasting blood sugar would be a blood sugar in the probably upper sixties, if a person is used to it. Now, if you have a diabetic who normally has a blood sugar of 200, and their sugar goes down to the 60's, they're going to have a hypoglycemic reaction. They might even have a seizure. But that's because their body is not used to it. And once again, what you have to understand is, it is your actual cells, the cells that you're made of, the ten trillion cells that you're made of that actually eat, and when you're measuring a person's blood sugar, in fact, when you're measuring virtually anything in the blood, you're measuring what's going on outside of that cell.

One of the reasons that people have diabetes, one of the reasons that people have high blood sugar is because that sugar isn't able to enter the cell very easily, because, for instance, the cell is insulin resistant, and insulin helps sugar get into cells. If sugar can't easily enter your cells, one of the ways that your body can compensate for that, to get sugar into cells, is to cause it to elevate, and so just by mass action, if you have just a whole bunch of sugar around in your blood, some of it can push its way into the cells, and so, the intracellular glucose might not be all that high even though the extracellular glucose that you would measure in your blood might be 200. Now, if you get that blood sugar down to, let's say, 70, and it can't enter the cells, the intracellular sugar, the actual sugar that gets into cells, can be extremely low, and that's then, what will cause the so-called hypoglycemic reaction, the shakes and the sympathetic nervous system response.

Dr. Mercola: Dr. Rosedale, we have a number of other questions we wanted to get to and cover, points, rather, and I'm wondering if you wanted to sort of summarize this, or if you have a number of other practical observations for the skin before we can open it up for questions on that.

Dr. Rosedale: Yeah. Certainly, we'll just touch on the topic of skin cancer, and actually, we can talk about any cancer, and we'll maybe have time to go into this a little bit more thoroughly later. But certainly, two of the major factors that will determine whether a person has cancer, and also how well they're able to deal with it is, once again, the amount of sugar, because aggressive cancers eat sugar for their energy source, and not fat, because they've kind of outstripped their blood supply, and they're kind of into an anaerobic mode. They're dividing so fast, which for cells, is a high level of exercise, and so, anaerobic activity requires glucose. One of the ways that you can minimize cancer is to minimize the fuel that cancer cells have to eat, and that's glucose. And the other factor there, we know that high levels of glucose also cause insulin levels to go up, and insulin also is a growth factor for cancer, and many, many cancers, apparently skin cancer also, is correlated with levels of insulin. So if you keep your sugar levels low, you're going to keep your insulin levels low, which is going to minimize the growth of cancer cells, and you can actually treat cancer by keeping insulin levels and glucose levels very low. Vitamin D**(**)** has been shown to

reduce skin cancer by increasing the ability of cells, essentially, to detect cancer and allow that cancer cell, essentially, to commit suicide; it's called apoptosis. And so vitamin D**(**)** levels are also quite important in reducing your risk of cancer.

Fatty acids, omega 3 oils, have been shown to reduce the incidence of skin cancer, and conversely, you can think of omega 6 oils, most vegetable oils are omega 6; corn oil, soybean oil, peanut oil, those types of things, are so-called omega 6 fatty acids, and they are essentially opposite to omega 3. So all the benefits you hear about fish oil, for instance, are true. I'm a great believer in people taking fish oil. If I had to tell the public out there to take one particular item that can reverse many of the diseases that they're seeing, it would probably be fish oil and magnesium.

But omega 6 is essentially the opposite of omega 3. It's pro-inflammatory, and they've shown that the more omega 6 you take, the more it'll get incorporated into cellular membranes, and the correlation between the omega 6 in cell membranes and aging is very high. In other words, the more omega 6 oils you take, the faster your cells are going to die, and that's not a great thing. But also, high omega 6 content has also been associated with melanoma and skin cancer.

Dr. Mercola: So, for some of our listeners, they may not be familiar with omega 6 with respect to, it's not a supplement they're going to go in the store and get, but that basically, it's any type of vegetable oil.

Dr. Rosedale: The vast majority of cooking oils are omega 6.

Dr. Mercola: Right.

Dr. Rosedale: So, all the cheap cooking oils, corn oil and soybean oil and cottonseed oil.

Dr. Mercola: Or even ostensibly healthy, unsaturated fatty acid oils, like safflower or sesame oils still are going to be loaded with omega 6.

Dr. Rosedale: Right. Loaded with 6's. But you can't totally stay away from 6's; they're everywhere.

Dr. Mercola: Um-hmm.

Dr. Rosedale: But you really want to try and minimize your intake because for most of people's lives, they've been eating an excessive amount of omega 6's, and they're accelerating their rate of aging.

Dr. Mercola: Yeah. The 6:3 ratio becomes very distorted.

Dr. Rosedale: Right. The ratio of 3's to 6's, which is extremely important. And so to reverse that ratio, I think, at least in the first several months of people trying to become healthy and reverse some of the damage done by their diet for decades, you really want to minimize your 6's and up your 3's, and you can reduce your risk of chronic inflammation, which can then of course have lots of benefits on your skin, but also the lining of your arteries, and also arthritis, heart disease, diabetes; all of these are associated with chronic inflammation. And if you want to improve all of those, and your brain also, we'll have to talk a little bit about inflammation, chronic inflammation, how it relates to diet, insulin and leptin.

Dr. Mercola: Well, I think this is a good transition point. What we're seeking to do, is every 40 minutes or so, have a little, two-minute break.

[two-minute musical break]

Dr. Mercola: I think what I'd like to do now is open it up for questions. If we can take some questions from the audience.

[instructions for questions from audience]

QUESTION:

Dr. Mercola: Welcome, Linda.

Linda: Dr. Rosedale, I did not completely understand the two types of acids. Could you spell those for me, the lipoic, or I just didn't understand what you said. And also, the carnosine; how do you spell that?

Dr. Rosedale: Carnosine. Okay. It's alpha lipoic acid. L-I-P (as in Paul) O-I-C acid. So alpha lipoic acid. And then the other is carnosine, C-A-R-N-O-S (as in Sam)-I-N (as in Nancy) – E.

Linda: Thank you.

Dr. Mercola: And for most of you who have subscribed to this teleclinic, the vast majority - I'd say 95%+ - have also signed up for the word-for-word transcript. So that will be available to most everyone in about a week or two.

QUESTION:

Ed: Dr. Rosedale!

Dr. Rosedale: Hi.

Ed: Hi. I really enjoyed your book. I thought it was brilliant. Your diet, which is basically a high-fat diet, a good, high-fat, omega 3-type diet.

Dr. Rosedale: Yes.

Ed: Does it run into the same kind of problem, long term, as the Atkin's diet, where you have ketone-induced kidney damage?

Dr. Rosedale: Okay. Well, first of all, there really hasn't been any really good evidence that ketones produce kidney damage. But let's talk about what "high-fat diet" really means. If a person wants to lose weight, for instance, you're not going to just drop it on the floor. Losing weight appropriately means, burning fat. Burning fat means that your cells have to eat fat. Your cells can burn two types of fuel. They can burn sugar; they can burn fat. If I had to summarize literally decades of research and tens of thousands of research articles, I would say, they all kind of distill down into a single sentence, and that is that your health and your lifespan is going to be determined by the proportion of fat versus sugar that you burn over a lifetime. And that means the proportion of fat versus sugar that your cells eat. And you want your cells to eat fat, which means that your cells are eating a high-fat diet. And you get good at doing something by doing it. You get good at playing tennis by playing tennis. You get good at playing golf by playing golf. You literally get good at burning fat by burning fat. And a person tends to burn more of what they eat. So if you eat, if you put fat into your mouth, you're going to be more apt to burn it, and then when you don't eat, your cells are going to be more apt to continue to burn fat.

Also, the type of food that you eat is going to determine your hormone levels, and your hormone levels of insulin and leptin in particular, are going to determine what you end up eating tomorrow. So, what you end up eating today is going to determine, for the most part, what you eat tomorrow and how hungry you are. And hopefully, we'll have time to talk a little bit about hunger because hunger determines what you eat, and the only way that you're going to be able to eat less is if you're not hungry. Very few people can use their cognitive willpower to fight hunger.

We'll talk about caloric restriction, because one of the major ways that you can reduce the actual rate of aging is to eat less. We know that, and you can do that in animals that are kept in cages, because they have no choice, and they might not be

very happy campers, but if you restrict calories in those animals, they virtually always will live longer. So the holy grail of health and diet is to mimic the effects of caloric restriction without necessarily having to tell the person to restrict their calories. But you can effectively restrict your calories that you put into your mouth by allowing your body to keep the fat stores that they have. So, in other words, if you allow access into the pantry of fat that a person has, your cells can be very satisfied by eating that fat without having to put extra calories into your mouth. That's really what you want to do, and that's going to be determined by the so-called *macronutrient content* of your diet. So if you eat a diet that has a higher degree of fat in it, you're going to regulate, especially, the hormone, leptin, which will reduce your hunger and increase your ability to access your fat pantry and feed your cells the fat you've had stored. That's 100%, really, determined by your hormones, which are determined by what you eat. That's the reason for eating a higher degree of fat.

Now, the Atkin's diet paid, certainly initially, no attention, essentially, to the type of fat that a person's eating. One of the things we've mentioned earlier in this talk is that the kind of fat you eat is extremely important. If you eat omega 6's, as opposed to omega 3's, your cells are going to age more rapidly. You're going to increase your risk of skin cancer, or any cancer. You're going to increase your risk of inflammation, which is heart disease. You're going to increase your rate of mental decline. Taking omega 3 oils, on the other hand, up to an extent, is going to do the opposite. You're going to improve your memory. You're going to reduce your risk of cancer. You're going to increase your insulin sensitivity and leptin sensitivities. You're going to improve diabetes. You're going to improve your health. That's just one example of the difference in the type of fat that a person's eating. So, the type of fat that you eat is extremely important. Fat can be your best friend or your worst enemy, depending on what you eat it with and the kind of fats that you eat and when you eat it. So to me, nutrition, essentially, boils down to fat metabolism. The rest of it, to me, is cut and dry. The more sugar you eat, the more unhealthy you're going to be. That's really simple. You want to reduce your intake of sugar and foods that turn into sugar as much as possible. Essentially, choose your health. The less sugar you eat, the healthier you're going to be.

Protein, there's a certain amount that you need. Eat that amount. If you eat excess, then you start getting into the realm of being unhealthy. That's also cut and dry. The only thing that is much more complicated and much more involved pertains to fat metabolism. So, fats are really, really important, and they can do more for your health than any other food, both in a positive way, and unfortunately, in a negative way. So I hope that answers your question.

Ed: Thank you.

Dr. Mercola: Well, thank you, Dr. Rosedale. With that, I think we're going to skip to the next topic, which was: How to increase your energy as you age gracefully. So if we can go into that topic, and then open it up for questions after we finish that.

Dr. Rosedale: Sure. And we've kind of just touched on that topic. So that's probably a good transition. Once again, and I'll repeat it because it bears repeating, that your health and your lifespan is going to be determined by your proportion of fat versus sugar that you burn over a lifetime. If you burn fat, you're going to be healthier. And fat is a more consistent energy source. Most cells, in fact, the vast majority of cells an the types of tissues in your body, prefer to burn fat than to burn sugar. Sugar is essentially there for most tissues as a turbo charger. Once again, I'll mention that you can burn sugar without oxygen. It's an anaerobic fuel. And that's one of the major reasons that sugar is around. If you had to sprint up a tree, away from a lion, you're not going to so much care whether you're aging a little bit more rapidly. You want to make sure that you're alive tomorrow, and so, your body will go into sugar-burning mode because you're not able to supply enough oxygen to your tissues to be able to burn fat, and so you'll burn sugar as an anaerobic supercharger to get you up that tree, away from that lion. However, you don't want to do that all the time any more than you want to turbocharge your car all the time. The more you burn sugar, the more that you burn a so-called anaerobic fuel, the faster you're going to age. It's a less efficient fuel, and fuel efficiency is extremely important.

We operate by the same laws of physics as your car and the rest of the universe. And one of the things that medicine seems to forget is that we are not above the laws of physics, and there are certain things that you hear that, to me, are just nonsensical. For instance, you would not pull into a gas station and see a pump that

says, “The fuel from this pump, the gasoline from this pump, is going to make your car run hotter and less efficient. It’s going to raise your radiator’s temperature”. You’d never buy that fuel. However, how many items out there are so-called *thermogenic aides*? They promise that you will run hotter; you’ll turn your food into heat. And they’re very popular supplements, but make absolutely no sense from a physical health standpoint.

Energy, if you look, again, we’re talking Physics 101, very, very basic Physics that you cannot forget. Energy can be divided, essentially, into useful work or wasted energy. Another term for wasted energy in Physics is heat. Heat is energy that cannot be put to useful work. It’s the so-called “graveyard of energies”, what all energy turns into after it’s spent. From a molecular standpoint, heat is just molecules in no rhyme or reason motion. It’s just totally random, chaotic, molecular motion. That’s what heat is. Now, we need some of it. In other words, we don't want to be a frozen crystal. We couldn't move. But extra heat causes a disruption in your molecular structure, and you don't want that.

What you want to do is you want to create the most efficient work environment for energy so that the majority, as much energy as possible, can be put to useful work. And here, we’re talking about the work of staying alive, and that takes a lot of work. That takes a lot of coordinated movement, coordinated instructions; that’s energy efficiency. It’s not how much energy you have. It is how much quality, how much useful energy you have. That’s what we want. That will be determined by hormones. If you have the proper instructions so that your cells know what to do with energy - that’s metabolism - you’re going to be healthy and you’re not going to have as much disease. Metabolism can roughly be defined as the chemistry that turns food into life. That means the chemistry that allows you, efficiently, to utilize the energy in food towards the work of staying alive. Keep that in mind when we’re talking about energy. It’s not how much energy you have. It’s the quality of the energy that you have. You can get energy just by, if you wanted to, pouring gasoline on yourself and lighting it. I mean you’d get a lot of energy. However, not a necessarily healthy thing for you to do. That’s not what you want.

So that takes you to a lot of other directions pertaining to health; for instance, thyroid. **.....** about thyroid. You want to make sure that you raise your body temperature up to 97.8 degrees, and if it's lower than that, that's not good for you. Think about that for a little bit. If we look at animals that have been calorically restricted, that's a very good paradigm for aging. If you restrict calories in animals up to 30% or so, but not keep them in a malnourished state. In other words, make sure that they have all the essential nutrients that they need, that they have the essential fatty acids, that they have enough protein; not too much, that they have enough vitamins. So this is caloric restriction without malnourishment. Animals will virtually always live longer. They've done it with many, many different species. They haven't found an exception to it in, now, it's been 75 years. It's been well known. So this is a well-known paradigm in biology-of-aging circles.

Dr. Mercola: Dr. Rosedale. I have a question for you on that.

Dr. Rosedale: Uh-huh.

Dr. Mercola: Do you think it's because there's just less calories, or it's because the insulin, or the leptin, levels, are lower? Or both?

Dr. Rosedale: That was a perfect cue. By the way, audience, that was not rehearsed. I was *just* getting into that, because the holy grail of aging, really, the biology of aging, has been to figure out why caloric restriction works. So it's very well accepted that it does. Now, they've been trying to figure out why. This reveals so much about health. Please allow me about five minutes to discuss that because it's so important.

Approximately ten years ago, Tom Johnston at the University of Colorado discovered a little worm, a little nematode that had a genetic mutation. And what really raised his interest, and subsequently raised the eyebrows of the entire scientific community pertaining to aging, was that this little nematode lived longer. So, here, it had a genetic mutation that had allowed its lifespan to be longer. Now, most mutations kill; yet having this mutation that allowed for longer life was really something. The first time it had ever been found that there was a gene, apparently, that had something to do with the aging process.

Subsequently, other research labs have discovered other mutations, most notably, one called, DAF-2, and that was discovered by Cynthia Kenyon at the University of California at San Francisco, and it did the same thing. When DAF-2 was mutated, the worm lived longer.

Now, a couple years later, a big advance in the biology of aging, perhaps, the biggest advance ever, was made, when it was discovered what DAF-2 did, and that was by Daniel Rovkin at MIT. What they found out is that what DAF-2 encoded was an insulin receptor. Now, that just blew everybody's mind. In other words, not only did the. Although they hadn't found it yet. They didn't know that this worm – this is an ancient, ancient worm that's been around for zillions of years; well, not zillions, but many, many millions – that that worm also utilized insulin, and what insulin did for this worm was regulate lifespan. Not sugar. In fact, even in humans, I would like people to understand that the purpose of insulin is not to regulate blood sugar. The purpose of insulin is actually to regulate the coordination of energy stores with lifespan and reproduction. We'll get into that in just a little while because that answers so many questions.

But what they've found is that when insulin signaling was kept low in this worm, it lived longer. That's really interesting. Ten years of subsequent experiments have only verified this fact in many, many different species. And the entire genetic pathway that essentially regulates the rate of aging in many different species of organisms has now been mapped out, and they're able, now, to manipulate those genes that regulate aging in many different species. And the very interesting part of this is that those genes that regulate aging seem to be almost identical from species to species, from yeast, to these worms, to flies, to even rodents, and perhaps, even to primates; that it's a highly-conserved mechanism, and if you play with these genes, and if you intervene to reduce certain genetic pathways, you will always increase lifespan. And again, when we're talking about increasing lifespan, we're not talking about improving the health during a normal lifespan - which is not a bad thing to do – but we're talking about increasing maximal lifespan, taking a mouse, for instance, whose typical lifespan is two years, and making it live four years, even up to six years.

We're talking about huge, like, the equivalent of a human living to be 300 years old or older. I mean, that's very significant. Now, whether humans can attain that ....

Dr. Mercola: Do you really think that's possible that we can live to be that old? There's never been a recorded case in the history of the world of a human living that long. But do you think it's possible?

Dr. Rosedale: No. Because that's not natural. That's not natural. What we're talking about here is going beyond natural medicine. We're talking here about genetic manipulations, which so far, certainly can't be done in humans. Is it possible that that can someday be done? It's possible. I don't know whether it's probable or not, and humans are much more complex; so there's a lot more things that can go wrong [in humans] than in a worm that has a fixed number of cells. It has 959 cells and never varies from that during its lifespan.

Dr. Mercola: So you think it's potentially possible in the future with some genetic engineering miracles; so maybe they will shut these genes on and off.

Dr. Rosedale: Right.

Dr. Mercola: Similar to worms, and extend their lifespan to those levels that you just mentioned.

Dr. Rosedale: I think it is possible, and in fact, even to this day, to some extent, we can do that already, but without, necessarily, chemical engineering or genetic engineering. You can do it with diet. You can regulate insulin by diet, and you can keep insulin levels low. You don't have to necessarily mutate the genes. What you can do is eat a diet that keeps your insulin levels as low as possible.

And to answer the question that you posed earlier: Yes. That is one of the mechanisms that many scientists believe regulate the rate of aging in caloric restriction. In other words, why caloric restriction works, many people believe, is by keeping insulin levels low. And we'll talk about leptin in a little while. I want to explain that and why that is so.

We talked about energy efficiency. Energy, throughout the universe, is a very prized commodity. You know, food wasn't always available. It was, when you were able to eat, you were lucky, and you had to hunt. Much of life, in our evolutionary history, ancestral history, was geared towards finding enough food, and you wanted to make

sure that you used that food appropriately. You wanted to make sure that you used the energy in that food appropriately and wisely, which means, efficiently. And there's two major endeavors that all life has to accomplish so that life can persist, and that's what nature wants. Nature wants the entire organism called life, you might say, to exist. The individual components are less important, which are you and I, for instance. In other words, you can take it down into a smaller level, and in our own individual self, we have skin cells, for instance, and all the time, those skin cells are dying and being replaced by others. You have no idea about it; it's just happening, and as long as you are staying alive and healthy, you don't care if some of your skin cells or some of your gut cells are dying. The same way with all of life. Nature doesn't care if individual components of life die. You and I are going to die. Nature doesn't care about that. But nature wants life itself to flourish. That means it wants particular components to reproduce. Like, you want your skin to be able to reproduce and replace old, damaged skin. Nature wants people, or pigs, or worms, to reproduce, to replace old, damaged cells or old, damaged worms and people.

Reproduction is very important. To reproduce, you need to eat. Those are the two biological imperatives, and if they hadn't been met and they hadn't been consistently met by all of our ancestors, we wouldn't be here talking today. So all of our ancestors had to eat and had to reproduce. And every organism has to constantly make that decision. The decision that all organisms have to make is whether to reproduce or whether to not reproduce and keep the old life around longer. That's called maintenance and repair. So even on an individual cell basis, for instance, every cell has to decide whether it should reproduce or whether it should stick around and live longer. That's what nature wants.

So you have to use your energy wisely and decide whether to, using a car example, you want to continue to repair your old car or does it get too expensive to do so? Is your car getting so old that it's costing more to keep it alive than it would be just to buy a new one? In other words, reproduce. That's what cells have to do. And it takes a lot of energy to reproduce. But ultimately, it's a better thing to do because the old organism is going to become damaged; it's going to become full of radiation. Genes are going to become mutated, and most mutations kill.

So usually, the decision whether to reproduce or whether to stick around and increase maintenance and repair enzymes and mechanisms via genetic upregulation has to do with nutritional stores. If there's a lot of food around, it's a good time to reproduce. If there's not a lot of food around, nature doesn't want you to even attempt it because it's wasted energy. Children aren't going to have enough energy to successfully survive, not enough chance of that. So, instead, genes are going to be upregulated to increase maintenance and repair.

The signal for whether there's enough energy available to reproduce or to upregulate maintenance repair, apparently, in an individual cell, is insulin. There's almost no question about that. So when insulin levels spike, it's a signal for cells to reproduce and to essentially downregulate maintenance and repair because there's no reason to keep the old around. It would just get in the way of the new.

Now, when we're talking about individual cells, cellular reproduction, unregulated – in other words, excessive cellular reproduction – is cancer. When you restrict calories in animals and they live longer, one of the major disease processes that you are mitigating is cancer because that's what animals die of mostly. They don't die of heart disease so much. Animals mostly die of autoimmune diseases, and even more so, cancer. So when you're extending lifespan in animals, what you're effectively doing is reducing their rate of cancer, and reducing their rate of cancer means you're reducing the rate of cellular reproduction, and in the meantime, you're upregulating the genes that cause maintenance and repair.

So the upshot of all this is that there's a strong connection between nutrient availability, reproduction and longevity, and the ability to coordinate those, like everything, is regulated by hormones, and in particular, they're regulated by the hormones that indicate energy stores and energy availability, and the major hormones in humans that regulate energy stores and energy availability is insulin, and even more so in humans, leptin. As such, they not only regulate your ability to burn fats or burn sugar, but they actually regulate your rate of aging.

So insulin has gone from controlling blood sugar, which is not true at all. Actually, the control of blood sugar is an upward direction by other hormones such as epinephrine and norepinephrine and glucagon and cortisone and growth hormone.

They make sure that you have enough blood sugar to feed your red blood cells. Insulin does not control your blood sugar. Insulin lowers your blood sugar, only because it's taking extra nutrients. If your blood sugar goes up, it's an indication you've got more energy available right now than you can burn. So insulin will take that extra energy and store it for a rainy day because food was never available all the time; it was feast or famine. So if there was extra, it behooved an organism. That organism would have a greater chance of surviving if it stored the extra. That is what insulin is doing. It's taking the extra sugar and storing it for tomorrow. But even more so, insulin is sensing how much energy is available and whether that energy should be used for cellular reproduction or whether it should be used for maintenance and repair. You want it used for maintenance and repair because that will equate to health and lifespan. Increasing cellular reproduction will only increase your risk of cancer. That is why it behooves a person to reduce sugar, reduce insulin and hopefully, sometime today, we'll be able to talk about leptin because newer research is showing that leptin actually, then, controls insulin more than the other way around, and that's why leptin is so important.

And if you're controlling the actual rate of aging, what you're then doing is also controlling the symptoms associated with that aging process. That means heart disease. That means skin wrinkling. That means mental decline. That means osteoporosis and arthritis and obesity and diabetes. All the processes that we think of as diseases are symptoms of aging. You get them as you get older, and that's because of the damage associated with getting older, and all controlled by the hormone that controls metabolism. There are no drugs to treat that. The only way we know, at this point, is either through genetic manipulation, that they're able to do in a simple organism. It's not feasible in humans, and we don't really know what the ultimate effect might be on that in humans. But the technology is there right now. The science is there right now. You don't have to manipulate genes to lower insulin. You just have to eat differently. And you can effect a more powerful result as far as health and aging and disease and longevity, by eating properly, than by any combination of drugs or surgery would every even dream of accomplishing. And I do that all the time in my medical practice.

Dr. Mercola: Or even hormone replacement, because that's a big .....

Dr. Rosedale: And hormone replacement. Yeah. You have to regulate the hormones that regulate metabolism.

Dr. Mercola: Um-hmm.

Dr. Rosedale: Exactly.

Dr. Mercola: But you can do it with your diet, not necessarily taking these extreme hormones.

[cross-talk]

Dr. Rosedale: **.....** can do it with diet, and supplements can augment the ability of cells to listen to insulin and listen to leptin. So, diet and supplements. That's where it's at.

Dr. Mercola: This is fascinating, Dr. Rosedale. I think it's just amazing how it always seems to go back to the simple basics and lifestyle readjustments and addressing what we've been preaching for so long now. But it's so wonderful to have this comprehensive, biological understanding of the importance of why we're doing some of these things, and I think that really will help us apply some of these strategies more effectively.

Dr. Rosedale: Yeah.

Dr. Mercola: What I'd like to do now - you've presented a lot of good, solid information - I'd like to open it up for questions.

While people are queuing up for questions, I'd also like to comment on something that I neglected to mention at the beginning, which is that I first heard Dr. Rosedale about ten years ago, when he was lecturing at a GLACAM Physician meeting in Chicago. And he is my initial mentor. It was about a three-hour lecture back then too, on a cold, wintry morning in Chicago, in which he explained to a group of about 50 of us or so, the mechanisms of insulin, and he convinced me; it was the most solid, compelling presentation ever, and I've really embraced and adopted that in my practice and personal life, and it's really had a dramatic and profound influence on the health of the patients I've been taking care of. And really, he's one of the pioneers in that, and I'm just so grateful to have had the opportunity to connect with him. Now, one of his newer interests is anti-aging. I'm sure that you can be convinced, or are

convinced if you're listening to him just briefly, that he clearly knows what he's talking about, and really can help enlighten us in this very important area.

Dr. Rosedale: Also, at this point, I really have to ask everybody to applaud Dr. Mercola for disseminating the information because the information is useless if it's not heard.

Dr. Mercola: Well, yeah. But that's easy to do. [laughter]

Dr. Rosedale: Well, that's not that easy to do.

Dr. Mercola: The hard thing is really understanding profound insights into human health because there's so much confusion out there, and that's really one of my motivations for starting the website and disseminating it, because it's so easy for the typical consumer to hear so many mixed messages that are ultimately motivated by economic incentives for these large corporations.

Dr. Rosedale: Right.

Dr. Mercola: So we really try to sort the truth out and spread that.

Dr. Rosedale: And I think the public really has to be extremely grateful for your ability to kind of sift through all this junk and really put the truth out there.

Dr. Mercola: Well, we're trying. So thank you for that acknowledgement. Is anyone lined up for questions?

QUESTION:

Susan: Hi. I just wanted to ask a quick question, back on the thing about thermogenic supplements, which I am in agreement with you on. But what are some of the examples of thermogenic supplements to just avoid? I think I know what you're talking about, but I wondered if you could be a little bit more specific.

Dr. Rosedale: Well, anything that uses the word, thermogenic, I would run away from, to tell you the truth.

Susan: Okay.

Dr. Rosedale: So, just, if it says "thermogenic", you ought not to take it. It could be anything that has a word like, "ephedrine" or "pseudoephedrine". Sudafed is a thermogenic agent, and they're using various permutations of that now. And you just absolutely need to stay away from that.

Dr. Mercola: Would caffeine qualify in that category?

Dr. Rosedale: Yes. Actually, it would. Definitely caffeine. Ma huang would qualify in that category. And again, you have to keep in mind that it's not the quantity of metabolism. You can just burn yourself up. That's increasing the quantity of metabolism. It's always the quality of metabolism. Another example of that would be, again, sticking to your car, because it's such, I think, a good example. If your car is running poorly, and it's constantly stalling every time you get to a stoplight, you can do a couple of things. One, you can take it to a mechanic and they could say, "Well, that's easy. If it stalls, just increase the idle". So instead of idling at 600 RPM, it now idles at 1500 RPM. That keeps it from stalling at a stoplight, but what's it going to do to the lifespan of your engine? Not very much. What's it going to do to how much heat is being produced? More heat is going to be produced, and if you look at your thermostat gauge, you'll see that it goes up a little bit. Then, if you check your mileage, you'll see that your mileage has decreased. Mileage in your car is equivalent to lifespan.

Another thing you can do to that car, which is certainly far superior, is to increase the efficiency with which it's able to use the gasoline. Make sure that the fuel lines are clean, that the timing is correct, using the proper gasoline. And if you do that, if you make sure that your car is squeezing as much work out of each drop of gasoline, it can idle at 500 RPM, and yet, it will still accelerate faster than in the other situation. So not only will it have more energy, but it will have more quality energy because most of the energy will be going into making the wheels turn, as opposed to being dissipated as heat. And the temperature gauge of your car is going to be much lower. So the temperature gauge of your car and its mileage are going to be highly correlated.

It is exactly the same thing in humans. I presented a paper to the American Aging Association almost exactly a year ago. It really raised a lot of eyebrows. Because, what we've talked about is that caloric restriction is kind of the sine qua non of lifespan extension. It's been known for a long time, and the biggest thrust in the biology of aging has been to figure out why. And there are certain commonalities that are virtually always seen in mechanisms that extend lifespan. And Dr. Mercola, you mentioned that one of these is reducing insulin and also reducing leptin and reducing

thyroid and reducing temperature. One of the things that's virtually always seen in mechanisms that extend lifespan, outside of very, very intricate genetic manipulation, is that temperature goes down, not up, and that almost has to be because you have to use energy more efficiently, so that less of it is wasted. Wasted energy is going to disrupt molecules. Heat is going to cause molecules to vibrate vigorously and cause damage. So that's the opposite of thermogenesis, as far as aging is concerned. You want to make sure energy is used really efficiently. And what I presented a year ago, is I showed that there was very highly-significant change in the exact same laboratory parameters that you see in caloric restriction when people followed the dietary program that I recommended; that free T_3, which is kind of the active form of thyroid, significantly goes down, that body temperature also goes down a little bit. The insulin greatly goes down. Blood sugar greatly goes down, leptin greatly goes down, and creatinine, which was very interesting – that has never been shown before – also goes down very significantly. So you're improving kidney function. Creatinine is one of those things that normally, typically goes up with age, indicating damage to your kidneys. So what we were showing, essentially, is that we were reducing the rate of aging, just by diet, but without restricting calories. We were accomplishing the same thing, essentially, by a diet that was high in good fats and greatly restricted the intake of sugar and foods that turn into sugar.

So thermogenesis is very important, but in the opposite way. One of the ways that your body has to increase the efficiency and to prolong its lifespan is actually to reduce thyroid. Reduced thyroid is not necessarily a bad thing. It can be a very good thing if it's being done on purpose to increase energy efficiency, in other words, if it's being done to reduce body temperature. And one of the ways that your body reduces the effective amount of thyroid, by the way – and for those of you who have read a lot about thyroid and things like that – a lot of information is not quite right. Your body will actually increase reverse thyroid. And so, having an increase in reverse T_3 may be a good thing. It's not necessarily a bad thing. Have a reduced body temperature could be a good thing. Now, it can be a bad thing too because your body temperature will reduce when you die. So it depends on the context. If your body is purposely trying to reduce the temperature so that you can live longer and healthier, hey, that's a good

thing, and that can be indicated by a reduced free T_3, and increased reverse T_3. So it's a little bit different than what has been taught to many people about thyroid and checking body temperature and having low body temperature being a bad thing and then trying to raise your body temperature. Uh-uh. Again, not the quantity of metabolism; it's the quality of metabolism. And that's going to be regulated, not by thyroid, but by insulin and leptin, which control thyroid. We know, for instance, that leptin controls virtually all of the functions of the hypothalamus. That's the little area of the brain that controls so many different body processes, your rate of breathing, your temperature, it controls your pituitary, it controls your adrenal glands, your ovaries and testes; it virtually controls all the other hormones in your body. And when we talked about health and lifespan being determined by the cell signaling, by the information given to your cells, telling your cells what to do, you can kind of think of that as like, the military, where you've got generals and colonels and lieutenants and captains and corporals and privates. Well, insulin and leptin, without any question, are the generals, and I would put leptin as, perhaps, the five-star general and insulin as, maybe, the four-star general. All the other hormones are subservient. They're going to listen to orders from leptin, from insulin, and if you don't have insulin right, if you don't have signaling from leptin correct, none of the other hormones can work properly, and your health is never going to be optimal. So you can take thyroid, but if you don't have insulin and you don't have leptin working properly, you could actually be causing damage to yourself as opposed to helping yourself. And the same with all of the other hormones.

Dr. Mercola: So wouldn't that have to hold true for testosterone and progesterone and DHEA.

Dr. Rosedale: Yeah, very much so. I mentioned the strong connection between nutrient stores, lifespan and energy availability and reproduction. So the hormones that actually control reproduction also control lifespan, and that's leptin. We know leptin very powerfully influences reproductive hormones, and that can be ..... You know, I thought it was really interesting. Do I have time, five minutes, to go into leptin a little bit?

Dr. Mercola: Well, I think we can maybe do that later. I'd like to maybe just open it up for another question, and maybe go to the next topic.

Dr. Rosedale: Sure.

Dr. Mercola: But if you could integrate some of the leptin info into some of the remaining topics that we agreed to discuss, that would be great.

Dr. Rosedale: Yeah. We'll do that now. We'll talk about the very powerful connection between leptin and reproduction.

Dr. Mercola: Absolutely.

Dr. Rosedale: Not just fat stores.

Dr. Mercola: Well, we'll keep people in suspense with that one.

Dr. Rosedale: Yeah.

Dr. Mercola: Is there another question on hold?

QUESTION:

Kathy: Hi. Thanks. Dr. Rosedale, I guess I'm confused about the glucose insulin, and you mentioned something about insulin's function isn't to reduce glucose?

Dr. Rosedale: Right.

Kathy: Maybe this will help explain. But I'm trying to interpret a lab with a very little, below normal fasting insulin, but a very high normal fasting glucose. I'm just kind of wondering, what could be explaining that, and maybe if the insulin is low, the glucose is high. And I thought, well, maybe that was the relationship. You say it's not true.

Dr. Rosedale: Let me clarify what I meant. When I say that the purpose of insulin is not to lower blood sugar, it doesn't mean that insulin doesn't lower blood sugar. It means that's not its main purpose. Its main purpose is not to regulate sugar. So when you wake up in the morning with a sugar of 150, you're waking up with a sugar of 150, partly because insulin is not able to do its work of storing the extra sugar. Now, you've got extra sugar around in your bloodstream, and it's not getting stored. So insulin is not able to perform its primary function of storing extra sugar as energy. And it's not able to perform its primary function of regulating lifespan, which is even more important. Therefore, the symptoms that go along with lifespan. So you're

disrupting your health in general, pertaining to cancer and heart disease, etc. But the reason that your blood sugar is 150 when you wake up in the morning is partly because insulin can't take the extra sugar and store it as fat, and very much because you might have excess cortisone. You might have excess epinephrine and norepinephrine, glucagons and growth hormone that is causing the blood sugar to go up. So, what you actually end up with as your blood sugar in the morning is regulated by other hormones, not by insulin. In other words, insulin's not trying to lower your sugar to be 120. It's just taking the extra sugar and storing it as fat. The actual number that you wake up is going to be determined, actually, by other hormones.

Dr. Mercola: And may that also be related to the receptor sensitivity of insulin?

Dr. Rosedale: Yeah

Dr. Mercola: And that's partially moderated by the exercise?

Dr. Rosedale: Yeah. That's what is preventing insulin from doing its job, is that the cells aren't able to listen. When we talk about cellular communication - that's a really good point, Dr. Mercola – when you talk about proper communication in general, you're not just talking about how much of a hormone is available. That is an extremely important concept. It's not how much insulin is available. It's not how much leptin. There can be plenty of insulin, and there can be plenty of leptin, which, in the majority of cases of chronic disease, that is the case; there's too much insulin. There's too much leptin. The important part is what your cells are able to listen to, and if your cells only listen to a whisper, even though there's plenty around, all that matters is what the cells are able to listen to. So if your cells are insulin resistant, it's hearing a very low insulin signal. If your hypothalamus is only hearing a whisper of leptin, it thinks that you don't have enough fat around. Now, you might have a hundred extra pounds of fat, but if your brain doesn't know it, if your brain can't listen to the signal from leptin, it's going to make you hungry, and it's going to make you eat more and make more fat. It's what your cells are able to listen to, and that's going to be determined not just by how much of a hormone, but the ability to listen. So speaking too loudly is bad; speaking too quietly is bad, and the ability of your tissues to listen is extremely important, and that has to be kept in mind.

So if you're talking about an individual patient that has low fasting insulin and high blood sugar, there can be two reasons for that, two major reasons. One is, they're not capable of producing any more insulin, that their islet cells are diseased, their pancreas is diseased. They're essentially converting into a type 1 diabetic, that they cannot produce enough insulin to exist properly. Or the islet cells in the pancreas are not getting the message that the sugar is high. In other words, the islet cells themselves in the pancreas can be so insulin resistant themselves, they can be so resistant to the message of sugar, that your sugar levels can go high, but the islet cells are not getting the message that the sugar levels are high, and so they're not releasing insulin into the bloodstream. So they might be capable of producing enough insulin, but they're not able to sense the blood sugar properly. That's another possibility. Still another possibility is when you measure insulin, you're not measuring pro-insulin; you're measuring a particular form of insulin. And one of the first things that becomes damaged in a diabetic are the islet cells themselves, and when they become diseased, they can't convert the precursor to insulin, called *pro-insulin*, into insulin. So if you measure that person's pro-insulin, it would be kind of interesting, and you might find that that person's pro-insulin is extremely high. That might be a good thing, actually. That means that they're capable of producing pro-insulin, but they're not able to convert the pro-insulin into insulin, and that just means sick islet cells; but at least they're not dead, and that can be reversed.

Dr. Mercola: That's a very good clinical point. So, I'd like to maybe spend just a few minutes now on the role of supplements. You touched on that on the earlier issue. But maybe if we can just spend five or six minutes or so going over that, to some of the issues of how important it is to take these supplements, and do you think it's necessary, or do you think that you can optimize an anti-aging program just with diet alone. And do you have any comments on detox programs.

Dr. Rosedale: Sure.

Dr. Mercola: I think there would be some good questions **.....**

[cross-talk]

Dr. Rosedale: Yes. There are just thousands of supplements. And again, how do you kind of weed through the ones that are most important? I would say, most of

the supplements can have significant benefits. But of all the supplements, how do *I* choose the ones that, to me, are the most helpful, at least for the patients that I see?

To me, they should have particular qualities. Because I feel so strongly about the role that particular hormones play in health and aging, particularly insulin and leptin, and the role that sugar plays in determining, not to the least, the metabolic hormone levels, I would choose those supplements that are very powerful in improving insulin and leptin signaling and reducing the damage associated with sugar. So anti-glycating agents, to me, are very important. We talked about some of those: Alpha lipoic acid and carnosine and benfotiamine, fat soluble forms of vitamin B1, acetyl carnitine, for instance. Those, to me, become very important supplements. Supplements that improve insulin/leptin signaling are very important, in addition to anti-glycating agents. And again, many of those are similar. Again, acetyl carnitine, we know. Fish oil improves membrane permeability and becomes very important. Magnesium, extremely important. Vitamin E. All of these things can improve the receptor activity in membranes, to not just allow for better insulin and leptin signaling, but allow better signaling from all hormones. And to me, as I mentioned earlier, it's signaling that is so vital in determining a person's health; less so, the individual parts. In other words, sugar is just listening to orders. It's listening to orders from insulin and leptin. You get insulin and leptin right, your sugar's going to be right. However, the converse is not necessarily true. In other words, you can regulate, you can bring down, sugar with drugs, but you're not really improving that person's health if it's causing insulin and leptin to become increased. All you're going to do is increase your risk of cancer, for instance. So you have blinders on. Most of the medical community has blinders on when it comes to diabetes because they just focus in on blood sugar, which is just listening to orders from signals. So you can take supplements that can augment that signal. You want to take supplements that can preserve membrane function, because that also improves cell signaling. And again, things like vitamin E and acetyl carnitine and magnesium, fish oil; all of the B vitamins also can help a person burn fat. And again, much of your health is going to be determined by your ability to burn fat. People get fat not because they eat fat, but because they can't burn it. And that has so much to do with your health in many different ways, and if you

can't burn fat, that means you have to burn sugar, and if you have to burn sugar, it's going to cause your sugar levels to rise, and then, when you don't eat – since you don't store very much sugar – your body's going to turn your lean body mass, your protein and bone, into sugar. So it goes on and on and on, as to the detrimental effects of not being able to burn fats, and there are certain supplements that can augment fat burning.

Dr. Mercola: Now, do you believe that the average individual, that the average individual – maybe not the average – but, say, the person who's really committed **.....**, and understands insulin/leptin physiology, is on a low-grain diet, or a slow-grain diet, a slow carb diet, actually, and has relatively low insulin levels or leptin levels, good insulin sensitivity, really exercises well – do you think there's a benefit for taking these supplements, or do you think that by controlling the food and the exercise that they're getting most of the benefits, and they [supplements] may not be necessary?

Dr. Rosedale: Well, I think that proper diet is the most important thing, and I think a person can experience a great deal of benefit if they just changed their diet and exercised properly, without taking extra supplements. That is the most important thing, to follow the proper diet. However, I think that if a person ate the proper diet and took appropriate supplements on top of it, that they can get to an even better level.

One of the things that I'm kind of fond of saying is that I am not practicing natural medicine. What we are trying to do is utilize the best diets to practice unnatural medicine. The natural course of events, and you have to understand that nature does not care if people die and if people are unhealthy, postreproduction; all nature cares about is that you're healthy enough to reproduce, and what happens to you after that, nature doesn't care. That's not what our aim is, though. I want people to stay healthy as long as possible and to live a very healthy, long, postreproductive lifespan. That is totally unnatural. There are no species on earth that particularly do that. So we're trying to buck nature. We're trying to counteract the natural course of events, and what we're doing then is using supplements in our practice in a therapeutic manner.

Dr. Mercola: That's a great perspective. I appreciate that.

Dr. Rosedale: Sure.

Dr. Mercola: So, I think it's been about an hour since our last break. So what I'd like to do now is give ourselves another two-minute break.

[musical break]

Dr. Mercola: So I think we can go onto the next topic now, and then we can open it up for questions again. The next topic would be how to improve your memory and reverse mental decline. And partially, this is related to the Alzheimer epidemic that's really going to be claiming the lives of millions of people, and maybe some practical principles. A lot of these topics, of course, merge together, because the principles are identical. But the understanding and the processes, the biological truths behind them are different, and I know for me, it certainly helps to, with motivation and to persist with some of these approaches, because if you understand it, then you can really tend to be better disciplined at implementing the program. So why don't we discuss the issues, or, the challenges with the memory issues and some of the things we can do to reverse them.

Dr. Rosedale: That would be great. I think when you talk about memory, again, we're talking about the brain, and therefore, we're talking about nerves, and really, the same processes that increase neuropathy cause mental decline and brain disorders, to a large extent. You very much could consider Alzheimer's disease to be a form of neuropathy, which it actually is. And when we talk about peripheral neuropathy in diabetics, which is very common, we're talking about nerve damage. One of the major reasons that nerves become damaged is due to glycation. That's well known, actually. And again, glycation is when glucose sticks to other molecules, mostly protein, and it has a high preponderance to stick to nerves. So, glucose and other sugars stick to nerves, and it prevents the nerves from transmitting electrical impulses properly.

So, anti-glycating agents work especially well for neuropathy and can really reverse it. It's been known for, really, maybe15 years. For instance, alpha lipoic acid has been used for a long time in Europe, especially Germany, and benfotiamine, to reverse neuropathy. But the same thing, the same mechanisms, the same diet, the same supplements that will reverse peripheral neuropathy will also be extremely good in both preventing, and even treating, the brain neuropathy that we know as, for

instance, Alzheimer's disease. Alzheimer's disease and glycation are also highly linked. Alzheimer's has a lot to do with amyloid protein. We know that it gets bundled and kind of sticks together, and one of the things that causes protein to stick together and to become clumped and to then improperly function is glucose. And when there's too much glucose around, it causes an increase in glycation and increase in amyloid deposition, and therefore, an increase in Alzheimer's disease.

One of the things that accelerates glycation is oxidation, and vice versa. Glycation also causes oxidation. So, they feed into one another. And so the more your tissues oxidize, the more they glycate, the more damage is produced. So those are the two major molecular mechanisms that cause damage. Now, there are others. But the major classification is oxidation, which causes damage to tissues. And we're talking about unwanted oxidation.

We need some oxidation, of course. As long as it's regulated, it's good. You couldn't breathe without it. Breathing and distributing oxygen around your body is definitely a form of oxidation, but it's regulated; it's wanted. And certain forms of glycation are good for you too. That's how molecules recognize one another as self, and it is definitely improper glycation that causes autoimmune diseases, for instance. So as long as it's regulated and it's occurring in an appropriate manner, it's desirable, but when oxidation and glycation are unregulated and unwanted, that causes the vast majority of damage that we associate with aging.

Now, insulin resistance can actually be considered a protective mechanism. The tissues that become insulin resistant actually don't become damaged in diabetes. It prevents the sugar from entering. So if you have excess sugar in that tissue with insulin resistance, that sugar can't get into the cell. You have to understand that the majority of damage occurs inside the cell. So again, when we measure a person's blood sugar, you're measuring what's going on outside the cell, and if a particular cell is insulin resistant, that sugar can't get into the cell and cause as much damage.

Where you see the damage occurring, for instance, in diabetics, are in those tissues that don't become insulin resistant, where insulin doesn't really regulate the entry of sugar. So if sugar levels are high, all that sugar can get into the cell and cause damage, and therefore, neuropathy, because nerves really don't respond much to

insulin, and so insulin can't keep sugar from getting into nerve cells. That means your brain too, the basement membrane of your kidneys, and the retina. The endothelium, the lining of your arteries, apparently don't respond that well to insulin; it does a little bit, and so sugar can build up in the cells that line your arteries. It sets up inflammation. Glycation sets up inflammation, and that chronic inflammation, that healing process, is what ultimately will cause plaque and damage to the eyes and damage to the kidneys and damage to the nerves.

So, the brain also doesn't really limit the amount of sugar entering the nerve cells in the brain. Therefore, if you eat a diet that is high in sugar, and actually, if your brain is using sugar as its primary fuel, it's going to cause much more damage. Sugar is a hotter-burning fuel. There's something about the anaerobic activity, the anaerobic burning of glucose, that it causes more damage. Now, all tissues, for the most part, can either burn sugar or fat for energy, and that's it. It doesn't have any other choice. You want tissues to burn fat or byproducts of fat metabolism. One of the byproducts of fat metabolism is ketones. Ketones are not bad for you. In fact, ketones are *great* for you as long as it's used appropriately and doesn't build up to a great level.

Now, one of the problems, when you talk about ketosis, if you have a ton of ketones coming out in your urine, you're not only making a lot of ketones, but it's also an indication that you're unable to burn those ketones. As long as you can burn ketones for energy, they don't build up to any great extent, and the only really bad part about ketones is if they build up to a great extent, and that's because you can't burn them, and then you get so-called *ketoacidosis*. Now, *ketosis* and ketoacidosis are not the same thing. Ketosis means that you're just producing ketones. That's a good thing. In any form of starvation, any time you're not eating, you should be producing ketones. Our bodies were meant to produce ketones, and they were also meant to burn ketones. Now, your brain can burn sugar or it can burn ketones, and it's been shown that there is much less damage occurring in your brain when it burns ketones, as opposed to burning sugar. And when your brain is burning ketones, it's not going to glycate as much, and therefore, at least theoretically, you're going to reduce your incidence of Alzheimer's disease.

Kids who, for instance, have really bad epilepsy, if you put them on a so-called *ketogenic diet*, which is now really kind of standard medicine -it's conventional medicine we're talking about here – their incidence of epilepsy goes way down. Your brain functions better. There's less excitation, unwanted excitation, of brain neurons when it's burning ketones, as when it's burning sugar.

So one of the things that you want to do to preserve brain function is to reduce the glycation of your brain. Your brain, all nerves, are extremely prone to this. Again, primarily diet. Don't eat foods that turn into sugar. And then, the same supplements that reduce peripheral neuropathy will reduce brain neuropathy; again, alpha lipoic acid and carnosine and allithiamine or benfotiamine, a form of vitamin C called ascorbyl palmitate, which is a fat-soluble form of vitamin C.

I prefer fat-soluble supplements because they have more of an effect within cells, because for any type of supplement to affect something inside the cell, it has to get through the cell membrane, and for that, it either has to be fat soluble or it has to have an actual chemical, an actual molecule, that can transport it through the cell membrane. Normally, you want something to be fat soluble for it to affect more of the interior of the cell. That's like acetyl L-carnitine probably is much better for your brain than regular L-carnitine because the acetyl group allows that carnitine to become fat soluble and enter the cells more readily. Acetyl carnitine, we know, has been shown to have great benefit for the brain. Certain supplements, like vinpocetine, increase blood flow into the brain, and that increases nourishment and it increases other antioxidants, anti-glycating agents and other nourishing agents to nerves, which are very important. One of the other aspects of nerves, and especially your brain, is that it is such a highly-metabolically-active tissue. It counts as about 5% of your total body weight, but uses about 20% of the energy. It's a so-called very-metabolically-active tissue.

So all of the things that we're talking about when we talk about quality of metabolism pertain especially to the brain because it is so metabolically active. So one of the things, because it's so metabolically active, it uses a lot of nutrients, requires a lot of nutrients. So you want to make sure that you give it the nutrients that it requires, and you want to make sure that it has the blood flow that it needs. One of

the other major factors that causes damage to the brain is reduction in blood supply. So anything that's going to cause your blood flow to be restricted is going to affect your brain to a great extent. Of course, the prime example of that is a stroke. When you really shut off a major artery into the brain, you get a stroke, and that's obvious. But what's not so obvious is people get many tiny, little ministrokes, where you plug off little, tiny capillaries or arterioles in the brain. That causes little, so-called *focal infarcts*, and that also is a very common aspect of aging, where you shut off the microcirculation into the brain. And you don't even have to get an infarct. You don't even have to have a little ministroke. You can just cause the blood vessels to constrict in the brain, and that deprives it of the nourishment that it needs.

One of the major things, and there's several things that regulate circulation; it isn't just how much plaque you have in your arteries. In fact, that's probably not even the most important thing that regulates blood flow, oddly enough. Medicine tends to treat your blood vessels like they would copper pipes in your kitchen, and they talk about plumbing, and you have the same type of things that the plumber uses to treat heart disease, which is kind of crazy. You have rotorooters and lasers that kind of burn off the plaque. They're not like copper pipes. They're living, and they produce chemicals, and they listen to signals, like every other cell in your body. And one of the major signals that blood vessels listen to is whether they should constrict or whether they should dilate, or relax, and you want them relaxed and dilated so they can distribute the majority of nutrients and blood.

Primarily, what will determine whether the blood vessels are constricted or dilated, once again, has to do with what you eat. And the major hormones that will regulate the constriction or dilatation of arteries are those that affect the sympathetic nervous system. That's part of the autonomic nervous system that will cause your blood vessels to constrict. And if you eat foods that cause surges in leptin, it will cause a stimulation of the sympathetic nervous system, and that will cause your blood vessels to constrict, and that will deprive your brain of nourishment and accelerate your brain's demise. So you don't want that. You want leptin levels to be kept low, and when you do that, you reduce sympathetic nervous system activity, it allows your blood vessels to dilate, and that improves circulation to all parts of your body, but it's

especially apparent in your brain. And that's another thing that you can definitely do for increased brain function; improving brain circulation.

So the two major things that you want to do for your brain in general, in broad terms, are to reduce glycation – because your brain is so prone to it – and you want to improve cerebral circulation. Oddly enough, they're both regulated by the same thing: Keep your sugar levels low. If you keep your sugar levels low, you're going to keep leptin levels low. You're going to reduce glycation, and there are many other things that will be affected, such as fatty acid metabolism. We know that the ability of all cells to convert fatty acids into the appropriately-beneficial fatty acids is largely determined by levels of insulin, for instance, and magnesium, which is affected by insulin. So a lot of these things kind of tie together.

If you eat a diet that causes surges in blood sugar and causes surges in insulin, it causes your kidneys to excrete magnesium, and when you excrete magnesium, you don't have enough magnesium around, and then you can't metabolize fatty acids properly, and then you can't make, for instance, DHA out of EPA, and then you don't have enough DHA to put into your brain.

That takes us back to another aspect of brain metabolism that, again, is like all other metabolisms, except, perhaps a little bit more so. Membrane permeability, membrane receptivity in your brain, is extremely important. When you talk about neurotransmitters, of course, your brain functions very much by the neurotransmitters. Neurotransmitters are hormones, and they have to be heard. They have to be received. So you have to have proper nerve reception for neurotransmitters to be heard, and there, you're talking about membrane permeability, and one of the major reasons that DHA, for instance, which is a form of omega 3 fatty acid that's so important in the brain, because it allows for greater membrane permeability. It allows for easier access of hormones, neurotransmitters into the nerves so that they can be more readily heard. So that's extremely important.

The downside, however, of the same fatty acids that are so important to your brain, which are highly unsaturated omega 3 fatty acids, is that they oxidize so readily. They turn rancid. In a very real sense, when we talk about oxidation as being a major molecular process causing damage, and that your brain oxidizes so readily, is

because fats oxidize so readily. And what is really happening as we age is that our brain is turning rancid. We're spoiling, and we want to reduce the rancidity. How do you reduce rancidity? Well, you take preservatives. And one of the major purposes of, and the most important antioxidants, are the fat-soluble antioxidants. The reason they're so important is they can help prevent the highly-important, polyunsaturated fatty acids from oxidizing and turning rancid. Vitamin E, so important, and the major reason it's so important is because it gets incorporated into cell membranes and helps prevent the very vital polyunsaturated omega 3 fatty acids from oxidizing and turning rancid. And so, the fat-soluble antioxidants are very important. And again, you have vitamin E and then you have phosphatidylserine and phosphatidylcholine and tocotrienols. All of these things are extremely important. Lipoic acid, ascorbyl palmitate, the fat-soluble form of vitamin C; all very important in helping maintain cell membrane integrity by reducing the oxidation of the polyunsaturated fatty acids that are in your brain. So these become very, very important also.

Dr. Mercola: Did you find that, when you're using the fatty acids, like fish oils, which are a good source of the EPA and DHA, that that has any influence on the insulin or leptin levels or sensitivity for the receptors?

Dr. Rosedale: Oh, yeah. Very much so, and there's lots of research that verifies that, that taking fish oil improves insulin sensitivity, very powerfully, actually. Again, I'll go back to an earlier statement that I made. If I had to list the one most important supplement for people, that they're so deficient in, it's probably fish oil, and that improves membrane function, and membrane function is what will determine hormone sensitivity, and not just to insulin and leptin, which has been shown quite convincingly, but I think, also to other neurotransmitters, such as serotonin.

One of the things that kind of really peeves me is the high use of serotonin reuptake inhibitors, things like Prozac, because the vast majority of people who have so-called deficiency of serotonin, don't. They don't have a deficiency of serotonin. They have a deficiency in the cells' ability to listen to serotonin. Certainly, one way that you can improve it temporarily is by increasing serotonin. But that's a poor way of doing it because the major reason that cells become resistant to a hormone is by overexposure,

and that happens to all hormones if tissues are overexposed to it. Insulin resistance is a prime example.

Insulin resistance is like sitting in a smelly room. If you sit in a smelly room for a long period of time, pretty soon, you can't smell it. And it's not because the odor is not there. It's because your cells can no longer receive the message because they've been overstimulated. The best way, then, to smell that room is not to add more odor, which would help very temporarily until you've burned out your olfactory nerve even more. The best way to improve your ability to smell that room is to walk out of the room for half an hour and come back. Allow the cells that are important in smelling that odor to regenerate. The exact same thing happens with diabetes. The way to improve the vast majority of cases of diabetes, so-called type 2, or adult-onset, or insulin-resistant diabetes is the more appropriate term, is to keep your insulin levels low so that your cells can smell insulin again. They can receive the signal. And that's what you want to do with all hormones.

So if you take drugs like Prozac to treat serotonin deficiency, it helps temporarily, but ultimately, over time, what it does is it causes the serotonin receptors to burn out even more, and then they have to keep upping the dose and upping the dose, and then if you try and get off of Prozac, because your body almost then requires really high serotonin because the cells can't listen to serotonin any longer properly, if you get off of Prozac, then you notice horrible side effects and depression and suicide. That doesn't mean you can't get off of it, but it means you have to get off of it really slowly because essentially, what the drug has done is addict you to it.

Dr. Mercola: Well, there's an increase in suicide even when you're on the medication.

Dr. Rosedale: Right, what you're doing is you're burning out the serotonin receptors. Exactly.

Dr. Mercola: And it's been so significant, the FDA was forced to require the manufacturers, the drug companies, to actually put a black box label on it earlier this year, or last year.

Dr. Rosedale: Right. It's just the general mindset of most conventional medical treatment is to just kind of hit you over the head. "Oh, you can't listen to serotonin?

We'll give you more. If you're insulin resistant, we'll just put you on insulin". But the problem is, people became insulin resistant by being overexposed to insulin in the first place. It's a prime example of treating the symptom and not treating the underlying disease. And this is kind of a general dictum, I think, in health and medicine. And if you treat the symptom, you're almost going to make the underlying disease worse because your body has a symptom kind of as a way to deal with the underlying disease. An example would be if you catch a cold, you get a runny nose. Why do you have a runny nose? You have a runny nose because our ancestors, our ancestral history, has taught us that we need to cleanse the sinuses, wash out the sinuses and mucous membranes, and then, you'll rid yourself of the offending organism. You'll rid yourself of the bacteria, the virus, the dirt, more rapidly. If you take a decongestant, all you're doing is negating millions of years of evolutionary and ancestral learning.

The same thing if you take insulin and you're insulin resistant, if you've got plenty of insulin, but you're insulin resistant and that's why you have diabetes and you take insulin on top of it, you're making yourself worse. And the same thing when you take things like Prozac. You're making the underlying disease worse, which is most likely receptor resistance to serotonin, as opposed to too little serotonin.

So what you really want to do is treat the underlying cause. Make sure the membranes are working properly. Make sure they can listen. Get them to take off their earplugs and earmuff so that they can listen to the orchestration of signals that are trying to take place. That orchestration! Every millisecond, cells are listening to thousands and thousands of signals simultaneously. This is a very fine orchestration of signals, and it's so much like going to the orchestra. If all of a sudden, you told the tuba player to play ten times as loud, I mean, that music is going to really be messed up. That's not what you want. You want to make sure that the music is played accurately, and that's what you have to do with hormones, and that's especially true in the brain because of all the neurotransmitters. Essentially, nerve cells are kind of naked. They're so affected by glucose and polyunsaturated fatty acid oxidation, and they're such a metabolically-active tissue, that all of the things that affect all the rest of your body, the lining of your arteries and your skin, are going to affect your brain,

but even more so, and that's why an almost inevitable process of aging is that we experience mental decline. And in fact, our brains shrink as we get older.

What do you mean by shrink? Well, it's actually dissolving away, oxidizing away. You know, if you put a piece of oily fish out on a hot summer day, and you just leave it there, eventually, it's just going to rot away, and that's really what happens to our brains. It kind of rots away. It sounds kind of gross, but that's the ultimate truth. You need to have that not happen as much. We can't totally prevent it, but we can absolutely slow it down, and you slow it down by absolutely, number one, eating a proper diet. Don't eat a diet that causes elevations in blood sugar. Extremely important. Don't eat a diet that is filled with excessive protein because that excess protein will also be made into sugar, and then, basically, you're teaching your body how to turn protein into sugar, and then when you don't eat, you're going to turn protein into sugar. But where you're going to get that protein is going to be from your muscle and your bone. That's the major cause of osteoporosis, is actually turning the protein in your bone into sugar for fuel because your body can't burn fat appropriately because it can't listen to leptin and it can't listen to insulin. If you're able to burn fat as your primary fuel, you'll leave your bones alone, and then, you'll reduce your incidence of osteoporosis.

So all these things are so interconnected, and it's very important to keep that in mind, that the basic molecular processes are common to all the tissues; your skin and your brain and the endothelium that lines your arteries. They're all subject to the same molecular processes that accrue damage, that we call "aging". It's all regulated by hormones.

Dr. Mercola: Another common symptom of aging is the loss of flexibility and joint pain and arthralgias, and certainly, from my experience, I've taken care of thousands of patients with rheumatoid arthritis, which is a very severe form of autoimmune arthritis, and it's been well documented in the literature, and certainly in my clinical experience, that the essential fatty acids, like the DHA and EPA from fish oil, are useful. And I'm wondering if there are any other specific recommendations you would have as it relates to improving the aches and pains and arthritic challenges that many people develop as they age.

Dr. Rosedale: Yeah. Sure. And again, I'd be remiss not to say that of course, that diet is going to be the most important. Don't eat sugar. Sugar glycates the proteins that line our arteries, and one of the major causes of inflammation in our arteries – not arteries – but in our joints – arteries too, but also in our joints, is glycation, and you want to reduce glycation in the joints, and you'll reduce inflammation.

Also, the major cause of autoimmune diseases have to do with sugar, sugar messing up the proper sugars that coat our cells that signal to our immune system that they're our own body parts, that our immune system should leave them alone. When glucose kind of messes up that needed and desirable glycation with unwanted glycation of glucose, you increase your autoimmune diseases, and you get things like rheumatoid arthritis. So you definitely want to keep your sugar levels low.

That being said, there certainly are some supplements that seem to reduce the incidence of, or at least mitigate, arthritis, and I think you mentioned one of those, Dr. Mercola, and that's certainly the omega 3 fatty acids, extremely important in membrane function, which also includes the membranes related to your joints. So you want to reduce omega 6's, increase omega 3's, and what you effectively do there is reduce inflammation all over the body, but much of that inflammation is manifested in joints. This can also reduce pain all over the place.

I remember a patient I had quite vividly, and he was seeing me for diabetes and heart disease. But one of the things that bothered him, that I found out subsequently, was that he couldn't lift his arm past 90 degrees, and he had been a very avid tennis player and couldn't play tennis anymore because he couldn't lift his arm, and that was because of arthritis. And after his diabetes and heart disease were very effectively treated, concurrent with that, he noticed that he could lift his arm almost all the way above his head; he could resume playing tennis. And I see that all the time.

People ask me, well, how did I get into this field? And how did I get into diabetes? Was I diabetic myself? No, no. I really wasn't. I was really just kind of looking for answers. But one of the things that I did have many years ago, almost 25 years ago, 30 years ago maybe, was very extreme Achilles tendonitis, and it prevented *me* from playing tennis. I actually liked to play tennis quite a bit too, and at that time,

I didn't know why. I just thought I injured my Achilles tendon. But it persisted for years, actually, and it was extremely painful. Then, finally, as some of this research came to my attention and I started realizing the importance of insulin and sugar and diet – and this was well over 20 years ago – and I reduced my intake of foods that turn to sugar, one of the things I noticed, just concurrently, not only did I become much thinner and stronger, but my Achilles tendonitis totally disappeared. To this day, I haven't had it back in twenty-some years, and I see that in many, many different patients.

So you definitely want to reduce glycation, keeping insulin sensitivity also helps fatty acid metabolism and it helps fats, proper fatty acids, to be incorporated in the cell membranes. That is just more vital than anything else you can do. There are supplements that can help. Glucosamine sulfate is a component of the joint lining and cartilage, and that seems to be quite a helpful supplement. Cetyl myristoleate is another component of joints that appears to reduce inflammation a great deal, a very powerful, apparently, joint anti-inflammatory agent, appears to work very well.

I mentioned the fish oil and the very powerful effects that omega 3 fatty acids can have on all tissues, also particularly joints. And if you're going to take fish oil, you have to take preservatives of that fish oil. I mean, omega 3 fatty acids, fish oil, we know spoils on a warm summer day very easily. But it spoils inside your body just as readily. I mean that's how your body is, over 98 degrees. It's hot in there, and it's going to spoil the fish oil that becomes incorporated into your cell membranes. So you need to take fat-soluble antioxidants, which are essentially fat preservatives. So vitamin E is important to take along with fish oil and other fat-soluble antioxidants.

CoQ-10 appears to help joints, like it helps all tissues. It helps energy production. One of the major problems with statin, cholesterol-lowering drugs, for instance, is that it not only reduces cholesterol, which I think is actually a bad thing; not necessarily a good thing, but it also reduces the same enzyme that manufactures CoQ-10. So your CoQ-10 levels fall, and then none of your cells can actually produce energy appropriately, and it can't produce enough energy to regenerate tissue, and your joints are tissues that need to be regenerated a lot because they're damaged a lot. I mean, every time you move, you're essentially damaging the joints, and you need to

be able to repair that damage. For that, you need to be able to make energy. So you might consider your joints to be another very metabolically-expensive tissue because there's a very rapid turnover of molecules and cells that line your joints, and for that you need not only energy, but the instructions of how to use that energy. CoQ-10, acetyl L-carnitine, lipoic acid, all the other things that are important in the lining of your arteries, for instance, all the things that help diabetes, all the things that reduce glycation, will help joint function quite a bit.

Dr. Mercola: I'd like to add one other item too that's really a lifestyle issue. During the summer, most of us have the opportunity to be exposed to sunshine on significant portions of our skin, and that, of course, will help our skin to produce vitamin D, and vitamin D has been well documented to radically reduce, by some mechanism that's relatively unclear to me, but it certainly reduces the incidence of autoimmune disease, and if one already is struggling with it, it actually helps a person recover from it. But then, independent of that, it's also been shown to be very useful of decreasing different types of arthralgias and muscle pains and useful in fibromyalgia. So it's an enormously useful tool, and it's been my experience, and it's certainly supported in the literature, that the vast majority of people are very deficient in vitamin D. So unless someone's got a deep tan or has been using large amounts of natural vitamin D, or at least, not large, but sufficient amounts, they're probably going to be vitamin D deficient.

Dr. Rosedale: Yeah. That's an excellent point, and there's other things that certainly relate to the immune system in autoimmune disease. I think we'd probably be remiss to not mention gut health.

Dr. Mercola: Um-hmm.

Dr. Rosedale: Your gut is your largest immune organ, and one of the major sources of inflammation. People who've taken antibiotics, especially, or many people because of what they eat, you can have a disruption in the normal flora of gut bacteria, and you might have too much candida, for instance, and not enough acidophilus, and that will cause irritation of the gut lining, and therefore, inflammation, and that will trigger your immune system, and that can also be a huge cause of autoimmune diseases, due to a variety of mechanisms.

When you cause inflammation or swelling of the gut lining because of improper bacteria in your gut, you increase the risk of absorbing particles of food that otherwise wouldn't have been absorbed. They're not digested properly, and then they act like viruses and bacteria; they're proteins that get absorbed that are not broken down properly, and then your immune system will upregulate to try and fight those, essentially, food particles that got absorbed that shouldn't have been absorbed, and some of that upregulation of the immune response can affect many other tissues.

Now, whenever you have inflammation in any part of your body, you know, if you stub your toe, you're going to increase the circulation of inflammatory compounds that will affect all parts of your body, including your joints, for instance. We know that inflammation then will affect the lining of your arteries. So you have things like gingivitis; we know it's associated with heart disease, and that's because the gingivitis is constantly releasing inflammatory compounds that circulate through the blood that affect the lining of the arteries, so that they also inflame.

That can also bring us back to leptin, for instance, if you eat a diet that causes leptin levels to spike. Leptin itself is a very pro-inflammatory hormone, and it's a cytokine; it's a pro-inflammatory cytokine that increases inflammation. But even more importantly, it mediates the production of other inflammatory compounds from your fat. And we know, for instance, that obesity has been associated with many chronic diseases, but it was never known why. Now we know why. It's because obesity is associated with elevated levels of leptin, which causes increased production of very pro-inflammatory hormones from within the fat, such as TNF-alpha, interleukins, and these will cause inflammation everywhere, including your joints, also your arteries; it will predispose your arteries then, to heart disease. So what you get, then, is just a global maladaptation of inflammation.

Properly utilized, inflammation saves your life. If you cut your hand, you want inflammation because it allows that cut to heal. It might heal with a little scar tissue, but you can live to be careless another day.

Dr. Mercola: Let me just interrupt with a comment, while we're still talking about the gut. The gut is also the primary producer of serotonin. So if people

struggling with depression, which is quite a common problem, improving the gut health through the mechanisms you just mentioned could also help depression.

Dr. Rosedale: Right. Everything is interconnected.

Dr. Mercola: Interrelated. Yeah.

Dr. Rosedale: Because essentially, what is occurring is that you're getting the wrong messages, the wrong signals that are circulating, and all your other cells are listening, then, to the wrong signal. And basically, your cells are getting confused as to how they're supposed to properly behave.

Dr. Mercola: What I'd like to do now is, you had mentioned earlier, but I'd like to expand a little bit about the leptin issue. So if you can do that, and then maybe, just follow it with a summary of your recommendations for supplements, because I think that's an area that I certainly don't focus on, on the website. I've been actually a bit anti-supplement focused, and I think the discussion here today has certainly helped enlighten me a bit and changed my perspective, and I'm seriously considering changing my position on that. So I appreciate it. But if perhaps you can just touch a little bit on leptin and maybe just recommend a supplement program with specific names and dosages, I think that would be great.

Dr. Rosedale: Absolutely. I've become very, very interested in leptin biochemistry and physiology because we'll see, subsequently, that it affects so much. And I think I mentioned earlier that to me, it's *the* most important hormone in the body. I will mention that for people that are unaware, I do have a book out that talks about it a little bit more extensively. So if you want more information, you can read a lot of the articles, for instance, that are on Dr. Mercola's website, but also read the book on it because it relates so much to health. We also talked about supplements in there too.

Here's the story on leptin in a nutshell, so to speak. Approximately ten years ago, there was mouse called the *OB mouse*, and it was called the OB mouse because it was obese, and it was used in many obesity and diabetic experiments, mostly for drugs. But they didn't know what made it obese until Jeffrey Friedman at Rockefeller University found out in 1994 that it lacked a hormone that nobody had known existed, called leptin. And when he injected this OB mouse, this obese mouse, with leptin,

within a few weeks, it became thin and non-diabetic and happy and reproduced a bunch, and it was just a huge turnaround. And it made front page headlines everywhere: "*Cure for Obesity Found*", and they had a picture of this obese mouse and then a picture of this thin, happy, healthy mouse, after having received leptin injections. And it was on the front page of all the major newspapers around the world.

Well, drug companies were tripping over themselves to be the first to genetically manufacture leptin to give to all the overweight and obese people; they thought they'd make zillions of dollars. Until they started measuring leptin in people, and they found that it wasn't quite what's going on in the mouse. When they measured leptin in people, they found that almost all overweight and obese people had high levels of leptin, and not low. So giving extra leptin to these people didn't do anything. It didn't do much at all. And so, drug companies kind of abandoned it after about a year or so because they couldn't make money on it. They knew it was important, but they didn't know how to control it. So now, they're looking at other hormones.

But aside from medicine, people into cell biology, especially, are continuing to look at leptin, and a very, very intriguing picture is emerging pertaining to leptin's connection to all of the chronic diseases of aging, and perhaps, even aging itself.

If things are working properly, what is supposed to happen is that the amount of fat a person stores should be highly regulated. In our ancestral history, it was important to store extra energy because food wasn't always available; so you wanted a little extra fat so it would tide you over in times of famine, because food was never guaranteed. However, equally important was not to be too fat because again, in our ancestral history, we had to be very mobile and we had to hunt, we had to run after prey. But more importantly, we had to run away from predators; we didn't want to be prey ourselves. And if the lion was chasing a group of people, which one is it going to catch? It's going to catch the fattest one that couldn't make it up the tree, and those fat genes, then, would have been eliminated from the gene pool.

So fat became highly regulated. You wanted a little bit, but not too much. And it appears that the major hormone that regulates the amount of fat that a person stores is leptin, and the way it does that is as follows: As you get fatter and fatter, your fat cells themselves produce leptin. Now, that totally changed the viewpoint of the way

science views fat. Previous to ten years ago, fat was looked on as just this ugly energy storage depot that everybody just wanted to get rid of, that it didn't really serve any other function other than to store energy.

But with the discovery of leptin, fat became an endocrine organ. In other words, it's an organ that produces hormones that are very powerful, and subsequently, they found that fat produces other hormones too and many inflammatory agents. It's a very biologically-active tissue. It's an endocrine organ, a very powerful one, and it produces leptin, and as you get fatter, you produce more leptin, and it's supposed to go to an area of the hypothalamus that regulates hunger. And it tells your hypothalamus that you've got plenty of fat available, that you ought not to produce any more, that means you ought not to eat, that means you ought not to be hungry. So it affects, very powerfully, hunger areas in the hypothalamus, and it prevents you from overeating by reducing your hunger.

The only way a person is not going to overeat is if they're not hungry. If you're hungry, you can use all your willpower you want. Ultimately, it's going to break down, and you're going to eat. Again, the two biological imperatives that we have inherited from all of our ancestors for eons has been to eat and to reproduce. So if a person's hungry, they're going to eat. The only way that you're not going to make extra fat and you're not going to overeat, is if you regulate hunger. Hunger is regulated by leptin and other hormones.

So as you get fatter, you produce more leptin. It goes to the hypothalamus, tells you to not make any more fat, and it does that by telling you to not be hungry, and it stimulates a certain part of your nervous system that tells you to start burning some of that fat off, that allows you to burn some of that extra fat off.

Problems occur when the hypothalamus stops being able to listen to leptin, just like your cells can't listen to insulin. They become insulin resistant. If your cells become overexposed, if your hypothalamus becomes overexposed to leptin, it can't hear the message, and so your fat could be producing all this leptin. You could be getting fatter and fatter and fatter, and it could be producing a bunch of leptin, trying to scream to your hypothalamus, to tell your brain that you're getting too fat. But your hypothalamus then isn't able to hear it, and it's hearing a whisper. It's thinking that

you have a tiny bit of leptin, and that means, normally, that you're too skinny, and that you won't be able to survive a famine. So it tells you to be hungry. It tells you to make more fat, and importantly, not to burn the fat that you've got because it doesn't think you have very much, even though you might have a lot of it. And if you can't burn fat, then you have to burn sugar. So it makes you crave sugar because it would prefer not to take your muscle and bone and turn it into sugar, which is what will happen when you're sleeping if you're leptin resistant because you can't burn fat then. So you have to burn sugar, and if you're not actually putting that sugar in your mouth, since you don't store very much, you're going to actually convert your muscle and bone into sugar. So lots of bad things happen.

Your hypothalamus has become leptin resistant. And there's a lot of things now associated with leptin resistance, not the least of which is diabetes, and it's been very convincingly shown that when you're leptin resistant, you're much more prone to be insulin resistant, and that leptin resistance is what will primarily determine your insulin resistance of your brain and your liver, which are the two major organs that will determine whether you become diabetic or not.

High levels of leptin, and leptin resistance, are highly correlated with cardiovascular disease for a variety of reasons, not the least of which is its effect on inflammation. High levels of leptin are associated with arthritis. High levels of leptin are associated with osteoporosis. We know that leptin highly controls calcium metabolism, along with vitamin K, for instance. Your osteoporosis is much more influenced by the protein content of your bones than its calcium content. The strength of the bone is determined by the protein content, and the ability of your bones to manufacture protein has to do with its ability to listen to leptin and the ability of the sympathetic nervous system to talk to your bones, which is influenced by leptin.

Leptin controls reproduction. It's been known for a long time, for instance, what women marathon runners stop ovulating, stop having periods, and they can't reproduce. And I thought it's pretty funny that initially, drug companies were hoping to make zillions of dollars on leptin by injecting people with leptin, but they found out that didn't work, and so it was abandoned. But recently, the FDA gave approval for the use of leptin in very skinny women, because if you give leptin to these skinny women,

they can reproduce again. They can ovulate. The reason that women marathon runners stop ovulating is because their leptin levels are too low, and if leptin levels are too low, it's telling your body you don't have enough energy to reproduce, telling your body, don't waste your time trying to reproduce, because you're not going to be able to. Instead, you can increase maintenance and repair. And so your tissues .....

Dr. Mercola: Could you stay on that for a moment. I'm sorry.

Dr. Rosedale: Yeah.

Dr. Mercola: Because you would think that insulin and leptin sensitivity are similar, so that a woman marathon runner would have very great insulin sensitivity and very low insulin levels, and it would actually correlate well with the leptin. But it seems to be the reverse. There's obviously other factors in there that are contributing to it.

Dr. Rosedale: Right. There are. Although insulin and leptin, many times, are parallel and they signal similar things, they do so to different entities. Insulin signals each individual cell. Each individual cell is a life in and of itself, and apparently, insulin is very, very ancient. They mention it's found in yeast. If you reduce insulin levels in yeast, they live longer, and if you reduce insulin levels in worms, they live longer. However, you can actually inject those worms with human insulin, and it will negate the life-prolonging effects of low insulin. The important part there is the importance of insulin and lifespan, but also the fact that worms can listen to human insulin; same thing. So that indicates it's extremely ancient. So, while each individual cell in your body is listening to insulin, what leptin does is coordinate the activity of the entire republic of cells. It tells the entire republic community of cells how much energy is being stored by the republic and whether that entire republic of cells needs to store more energy or whether to burn some of that energy off.

So you have, kind of two major classes of signals; signals that speak to each individual cell, and signals that coordinate the activity of the ten trillion cells that occupy the entire republic. That's what leptin does, and it regulates the energies of the entire republic of cells. And without proper energy use, nothing else by that republic, and nothing else by each individual cell, can perform properly. In other words, to be a heart cell, to be able to constrict properly, you have to be able to use energy properly.

There's a difference between burning sugar and fat, and insulin and leptin will determine your ability to burn sugar or burn fat. So proper insulin and leptin signaling kind of cascades down into health and longevity, and conversely, improper insulin and leptin signaling will also cascade down into disease and a shorter lifespan. And the only way that we know to properly communicate insulin and leptin, to have your cells be able to regenerate their ability to accurately listen to insulin and leptin is by dietary and supplementary needs and changes. There are no drugs that can do it, absolutely none.

Dr. Mercola: Well, that's a good segue because I think I still want to leave a little time here for a question. So perhaps if you could recommend your supplement proposals for most of us, what you would feel is optimal to improve this insulin and leptin sensitivity and longevity, that would be appreciated, and then, we can open it up for a question.

Dr. Rosedale: Okay. Can we do that now or?

Dr. Mercola: We'll do it now.

Dr. Rosedale: Sure. Well, there's a very long list. I like all of the B vitamins.

Dr. Mercola: Well, maybe could you subdivide it into groups that you'd recommend for most anyone without even really thinking about it. I mean, essential fatty acids would definitely be something that I can't think of a person I wouldn't recommend it for.

Dr. Rosedale: Right. I totally agree with that.

Dr. Rosedale: Right. Yeah. Omega 3 fatty acids are extremely important for everybody, and I think we've definitely, I think, emphasized that. Then, you need the fat-soluble antioxidants to protect the highly-unsaturated omega 3 fatty acids.

Dr. Mercola: For any one other than vitamin E? Would you say vitamin A too or?

Dr. Rosedale: Vitamin A to some extent. I think the fat-soluble form of vitamin C is quite important, so-called ascorbyl palmitate.

Dr. Mercola: Is that available in a supplement or is that in a food?

Dr. Rosedale: That's a supplement.

Dr. Mercola: And what's it called?

Dr. Rosedale: Ascorbyl palmitate.

Dr. Mercola: Ascorbyl palmitate. Okay. And what type of dosage is in there?

Dr. Rosedale: It's a fat-soluble form of vitamin C. And that's able to get into cells more readily.

Dr. Mercola: And what's the dosage on it?

Dr. Rosedale: Well, you can use it, actually, in essentially, a milligram for milligram for regular vitamin C.

Dr. Mercola: Okay.

Dr. Rosedale: I normally put people on about 500 mg of ascorbyl palmitate.

Dr. Mercola: Is it wise to split that up throughout the day, or, because it's fat soluble, it's not as important?

Dr. Rosedale: Right. It's not as important as the water soluble. When something is fat soluble, it kind of sticks around for a long time. It gets incorporated into the fat, into your fat membranes and stays there for a long period of time. So you could even take it once a day. I usually have people take it twice a day.

Dr. Mercola: Okay. That's interesting. I hadn't heard of that before. Alright. So, vitamin C, A, E and then the omega 3 .....

Dr. Rosedale: Lipoic acid.

Dr. Mercola: Lipoic acid. About 200 mg?

Dr. Rosedale: Acetyl L-carnitine is anther very important component of cell membranes, but especially the mitochondrial cell membranes. We haven't really touched that, and we probably don't have a lot of time to talk about mitochondrial health itself. But in the biology of aging, mitochondria are looked at very, very closely. They're kind of the little power plants inside the vast majority of cells, that use oxygen to help generate energy. Consequently, they suffer a lot of damage, and one of the major theories of aging is that our mitochondria become, ultimately, very damaged. They have their own DNA. In fact, it used to be very widely accepted that mitochondria used to be bacteria in and of themselves, that got incorporated into our own cells, and we kind of created a symbiotic relationship with mitochondria, whereby our cells protected them, and they produced energy for us. And they have their own DNA as a

result of this, that their own DNA is circular DNA, and it's much more prone to damage, and ultimately, our mitochondria become mutated and damaged and can't produce energy appropriately. So anything that helps preserve mitochondrial membrane integrity has been shown to be very beneficial in terms of lifespan.

Dr. Mercola: But there wouldn't be any distinction or difference between the mitochondrial membrane for preservation and the normal supplements you're just reviewing? It'd probably be fairly similar?

Dr. Rosedale: Well, with the exception of one, and that is that resveratrol, actually **.....**

[cross-talk]

Dr. Mercola: Ah! That's a good point. I was going to ask you about that.

Dr. Rosedale: Yeah.

Dr. Mercola: That, to me, seems to be the most single, exciting supplement, other than the basic foods, like the omega 3 fats, to help extend life, and I would definitely appreciate your insights on that.

Dr. Rosedale: Yeah. Resveratrol is a component of, essentially, a red, purple pigment found in grapeskins. It initially was thought to increase health, and perhaps extend lifespan, by being an antioxidant.

Dr. Mercola: Um-hmm.

Dr. Rosedale: But that really didn't make a lot of sense because just plain, infusing yourself with antioxidants might not be a good thing. As I mentioned, certain types of oxidation are very good. They use oxidation to kill cancer. You use oxidation to get rid of old, damaged debris, and you use oxidation to breathe, in and of itself. Again, it's not just whether you have oxidation or whether you don't. It's how well it's controlled, when it's taking place, where it's taking place, etc. What resveratrol has been found, and this gets - I'm sorry, I'll apologize in advance – a little bit complicated, but I mentioned earlier that there are genes that can be turned on and turned off that affect maintenance and repair, and therefore aging. One of those genes, in mammalians, is called SIRT-1. In worms, it was called SIR-2. When those genes were upregulated, it showed that maintenance and repair is also upregulated, and lifespan is extended. It's a good thing

So researchers have been looking for what are called SIR-2 or sirtuin mimics, food agents, food components that could mimic and upregulate SIR-2 or sirtuin, SIRT-1 activity. And the primary one that researchers have come up with, mostly at Harvard – David Sinclair, I believe, is the researcher who has done a lot of this work – was resveratrol. And resveratrol upregulates the SIRT-1 gene. It's a sirtuin mimic, and that has been shown to extend lifespan, at least in really simple organisms. Now, whether it can extend lifespan in humans is still open to debate. But it looks like a very promising agent, and it does so primarily by helping preserve mitochondrial membranes and preserve mitochondrial health, which is also what acetyl L-carnitine, and the combination of lipoic acid, for instance, and acetyl L-carnitine - that combination has actually been patented by a group at Berkeley, but anybody can take it separately -

Dr. Mercola: Do you think collectively, though? I mean, resveratrol is a polyphenolic bioflavonoid, and usually found, like you just said, in grape skins. But there's a whole other group that are really similar, and I'm wondering if they haven't been yet discovered, such as in the fruits, like raspberries and blueberries and all these other bioflavonoid that, just because they haven't been researched, doesn't necessarily mean they aren't performing useful benefits very similar to the resveratrol.

Dr. Rosedale: I think that's absolutely true. I think that grapeskins were studied because they were available. If you make white wine, you take off the grapeskins, and so you have a lot of grapeskin. Wineries have a lot of grapeskin available. And I've mentioned previously that the best part of any fruit or vegetable is actually the outer skin because they [growing fruits] can't run around, and so they're constantly exposed to radiation, and so you have to preserve the little embryos inside that fruit or vegetable, and so you have powerful anti-radiation, antioxidants, on the skin of fruits and vegetables. Grapes have a lot of skin. Blueberries have a lot of skin, relative to the amount of pulp, because they're smaller, and therefore, they find the greatest amount of benefit in those.

I'm not real fond of the pulp. A lot of the interior of the fruit or vegetable is sugar water, and you want to avoid that. I think sugar will negate any other benefit it might give you. But if you just have the skin, then you're forgoing the sugar of that fruit and

eating the most beneficial part of it, and that indeed is what is being found, that there are some very beneficial aspects of grape skin and of blueberry skin, and I have absolutely no doubt that you're correct, Dr. Mercola, that there's probably many other aspects of the skin of other fruits and vegetables that might be able to mimic SIR-2 and other aspects of the aging process, that just haven't been looked into yet because they're just not as readily available and researched.

So I'm asked about juicing for instance. I think juicing is great, but throw away the juice and keep the pulp because the pulp has most of the benefit. The juice has too much sugar. And I think that's being borne out. And sugar is so damaging that it's going to undo any other benefit, I think, of food that it's associated with.

Dr. Mercola: Would you feel that also holds true for low-glycemic, or slow carbs, such as celery – I think would be a good example – or lettuce or?

Dr. Rosedale: Yeah. Now, those two foods I think are just fine. It depends, I think, on what makes it low glycemic. There are essentially two ways that a food could be low glycemic. One is if it's a fiber. If it doesn't turn to sugar in the first place, it's low glycemic. That's fine. That's great. Fiber, the best aspect, the best part, about fiber is that it can't turn to sugar. The most that fiber can turn into is short-chain, fatty acids, and that's done by bacteria in the gut, and soluble fiber in particular can be changed into short-chain, fatty acids in the gut by bacteria, and that's useful, and actually, the gut lining uses it as fuel, and it's not going to raise your blood sugar at all.

Then there's insoluble fiber, which essentially just acts as a scrub brush, and again, it's fine in that it gives you substance, I suppose and helps clean out your gut, without increasing blood sugar. So fiber is great, and if it's low-glycemic because it's made of fiber, perfect.

But there are other ways that you can be low glycemic and not necessarily be healthy. You have to understand also that when you're measuring the glycemic index, you're only measuring one sugar; you're only measuring glucose. So there's other sugars, at least as damaging, and actually more damaging, than glucose. For instance, fructose. Fructose is a horrible sugar. It so-called glycates, or a more appropriate word would be, "fructosylates", proteins and DNA enzymes, etc, DNA proteins, more readily,

much more readily, than glucose does. But it's not measured when you measure a glycemic index because it's only measuring glucose. So therefore, for instance, white table sugar has a lower glycemic index than a potato because a potato is turned almost entirely into glucose, whereas white table sugar, sucrose, is turned into glucose and fructose, and only the glucose portion is measured, and that doesn't mean that white table sugar is good for you, or better for you than a potato. They're both horrible.

Dr. Mercola: And that points out the whole fallacy of the glycemic index.

Dr. Rosedale: Yeah.

Dr. Mercola: Which is really a foolish way of trying to categorize

Dr. Rosedale: Yeah. It's good for illustrative purposes, but it's far from perfect. Also, one has to realize that due to monetary and time constraints, the glycemic index is only carried out for about three hours, and so, if you have a food that turns into sugar more slowly – in fact, let's say it doesn't turn into sugar completely until about five hours – it's getting a short shrift. It's not measuring the last two hours of sugar, and so it's going to have a lower glycemic index because the experiment just isn't carried out long enough. And to me, the important part is the glycemic load. How much total sugar is your body being exposed to? How long is it going to raise insulin? How long is it going to expose your tissues to the glucose so that it could glycate? And how long is the insulin going to be raised so that the tissues become resistant to it?

Now, if I had to pick one over the other, I would say that it's probably less unhealthy to eat a more slowly-absorbed sugar, or carbohydrate, than one that is rapidly absorbed that will spike your sugars and cause insulin to surge. But they're both bad. The length of time your body is exposed to glucose and the length of time your body is exposed to insulin and leptin are going to determine the total amount of damage.

Dr. Mercola: So it's the area under that curve where you're drawing your graph.

Dr. Rosedale: It's total area under the curve. Yeah. And the glycemic index doesn't measure the total area. It only measures the area under the curve for the first three hours.

Dr. Mercola: Hmm. Well, that's interesting. Alright. Well, I'd like to at least leave a few minutes open for questions now. We've got under 15 minutes left, and if we can squeeze a few in.

QUESTION:

Adrienne: **.....** has changed in the past half hour. But you were talking about sugars, and I wanted to know about the sugar alcohols, like xylitol.

Dr. Rosedale: Right.

Adrienne: And if they're as damaging as glucose or fructose or?

Dr. Mercola: If I could add an extension to that question too. If you believe there are any safe sweeteners, such as raw honey or any other components, like stevia, you might comment on.

Dr. Rosedale: And those are, I think, great questions. I would have to say that the research on that is still rather fledgling because it really hasn't been used very much until the last few years. So the research is still happening, and some of what I say might change in the near future. Of the so-called artificial sweeteners, xylitol is probably the best of them all. There have actually been shown to be benefits from xylitol on the immune system. And it certainly seems to affect the gut in a less harmful way. Most sugar alcohols can cause a lot of gas and diarrhea, where it seems to be much less so with xylitol. So if I had to pick one, it would probably be xylitol.

That being said, there is certainly a downside, because it is very sweet, and what happens when you eat anything sweet, I mean, what makes it sweet is that it has to stimulate your sweet receptors in your tongue, and if you eat anything sweet, what you do is you ultimately become sweet resistant, in that you tend to burn out the sweet taste buds, which requires, then, foods to taste sweeter and sweeter for you to be able to sense it. Therefore, you demand sweeter and sweeter foods. Then when you eat something, for instance, like almonds, they don't taste sweet anymore because you can't taste the subtleties any longer because you kind of burned out a lot of your receptors. If you didn't eat artificial sweeteners, if you refrain from eating sweet foods, and then you had almonds, it tastes completely different. It tastes sweet. Then, your sweet cravings are satisfied.

Other research has shown that the more sweet foods that you eat, the more you're going to crave carbohydrates because they turn into sugar. So it isn't just the sweet taste you want; you end up craving foods that turn into sugar, and so it makes it harder to stay away from sugar-forming carbohydrates. So there is definitely a down side. So the most immediate effect is, yeah, it's not going to do you much damage. It's not going to really glycate that much. Sugar alcohols themselves have fewer calories, for instance, than regular carbohydrates, so that the immediate effects are certainly less damaging, to eat sugar alcohols, than to eat sugar or starches that turn into sugar. However, the long-term damage is, as yet, somewhat unknown.

Theoretically, you get some of the damage I mentioned to your taste buds. It's not so much, again, what you eat today, but what today's eating makes you eat tomorrow. And eating sugar alcohols might not make you eat the right foods tomorrow. But you do get less glycation. Again, if I had to choose between the two, I would definitely have xylitol over white table sugar. I mean, no question about that. But I don't think that you can eat the xylitol with complete impunity. There is a price you're going to pay for it, although probably lesser of a price than if you ate regular sugar.

Dr. Mercola: Do you have any concerns about something like raw honey?

Dr. Rosedale: Oh, yeah. And there's many different terms for sugar, and although raw honey contains other elements and certain antioxidants and can actually help benefit the immune system in certain ways, it does have some active beneficial ingredients, but it has tons of sugar, and I'll stand by the previous statement that I made, that if there is something that's going to raise your sugar, the detriment is going to far outweigh any benefit, and so, I think that the sugar content of raw honey is going to outweigh any other benefit that it might give you.

Dr. Mercola: Okay. That's good.

Dr. Rosedale: And I don't recommend it, then. It's going to raise your insulin. It's going to raise your blood sugar. It's going to cause **.....**

[cross-talk]

Dr. Mercola: So the actual specific sugar, or monosaccharides, in the honey are not necessarily less damaging or harmful. It's just the total glycemic load.

Dr. Rosedale: Right. It's just the total glycemic load.

Dr. Mercola: Okay.

Dr. Rosedale: Absolutely.

Dr. Mercola: Do we have another question?

QUESTION:

Matteo: Hi, Dr. Rosedale. I picked up from what you were saying, one of the keys to good health is to train your body to burn more fat, as opposed to burning sugar.

Dr. Rosedale: Exactly. And if you get nothing else out of today's talk, you've learned a lot.

Matteo: Okay. Great. Well, I've got that, and I've heard a lot of what not to do, and sweets and sugar and all that. Can you give us clear, specific, practical advice on what type of diet we should have. What should we be eating to train our bodies to burn more fat?

Dr. Rosedale: Great. Once again, I want you to understand what we're talking about when we're talking about eating. To fill your cells, and we want your cells to eat fat because if your cells are able to eat fat, it's going to be much less damaging, and then your body is going to crave less sugar. For your cells to be able to eat fat, your brain has to be able to listen to leptin. And so, you have to eat a diet that essentially is going to regulate the hormones that determine whether you're able to eat fat or not. Again, the biggest one of those is going to be leptin.

What causes your brain to not be able to listen to leptin properly is surges in leptin, and you have, essentially, two levels of leptin. You have kind of a baseline level, and you have spikes in leptin, depending on what you've eaten. What causes spikes in leptin is when you turn sugar into fat, and lipoproteins, within fat cells. So when there's metabolism of sugar through the adipocyte, through the fat cells, your fat cells put out these huge spikes in leptin, and you need to avoid those spikes. It is those spikes that I believe cause the majority of leptin resistance. Again, we boil down to essentially the same diet that mitigates against insulin resistance. You want to eat a diet that does not convert a lot of foods into sugar. Don't eat starches. Don't eat excess protein. If you're hungry, you need to eat something that won't raise your blood sugar,

and that's going to be fat. Also, eating fat - and again, we'll talk about types of fat – eating fat trains your body to burn fat. And you get good at doing something by doing it. So when you eat fat, you keep your metabolism, you keep your physiology, into kind of a fat-burning mode. There's certainly different enzymes, different genetic upregulation that is required to burn fat, as opposed to burning sugar. So at least you're not switching between fat and sugar burning. And it's been shown that our body has a harder time switching between the two as we age. So maintain fat burning. That way, when you don't eat – let's say you're sleeping at night – and your body then is more insulin sensitive, it's more leptin sensitive, it's already been burning fat during the day, it's going to continue to burn fat at night. Essentially, that means that your cells are continuing to eat fat at night when you're sleeping, and it's going to get that fat from the fat pantry that everybody has. Some people have more than others. And that's what you want. You want access into the pantry in your belly that is fat. If however, you're insulin-and-leptin resistant, you can't access that pantry. Then you have to burn sugar, and if you don't actually put sugar into your mouth, and your body will make you crave that sugar to be able to do so, but at night, you're not going to be doing it when you're sleeping. Then you're going to make sugar out of your lean body mass to feed the cells the fuel that it requires because it can't burn fat.

Now, certain types of fat are more beneficial than others. Certain types of fat are more easily burned than others. And that gets into a more complicated physiology. It has to do with the location of a particular fatty acid on the fat, on the triglyceride. Triglycerides are three chains of fatty acids that are hooked together by a glycerol molecule, a 3-carbon molecule, and whether that fatty acid is on the end of that molecule or whether it's the middle fatty acid determines whether it gets burned or not. The chain length, the longer – everything else being equal – the longer the chain length, the harder it is to burn. So most of the time, long-chain, saturated fatty acids are more difficult to burn than longer-chain polyunsaturated fatty acids, for instance. They're easier to oxidize. Just like they oxidize outside of your body. In other words, they turn rancid. Polyunsaturated fats turn rancid easily. That means they're oxidizing. Well, they can oxidize in a more controlled manner inside cells, more easily. So they're more easily burned, other things being equal.

Shorter-chain length is even easier to burn. So you have certain saturated fats, such as coconut oil, which are so-called *medium-chain triglycerides*. That means that they're not long-chain triglycerides. They're medium chain; they're shorter, and they're much more easily burned. And there, you have kind of the better of both worlds. The downside of polyunsaturated fatty acids is that they can oxidize readily, and that can set up inflammation and cause damage. So that's the problem, let's say, with omega 6 fatty acids, that they end up oxidizing and causing inflammation, but they're easily burned. Short-chain or medium-chain saturated fatty acids are very stable. They don't oxidize very readily, so they don't cause inflammation. They don't cause damage, and yet, they're still easily burned. So things like coconut oil are very good for you.

And I want to kind of preempt a lot of what I'm saying, that if you train your physiology, if you become insulin/leptin sensitive, if you become healthy, so that you can burn fat easily when you need to, the type of fat you eat becomes a little bit less important because you're just going to end up burning it. Your body is really adept at burning fat, and so, if you happen to eat, let's say, some peanut oil, which isn't a good thing, and I do not advocate it, but it's going to cause you less damage than somebody who's insulin and leptin resistant, who can't burn it properly. Because then it gets incorporated in the cell membranes because you're not able to burn it, and then it can do damage.

Dr. Mercola: Dr. Rosedale, would you say one of the important components of this, rather than giving this general, philosophical approach, also, is to integrate the exercise? Because if you're exercising and the exercise is stimulating your system to burn fat efficiently, it gives you a lot more flexibility. So that would be an integral part of the equation.

Dr. Rosedale: Yeah. Again, first, you have to become insulin and leptin sensitive. Now, exercise helps you become insulin and leptin sensitive because it keeps your sugar levels down. But if you exercise, if, for instance, you're just starting out, and you eat terribly and you think that exercise is going to be your tool to become healthy and you don't pay attention to what you eat, you're going to remain insulin and leptin resistant, and if you exercise, then you still have to burn sugar. You're not going to even dig into your fat stores. I see that a lot in patients. I can't tell you how

many patients I see that come in and tell me that they exercise their butts off, and yet, they don't see any benefit, and that they don't lose weight and that they don't get stronger, and that's because they're not becoming insulin and leptin sensitive. If you use exercise in conjunction with a good diet, exercise can do wonderful things.

And exercise can be like a morning-after pill, as we've talked about previously, to help keep your sugars down if you've eaten the wrong food or even if you've eaten the wrong fat. It's better to exercise and kind of burn it off than to keep it around. But it's better, absolutely, in the first place, to not eat it in the first place. And then, exercise can augment a good diet and take your health to the next level. But exercise without good diet, although arguably better than no exercise at all, is not going to near give you the benefits it would if you associated it with proper nutrition, including proper diet and proper supplementation.

Dr. Mercola: Well, I think we've approached the end of our time limit for today. So I think that's a phenomenal answer to that question, and I want to thank you so much for joining us today and enlightening us. I know it's been enormously useful for me, and you've really helped shift, even within the teleclinic, my views on, I thought, some important topics, and actually, I'm going to be changing my position based on the information you shared. So I'm very grateful and excited to have the opportunity to participate on it with you.

Dr. Rosedale: Oh, and thank you very much for giving me the forum to help disseminate some of this, I think, very important information.

Dr. Mercola: So we hope everyone on the call enjoyed it, and we'll be shipping the completed audio versions and the transcripts to you shortly. So thank you everyone for participating, and hopefully you'll be able to apply it.

So just one last comment too that I wanted to mention, a followup to that last question, is that you gave some great philosophical points. But I think for people who want specific recommendations, you've written a book called, *The Rosedale Diet*. And you can just type that in on our site, and you can find that. Also, complementing that would be the *Total Health Program*, which is really highly complementary to what

Dr. Rosedale has been saying, especially some of the metabolic typing components to optimize your specific fuel for your unique biochemistry. I think these would be two other great resources for people to consider.

Alright. Well, thank you, everyone, and I'm just glad you were able to join us, and I hope you're able to apply all the beneficial wisdom that Dr. Rosedale was able to share with us today. Thank you.

Dr. Rosedale: And thank you all for listening.

Dr. Mercola: Alright. Bye now.

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