Ray Peat: Nervous System Protect & Restore

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Speaker 1: I just want to point out that Ray has a PhD in biology and biochemistry with a specialization in physiology from the University of Oregon. From fifty-nine to the early eighties he taught classes in anthropology, biology, physics, nutrition, [inaudible 00:00:28], metabolism, and psychology, at colleges in Oregon and Mexico. And he also conducts private nutritional counseling.

He started his work with progesterone related hormones in nineteen sixty-eight, and I don't know if most people know that John Lee got his material from Ray Peat. Dr. Crystal's brought Garcia today, but the work that John Lee proposed, that most people have read, it's coming from Ray. And, as you probably know, Linus Pauling said "If you're ten years ahead of your time you get a Nobel Prize, but if you're fifteen years ahead of your time you're called a quack."

Unfortunately, Ray is fifteen years ahead of his time as he's also shown with coconut oil, which fifteen years ago he was promoting and everybody thought it was poison and now every health food store has about six varieties of coconut oil and everybody's using it, but they didn't believe him fifteen years ago. So he's been working on both practical and theoretical aspects of energy in the body structure independent on every level.

Anyway, he says "Marketing your products without understand just what they do and why they do it seems to be adding confusion rather than understand as hundreds of people sell their misconceptions with products. They very concept of marketing is at odds with the real nature of these materials, which has to do with protection and expansion of our nature and potential, distorting the idea of human nature's soul when people are treated as the market."

Anyway, I give you Ray Peat.

Ray Peat: The reason I was late getting into biology, starting graduate school in 1968. I graduated from college in 1956. It was my first experience with biology classes in 1950 and '53 that made me think that biologists were, sort of, demented or doing something completely anti-scientific because in the 1940s I had read people, for example, Russian psychologists ... In 1948 I read an article that explained the distribution of chromosomes in the population.

Forty-six chromosomes was the model number but there were perfectly healthy people that had forty-seven or forty-five even some with two, more or less, but usually the farther you were from forty-six chromosomes the more likely you were to have some kind of [inaudible 00:03:47]. But, anyway, they looked at it statistically and forty-six was very clearly the model, most common, number in the population and they looked at lots of people.

Then, two years later when I got to high school, biology in the textbook said humans simply have forty-eight chromosomes, period. And then, in college biology, same thing: humans have forty-eight chromosomes. Nothing about statistical variability. It was 1956 before American biologists discover that we

have forty-six chromosomes. And the textbooks never made a big thing about whether they were eight years behind other relatively backward countries, backward economies, in something that seems as simple as counting chromosomes.

Anyway, when I graduated from college I had had a very bright literature teacher, literature and humanities, so I decided that maybe the real understanding of the world could be by studying literature and philosophies, but when I got to the university--this was in the peak of McCarthyism--the English department was one of the, basically, cowardly, closed-off, parts of the university.

I tried several different departments. The psychologists were the best people I could find at the university at that time. I almost majored in psychology. But then I found that you had to believe in Watsonian behavior or at least Skinnerian behavior to get through the biology department. Consciousness was not reality at that time and my professors actually explained why you don't need to use an anesthetic for circumcising babies: because they're not conscious. And the fact that they writhed around and screamed and turned red, when they're being cut, that's just a reflex. Consciousness develops at the age of one and a half years when the [inaudible 00:06:28] is completely deposited, and that's the time at which the brain stops growing. Brain cells multiply. At one time they said only up until the sixth month of gestation, then they gradually extended it to a year and a half.

But consciousness at that time was sent, if there's such a thing as consciousness at all, it doesn't begin until a baby is a year and a half old when there's no longer any division of brain cells. You remember at that time brain cells didn't reproduce. Heart cells didn't reproduce. It was in 1990 when brain cells and heart cells had been discovered to be able to reproduce, even in adults. But one of the other people I read in the nineteen forties was [inaudible 00:07:28], a developmental biologist who had been demonstrating organ regeneration in the thirties, all through the forties, and that brain cells and heart cells can be stimulated to regenerate.

The last ten years or so the advent of cloning and stimulated regeneration of the stem cells and so on, this is causing a lot of turmoil in the biological world. You don't get the sense in the newspapers of what this is doing to professors who ... Until [inaudible 00:08:13], I guess, there were still people who were saying [inaudible 00:08:16] is impossible because, in principle, you can't clone an animal from a somatic cell. You're going to clone vegetables because they're different but people were saying, right into the 1990s, it's impossible to clone an animal.

But a guy named Gurdon was cloning frogs and amphibians back in the sixties but that was impossible too because frogs are animals and animals can't be cloned from somatic cells. There's this, sort of, underground of fact in biology

that the superstructure mainstream, the people that educate medical students, this reality is something very different from science.

In the nineteen seventies all of my professors, I think I heard every one of them at some point, say something like "Today a hundred thousand of my brain cells died." At that time it was a hundred thousand per day. Previously it was ten thousand per day. But in 1970 and article in science took advantage of this back ground, all biology professors believing that their brains were dying massively every day of their life, and of the knowledge that people used to program computers by punching hole in cards, introducing information by punching out pieces of card, this article in science explained memory and learning through the lifespan in terms of selective death of brain cells. If we're losing a hundred thousand brain cells every day, just think of how this compares to a computer where you punch out hundreds of thousands of bits of information on each card you put into the computer.

I can name probably twenty completely insane ideas that were currently in the biological community. For example, probably half of my biology professors at one time cited a study by August Weismann who, in 1889 or 1890, cut the tails off fifteen hundred mice over a period of twenty-two mouse generations and said this disproves Lamarckian and Darwinian inheritance, or evolution, of acquired traits. Of course, Lamarck, even when I was eight and read this in an encyclopedia, it was obvious that Weismann was making propaganda because Lamarck said "Animals that strive and adapt and acquire new traits by [inaudible 00:11:41] adaptation pass some of those traits on to the next generation."

And Darwin, my parents had some books, including Darwin's first editions that had the introductions, like The Descent Of Man had an introduction in which Darwin said "People are saying that I based evolution on the Malthusian idea of the survival of the fittest and elimination of unfit" and so on. He said "Here are the things that I believe account for evolution" and he named the things that Lamarck and Darwin's grandfather, Erasmus Darwin, was an evolutionist in the eighteenth century. At the very end of the eighteenth century Erasmus Darwin was saying exactly the same things that Lamarck said, that sexual selection and adaptation and inheritance required traits. Darwin, as late as the 1860s, said "You're distorting me. I agree with Erasmus Darwin and Lamarck on these points."

By the end of the century Weismann was typical. The social Darwinists said Malthus had the right idea, that weak people are eliminated so the human species is improved by misery, poverty, disease, and water, are improving the human species. A literary critic wrote that he had seen evidence that the king hired Malthus specifically to help put down the revolutionary spirit because the monarchy was realizing that they were in danger because people were impoverished, diseased, and hating to be killed in pointless wars, so he had Malthus say "It's good to suffer. Poverty, disease and war are creative. They eliminate the bad stuff."

Now this is Weismann's mouse-tail experiment, just one wildly propagandistic thing, that he had to knock down Darwin and Lamarck. His main work was counting chromosomes even though he had such bad vision that he couldn't use a microscope. In 1890, he determined that the development of an individual from an ovum is possible because the genetic material, such as Mendel identified, the genetic material is all there in the ovum and, when that fertilized egg divides, each of these subsequent divisions loses some genetic information. Obviously, you couldn't clone from a somatic cell because not all of the genetic information is there.

He said the [inaudible 00:15:26]. He said "Each time you differentiate to a new tissue or organ, that's because you've lost some of the genetic information that was in the ovum." Remember, this was sixty years before Americans learned to even count the average number of chromosomes in people. A guy who couldn't use a microscope because of bad eyes created the doctrine of the deletion of information to explain the expansion of complexity from a fertilized egg to an adult organism.

Weismann said the body is mortal. It doesn't have everything it needs to create itself. If you take only one part, it's going to wear out. The wear-and-tear theory started there, at the same time, but the mortal tissues of the body aren't all there and they're eventually just going to wear out. Programmed aging, essentially, derives from this idea of the deletion of information. The whole trend of twentieth century biology was building on this idea of increasing complexity by deleting information, and so the guy that said learning is because our brain is dying, it was exactly analogous to Weisemann's "the organism develops because it looses information".

In the fifties there were people who said that you can x-ray bacteria and cause them to mutate into new forms by destroying their genes with x-rays. This was, as weird as it seems, bacteria that had lost their genetic information, were said to have given rise to the next higher complexity in evolution and that all of the [inaudible 00:18:03] of complex organisms were believed by the Weismann principle to have derived from bacteria that had lost information.

That picture of progress through loss, I think, traces back to the time that Erasmus Darwin, he had a slogan painted on the side of his carriage: "From seashells everything comes". That got him in trouble so he had to paint it out fairly quickly because people realized that evolution was contrary to the creationist doctrine. For example, well into the nineteenth century, to graduated already from a study at British universities, you had to essentially sign a loyalty oath that you believe all of the tenants of the Church of England. People like Shelly were not welcome at the English universities.

Earlier, censorship was tightening up all through the eighteenth century and people like Darwin, instead of writing scientific treatises about evolution, that's

what Lamarck did in France which was relatively loose, Darwin wrote a poem about nature of life and put his ideas of acquired, adaptive, homosexual selection, creating evolutionary progress.

The deists, remember, didn't want to deal with church officials entering, for example, the investment market saying that God could intervene at any time. To have anything secure, the deists wanted sort of a mechanical, clockwork universe. It was predictable, so that they could start projects and have confidence that they could finish them without God intervening. And so they said God was like a clock maker who started the world running, and he was such a perfect creator that he made it so that it would run all by itself, forever. But it was like a clock that he was winding up and setting in motion and then staying out of it so the physicists and engineers and anyone could count on certain reliability in the world.

But as people started working on steam engines and understanding what happens to the energy and the fuel, the laws of thermodynamics were eventually extracted from understanding how steam engines work, and they said the nature of reality is that everything is running down in the closed system. It can't do anything but run down. So physics was set on the same kind of path. Nothing can be added to the world because that's God's province. The only thing that can be done to the world is it can get poorer, losing information or losing organization, losing energy, difference gaining entropy.

I think this historical picture accounts for why biologists at the time I was first taking biology courses, why they could believe such impossible to believe things. In studying literature the only person that really appealed to me in English literature was William Blake who, in many different places, he had physiological descriptions, for example the number of nerves in the optic nerve, his count was closer than any count until the electron microscope was developed about a hundred and eighty years later or so.

Blake described evolution which, obviously, he was getting these ideas from the culture. Erasmus Darwin was a contemporary with Blake and was a very famous intellectual so there was this oral culture in London and other big cities in which advanced, two hundred year advanced, ideas in physiology, biology, evolution, development. For example, in this same time, I think was from Swedenborg, the religious leader who was also an engineer and biological experimenter. Swedenborg, I think, is where Blake got the idea that showed up in his book. That the nerves develop and invade the other tissues. This wasn't demonstrated until, I think, 1911: how the embryo intervades the tissues. The nerves come from the top and go down into the various tissues and, at late stage in development, intervade the muscles and skin and so on.

Remember, Malthus was not censored but everyone who had an alternative idea of what's going on in society and evolution was likely to get hanged if they were too blatant in their description of things the king didn't like. Blake was tried for

treason, for sedition, in 1804 and after that he was much more circumspect in the way he described his evolutionary and physiological ideas. They became very hard to interpret.

That was the general situation, that there was this amazingly rich scientific culture that was like a piece of the twentieth century, set there in eighteenth century London, and people that did get published, like Malthus, were the people who were put up to the task for a political reason. When contemporary textbooks write the history of their science they look at who got published and physicists and engineers and biologists who held the right ideas were the ones that got published. But the really good ideas were things that people talked about in secret.

The idea of being ahead of your time, it's really more like being under your time because there's this two hundred years of, more or less, contemporary thinking. Other people that I read in the nineteen forties, in the time that I was eight to twelve-years-old or so, J.C. Bose was one of the interesting people who, around 1900, had been very popular and exciting as a physics researcher and a biological researcher and a radio researcher in England. But after two or three of his lectures people started thinking about the meaning and that he was showing crystals and metals and vegetables and animals all have sensitivity and reactivity. You could fatigue a piece of metal, for example, and let it rest and it would recover just the same way a fatigued muscles recovers.

When the British biologists started realizing the implications of what Bose was saying they went back to a more abstract kind of biology and he didn't give anymore seminars. He back to India and Marconi sent his men to try to get Bose to be involved in the Marconi radio company because Bose had invented the sensor for radio detection. Ordinary sensors at that time had a ... The sensor would pass a current, which would turn a current into a bell. It would ring the bell and activate a hammer that would knock the sensor back into a starting position. They were sort of like a Rube Goldberg apparatus. You could only detect a signal as fast as your hammer could re-sensitize the thing.

Bose, by understanding the fatiguability and recoverability of material, used metal particles and mercury coatings and pressure and such so he could tune up his radio sensor and it would spontaneously recover its sensitivity. So you could keep sending it a signal and do practical radio communication. That was one of the devices, if you used it too much, too fast, too long, it lost sensitivity, just the way an overworked muscle or brain loses sensitivity. So he would let it rest and then would come back and work like a fresh one, just like resting your brain or muscle.

One of my next newsletters is going to be on this idea of fatigue and what it has to do with inflammation, excitation, and, eventually, damage to the tissue and atrophy of the tissue. As far as I know the people I call [inaudible 00:29:53], they didn't make any special records or connection to J.C. Bose but these ideas of

material substance being sensitive and responsive the same way living substance is, these were in the culture and A. I. Oparin, who is considered one of the founders of the study of the origin of life, 1924, I think Oparin's book was, which explained a jelly conception of the origin of life: that organic materials would [inaudible 00:30:42] spontaneously. And Oparin got his ideas from this Belgian Bungenberg de Jong who wrote, in 1922, a book on, he called it, "complex coacervation" which is like a colloid that reestablishes new equilibria until you get several phases that are all stapled with one another. Some of them a lot of oily materials. Some that are more water.

But Oparin and Bungenberg de Jong where the pioneers of the jell conceptions of cytoplasm, even though there were people who realized that the cytoplasm is a jell and that the membrane isn't a necessary component, these people did the thinking and the experimenting that showed how a jell can establish itself, remain in equilibrium, have preference for certain types of material that it will dissolve, oily material preferentially over watery materials, and that certain salts will be concentrated just passively, just in the physical arrangement of materials without any pumps or energy being involved in that stage.

Le Chatelier was another contemporary. Vernadsky, the Russian, went around the world. He hoped to get an appointment in the United States but no one wanted to have a geobiologist or a biogeologist on their faculty so he was mostly working in France and Russian and he recognized in Le Chatelier's principle, which chemists all know about but don't really apply it very far. Le Chatelier's principle is that, when you disturb a system of substance, the substance responds so as to reduce the stress.

Vernadsky showed that any energy impinging on any substance creates order of a certain kind, depending on the nature of the energy and pinging on the substance. So sunlight running through air or seawater, whatever, organizes that in a certain way and the energy, by Le Chatelier's principle, minimizes the disturbance. So a continues flow of energy is going to continuously restructure and reorganize, adding information to the system. When you flow energy through any substance that has any capacity for memory, it's going to remember "Now this is the second passage of the energy" so it's never the same as the first passage. The substance remembers by changing its structure.

Water, in the nineteen thirties and forties, was already being realized to have intrinsic memory and have long-range ordering processes that made water near a surface different from the water at a great distance from a surface. And the water that had been near a surface will remember some effects, structuring effect, that it had. For example, where a body of water or a drop meets the air it forms a film that's tough enough for a bug to walk on. That's the sort of structuring that happens anytime something different is introduced into the water.

Vernadsky, by applying this principle, showed that all substance, especially wet, gelatinous substances, are able to store experience or store the record of energy that's passed through them. A lot of people were thinking about the origin of life in terms of a warm soup, is how a lot of American biologists described it. Sidney Fox, who was a student of Oparin's and understood de Jong's work, he suggested that maybe life didn't start in the soup. He thought, possibly condensing amino acids formed in clouds, or wherever, might have condensed onto hot, volcanic rock. So he just threw some powdered amino acids on hot volcanic rocks and sprinkled a little bit of water, just enough to make a very viscous jell. Then he scraped the stuff up and hour or two hours later and put it in water and looked at it under the microscope and it had formed something much more specific that the complex Cervantes that Bungenberg de Jong had studied.

Sidney Fox's mixture of amino acids had spontaneously and almost immediately formed little bacteria like particles of very uniform size and shape. When he added amino acids to the watery solution that these were floating in, the things would grow, incorporating the amino acids into their structure, even produce offspring. They would reach a certain size and a bud would form. In the absence of water, slightly moist, hot amino acids polymerize spontaneously into proteins and those proteins spontaneously form little bacteria-like particles that break up, following the coacervation principle. They are more stable at a certain small size. The proteins that make up those particles can catalyze reactions, incorporating new amino acids into new proteins, allowing them to grow.

In an hour or two, Sidney Fox demonstrated something very much like the origin of life that Oparin and Bungenberg de Jong had just postulated as possible. Sidney Fox demonstrated real, growing organism like things with real proteins spontaneously synthesized. The inflammatory process that causes atrophy and inflammation, tumor formation, aging, tissue [inaudible 00:39:24], this is structurally just like fatigue. If you imitate ... If you start thinking of the living stuff as substance rather than information then you ... Imagine you're a chemist or an engineer with a gob of stuff to analyze you look at it under different conditions of temperature and pressure and saltiness and wetness, the amount of water versus salts. When you look at the living organism, or at its cells, in this way, as substance, everything gets infinitely simpler.

When you look at it from the Weismann influenced kind of biology, you have the God-created, infinitely complex genome, which is being torn down to create the various structures, but it's essentially an infinitely complex process. It's so complicated that you can't calculate it. But when you look at it from Vernadsky's, Le Chatelier's, and Sidney Fox's perspective you see that physical processes influence the behavior. When you look at any conditions such as dementia, cancer, arthritis, epilepsy, paralysis, migraines, emphysema; all of these are physical processes as well as biological processes. A common feature that they have is the cells get too wet. The jell that's put into a watery solution without enough salt or sugar, or things dissolved in water, swells up and can eventually decompose just for getting too wet.

All of the fatiguing, inflaming, tumor forming, atrophy producing, biological processes involve this accumulation of water out-of-control. The jell is no longer in control and excluding water stuff. The jell is forced to take up too much water and along with the water it tends to take up random amounts of protein and fat and salts that shouldn't be there. For example, the healthy cell excludes calcium and takes up magnesium. If you immerse it in too much water, without enough sodium, that alone will cause the cell to take up calcium and the calcium and the water excite the cell. For example, to apply this to epilepsy, if you make a person drink too much plain water it can bring on the seizure.

Another way that neurologists can test for epilepsy, they used to do this: actually have a person drink a pint of water and if they had a seizure that proved they had epilepsy. Or they have them hyperventilate and, if they had a seizure from hyperventilating, that proved they had epilepsy. When you hyperventilate, you reduce the amount of carbon dioxide in your blood. That allows water from the blood to move out into the cell, such as the brain cells, causing them to swell, get excited, and in the case of epilepsy it can cause a seizure or in other situations it can cause cramping pain.

Are there any questions or comments up to this point?

Speaker 1: [inaudible 00:44:31] when you were talking about William Blake. A lot of what William Blake wrote was poetry and what I got from his readings, at medical school, he was [inaudible 00:44:39]? Was that a cover or was that him?

Ray Peat: Yeah. He referred to God as old [inaudible 00:44:46].

Speaker 3: Through all his illustrations are profoundly religious.

Ray Peat: Yeah. He was--

Speaker 3: It's like out of the middle ages.

Ray Peat: Yeah. But he came from a sect that used language in a particular way and when you look at the conflicts between two different poems, one [inaudible 00:45:11] sounding like an atheist ridiculing a beastly, cruel God. He basically says that doesn't exist. The only God is manlike. So he was a humanist speaking a very old fashioned religious language.

Speaker 4: You make some analogies as what [inaudible 00:45:39] today. I know, for instance, germaphobes that [inaudible 00:45:42] and I swear it's like going to a religious meeting. There's just a way of thinking that is acceptable and, say, to talk about nutrients is unacceptable, and everything has to be named by the drug companies, the FDA, and they really suppress knowledge.

Ray Peat: I try to avoid taking any genetics courses. I think I did take one but I read the textbooks they were using in other genetics courses and one of them was called Classical Papers In Genetics. I read that just to see what they considered their history to be. Were there some really good genetics ideas that were apart from this Weismann/Mendel organ religion and all the papers in that book of classical papers, that supposedly are the foundation of modern genetics, all of them said these data consistent with the idea that ... There was no confirmation of an idea. It was simply "It can happen."

That's, surprisingly, how since has been working in the twentieth century, consistent with not "Disprove all of the alternatives and leave something that is very convincing" but basically just saying "It could happen" in line with this evidence. In magazine science, the conclusions often have nothing to do with the data as if they editor didn't read them.

Speaker 5: Could you talk a little bit about hydration effects involved with, let's say, blood hydration versus extracellular hydration, intracellular hydration also, and how hydration may relate to developmental cycles, in terms of gestation and the evolution of organisms?

Ray Peat: At an early stage when they cells are growing fast, like the fertilized ovum and early cell divisions, there about ninety-two percent water. In an old organism the water content gets weighed down to seventy percent or something like that. In 1920 someone found that just putting cells in a hypotonic solution forced mitosis to start. When a cell is rapidly dividing and forming a new organism, the high content of water stimulates a certain kind of activity that, in context, creates increased mass and complexity. When the organism is mature and doesn't want tumors popping up everywhere, the body fluids, cells, intracellular and extracellular, are relatively dehydrated. But you can stimulate regeneration just by increasing the moistness.

In the 1950s some magazine described someone who had the end of their finger cut off at the base of the fingernail. They kept it sealed and moist and found the finger had regenerated. Remember that, twenty of thirty years later, I knew two people: a little kid who cut off the end of his finger the same way, right at the base of the nail, and a carpenter who sawed off the end of his finger. The kid's mother put his finger in a ballpoint pen case so it was not touching anything but the atmosphere was sealed around it, and the carpenter used a cigar tube to put over his finger. They now both have perfect, normal length fingers. The fingernail looks perfect even though there was no fingernail visible after they cut if off.

Adults can regenerate nicely formed tissue and very visible bone and skin and everything takes on a normal shape when the conditions are right. I think, besides the humidity, the carbon dioxide that's kept present in equilibrium within the [inaudible 00:50:51] tissue, is a factor that prevents it going wild in the mirror scar formation or tumor formation. I think that's the main function of carbon dioxide. When sugar is fully metabolized it all turns into carbon dioxide

and the carbon dioxide can, but doesn't necessarily, be turned into carbonic acid by combining with water. Sugar constantly streaming into the cell means that water and carbon dioxide are going to be constantly streaming out of the cell. In terms of binding with water and leaving the cell, that's one way the carbon dioxide, as it's formed, tends to remove water from a certain compartment. Carbon dioxide in itself is acidic before it forms carbonic acid.

This is another thing where the mainstream culture talks about hydrogen ions as how you conceive acidity. The home way of talking about it was typically in terms of the concentration of hydrogen ions. That's what pH means. The real theory in acidity is just the opposite. It's the binding of electrons rather than the releasing of protons, hydrogen ions. Lewis was the person who explained the correct, general, theory of acidity and so these are called Lewis acids. A Lewis acid doesn't necessarily contain any hydrogen or protons so there's no pH involved but it still has all the properties of acidity because it is binding electrons and when you bind electrons you tend to liberate protons anyway.

Carbon dioxide, in itself, when it binds it a protein, is acidifying the protein, just by pulling electrons away from the protein. Most all biological jells and most jells in general are made with acid polymers. If you acidify a gel it tends to contract and if you add alkalide to it expands and swells. The acidifying function of carbon dioxide tends to squeeze water out of the cells just by what the carbon dioxide is doing to the proteins. Carbon dioxide is a stabilizing and shaping [inaudible 00:54:19].

Speaker 5: Is there any difference between sugars and fats?

Ray Peat: Yeah. Sugar makes more carbon dioxide per unit of energy. At high altitude, or in the presence of an atmosphere rich with carbon dioxide, the cells ability to resist fatigue--fatigue being seen as the same as inflammation, swelling, uptake of too much water--in the presence of extra carbon dioxide or at high altitude where there is less oxygen pressure, so your retain the carbon dioxide that your tissues produce because it isn't being competed against by the excess of atmospheric oxygen. At high altitude you retain your own carbon dioxide as if you have an enriched atmospheric carbon dioxide. At high altitude or in the presence of carbon dioxide you can work harder and longer without getting fatigued. I think that's entirely the effect of carbon dioxide on the water.

There are effects on the ATP too. The equation for making ATP is to dehydrate the precursors and when you destroy ATP by de-energizing it you add water, hydrolyze it. If you look at the equation, if you could just pull water molecules out of the environment, ATP would spontaneously form and it wouldn't take any fancy machinery, just dehydrating the compartment should cause spontaneous cross correlation. I think carbon dioxide, by its effect on jell, and by taking water out of in carbonic acid, I think that's how carbon dioxide contributes to raising the energy and endurance of cells.

At high altitudes, in Nepal, there was a study of, I think it was, sixty-seven households, looking for different diseases. They didn't find any cases of Alzheimer's or other dementia. They were extremely efficient in brain diseases in general but the absence of aging dementia was remarkable. That's something that's been known for over a hundred years, that high altitude populations are very resistant to the diseases of aging: cancer and heart disease, for example. In New Mexico alone, which is a relatively small population, but the figures are clear that for every, I think it's fifteen hundred feet, you get a five or ten percent reduction in mortality from heart disease, and same with cancer around the world. Insurance companies have known that cancer is relatively scarce in Nepal and Bolivia and all of the high altitude places.

Speaker 6: [inaudible 00:58:16]

Ray Peat: Well, carbon dioxide is retained. It has an antioxidant function. There's less oxygen but the carbon dioxide is ... I think carbon dioxide is really what oxygen is being used for. It undergoes chemical reactions but the production of carbon dioxide, I think, is what really creates the structure of the cell, maintains the jell in the living state, and makes the energy hard to deplete. All kinds of muscle and nerve tests: grip strength is stronger at high altitude, even though the oxygen is lower. It's an example of the toxicity of oxygen or the anti-toxicity of carbon dioxide.

Speaker 7: [inaudible 00:59:17]

Ray Peat: It's tending to damage their lungs and make their emphysema worse.

Speaker 8: What was the question? His question.

Speaker 7: I'm saying how do you explain the, speaking of emphysema for example, walking around with oxygen tanks and apparently thinking they're improving but from what you're saying they're getting worse?

Ray Peat: I think it's a similar thing to altitude sickness. Many places are still treating altitude sickness with oxygen but someone noticed that the device they were taking up on Mount Everest, a plastic bag that they would put the sick person in, zip them in and blow it up with oxygen, they would get better, recover from the mountain sickness, but someone analyzed the air and they were concentrating their own carbon dioxide in this plastic bag. So someone tested, just having brief carbon dioxide at high altitude, and it worked.

Speaker 9: ... To get those excess ions out of the cell and reverse aging [inaudible 01:00:48]?

Ray Peat: I think that's related to the fact that aging involves a plugging up over all kinds of sensitive points on macro-molecules in the cell. Glycation is something that is identified with diabetes and Alzheimer's disease. It means the attachment of sugar-like fragments to proteins and especially to receptors, or sensory points in

the cell, regulatory points, and that happens. They call it glycation as if it's caused by glucose but actually the oxidized products of polyunsaturated fatty acids are many times more active in causing glycation. The glycation happens mainly on lysine amino groups of proteins but you can glycate any molecule that has an amino group and that pretty well inactivates it.

The normal function of a good concentration of carbon dioxide is to bind two lysine groups in hemoglobin. That's how oxygen is released in tissues where you need it because carbon dioxide comes out of the cells, binds to lysine, forming a carbamino group on the hemoglobin, acidifying the hemoglobin, and making the oxygen available for the cell to get. Then when you get in the lung, where the high oxygen concentration, the oxygen displaces the carbon dioxide, but the carbon dioxide binds that way to insulin receptors, nerve receptors, anything that has a lysine group, carbon dioxide is normally there protecting it and acidifying it and stabilizing the structure in the sensitive position or condition.

So just hyperventilating, I think, is contributing to the aging process in which things tend to get glued together by glycation.

Speaker 5: Do you know if anybody's ever measured this competing effect between carbon dioxide interfering with glycation reactions and the fact that glycation reactions themselves are dehydrations and therefore would be enhanced by a dryer environment? Therefore, you predicted they would go the other direction. In terms of aging itself, becoming dehydrated.

Ray Peat: I think some of the dehydration with aging is the normal defensive process. In extracts of tissue slices and cell cultures and whole animals and organ treatments, if you inject a hypotonic solution which, remember, the hypotonic causes tissue swelling, excitation, inflammation, the hypotonic solution, like sea water instead of isotonic saline or called, sea water is about seven times strong than the salt solution of the blood, or even ten times stronger.

A lot of hospitals are using the concentration of sea water, seven times normal strength, to revive people and it works better than isotonic saline. In the individual cells and tissue cultures, and so on, it has an antioxidant effect that protects against oxidation, free-radical damage, all kinds of damage protection, by not just concentrated salt, sodium chloride, but concentrated sugar and urea have similar effects in protecting cells. So I think the dehydration of fluids in aging, part of that is a defensive reaction.

During a seminar, once, in 1991, one of my professors knew I had read, unlike the other people at the university. He said "Do you think is true that all of these tissues, different tissues of the organism, are isotonic with blood?" So I went down and, in about an hour, found an experiment which took out very fresh snips of tissue and dropped them in isotonic, double concentration, triple concentration, and so on, solutions and found that most tissues from an adult

organism are stable only at about a triple osmolarity, two or three times more concentrated than the bloodstream.

So there seems to be something special about the blood that makes us able to handle it at the isotonic but hypotonic to our functioning tissue cells. And I think that's the barrier of fiber on the inside of capillaries interacting with the movement of carbon dioxide out of the cells. Did you have a comment?

Speaker 10: Is there any correlation between your comment on these stories of how high altitude populations age slowly and the fact that runners from Kenya and Ethiopia set world records on a regular basis? Also, is there relation between and caloric restrictions on the--

Ray Peat: Yeah. Caloric restriction reduces the amount of damage to the mitochondria and energy producing system so the cells are actually metabolizing at a higher rate than animals that are eating lots of vegetables and such. The toxins from a freely chosen diet quickly slow down the metabolic rate. In calves, which are born with very saturated brains because they're basically getting butter fat incorporated in the brain rather than vegetable oil, their mitochondria slow down in proportion to the linoleic acid getting incorporated into the mitochondria in the cardiolipin that regulates the mitochondrial energy production.

There was a paper you can find on the Internet called "Uncoupled And Surviving". It's about a mouse that is natural very hypometabolic, burns energy at a tremendous rate, and lives much much longer than ordinary mice. That's a general rule. That the high metabolizers live longer than the low metabolizers. And they tend to have bigger brains. The biggest fossil brain, or skull, even found was on Mount Kilimanjaro. I've always thought that that was a combination of some kind of a good diet plus the high altitude because when you do the opposite, when you increase the oxygen tension or do any of these things such as disturbing the amount of water the tissue can handle, the brain gets smaller. Radiation causes the tissue to swell and take up water and the chronic effect is to cause the offspring to have smaller brains.

I think all of these things: polyunsaturated fatty acids, radiation, estrogen, and too much oxygen, are all doing exactly the same thing. Overexciting the tissue. And keeping it from going along the normal path of complexification and adaptive complexity.

Speaker 11: Ray, do you drink your eight glasses of water a day?

Ray Peat: No. I've always kind of thought Heraclitus had something when he said "Dry souls are best." Heraclitus, the Greek guy that said "You can't step in the same river twice." He also said "Dry souls are best."

Speaker 12: [inaudible 01:11:17] I don't think anybody in this room knows who Gilbert Ling is.

Ray Peat: When I went to graduate school I was intending to become a nerve biologist, primarily. The professor would refer us to articles and journals that seemed pretty irrelevant to the actual problem it was supposed to be solving. I would look through the same journal and found that there were articles published the same year that were much better solutions than the professor had referred us to and eventually, over a period of three or four weeks, first term in graduate school, I found that Gilbert Ling was turning up more and more often as a person who had solved the problems that were being not solved by the conventional, mainline biologist.

So I wrote to him. He answered nicely and said "You just don't understand what science is. Science is money and prestige and power." He's the one that developed the glass micro-electrode, which used to be called the Ling-Gerard micro-electrode. He not only developed it, he decided it wasn't measuring the membrane potential that everyone since has claimed that it does. He says there is no membrane potential.

In my lab with that same nerve biologist, I was using a Ling electrode in a muscle cell, on a celloscope, and with a micromanipulator I would move it into the cell and back, different places in the cell. Professor came by and was watching what I was doing and I said "Look. Each place in the cell has its own distinct electrical potential." He turned so fast. He couldn't look at the evidence because, if there's a membrane which is creating the potential, everything inside is a dilute solution. You can't have regional potentials. Gilbert Ling explains why a cell is an aligest, or a water softener, which retains ions passively, doesn't expend the energy to do that.

You can take hair, clean all of the ions out of it, dip it in the blood serum, and it'll take up magnesium and potassium just like a living cell. But people are still talking about membrane pumps and at Gilbert Ling's site on the Internet, gilbertling.org, you can read a lot of his papers on how, basically, [inaudible 01:14:41] corrupt mainline biology and medicine.

He is following up [inaudible 01:14:52], more or less a contemporary of Gilbert Ling, who wrote a very good book, you can find it in one of the big science libraries here, on the behavior of ions in cells.

Speaker 12: Would you go back to the pH? How the more measure of pH if the [inaudible 01:15:16]

Ray Peat: A guy named Beach, at the National Institute of ... I think its, Alcoholism. One of the national institutes. Have demonstrated that we can use [inaudible 01:15:37] to nature intracellular pH distinct from the extracellular. He was the first one I know of to demonstrate that tumors have higher intracellular pH. It's the extracellular acidity that lactic acid causes but the tumor itself, intracellular, is exitum and alkaline relative to normal cells. Excitation of any sort will eventually

produce an alkaline field around the nerve of the muscle as well as swelling, just like any jell that gets alkaline will swell up.

Speaker 13: Is it necessary to make body alkaline [inaudible 01:16:27]?

Ray Peat: Acid, basically, is protective as long as it's involving carbon dioxide. Carbon dioxide is oil soluble. If you added one percent or so to the air here, we would add it to our blood and soft tissues. It would concentrate inside cells more than in the water. But it would go on increasing for months just breathing the same concentration that it finally builds itself into the bones, strengthens the bones as calcium carbonate, before the calcium phosphates form.

We're as if we've been deprived of carbon dioxide, chronically. I think that's one of the things that causes the tendency to inflame and tumefy and atrophy with aging.

Speaker 14: [inaudible 01:17:32] help osteoporosis?

Ray Peat: Yeah. That's how vitamin K works. Vitamin K activates carbon dioxide and helps to integrate it into the bones.

Speaker 15: So we should all walk around with a bag over our heads.

Phil: Are you contradicting Mendelian's theory of theomorphism as to divide [inaudible 01:18:10] more acidic, all these different protides or whatever your name would be for normal, down-around-the-reverse-clock, into these viruses, bacteria, fungus, and then cancer cells?

Ray Peat: The carbon dioxide [inaudible 01:18:30] acidifies inside cells and stabilizes them. It's regulating. It's hauling calcium outside cells and helping deposit it in the bones or send things out the kidneys. It's ability to combine with water and become a counterion to metals accounts for, I think, all of the so-called active transport of metals, the active streaming of metals out of cells or into cells. That people used the ideas of pumps to account for those kidney movements and so on.

Gilbert Ling, several times, has calculated that the cell, just to operate one or two of its pumps, would need fifteen times more energy then it could possibly derive from the energy available as food and oxygen. The blood is alkaline because of the movement of carbon dioxide keeping the alkaline metals in motion.

Speaker 17: You've only got a couple minutes and most of us are practically oriented. Could you--

Ray Peat: Yeah. About three years ago I was thinking about this carbon dioxide thing and I had mentioned how it regulates brain circulation to one of my nutrition classes. I'd said soda, meaning soda pop, as a carbon dioxide source but next week a girl

said she had given her paralyzed mother who was [inaudible 01:20:39] from a stroke, six months she had been half paralyzed, she gave her spoonful of baking soda and a glass of water and in fifteen minutes the paralysis lifted. Then I started trying it every time I heard of someone who had a stroke.

Recently in Mexico a guy had been, basically, just a wad on his bed for three weeks after a stroke. A guy gave him a spoonful of baking soda and a glass of water and within a few minutes he could move his hand and the next day he could walk across the room but not very well.

Dementia. I think I've told you before about the woman who had epilepsy for twenty years, fifteen or twenty years, and her neurologist had documented her IQ decline. That was all he did on his handy little check-ups. He said she was not to go out of the house by herself. She was so demented she couldn't find her way home. She took Progesterone and three or four days later she came back all by herself. She was recovered and able to do everything. She went to graduate school and got her masters degree. Straight As.

Speaker 18: Did she fire her doctor?

Ray Peat: I tried to get her to go back and talk to him but, in general, these people who have these sudden total recoveries embarrass their doctors, I think. Like a guy with Lou Gehrig's disease. He had a doctor that said he would work with him but that involved just watching him rather than actually participating and prescribing. Anyway, this guy was declining along with the other patients in the waiting room that he saw every week and when he started using Niacin Progesterone light on his head for a couple hours everyday ...

Speaker 19: [inaudible 01:23:03]

Ray Peat: Just infrared--

Speaker 19: [inaudible 01:23:08]

Ray Peat: Anyway. He, after a few months of declining, started improving. I think it was six or eight months after he started he sent his toilet equipment and wheelchair and all of those things back to the store and showed off that he could do leg lifts and went back to work at his company and had no more Lou Gehrig's disease.

Baking soda and salt and sugar is another thing. Sugar stops the excitotoxic process. It works with Niacin to stop the polysis that produces the fatty acids that activate the excitotoxic process. So sugar and salt and baking soda and breathing in a paper bag and getting a lot of light and taking Thyroid and Progesterone, the only thing wrong with it is that some people recover so fast that no one believes they could have been terminal.

Speaker 20: Would you talk more about the [inaudible 01:24:20]?

Ray Peat: At the hardware store, or chicken store, you can get these things called infrared light bulbs. They have a cone-shaped, aluminimized reflector and a clear front and they cost about three dollars. They're designed to run at a hundred and thirty some volts so, at a hundred and twenty volts, they put out a lot of infrared and red light compared to ordinary condescend bulbs. That's good enough. It saves--what?--thirty-eight hundred dollars cheaper than ...

Speaker 20: What's the cone-shaped [inaudible 01:25:04]?

Ray Peat: That's just the reflector but it--

Speaker 21: Reflector flood!

Ray Peat: Yeah. A flood light.

Speaker 22: Would you talk about coconut oil and your--

Ray Peat: Yeah. Coconut oil is anti-inflammatory. If you put EFAD, Essential Fatty Acid Deficiency, into PubMed and do a search you'll find that animals that are deficient in the so called "Essential Fatty Acids", who have none of those fats in their diet, are hard to kill with endotoxin or mechanical trauma or a variety of poisons. They don't get arthritis in inflammatory diseases from the normal causes. So coconut oil and butter and the waxes from sugar cane and beeswax are being used for the same protective anti-inflammatory effect.

The [inaudible 01:26:12] that we make based on palmitic acid, which is found in butter and coconut oil, these are anti-inflammatory things. The [inaudible 01:26:23], acid, and this derivative are powerfully anti-inflammatory. When we eat vegetables and vegetable oils, we stop making these anti-inflammatory substances and instead make the prostaglandins and the inflammatory things. One of the differences between palmitic acid and linoleic acid is the, besides the effect, pro and anti-thyroid and pro and anti-testosterone and progesterone and so on, the cell tends to take up more water when it has polyunsaturated fats just because the double bond tends to associate with water more easily than the purely hydrocarbon saturated fatty acid.

Speaker 23: [inaudible 01:27:14]

Ray Peat: Full-spectrum doesn't stimulate. For example, the ultraviolet stimulates your production of vitamin D. But ultraviolet and blue light are both toxic, for example, to the retina. Blue light is destructive to the retina. One of the main things that causes blue, white, and ultraviolet light being toxic are the polyunsaturated fatty acids because they react with high energy radiation.

Speaker 24: So, here were are being told to cut down on salts and lower our blood pressure. [inaudible 01:28:22] some salt.

Ray Peat: The Gail and Tom Brewer man-and-wife couple wrote a book on what every pregnant woman should know about. Nutritionism and ... He had two associates, Shanklin and Hodin, who wrote a book more technical than the Brewers wrote about the importance of salt in preventing high-blood pressure in pregnant women. Salt restriction is pretty sure to cause hypertension in pregnancy. I made the analogy between premenstrual syndrome and pregnancy and suggested that women who swell up before their period tried eating as much salt as they craved during that time, and usually they crave extra salt like pregnant women. When they ate lots of salt they didn't swell up.

My old friends who were taking high-blood pressure stuff, I suggested that they tried the same thing. I found that other people had tried that and saw that a salt restricted diet raised adrenaline, made them have insomnia as well as high-blood pressure, and when you gave them more salt you lowered their adrenaline and generally tend to lower their blood pressure. A man named McCarren demonstrated that calcium deficiency is more important than sodium excess but extra sodium and calcium really will protect you against most high-blood pressure.

Speaker 25: The kind of salt, is that important at all? [inaudible 01:30:19] salt is pretty stripped. Should it be like a [inaudible 01:30:22]?

Ray Peat: It's good to use natural foods like lots of milk for the calcium, lots of fruit for the potassium, and any source you can get sodium. To a great extent, one salt can substitute for the other because it's the bionic strength and the osmolarity that's important--

Speaker 26: Is there one salt that [inaudible 01:30:51] sodium?

Ray Peat: Yes. Sea salt at a beach is good, practical source. An English doctor who went back to her native Mongolia where they average thirty grams of salt per day. She gave blood pressure tests to everyone she could find and couldn't a hypertensive person, all the way up into their nineties. I shouldn't say anything about the rest of their diet. I think that's an example that ... Even thirty grams is compatible with good health ...

Speaker 27: Two question. One for her. I just have a comment. I had a friend who taught chemistry and medicine at a university in Buffalo. He cured himself of cancer by drinking sea salt and saturated, like you talked about, at dinner. Huge amounts of salt, like a liter of water a day, and completely nothing else. He didn't change his diet or anything.

Ray Peat: There have been studies recently of treating ulcers with different concentrations and ten times isotonic is curative for ulcers. Stomach ulcers included. Sea water tends to be strong enough to help cure stomach ulcers.

Speaker 27: Do you have [inaudible 01:32:21] explanation of coffee? I tried to explain to him.

Ray Peat: Coffee is our richest nutritional source of magnesium. It's a single source.

Speaker 27: And also progesterone? It produces progesterone, right?

Ray Peat: Caffeine, I think of it as a vitamin because it so closely fits into our system or uric acid and salt. Empirically, the people who drink the most coffee tend to have the best health, the lowest cancer, and [inaudible 01:32:56]

Phil: One more question. I have heard that Ray Peat recommends eating ice cream. I want to know what the real truth of this matter is.

Ray Peat: For about, I guess fifteen years, I [inaudible 01:33:43] and it didn't effect my weight. But when I added about an ounce of coconut oil, my weight went down in spite of eating a quart of ice cream plus and ounce of coconut oil. Then Peninsula Creamery, over here, got squeezed out of the market by evil distributors. So then I went to Breyers which was the next best thing. But then Breyers started adding horrible gums to make the product have a long shelf-life. So there's only one or two flavors of Breyers that is still really edible: vanilla and French vanilla.

Speaker 28: You might had that Ray has an excellent website and a very, very readable [inaudible 01:34:36]. I went onto his website for the first time and it's absolutely excellent. I didn't understand some of the things he was talking about. But let me tell you something: the website is outstanding. Except there's the naked women.

Phil: There's one other thing too. Is it true that you do counseling for a small fee?

Ray Peat: Yeah.

Phil: This is one of the best bargains in the world. It's like Steve Foster's counseling for a small fee. If you have some questions and want to get another perspective, call that phone number up there and talk to Ray. Here's a man who's not in science for the money. But, on the other hand, he's got bills like everybody else. So I really think that it'd be good for both of you if you give this man a call. Anyway, thanks very much, Ray.

Ray Peat: Thank you.

Speaker 29: There's product out there on the market right now called Oregacillin that actually has been shown effective against the bird flu. It's produced by Physician's Strength and they do have a protocol and they use it in combination with oiled oregano. And I can bring you, or email you, the protocol. Hi. I'm Dr. Audrey McAfee.

Phil: So you're an MD? MD. Okay, good. Well that's another thing we should know about then. Bring that in. So we can investigate that. Now ... Hey, Dean. You're late. Okay. Since we have two reports I want to get right to our first report. One more thing. Hurry up.

Speaker 29: I was looking through this ... Preparing for the pandemic. On page sixteen it talks about Tamiflu and it mentions Relenza and it doesn't seem to say Relenza is better. But the one study I saw said that Relenza worked better than Tamiflu and Relenza is available.

Phil: Yeah. That's the expensive one too. Okay. Well, anyway. You all do your homework and then we'll have something to talk about next time. Beth [inaudible 01:37:03] is going to be on that panel and so is Steve Fox and myself and Mike [inaudible 01:37:07]. The rest of you will have plenty of chance to add into it because the thing that we want to know is "What would [inaudible 01:37:18] do if she got the flu?" What would you do if you got the flu? If you had done some research in [inaudible 01:37:24]. So we can all take advantage of each other's ideas. And here's Dean Fox. We're going to ask him next what he would do if he had the flu.

I wanted to talk about this article on Perceptin today but we don't have the time, unfortunately. The Mercury News, they are studying the advanced cancer drug Perceptin. As it turns out, for 366,000 dollars, if you have a certain kind of breast cancer, for 366,000 dollars, over five years, you can reduce your risk of relapse by 50 percent. That's good news in a way. The bad news is the price tag. So there's two issues there.

The thing that struck me, I just want to mention briefly, is that in the October issue of LifeExtension magazine they had an article on CO210 and cancer, which we sold out of already, unfortunately, but I'd like you to take a look at it. In that article, they refer to four articles. You know how LifeExtension is great with references. This article, about a six page article and thirty scientific studies cited, a footnote into the article. They make a claim and then they put a footnote after it and you look in the footnote, what article that goes to, which I really like. So they might just kind of puffing up their bibliographies.

Anyway. This article shows, I think, that CO210 is so much better than Perceptin and, yet, what do we hear about it? In the newspaper. This costs fifty dollars a month. Perceptin 3,220 dollars a month and we hear about the Perceptin, which is another story about the great Satan, also known as Big Pharma. So keep track of that. And if you can get a hold of that article in LifeExtension magazine it's well worth while because, here, just to read you a little bit about it: several women in this study, first they started with 90 milligrams and got partial remission and so forth. Then they went to 390 and the tumors disappeared. Not in every case but in several cases. So, I think, 4 out of 32 of the tumors disappeared completely. This is a better way of treatment, not just prevention. Treating cancer. And as you know CO210 is among the more expensive supplements. Still, you can take

400 milligrams a month for, probably, 25 dollars or something like that. So I would look into that.

The other thing is the vitamin C treatment, which we've been talking about before, and the [inaudible 01:40:30] study just came out, which I referred to last month. Again, the vitamin C treatment, vitamin C IV, increasing hydrogen peroxide, and doing other things, such as we'll learn more about next month when we talk more about vitamin C with Bob [inaudible 01:40:48]. Vitamin C is also a tremendously powerful treatment for cancer. And now the NH itself has established that in a very carefully done NH type of study. I want you to kind of investigate those things because if you go with what you read in the newspaper, all you're going to do is feed Big Pharma, and you're not necessarily going to be doing what's best for yourself.

The first report that we have is our board meeting. We were very blessed, really, by the fact that Dave Asprey had a friend by the name of Ron Snyder who he recommended to us. He said "Ron can come and help us launch ourselves." We're all aware that we've got a tiger by the tail here. That there's a tremendous need for the kind of information that we get at these meetings. We don't get it from our doctors. We've been misinformed and misled by Big Pharma that tells us what's in their interest, not what's in our interest.

We want to become the biggest and best organization that we can become. So we brought Dave Asprey and his prescence to do that. He said "Okay. What I want to do is bring my friend Ron Snyder on, who's an expert and kind of, just, gifted in getting groups together and trying to figure out what they want to do and how they want to do it." So we had a meeting. It was dynamite. The report was in the newsletter. I want to bring Ron up here. Unfortunately, Dave didn't make it. Okay. Let's do that. Okay. So let's take our other report first. John? Let me introduce you before you get up.

John Ferrer, as you know, is part of our community and a wonderful biochemist, lives in Florida, so we kind of grab him only when he's in town. He came in town this time to go to the symposium on stem cell research and regenerative medicine, which was held last Tuesday in San Francisco by the American Federation for Aging Research. Is that right? Well, through Johns intersection, we were able to go up there, several of us, and it was a tremendous event. Sandy [inaudible 01:43:16], Mike, myself, Dick [inaudible 01:43:19]. Dick are you here? Yeah. And Mitchell Miller. Were there. We hear some of the best science in the Bay Area. People doing research on stem cells.

As you know, the promise of stem cells is renewable body parts, is what it amounts to. They're right there. They can already do a little bit of it. There's no question. There's going to be six different ways to do this and get the kind of cells we need to get the body to regenerate. It's just a question of which is the best way. So it's a very exciting thing.

The good news is, not only did we have a wonderful time, got to hear all these great speakers, have a free steak dinner with wine and all the best stuff for free, thanks to John's intersection, but we also landed four or five speakers, and we're going to have a couple speakers from Stanford, probably Irv Weissman and Helen Blau, who are leading the charge on stem cell research and they're going to be here next month. Not next month but in the next few months. In the spring. They're talking about stem cell research so stay tuned because that's going to be a very important part of our futures. I'm sure you don't want to be the last one to know if your seventy or eighty-years-old.

I'm the one kind of on the edge. They're just finding this stuff out in time for me, hopefully. [inaudible 01:44:49] a few more days. Okay. John! John's going to give a report on some of the conferences he's been going to. He goes to conferences all over the world.

John Ferrer: You won't miss much by not seeing my slides because they're basically just keywords to remind me what to say. I've been to three conferences in Europe, and about half a dozen conferences in the last six months, related to research into aging. The first one in Europe was in Italy and it was conference on a subject called autophagy. Autophagy is a swallowing of damaged mitochondria inside the cell. It's a way for cells to renew themselves. There is a lot of new research turning ways that mitochondria have a half-life of about six weeks in the cell. Even in brain cells which live all your life. If you're sixty-years-old, you've got brain cells that are sixty-years-old but your mitochondria in your brain cells are only a month or two old.

Somehow the cell is constantly recycling the mitochondria. We've always been wondering "How is it that the cell knows how to do this?" Well, there's information turning up and I think that, in the next five or ten years, we're going to see new therapies emerging out of this subject. You might want to keep a keyword in your Google News browser. You all know about Google News, right? You can put keywords into it and anytime your keyword pops up, anywhere in the world, in any of the world's newspapers, it'll get sent to you as an email. Pretty handy.

So look up autophagy. That'll be a good one. In June, some of you may have gone to the American Aging Association meeting in Oakland, California. The American Aging Association meets once a year. Top-quality research. The next one's going to be next June in Boston. They started out the first day of the conference with a pre-meeting on nutritional interventions. It probably comes as no surprise to anyone here that there's a lot of benefit to eating highly colored fresh fruits and vegetables and even some cooked fruits and vegetables. I found this interesting: to get the greatest benefit from things like tomatoes, you want to cook them with olive oil, so that they get assimilated by your digestive system.

Another thing that I found very interesting was that walnuts, like almonds, are just loaded with antioxidants. I had been thinking of blueberries and blackberries

but almonds and walnuts, especially if they're [inaudible 01:48:04] are just loaded with antioxidants and good fiber.

Recently, in August, at the International Association of Biomedical Gerontology in Denmark. They meet only once every two years but they tend to get more international speakers, more Europeans and more people from Australia and Japan, than most of the American conferences. I found it very interesting that Robin Holliday showed up. Some of you maybe studied biology and molecular biology. You've heard of the way that the chromosomes recombine during meiosis and sexual combination called the Holliday junction. This was the man who came up with the Holliday junction and he is very interested now, he is just recently retired, and he's still interested in studying aging.

I asked him "When you first thought of the Holliday junction was it immediately acclaimed?" Did people pat you on the back and congratulate you? And he said "You must be kidding. I was a graduate student and nobody would take me seriously for years until, finally, we got electron microscope images of the junction, and once people could see it they believed in it." Sometimes the technology for imaging is very important, which reminds me that the National Institute on Aging is starting a massive collaboration of thirty university MRI imaging facilities to try and discover "What's the best way to see Alzheimer's disease as early as possible?" This is important not only clinically for diagnosis but, more importantly, suppose you've got a drug or an herb or something and you think it does good for Alzheimer's. In the old paradigm, you give it to the person for twenty or thirty years and then when they die you cut open their brain and see whether it did any good. Or you give them a memory test every six months and see if they can remember 27 words that you recite to them.

The ability to actually see the pathology of Alzheimer's developing, I think, is going to be tremendously important in just the next couple of years. They're already developing and, I think, the local center of greatest interest is UCSF. UCSF has a great brain imaging facility and I believe the leader of that facility is actually coordinating this whole consortium of thirty universities across the country. So that's, I think, a very important topic to keep in mind.

Right after the Denmark meeting, there was a meeting at Woods Hole, Massachusetts, which is near Martha's Vineyard, just on Cape Cod. The Woods Hole marine biology lab has been around for something like 100 years and very well renowned. Larry Ellison has not been around that long. He's here in Redwood Shores. He has a company called Oracle and he and Bill Gates are vying to see who can upstage the other one. Larry Ellison has, for the last six or seven years, been funding aging research, which is very important. He has the Ellison Medical Foundation. You can find all of these things on the web, by the way.

So every year they give grants to university researchers, both senior researchers who are switching into aging, researchers who are continuing working aging, and new researchers who have just gotten their lab set up and are starting in aging

research. Every year he has them come to a symposium to report and tell each other about what they're doing. Did you have a question?

Speaker 4: No.

John Ferrer: And so they met in Woods Hole, Massachusetts, in August. One of the most interesting speakers was, in fact, Helen Blau, that we just saw a couple days ago in San Francisco. But she's in Stanford here. And she's doing marvelous things with stem cells. She has developed ways of marking the stem cell so that you can see them in mice because a lot of the early work is done in mice before you start doing it in people. She's found bone marrows in stem cells, from adults, will, on occasion, go into the brain and fuse with brain cells and take over the function of a brain cell that was failing, in a sense, restoring it. What she's doing now is learning how to take the stem cells out of the bone marrow, or blood circulation, give it certain growth factors, in laboratory dish culture, so that she can grow millions and billions of them out of just one, and then re-inject them into the animal or eventually into the human.

One of the possibilities is that instead of trying to get an embryo from some unrelated fertilized egg, you take it from the patient themselves. You only need one cell. Everybody's got a few hundred at least of these cells. You take one of these cells. You multiply it in the laboratory dish into millions or billions. Inject it back in. And all of a sudden, you've got a totally compatible stem cell infusion that goes in. If you've got diabetes it goes in and takes over the eyelets function. If you've got liver deterioration it goes in and takes over the liver. If you've got brain deterioration, Alzheimer's, neurodegeneration, it goes in and takes over the functions that are necessary. I'm really glad Phil got a chance to talk to her on Tuesday and invite her to speak here because it's going to be ... And she's got marvelous slides. When I told you about Robin Holliday and the election microscope, she's got pictures of these cells fusing inside the brains! There's no doubt of what's going on. It's just fantastic.

The following month, in September, Aubrey de Grey organized a conference called Strategies for Engineered Negligible Senescences. I don't know if it's such a great acronym but it does make sense: S-E-N-S. Several people in the audience went over to see it. The interesting thing about this conference is Aubrey's focus is not primarily to understand aging and what causes it, ultimately. Aubrey's main focus is to understand what aging does to the body before the pathology starts. He divides things into three boxes. There's metabolism, right? You've got your mitochondria turning sugar into ATP and throwing off free-radicals, which then go and the free-radical interact with membranes and proteins and cross-link them and do all these things and eventually these cross-linked proteins aggregate and they result in damage like Alzheimer's disease, Huntington's disease, or even dying muscle cells, which cause old people to become more frail.

So that's the ultimate pathology. Metabolism is what starts it out. If we tried to stop the cause of the damage that occurs in the middle, the damaged proteins, if we tried to slow down metabolism, well that's not really so healthy. So he's not focusing on how metabolism causes the damage. He's focusing on "How can we engineer away the damage?" which I think is a novel way of looking at it and not all of the gerontologists in the world understand, exactly, the distinction. As a result, because he's getting a lot of press and because he looks a little unconventional in his attire and his bread and because he's approaching it from the standpoint of cleaning up the garbage rather than slowing down its accumulation, there's been some controversy and there will be continuing to be controversy.

But the lineup of speakers that he brought to this conference were all focused on "How can we clean up the garbage?" He brought over experts and stem cells. He even brought over the group from South Korea that had cloned human embryonic stem cells. He had a researcher, [inaudible 01:56:48] from Wistar Institute in Philadelphia. She has been studying things like rheumatoid arthritis and obesity and they made variations on mice that were genetically designed to get fat and have bad joints. They discovered, quite by accident, that his mouse regenerates almost as well as a salamander. Those of you that have studied regeneration, what it means is, if you cut them or take a bunch of skin out of their ear, cut off a digit, you don't just get scar tissue, but the tissue grows back the way it was supposed to.

Developmental biologists have known this for years: that salamanders will do this. But it was commonly believed that males would not do this. So here they've got a mouse that's pretty much like any other mouse with a couple of genes that are changed. And all of a sudden they have a mouse that's able to regenerate. So we've got the scientist who's an expert in rheumatism and obesity now handed into her lap a marvelous mouse model of regeneration and she's scrambling to learn everything she can about regeneration and make the best that she can out of figure out "We've got a mammal that regenerates. Mice are a lot closer to people than salamanders." So I think this is another one you're going to want to be watching in the future. The MRL mouse from Wistar Institute in Philadelphia.

What else did I want to say? Oh! Just a couple of weeks ago, up in Marion County, there's an institute called The Buck Institute for Age Research. It's the only institute in the world of its size that does nothing but aging research. It's in Novato and they had an annual symposium and this time they were looking in pharmacological interventions that might affect lifespan. A lot of the interventions that the various speakers were looking at had to do with making flies or worms live longer and looking at dietary restrictions.

But there were a couple of talks that stuck in my mind. One was Ashley Bush from Harvard Medical School who has been working for about ten years now on Alzheimer's disease. He has been looking at the interaction between metals and proteins in the brain that aggregate and form these plaques. He found that, if

you could get the metals to go away, the plaques would dissolve and go away too. Not only that. I've learned something from hearing him talk and talking to him afterwards. My thought in the past had been "What does Alzheimer's disease do?" Well, it kills brain cells, you have fewer brain cells, and you don't think so well and you don't remember so well. He said, ultimately, that's true. But a lot of the symptoms of early stage and mid-stage Alzheimer's disease are from sick brain cells that have not died yet. His results now are indicating that, if we can get in there, get rid of the plaques, we can restore the sick cells to health and, essentially, not just slow the rate of decline of an Alzheimer's patient but actually create improvements.

Most of what he's been doing he's been doing in mouse models. But a couple years ago they tried it out in a preliminary clinical trial in Australia with just 30 patients and they used low dose of this experimental drug called Clioquinol because they weren't sure if it had side-effects or not. But even with a low dose they were able to slow the rate of decline and they think--