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EFFECTS OF STRESS AND TRAUMA
Ultrasounds Radio with Eluv (2014)

***Q:** Tonight's theme is about how the body reacts to stress and trauma. Let's first talk about the day-to-day stress, and what happens to the body and the brain, physiologically?*

RP: If you're really healthy, then you can meet challenges without experiencing something that Hans Selye would have called stress. For example, if you are not very healthy, just skipping a meal can put you in really serious stress. But a healthy person stores something like 7 or 8 ounces of glucose in the form of glycogen in the liver and the muscles and brain. And since at rest the muscles can burn primarily fatty acids, your brain is the main thing that consumes glucose.

If you're inactive and relaxed, you can easily go 12-15 hours without eating or without any stress at all. But if you're not able to store that much glycogen, (for example low thyroid people, or people with a history of severe stress aren't able to store very much glycogen), and so when you run out of sugar, whether it's from going all day without eating or because your liver isn't very efficient, your body tries to increase the available glucose. Normally, just being awake makes enough adrenaline to mobilize as much glucose from your stores as you need. But when you run out of that stored sugar, your brain still requires sugar to function properly. So, instead of just increasing the adrenaline more and more, when the adrenaline reaches a certain level and can't get the blood sugar up from storage, then you turn on the cortisol. And that's the classic stress that can be harmful, because the cortisol dissolves first tissues which are very fragile (like the thymus — that starts turning to sugar immediately when you run out of stored glycogen). And when the thymus is gone in just two or three hours of intense stress, that happens to be one of the reasons they think adults don't have thymus glands, because by the time they're dead and are analyzed, the thymus has been eaten up by stress; they might have had a perfectly normal thymus until they were sick and dead.

After the thymus is consumed and turned to sugar, the cortisol starts breaking down your muscles, then your skin. The brains, lungs and heart are spared from stress, partly because in a healthy person they are very saturated with androgens (testosterone and DHEA especially) which block the breakdown function of cortisol. If your brain, lungs and heart are short of those protective steroids then that's where the stress really starts causing severe, deadly damage. The post-traumatic stress disorder is produced when someone has had such terrible stress, such as being tortured or being in terrific catastrophes, that they not only deplete their stored glycogen and breakdown the expendable tissues like thymus and liver, but then the cortisol starts damaging the brain and heart, and so on. So they get very severe chronic symptoms. Once the stress is completely resolved, then the brain can massively regenerate itself. For example they've seen MRIs of girls who have been in anorexia for months, their brain shrinks from living on the cortisol breaking down their tissues, but when they start eating the brain can rebuild itself in just a few weeks.

***Q:** How often does one have to eat in order to not have this stress reaction happen?*

RP: The famous argentine biologist, Bernardo Houssay, in the 1940s, was the first one to show that if he fed his animals only once per day, they not only tended to get fat (on the same amount of calories), but they had a high incidence of diabetes. But if he fed them at least 3 times a day, or more, then they were very resistant to

diabetes, and were less fattened on a given number of calories. More or less nibbling all the time is the safest thing, but if you have a really good diet and aren't under emotional pressure, then a person can get along on one or two meals a day.

***Q:** What is the optimal diet? Do blood types intervene?*

RP: The blood type has almost no effect, because you can see in even very different species of animals, that have very different ways of living, you can see the same processes [audio drops out; end of the sentence missing]. So, there's a universal animal diet which is optimal, but the proportions vary with the type of activity and body size, and metabolic rate and personal history. Your previous stresses will affect what you need.

***Q:** For someone who is stressed and not healthy, what is the recommended diet?*

RP: One of the reasons that the single meal eaters tend to get fat and diabetic, is that it triggers a great surge of insulin, and the insulin then triggers cortisol. If you can eat foods that don't trigger insulin, that's the ideal thing. And fruit happens to be the best single type of food for not triggering the stress reactions, because it combines very small amounts of protein, with large amounts of sugar and minerals. Potassium happens to handle sugar in place of insulin, and the fructose component of fruit doesn't require insulin. So, eating a lot of fruit, even at one meal a day, produces much smaller amounts of insulin, obesity, and cortisol, than eating, for example, just one big meal of meat and potatoes. Meat powerfully stimulates insulin and cortisol. And starches are more stimulating to insulin than sugars.

***Q:** So it's almost counterintuitive, when you're talking about eating fructose in the form of fruit, with people that are insulin sensitive?*

RP: For about 100 years, fructose has been recognized as the ideal sugar for diabetics because they can metabolize it without needing insulin. It used to be sold in health food stores all across the country. And you can still find it in most health food stores for diabetics.

***Q:** Now let's talk about the difference between high fructose corn syrup and fructose found in fruit.*

RP: The funny thing about that is if you look at the fructose and glucose content, it seems to be not very different from any old sugar, maybe 45/55 percent, rather than a 50/50 balance fructose and glucose. But people actually thought to analyze what is in the stuff (other than fructose and glucose). And it turns out that the reason people get fat on soft drinks that contain HFCS is that it contains a huge amount of calories that are neither fructose or glucose. It's the syrupy component, basically a type of corn starch or corn syrup, which they don't count because it isn't fructose or glucose. But, it's there, as calories.

***Q:** You see it in so many things, from salad dressings to soft drinks.*

RP: It was a trick, because of the boycott of Cuban sugar, starting in the 60s. The price of sugar went up, because they wouldn't buy it from where it was cheap. So the corn starch producers learned how to produce something resembling sugar. It's really like the old Karo syrup which was not a very appetizing way to sweeten things. But during the second world war, I think the Germans pioneered it. But in the United States, sugar was scarce, and corn syrup started being used in canned things, and even in homes as a substitute for sugar. The sweeter form, the more palatable

form, that they called high fructose corn syrup, was developed in the 60s in response to the increased price of sugar.

Q: They've done a similar thing too with oils in food.

RP: Yes the cotton seed industry was a major power behind that at the end of the 1800s. To make cotton textiles more economical, they had machines to get the seeds out of the cotton. And in proportion to the production of cotton, they were accumulating seeds that were too toxic to feed their animals. And they found that they could squeeze oils out of the cotton seed, and by chemically hardening it, they could sell it as artificial butter. And the butter industry finally was required, for I guess about 20 years, to sell it in a colorless state. And a person had to add the color, so that it wouldn't ruin the butter industry. But the seed oil industry gradually got powerful enough that they could convince people that it's better than butter. But in fact, it has many toxic effects, that the butter doesn't have.

Q: Is this the same as rapeseed oil?

RP: The first rapeseed oil happened to cause severe heart disease, and the industry wanted to sell it for margarine, cooking oil, etc. And there was a particular oil in that plant that they decided to blame the heart injury on. But Hans Selye did experiments on it, studying the type of lesion in the heart produced by rapeseed oil, and he found that it was the linoleic acid in it, which is still in it. They took out the peculiar unusual fatty acid (they initially put the blame on), but the "essential" fatty acid — linoleic acid — is heart toxic. Hans Selye showed that if you added cocoa butter (highly saturated stearic acid) to the rapeseed oil, it no longer caused the death of the heart cells. It's actually the excess of the polyunsaturated fat that made the rapeseed, cottonseed, or canola oil toxic. All of those are actually toxic if you eat very much of it.

Q: What about soybean oil, because they're all GMO now?

RP: It's still the polyunsaturated component, which is that it turns into prostaglandins, which promote all kinds of inflammation and degenerative diseases. As early as 1964, a Dutch researcher named Böttcher [reference: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1898794/pdf/procrsmed00204-0048.pdf>] sliced open the lesions in atherosclerotic arteries at all different stages of development, and analyzed the fats in them. He called it a primitive idea that cholesterol got diffused out of the blood into the artery and damaged it. He said that the situation is very different from that; many fats change at the beginning, before the change happens in the cholesterol. And in the most advanced lesions — the furthest advanced atherosclerosis — he found that the content of linoleic acid was highest in the worst lesions. And after that, many other people demonstrated that the oxidation products of these unstable highly unsaturated fats are found increasingly in the atherosclerosis.

Q: All of these oils – canola oil, soybean oil, high fructose corn syrup, butter substitutes — are being advertised as better for your health. It's really about the consumers self-educating themselves and looking beyond the advertising.

RP: Yeah. They have to think of some excuse for claiming that people should buy them, because they don't taste good. So the idea that if they're essential, in some sense, then the more you eat, the better they are. But in fact, it's very questionable whether they're essential as a nutrient at all — animals can live more or less indefinitely — you can grow cells forever in a dish without any of those. Which, I think, that alone proves they are not essential nutrients. The more you increase in the

diet, there is a direct relationship with the incidence of spontaneous cancer, in proportion to the essential fatty acids. That was first demonstrated in 1927, and over and over. But the industry keeps publicizing them as health foods.

***Q:** There's been a big resurgence of grass-fed beef.*

RP: Yeah. In the ideal diet, beyond fruits, the ruminants are able to detoxify the polyunsaturated fats in grains or grasses. And it happens to be vitamin E in the grass which enables them to convert polyunsaturated linoleic acids into the trans fatty acids. And there's one of the components of butter, or beef fat, that is being sold as a drug or as a health food, because it counteracts the toxic effects of the PUFAs. That's called the conjugated linoleic acid. And you get some of that in beef, butter, cheese or milk. The high ratio of calcium to phosphate in butter and cheese comes from the fact that green leaves — if the cow is allowed to eat at least some hay and grass — contain a low amount of phosphate and a high amount of magnesium, calcium and other safe minerals. Too much phosphate (from grain based or meat-based diets, mostly) becomes toxic if not balanced by at least as much calcium and other minerals, including magnesium. So, milk, fruit and cheese give you the main nutrients. And the regionally deficient things, such as iodine and selenium, can be found in some kind of seafood. And then you will be getting the basic things for anti-stress foods.

***Q:** So, this would be more difficult for vegetarians?*

RP: Yeah. But if you concentrate on well cooked greens, the protein and minerals balance in cooked green leafy vegetables is essentially about the same as milk; it's just less concentrated because of the high cellulose diluting it. A variety of cooked greens will provide the same type of protein that milk provides, as well as the very favorable balance of potassium, calcium, and magnesium in relation to phosphate. But you need to cook away or wash away, or skim away the anti-nutrients; for example too much spinach contains oxalic acid which tends to take the calcium out of your teeth, and some leafy vegetables have chemicals that block your stomach's digestive enzymes.

***Q:** What other vegetables would be better cooked as opposed to raw, besides spinach? Do you advocate raw foods or raw salads in the mix?*

RP: The very juicy fruits are best raw, but if they're starchy, like plantains or bananas, they should be cooked by preference, because the starches can enter the blood stream and cause allergic reactions; it's called persorption: the particles enter the bloodstream, and can block capillaries and arteries, causing cells to die, until the particle can be broken down. But it can stay in place long enough to kill cells in the heart, brain and lungs. Feeding mice on a very high raw starch diet, biologists in Germany found that they were very prematurely aged, because of the death of cells in all of their organs that were blocked by starch grains. Starches, like potatoes, are almost a perfect food if they are very well cooked, because you want to break down the starch. The non-starch ingredients of a potato have almost a perfect balance of nutrients (B vitamins, essential amino acids, carbohydrates in the right proportion) and the only thing that is lacking in a pure potato diet would be vitamin A and vitamin B12. Otherwise, they're a very balanced food.

***Q:** Are you speaking of sweet potatoes, or white ones?*

RP: White potatoes. Some white potatoes contain enough carotene to provide vitamin A requirements. But sweet potatoes often contain so much carotene that it interferes with digestion. And too much carotene has anti-hormonal effects; it can

slow down your production of thyroid hormones, progesterone, adrenal hormones, and so on, If it accumulates to the point that it's making your palms turn orange.

Q: Which it does with some people that are juicing carrots a lot.

RP: Yeah. I constantly warn people about that. There are good chemicals in the juice, good nutrition, but unless your thyroid is pretty active, it's going to accumulate the carotene, because you convert carotene to vitamin A, if you have vitamin B12 in proportion to how active your thyroid hormone is. If for some reason you are getting more carotene than your B12 and thyroid can handle, then it turns off the thyroid function. I experienced that myself 40 years ago, eating so many carrots that I suppressed my thyroid. But, if your thyroid is good, then having a whole carrot every day has some very important anti-stress functions.

Yesterday I heard from a woman who said that she had started a daily carrot salad and had almost immediate relief from all of her premenstrual and digestive problems. We have measured the blood hormones in a few people after they had started a daily whole carrot. It's the stimulating effect on the intestine. The fiber in the carrot isn't digestible, and so the excretion of the bile into the liver carries all kinds of detoxified chemicals and hormones. If you have fiber in your intestine, these toxins, that the liver has got rid of, will be carried out, bound to the carrot fiber. But without enough fiber, they can be absorbed and recycled. So your estrogen tends to go up as the fiber in your diet goes down. And that in turn turns off your thyroid and progesterone, so it can cause all the symptoms of estrogen and cortisol excess. And in just 3 or 4 days we've seen the cortisol and estrogen level in the blood drop as the progesterone comes up, just from eating a daily carrot.

Q: It's interesting how the foods we eat influence everything about our body.

RP: Yes. A lot of Americans, partly because a bad industrialized diet, are now going around in a chronically stressed condition. It's sort of like a learned helplessness or post-traumatic stress syndrome. The diet keeps people in a high cortisol, high estrogen state. So if you're going to have any stress, you should, well before you have to do any important work, make sure that your diet isn't creating the day-by-day stress. For example, by checking your thyroid function (just by measuring your temperature and pulse rate when you wake up). And then, in the middle of the day, those should rise, so that your pulse is maybe 80 per minute at rest, and your temperature should be around 98.6 at rest. In the morning it's ok for them to be about 10% lower pulse rate and maybe 97.8 degrees or so.

Q: This can also be influencing the fact that men are also having hormonal issues as well, correct?

RP: Sure. When a man is on a very bad diet, or is under stress or has an accident, the estrogen level rises, sharply. In old age, with any of the degenerative diseases, men tend to have a sharp increase in estrogen.

Q: So they can avoid this, or monitor this, by their diet?

RP: Yeah. And your temperature is the quickest way, because estrogen lowers your temperature. Thyroid and progesterone and DHEA help to maintain a good steady high metabolic rate, even at rest.

Q: When people get cold when they're sitting there in front of their desk or at home, then that may indicate that the hormones have changed and the thyroid is dropping?

RP: Yeah. And one of body's tricks to compensate for hypothyroidism is to increase adrenaline. And so, some people are hyper alert and anxious, and have a high heart rate, even though their thyroid is really low. And their temperature can be held up and look normal, except that it's likely to be higher when you first wake up in the morning, and then decrease when you eat something.

Q: *So it switches?*

RP: Yeah, because the night time is when you aren't eating, and your adrenaline and cortisol rise; those can tear down your tissues at such a rate that they keep your temperature up. Then when you eat something and lower the stress, you see that your metabolism is really not so high. And when the adrenaline is very high, even though your oral temperature might seem normal, your hands and feet will be cold, and maybe even the tip of your nose. Because the body is directing the energy, so as to not deprive (or chill) your brain, lungs and heart. But your body can consider your hands and feet somewhat expendable, and will let them get very cold.

Q: *So, if we up the stress levels, and we've been speaking about general stress, and someone does have surgery, there are additional (or more severe) chemical changes. Some of the symptoms in post-surgery can include low energy, or weight gain, or hormonal changes, or even depression and sleep disorders.*

RP: And even dementia. Lately, they've been measuring mental function after major surgery. And for months, even years after a major surgery, people's mental function is often slowed down. That is because of the chronic effect of cortisol, which slows nerve conduction. It protects some of your tissues from inflammation, but it progressively damages your immune system and your nervous system.

Q: *What are some of the best things for recovery?*

RP: The thing about surgery (as opposed to a car accident or being tortured or something else) is that you can prepare for it. And even standard medical sources are now saying that you should check thyroid function before you schedule someone for surgery. Because a hypothyroid person doesn't do well in surgery, because their cortisol is already high. Before Hans Selye made stress famous, an American surgeon George Crile, in Cleveland over 100 years ago, was studying shock from surgery, and what you had to do to minimize the shock. And shock, as he understood it, came to be part of the shock and stress, as Hans Selye interpreted it. And for Selye, an excess of estrogen was enough to create the whole shock syndrome.

In George Crile's Cleveland hospital that he worked at in 1908, the mortality rate from all the surgeries was 4.4%. After he devised a way to reduce stress, in 5 years of application, it had cut the mortality to 1.8%. His basic procedure was to convince the brain that nothing had happened. He called it anociassociation, meaning getting the brain to not notice the noxious events. And he found that histamine was released by morphine when it was used to control pain, and that histamine brought on all of these other stress hormone changes. And so, he added an anti-histamine, an herbal drug called Scopolamine (basically an anti-histamine, anti-stress preparation) to go with the anesthesia. He was using a local anesthetic to stop the brain receiving any of those harmful signals; first he would anaesthetise the skin, then when the skin was cut, each layer would get a local anesthetic. But a careless, quick surgery nowadays often is very rough. The patient wakes up with changes in the brain from surgery's powerful noxious stimulation. So, if you can get the doctor to reduce the trauma of the surgery, that's a very important part of recovery.

The hypothyroid person doesn't recover very well, because since their metabolic rate is low, their temperature is also very low. Since the surgery is turning on the stress hormones and turning off the thyroid function, temperature tends to drop drastically during and following surgery. In proportion to how the temperature falls, the person's recovery is impaired. So everything that will keep your temperature up during and after surgery — preparing with at least two weeks of adjusting thyroid, so that you're not hypothyroid — that makes the recovery a lot faster.

A study in Mississippi (I think) where the intensive care people checked the patient's vitamin D levels as they came in, found that out of 278 cases, only 3 people had normal vitamin D. Partly, that means that deficient people get sick more often, or that sickness lowers your vitamin D. But some of them had as low as 8 or 10 ng/ml, where it should be 50 or 55 (that's the normal range). And when he got the dietician to check their vitamin D levels and supplement vitamin D, the length of stay in intensive care was cut in half, survival increased, and the expenses of the vitamin D saved the hospital more than half of the expenses, just by that one vitamin.

***Q:** You mentioned a herbal antihistamine earlier. What was that again?*

RP: That was Scopolamine and that is sometimes available if a person is nauseated after surgery. That's a very safe anti-nausea drug which does several things; it helps to hold up the body temperature besides stopping the nausea.

***Q:** Can it be used with anesthetics?*

RP: Yeah. It was part of the anesthesia that was pioneered by George Crile and it's still occasionally in use, but since it's a generic herbal chemical, the drug companies aren't very keen on having it promoted. But it is available both as part of the anesthetic and part of the recovery program.

***Q:** And what can people do as far as specific diet for post-surgery recovery to help their brain and their body recover?*

RP: The same foods that are generally good, but emphasizing the things that are lost specifically by high stress which are protein, zinc, some of the B vitamins are turned over very fast in stress so foods like liver and oysters and eggs, which are rich in the trace minerals, and protein, as long as you're getting adequate carbohydrate and calcium. These happen to be high phosphate foods, along with the protein, but they have the highest concentration of the healing minerals and vitamins.

***Q:** We spoke a little bit earlier about cheeses and I wanted to ask you a question relating to pasteurization. You mentioned that there's beneficial nutrients. Does this get discounted once the milks or cheeses are pasteurized?*

RP: No. It's such a tiny amount. They pasteurize it now in I think it's something like three seconds at a high temperature, and then it drops immediately, so there's very little oxidative damage done now with pasteurizing.

***Q:** So it's a quick flash pasteurization?*

RP: Yeah. It might lower the vitamin A content 3 or 4 percent, something like that, but since it's such a good, rich source of all of these nutrients, no one is going to suffer deficiency if they're eating pasteurized milk and cheese.

***Q:** And what's your feeling about exercise during that recovery time for people that have gone through surgery?*

RP: I think it's better just to regain flexibility and mobility in a gentle way, not to worry about muscle-building exercises. The time to think about that is before surgery, because in one study of old people, they found that the fatter they were, the better their long-range survival was in the six months following the surgery. The death rate was much higher in the lean, low body mass people and the survival went up directly in proportion to the body mass. In aging or stress, the muscles are shrunk. It isn't just the fat that is buffered against stress, but it's mainly the mass of the muscles. Exercises such as deep knee bends, mild weightlifting with dumbbells, just a few minutes a day of mild resistance exercise of that sort can keep your muscles sound and relatively massive. Muscles are themselves a hormone source; they can produce testosterone instead of cortisol when you're doing these resistance exercises, so the muscle building is protecting your heart and brain as well as building up the reserves of tissue that are part of your resistance against stress.

***Q:** You've mentioned that the cortisol damages the brain once the trauma has happened. Is that reversible over time, if someone is following a protocol that would support their greater health?*

RP: Yeah. It's probably just the same as the following anorexia, that they've seen that young women can have great and quick regrowth of the mass of the brain substance just by stopping the stress and starting to eat well. And I think that would happen with old people who are partially demented by the stress of very serious surgery.

***Q:** Regarding adrenals, many people today seem to suffer from low adrenals, or adrenal fatigue.*

RP: I've mentioned that the muscles are an important source of steroid synthesis. Our biggest endocrine gland is our brain. And the brain stabilizes all of the organs. And if your brain is experiencing stress, that shifts the adrenal function to cortisol, rather than DHEA, and progesterone, and the androgens. And the adrenals shouldn't produce simply the stress-promoting hormones; they should be putting out some of the defensive protective progesterone, DHEA, and pregnenolone as well. But when your brain gives them these super stress signals, then they will overact. Hans Seyle defined the adrenal failure as when the adrenal gland begins bleeding, and the cells that make steroids die. But the adrenal cortex is extremely able to regenerate, as fast as the thymus and thyroid gland. The cortex of the adrenal, if you're well fed, and if you stop the stress signals, it can regenerate. So, what Hans Seyle was talking about was an acute stress causes immediate bleeding of your stomach and intestines. That's because of the high cortisol production, among other stress hormones. And if you continue that too long, without feeding some of the curative nutrients (sugars, zinc, magnesium, calcium, vitamin D, and so on), then the adrenal glands can't keep up the intense work, and they start bleeding, and tissue dies.

Too much estrogen is one of the things that can contribute to overacting of the adrenal cortex. In animal experiments, we saw that just injecting a big dose of estrogen will cause adrenal enlargement in a moderate case, or bleeding and death in an extreme dose of estrogen. I should mention that cholesterol, and thyroid, and vitamin A are the important things for keeping the adrenal cortex from getting stressed to death, because the cholesterol is the raw material for making cortisol and the other stress adaptive hormones. And without enough cholesterol, and thyroid, and vitamin A, the cells are stimulated, but can't work. So they just give up and atrophy.

***Q:** What sources of cholesterol would you recommend?*

RP: A good diet, plenty of fruit, and milk in the diet will allow your tissues, especially the liver and brain, to make as much cholesterol as they need.

Q: *Would you recommend eating liver? Or heart, kidneys, from grass-fed beef, for example?*

RP: Yeah. Except for the ratio of calcium to phosphate, the liver has the highest concentration of the anti-stress nutrients. So at least twice a month there should be a good meal of liver for stress resistance. Maybe once a week; four ounces a week is a safe and effective amount.

Q: *Good ol' liver and onions, eh? (laughter). Dr. Ray Peat, thank you so much for joining us tonight.*