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DNA and Cell Reprogramming Via Epigenetic Information Delivered by Magnetic Fields, Sound Vibration and Coherent Water

Webinar Transcription with
Dr. Carlo Ventura, M.D., Ph.D. and Dr. Rollin McCraty, Ph.D.

Dr. McCraty: Well, good day, everyone. This is Dr. Rollin McCraty, the Institute of HeartMath. And I see a lot of people are still logging in to today's webinar. So before we start the formal presentation, we'll give it a minute or two here to let those that are still logging in get logged in and synched up.

It's my great honor today to introduce Dr. Carlo Ventura who's become, well, I feel a very good personal friend and colleague. And we're starting to collaborate together to do, I think, some rather innovative research in the relatively near future. And I asked Carlo to do this webinar because I'm so fascinated by the, I think, really leading-edge research that Carlo is doing in the field of epigenetic information and how he's able to change the programming of stem cells through magnetic fields and sound vibrations. And he'll also talk about some coherent water work that he's doing.

So, Carlo, hello and thank you so much for joining us.

Dr. Ventura: Hello, how are you? Thank you very much for the introduction. And first of all, I would like to thank you and the Institute of HeartMath for organizing this webinar and for the unique opportunity to be here with all of you.

I would like to focus in this presentation on several features of DNA on the relevance of its architecture and shapes as driving forces that can modulate the expression of genes, unlocking the potential of any given cell to be transformed into the many different subtypes that define the structure and function of our organs throughout the adult life.

As you know, DNA is a very long molecule. It's about two meters long. And it is compacted in a very small nuclear volume with a diameter of only 50 to 70 microns, usually. Only one or two percent of the overall DNA left contains coding sequences; that is, sequences that will give rise to a messenger RNA and to a protein that would, in turn, specify the structure and function of our cells.

The huge remnant part was believed to be sort of meaningless garbage structure until very recently. And it is now clear that cell commitment and differentiation is controlled by a

complex of play between the cell signaling, the environment, and the continuous dynamic remodeling of this so-called garbage DNA into loops and domains.

We are now understanding that we are facing an architectural DNA that is capable of acquiring a temporal and special organization, what we call epigenetics, shaping and specifying the multi-faceted gene expression motifs that are part of the information of life. So the environment is important. We know now that even during pregnancy or childhood we may have adverse event in the environment that can affect epigenetics, the nuclear volume and form and shape in the cells, as well as the transcription of our genes automatically leading to huge changing epigenetics and some patterning in behavior.

So the environment is important. And, Rollin, you're right. As you said, it's important to understand that when we say "environment," we may also think about our mind, our consciousness, the possibility to right our coherent state and change the environment and the way the environment may affect this epigenetics, the beginning structure and function.

Dr. McCraty: Carlo, if I may, before you move on, I think for some of our audience and listeners, it might be good just to talk a little bit about what the term "epigenetics" actually means. My simple understanding, and I want you to add to this and correct me if I'm wrong, but "epi" just means above or outside of the gene. Is that correct? So, in other words, it influences outside of the DNA itself in the genes that actually act as to program or control the gene. And this has been a revolutionary finding in that we're not locked in necessarily to our genetic code, that things in the --

Dr. Ventura: Absolutely. It's a new possibility of freedom that we have through epigenetics. So we're not back simply on the genetic code, but we are more and more free, and we can rely on epigenetics to change the function of our genes.

And within this context, stem cells may hold a promise for the rescue of severely damaged tissues that cannot be saved even by the most advanced pharmacological or surgical treatment. And this perspective has paved the way to another paradigm in the handling of complex diseases. Just think about cardiovascular diseases or neurodegenerative disorders. And this new is the so-called regenerative medicine that these uses stem cells and cell therapy to rescue a damaged organ.

However, as you can see in the slide, that hope mainly arises from the feature of totipotent embryonic or pluripotent embryonic stem cells that are able to self-renew and capable of producing all the progenitor cells that leads to many component subtypes including the indeterminately differentiated cells that make up the complete organism, not only for ethical issues but for immune rejection tumorigenic problems are associated with embryonic stem cells. Most of the effort in regenerative medicine has been focused on the use of multipotent adult stem cells.

Now, these cells excreted remarkably lower differentiating potential. They cannot be turned on in all the cell types on the human body. And their differentiation, their transformation is often

not complete. So we're talking about cardiac-like cells, neuro-like cells that come out of the multipotent stem cells.

Dr. McCraty: So, Carlo, if I may, could we give, for me and I think some of our listeners, a simple definition, or what's the difference between a totipotent and a pluripotent?

Dr. Ventura: Well, a totipotent cell is a single cell, a fertilized egg, a fertilized oocyte that can give rise to the entire individual. A pluripotent cell is a cell like the so-called embryonic stem cells that can be transformed in any cell type that can give rise to many organs and tissues, but there is no possibility for a pluripotent cell to give rise as a single cell to an entire individual. A multipotent cell is somehow placed at the lower hierarchical scale level, as you see in the slide, since it can be oriented to become literally any kind of cell. But usually this kind of transformation is not completed after it became a real competent terminally differentiated cell. So the repairing potential due to these multipotent adult stem cells appears to be mainly related to their ability to secrete a number of molecules that turn on the inherent ability of tissue cells healing rather than, as I said, the true stem cell differentiation toward a given cell type.

On the other hand, it is now increasingly becoming evident that even non-stem, human, adult somatic cell, like a fibrocyte or a fibroblast, can be transformed or reprogrammed back to an embryonic-like state by viral vector delivery of a few one to four degrees. So reprogramming cells is to be [indiscernible] stem cells can be transformed into lineages in which these cells would never otherwise appear. And this kind of transformation is related to the acquirement of new confirmation, new architectural domain in the DNA above the gene sequences. But, once again, the possibility to reprogram even a non-stem adult cell [indiscernible] pluripotent embryonic-like stem cell is mainly associated with epigenetics changes.

Dr. McCraty: Okay, so if I understand what you're saying, we could have a cell that's become, say, a skin cell or a fat cell or something like that, and the idea here in regenerative medicine is to take that cell backwards, so to speak, to a pluripotent state where it can then be reprogrammed and become a different type of cell? Is that what you're saying?

Dr. Ventura: That's correct. It's like a time machine. You're reprogramming somehow backward with these cells to an uncertain state in which any kind of decision is somehow possible; even the decision to become virtually any kind of cell of the organism. And just think about the tremendous potential, this discovery. This is why the two guys that made this discovery, Shinya Yamanaka and John Gurdon got rich into the Nobel Prize in medicine for their discovery that even non-stem adult cells can be epigenetically reprogrammed backward to a state where they can eventually give rise to neural cell, cardiac cells, skeletal muscle cells, or insulin-producing cells. So this is really relevant, a step forward in science.

But despite these new achievements, stem cell commitment and differentiation is still poorly understood, and it represents an extremely low-yield process, especially for a number of commitment that have long been considered as a major target in regenerative medicine including, as I said, the cardiac differentiation neurogenesis or the transformation into vascular

cells. You have to consider that usually the differentiation of an embryonic cell into a cardiac cell; it's a very low-yield process. It's about 0.002% of the overall differentiating potential of the stem cells within the embryonic body.

So the main message is that we need to talk to stem cells or even to adult non-stem somatic cells to re-awake their healing potential insofar it was believed that all the chemistry may be able to talk to our genes or to handle the epigenetic information stored within DNA module.

But I would like to tell you a different story, not only molecules, as we say in this slide, but we can also turn on stem cell cardiac differentiation with physical energy. We first demonstrated that we can do this with extremely low frequency magnetic field. There is first page of the paper that we published in *The FASEB Journal* in 2004 and 2005.

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And as you can see here, by exposing stem cells to a magnetic field, extremely low frequency magnetic field with a .8 [indiscernible] intensity, which is basically the magnetic field which is delivered throughout the power lines, we can trigger a number of genes that drive the cardiac cell commitment, genes that somehow tell the stem cell, "You're not going to be non-differentiated stem cell anymore, but you will be oriented to become a cardiac cell."

But more than this, exposure of the stem cells to these magnetic fields, they also enhance the expression of genes that encode for carrier-specific proteins, proteins that, for instance, drives the contraction of the myocardial cell.

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And here you won't see the movie on these cells, but you can imagine on your left side that natural chemistry, like [indiscernible] they orchestrate the differentiation of stem cells towards beating cardiac cell. But we can actually do the same thing by exposing the cells to a magnetic wave, to a magnetic field.

But more than this...

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Dr. McCraty: Go ahead. That's amazing that you're able to use magnetic fields to deliver, if I understand it right, information to the DNA that changes the chemistry, if I understand what you're saying.

Dr. Ventura: Changes the chemistry and it goes through the transcription of the genes. So we were able to influence also the expression of genes in nuclei that were taken out of the cells. So the magnetic field will act somehow by changing sort of memory within the cells, and this memory was permanently changed even when nuclei were taken apart from cells.

Later on, we moved a step forward and also using magnetic fields but a different kind. We used a magnetic field of 2.4 GHz, like the Wi-Fi band, which is the same kind of magnetic field, which is used in Internet connection worldwide. And we have been using a device that we named Radio Electric Asymmetric Conveyor, REAC. That was invented by Dr. Salvatore Rinaldi and Vania Fontani in Florence. And this device has the ability to modulate stem cell to differentiation or even transform an adult non-stem cell, like a human skin fibroblast, to behave like a stem cell.

The physical underpinning of the REAC technology may be the following: Upon the interaction of two oscillators, namely two electromagnetic fields, a resultant oscillatory pattern may be generated [indiscernible] a resultant current in magnetic field. The exploitation of the REAC technology implies that among the interaction of these two oscillators, one is represented by the oscillating electromagnetic field generated by the cells or by the entire organism; in the other one, by a weaker electromagnetic field produced by the REAC device itself.

Upon the establishment of such a dual system, a resultant electromagnetic field or current is generated that induces the cells or the organism to respond in a sort of autologous fashion with [indiscernible] radio electric micro-currents that we think may ensue from an array of cellular ionic fluxes. So by the aid of REAC technologies, these autologous radio electric currents can be focused and conveyed back to the area that we would like to treat in a patient or to the cells that we would like to expose and eventually reprogram. So here --

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Dr. McCraty: Well, if I may, just on that, it took me a while to understand this as well, because you just said a lot there that a lot of people probably wouldn't be able to follow. But if I more simply understand what you're doing there, you're setting up a resonant loop or a resonant communication channel with [indiscernible] and the genes. Is that a way of thinking of what's happening here?

Dr. Ventura: Absolutely correct. It's a kind of bioresonance. So we are picking up the endogenous signal that is generated by the cells or the entire body and delivering backwards to the cells or tissue or the conveyor electrode. This is mainly the basic theme behind the REAC technology.

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And what we need, we first started with mouse embryonic stem cells and exposing the stem cells just for two days to the electric currents and then culturing these cells for additional seven days without any REAC treatment.

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And we were able to prove that radiofrequency energy loop was able to remarkably enhance the cardiac, neuronal, and skeletal muscle differentiation, as shown here, in mouse embryonic stem cells.

So we started to provide evidence that radio electric fields asymmetrically conveyed by this technology, they represent new tools for improving tissue regeneration.

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Actually, what we saw was the ability of this modulated magnetic field to prime the expressional genes that trigger and drive the differentiation of stem cells toward cardiac, neuronal, and skeletal muscle, as shown here.

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And also, specific target, neural and skeletal muscle proteins were [indiscernible] by exposure to this REAC technology. And when we give a look by confocal microscopy at the induction level, we could detect the expression of specific neural microprotein or skeletal muscle microprotein or specific cardiac-related microproteins that specify the acquirement of a terminally differentiation state.

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And you can see here the huge difference in the number of spontaneously beating cardiomyocytes that we can achieve after treatment in the presence of REAC compared to the untreated [indiscernible] stem cells. As you can see here, the difference is very huge not only in terms of the number of cells, but even the quality of contraction is completely different.

Once again, I have no chance here to show the movie of these beating cells, but they do create a sort of pacemaker activity in the tissue culture and also a specific wave loop form of contraction that very closely resembles what is going on in a real heart.

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Dr. McCraty: So, in other words, the cells that spontaneously start to beat in the culture and group together, kind of like what happens in a real heart? Is that . . .

Dr. Ventura: Yeah. It's a system that is quite good in term of basic science since it somehow recapitulates what's going on in the embryogenesis in the animal species, including humans.

Then we moved on to human adult stem cells. See, as I said before, these cells are mainly actually used even in humans for regenerative medicine purposes. So, as I said, these adult cells are mainly the basis for the future efforts in cell therapy. And we wanted to know whether the exposure of these cells to the REAC-modulated magnetic fields may trigger the differentiation on these cells, that as I said, are not able to complete a program of cardiac,

neuronal, skeletal muscle differentiation. They only try to behave or become something close to a real cardiac cell, but they do not complete spontaneously this kind of trajectory.

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What we use, we use another system. We started from fat tissue, lipoaspirates, that were processed in a non-enzymatic fashion throughout another technology that we named Lipogems to harvest the stem cells. And this technology was developed by Dr. Tremolada, plastic surgeon working in Italy in the Diabetes Research Institute in Miami as well. And it's important that by using this technique, once again, we used mild mechanical forces to harvest the real micro-environment where the human adult stem cells leave, which is kind of particular vascular fraction where the cells stay within the vessel wall. And these cells are not flaccid like usual metals that employ in times collagenase to isolate these cells.

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So we took advantage of this kind of preparation that is called, as I said, Lipogems. So this is the most logical --

Dr. McCraty: If I may, just to clarify there, from what I'm understanding in talking with you, this is a revolutionary thing that you're talking about because you're really able to collect stem cells from humans, their own stem cells, for future treatment back into that person from their own fat tissues, if I understand that.

Dr. Ventura: Not only collect stem cells, but even collect stem cells within their own real micro-environment. As you said, the environment is very important. And if you simply harvest stem cells by isolating these cells throughout enzymatic digestion, as it's usually done, then you will have stem cells, but you will destroy their own micro-environment, and then you will somehow unlock their self-figuring network from their epigenetics. We know now that harvesting stem cells within their own environment is equal to make a revolutionary strategy of tissue transplantation. The stem cell micro-environment is like a tissue within the tissue and it contains the stem cells.

But as you can see in this slide, by simply placing one milliliter of this micro-environment in a tissue culture medium, you can release the stem cells that can attach to the tissue culture dish and then start to proliferate [indiscernible], as shown here.

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So we decided to use this kind of approach because the Lipogems approach is, to our knowledge, the best way to deal with intact human stem cells.

Even in these circumstances, the exposure of human adult stem cells to REAC-modulated magnetic field was able to trigger the expression of a cardiogenic gene program, like from here. . .

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. . . or the expression of genes that trigger the differentiation toward a neural fate or the differentiation into skeletal muscle cell. In other words, we were able to turn human adult stem cells into embryonic-like stem cells that are able to express a kind of genes for this kind of complex differentiating pattern.

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Dr. McCraty: Carlo, I'm sorry to interrupt you, but this is what you were talking about earlier where you're able to take a cell that's become subtype and take it backwards to more of a stem cell that can be reprogrammed into the type of a cell you want it to become. Is that correct?

Dr. Ventura: Yeah, it's correct. We're still within the frame or the context of the stem cells, so we are reprogramming a multi-potent stem cell backwards to a pluripotent embryonic-like stem cell starting from a human adult cell, human adult stem cell. So this is important because we can, as shown here, transform these adult human stem cells into cardiac cells, as shown here . . .

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. . . or skeletal muscle cells or neural cell. And this was achieved by exposing a human adult stem cell to radio electric fields delivered by the REAC technology.

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And we moved a step forward, more forward. As you said before, the Nobel Prize in physiology medicine has been recently attributed to these investigators, Dr. Yamanaka and Dr. Gurdon.

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They discovered that by delivering a few genes, three to four genes by viral vectors into human adult fibroblasts which are not stem cells, these are adult somatic cells, these cells to be transformed backward into embryonic-like state. So they were speaking about induction of pluripotent stem cells, as you see here.

So this was a revolutionary discovery not only because this says, once again, that the environment is so important because these genes that were introduced into the adult somatic cells were encoding for proteins whose role was mainly to change the shape of DNA. So by changing the shape of DNA, by changing the epigenetics, once again, you can set the clock backward in an adult somatic cell to become an embryonic live cell. So the idea was also to work with fibroblasts and with cells that are located within the scar tissue to eventually use the scarring tissue to rescue a damaged organ, which is a totally revolutionary idea.

Unfortunately, this kind of approach was afforded by the use of viral vectors that were modified HIV, so their use is not readily envisionable in humans due to the risky side effects. Moreover, these cells were -- these reprogrammed cells were somehow frozen into an embryonic-like state with a very, very low yield of subsequent redifferentiation into, let's say, a cardiac, neuronal, or any other important subtype. So the contribution to the issue of regenerative medicine or future therapy approaches in humans was just an expectation, a big expectation at the beginning.

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What we did is to expose human adult fibroblasts taken from human skin to the radio electric fields conveyed by the REAC technology. And we were able to show that these cells were directly transformed into cardiac, neuronal, or skeletal muscle cells simply with a physical energy without the use of viral vector or synthetic chemistry.

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This slide just shows you, to cut a long story short, that the exposure of the cells, these human adult somatic non-stem cells to the REAC field was not affecting the cell viability or the survivability of cells.

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But the exposure to the radio electric fields was able to, once again, drive the expression of genes that commit these cells to a cardiac lineage or drive the expression of genes that specify the differentiation into cardiac myocytes or --

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Dr. McCraty: If I may, I'm going to back up just one thing, what you were saying there, because I think it's an important thing. And I didn't really understand this until we had more chance to talk in private at your lab when I was visiting you, but the significance here, as I understood it, Carlo, is that like, say, in somebody who's had a heart attack and they have a lot of scar tissue on the heart, that you turn that scar tissue back into a functional heart muscle. Am I saying that correctly?

Dr. Ventura: Correct. Not only heart muscle, but as the case here, we were able to drive the expression of neural genes or skeletal muscle genes. And any damaged organ is a scar. So the brain is a scar, the skeletal muscle is a scar; the pancreas is a scar in a diabetic subject, and so on and so forth. So the idea is to consider the scar tissue as a kind of aberrant attempt of the organism to repair, to rescue, but without completion. And by this kind of exposure to modulated magnetic field, we may eventually make this kind of effort natural, endogenous effort complete, complete to the rescue.

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Importantly, this kind of modulated magnetic field delivered through the REAC technology, we're able to time-dependently regulate the expression of genes involved in the reprogramming of the skin fibroblasts cells into pluripotent cells. All the genes that you see here were the genes that Yamanaka was able to induce in human skin fibroblasts with viral vectors. We were able to do this simply with physical energy without any risk related to the use of viral vectors.

Dr. McCraty: Just slow down for a second here. And by "physical energy," do you really mean the magnetic fields?

Dr. Ventura: Absolutely magnetic field. And more than this, as you see on this slide, these genes were first up-regulated on the right side of the graph and then down-regulated. This is very important because we now know that in order to achieve a high yield of subsequent differentiation of these reprogrammed cells, the same genes that were triggered to achieve this kind of reprogramming must be shut down in order to allow significant terminal differentiation.

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And as you can see here, we were able to obtain a huge amount of cardiac cell, skeletal muscle cells and neural cells starting from a non-stem human adult cell that was exposed to the modulated magnetic field. And it's very important because in the Yamanaka experiments, the final yield of this commitment is below one percent, even lower. Here, as you can see, we have a huge amount of terminally differentiated cells, usually between 15 or 20% for each lineage. That means that we only left maybe 15,-20% of non-differentiated cells.

Now, another important point is that the non-differentiated cells that we can leave with this kind of technique were simply human fibroblasts. No embryonic stem cell anymore. This is important because otherwise having a huge amount of non-differentiated embryonic live cells is a tumorigenic risk. So, once again, this kind of strategy using a magnetic field to talk to the stem cell epigenetics is more safe than the usual way of delivering a gene by a viral vector or using chemistry to modulate the gene expression because, in these last cases, you're not inviting a tumorigenic risk.

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I don't know if I make this point clear, but there is another possibility to reprogram a cell with physical energy, not only by using magnetic field, but even with sound vibration.

Before going further in this discussion, I also would like to remind that our results are also in keeping with the use of radiofrequency waves, with the one that we applied that corresponds to a kind of harmonic, of a therapeutic matter, that Dieter Broers has developed within Free University in Berlin, in Germany. We also intend to cooperate within neutral projects in the future. Dieter Broers is currently investigating also the relationship between the cosmic and the terrestic [phonetic] electromagnetic fields and their effects on the state of mood and

consciousness [indiscernible]. And this is also what it turns out in his field of solar revolution and his book.

So, once again, we've talked about a huge environment, which is the cosmic or the terrestic electromagnetic field that can conceivably affect our behavior, our mind, our consciousness, and as a consequence of that, it may also interact with epigenetics and DNA. And this is, once again, what we would like to explore together with you, Rollin, and [indiscernible].

Now, another issue that makes the whole of physical energy and the environment even more consistent in terms of the potential of affecting a cell, reprogramming an epigenetic, is the vibration, the acoustic vibration, the sound vibration.

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Here, once again, I don't have a movie running, but if we look at cells, even in structure, what we call the cyto and nucleus [indiscernible] which is made by fibers and [indiscernible], we will never see something static but something really vibrating. It's a continuous vibration with specific frequencies in our mindset.

And also, within the nucleus, you can see here, within the nucleus of cells, you can see here with this kind of scaffold, which is not static. It's continuously vibrating and remodeling. And you have to imagine that the DNA cells [indiscernible] within this scaffold. So all the world of cells is vibrating, and it is vibrating in resonance with the [indiscernible] matrix as well. So it's a world of continuous vibration.

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And this kind of vibration can also be perceived by specific [indiscernible], like the Atomic Force Microscopy, AFM, which can also detect the nano-mechanical vibration factors that is arising from cells. And by working with dear friend of mine, James Gimzewski, worldwide-known physicist at the University of California . . .

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. . . we are now collaborating on the issue that there may be a sort of nano-mechanical signature during stem cell development and patterning. The work that Gimzewski and we have done also provides evidence that cells can emit specific vibrational patterns that can be recorded by the Atomic Force Microscopy as sound. Here is an example of the sound that is emitted at different temperatures by a single cell, so you can actually -- I hope you can hear the sound of a single cell at 22 centigrade.

[Sound]

Or -- well, sorry. Can... Well, it's not working, unfortunately.

Dr. McCraty: We heard the first one okay.

Dr. Ventura: Yeah. I hope this one -- let me check again.

Dr. McCraty: Yeah.

[Sound]

Dr. Ventura: Okay, this is 26.

[Sound]

Dr. Ventura: Thirty, 30 centigrade. And this is simply cue the cell with the tip of the microscope.

[Sound]

Dr. Ventura: It's not the sound. It's not a harmonic vibration anymore.

Dr. McCraty: Yes, it's static.

Dr. Ventura: Yeah. So our idea was just to record the sound that is emitted from a stem cell that is undergoing a specific differentiation, let's say, cardiac differentiation. You see whether the sound may be somehow different from a sound that is emitted from a cell that is taking another route by neural or skeletal muscle or whatever. And our first line of evidence is positive. Of course, this is the kind of work which is still going on, and we are currently investigating the effect of the sound of the heart that was recorded by a worldwide famous jazz musician, [indiscernible], who lives in New York and apply this kind of sound to stem cells to see whether we may eventually turn on specific route of commitment from these cells.

So it's totally new area of inquiry, the idea of using the nano-mechanical vibration to drive a specific differentiation or cell reprogramming. But, once again, it tells us about the importance of the epigenetics and the shape of DNA.

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Dr. McCraty: Before you go on, if I may, I just want to kind of slow-frame a little bit and let people -- you just showed this and actually played, because we always hear about how the cells are vibrating and this and that, but what you just did is actually literally recorded the vibrations of cells using advanced technology and we just heard the sounds that cells make and how the pitch of the frequency of the cell, the vibration of the cell is changing as you change the environment around the cell, if I understand this right. Is that correct?

Dr. Ventura: It's correct, it's correct.

Dr. McCraty: It is amazing. I just wanted for people to really understand what you just told us, and this is probably the first time that anybody's ever actually heard a recorded sound that the cells are actually vibrating at.

Dr. Ventura: Yeah, and also you have to imagine that the so-called cardiogenesis, the framework, yeah, of cardiac differentiation is the first morphogenetic event occurring in any species, rodents, amphibians, primates, and human as well. And it's amazing that the heart is first to vibrate, the primordial heart starts to beat, so it must emit somehow the sound. And also, it's intriguing that due to this continuous beating; there must be some radio electric current and magnetic field as well. So, once again, sound and the magnetic field of vibration and the magnetic field or an electric current may work together to establish what we call "information" or a morphogenetic field, which is driving the fate of our organs.

And, once again, it's so important the work that you're doing on the coherence state, on the heart rate variability, and the possibility to enhance the consciousness in the coherent state because, once again, this is not simply environment in generic terms, but it may be the environment that talks to our DNA and it changes the features of DNA and eventually may give us a further chance to use, practice to achieve a coherent state, to also achieve maybe in the future self-healing processes in our body. We will see. This is, I think, very, very important for the future.

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And here is a dark image of what DNA looks like when it is visualized by Atomic Force Microscopy. You see this little dark spot here indicated by an arrow, this is a transcription factor. A transcription factor is a protein that somehow changes the confirmation of DNA. And it is crucial for driving the function, what we call the expression of our genes.

Now, as you can see here, every time a transcription factor interacts with the DNA, it creates this kind of loops, and we can measure the strength of this loop, the vibration of this loop, as shown here. So, once again, these loops or domains are not static. They are dynamically remodeling themselves. They are vibrating, so they kind of make eventually a cell which is so subtle that we cannot detect so far.

But what's important to stress here is that what we call a gene may be just this tiny part of this structure. The rest is just architecture. It's just epigenetics. And all these loops are epigenetics. These loops do not contain any coding sequence, any gene. The gene is just a small, minimal part of the structure. So it works just because of this shape, because of this dynamic architecture, and this is the environment of the gene. This is above the gene, as I said, and this is epigenetics.

Now, we can talk to this epigenetics by magnetic field, by energy, and by changing the environment.

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Another important step is the fact that water is maybe really crucial for our internal dynamics. We have to imagine that 77% of our weight is made by water. And if we count the number of molecules, water is about 98 to 99% of all the molecules in the body. And so it has a crucial role in the cells. And it's also important to stress that when we talk about water within cells, this water is not water like the bulk water, but it's water somehow bound to a surface. And we have many surfaces within the cells where water molecules can bind to. Just think about the cellular membranes that [indiscernible], the nuclear envelope, the cytoskeletal microtubule, the DNA cells, all the proteins that make a contraction. These are all hydrated molecules, so they are tightly bound with water. And the water that is bound to these molecules, it can be considered as coherent water. What does that mean? When we say "water," we can imagine as short-range [indiscernible], which is the H2O molecule, as we all know. But we can also figure out an ensemble of water molecules can somehow pulse and dance at the unison within a given environment where these molecules are bound, a protein of the cell, tubules, or scaffold within a cell. So we talk about coherent water because this water somehow can be visualized as a long-range evident ensemble of molecules.

Now, a fascinating [indiscernible] was provided by the group of Emilio Del Giudice and Alberto Tedeschi that we're talking about this coherent water for since many years. And later on, the Nobel Prize, Luc Montagnier, came up with this paper in the *Journal of Physics*, talking about DNA waves and water. So, basically, it's like saying that water can be signalized non-locally with kind of biological information to generate coherent domains capable of transferring information.

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So what they did is a simple crucial experiment. They took a cube containing a DNA molecule from a bacterium. They put this tube into a coil, so they exposed the DNA within tube to a magnetic field that was close to the [indiscernible] resonance of 7.80 GHz . And upon a specific DNA dilution, when it was very diluted, they could observe the emission of an electromagnetic signal from the water containing this diluted DNA.

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What was totally amazing is that when they put another tube above to the previous one just containing water and nothing else, also the second tube started to emit an electromagnetic signal after 18 to 24 hours of exposure. And when they put all the building blocks that are needed to create a new DNA strand molecule, they were able to come up with the same original DNA sequences. So it means that somehow water nano-structures and their electromagnetic resonance can faithfully maintain and propagate DNA information. And, once again, a major role of a magnetic field is highlighted, because if the system is somehow shorted by [indiscernible], the [indiscernible] cannot be reproduced anymore.

[Slide change]

So, basically, I hope to have given you the idea that the cell can be a very dynamic, flexible entity. The DNA is important, but the information is not simply stored within our genes, but it is stored also in the shape and the architecture and that such architecture is somehow -- can talk with the environment, it is part of the environment, and its signaling may also be featured in a kind of non-local [indiscernible], and this, I think, the last frontier to be developed and to work with, which is trying to understand this new [indiscernible] of quantum non-locality singularly.

And I would like to conclude my presentation with a few sentences that I was sharing with James Gimzewski. This slide says in both the philosophical and the visual sense, "seeing is believing" does not apply to nano-technology. We may say to any extreme analogies within quantum physics or molecular biology, for there is nothing even remotely visible. And on the atomic and molecular scale, when we go deeper and deeper, data are recorded by sensing and probing in a very abstract manner, which requires complex and approximate interpretation. And more than in any other science fantasy, the creativity, the curiosity, and the ability to come up with a story of information becomes necessary to describe what is the sense and the not seen.

And, once again, probing and sensing may be a new route which we may enhance our coherent state and change our environment and our DNA. So information is, once again, the essence of life, and it's part of the DNA coding in the sense that we have, once again, to consider the epigenetics and the environment.

And based on this, also our institute, the Visual Institute of Developmental Sciences that I have the honor to chair in Italy, is based on this view. This comes from the Sanskrit "Vid/Veda" that means perceiving things through different eyes. And also the Visual Institute of Developmental Sciences, our effort to work within the field of continuous remodeling and transformation, hoping that the science is -- it's not going to be an envelope anymore, but it's going to be something developmentally connected with our consciousness, with our heart.

[Slide change]

And I would like to thank you and thank everybody for joining us and all the people that have contributed to this data. First of all, I would like to thank, once again, Rollin McCraty and the Institute of HeartMath. I would like to thank all my co-workers at the National Institute of Biostructures and Biosystems, the VID Laboratory of Molecular Biology and Stem Cell Engineering; the Rinaldi-Fontani Institute, Salvatore Rinaldi and Vania Fontani who were the inventors of REAC technology; people working the Department of Biomedical Sciences at the University of Sassari, the quantum physicists that helped us in formulating -- I call this as interpretation of data, especially in the context of quantum [indiscernible] signaling; the Department of Chemistry and Biochemistry, UCLA, California, Los Angeles, Dr. James Gimzewski. And I would like to thank Dr. Abdullah Alabdulgader, the Prince Sultan Cardiac Center in Saudi Arabia. He's doing fantastic work in collaboration with Rollin McCraty on just on the effects of cosmic and terrestic electromagnetic field. And this is going to be, for sure, a wonderful opportunity for future collaboration. And the Cell Transplant Center and the

Diabetes Research Institute and WorldWide DRI Federation and Miller School of Medicine in Miami, Camillo Ricardi and Carla Tremolada, I would like to remind, is the inventor of the Lipogems device that provided us with so nice human adult stem cells. And, once again, thank you for inviting us.

Dr. McCraty: So, Carlo, what a wonderful presentation. Maybe take a couple of minutes here, because I think part of what I know you and I talked about in our collaboration, just to help give people a perspective here, I think it's been absolutely proven now that epigenetics is very real in many labs, not just yours. And some of the, I think, very important findings we were talking about this before the webinar started, for example, that's been done at UCLA, Steven Cole, people like this, that have shown that in early childhood, adverse environment, a lot of stress and things like this, that leads to epigenetic changes that are with that -- as the child grows, that they're with them for a lifetime and that basically those type of changes are down regulating all the processes in our body that underlie our ability to have strong immune systems and increasing the process that create inflammation. So this has finally given the link, the understanding to why early childhood trauma, for example, can cause many, many problems later in life that we're even starting to see in heart rate variability recordings and things like this that show up in specific ways.

So that's, I think, pretty well established now for those that really understand what the state-of-the-art is, but what we're suggesting here is, that it's not just bad things.

Dr. Ventura: Yeah, we can do the reverse.

Dr. McCraty: Exactly, and as we become more coherent in our language, we're changing the energetic information in our system. This is what we hope to prove in our collaborations, that that also leads to epigenetic changes that sort of open the DNA to express new things and --

Dr. Ventura: I'm sure that this will happen. I'm sure, because in many issues, we're facing reverse remodeling. So the story can go both ways. And we can do the good things and the reverse of the effects of the bad environment. We can create a new environment, a positive environment, an environment where we can increase our consciousness and people can practice to achieve this. And I think our goal is going to be just to prove that we can go down and down, up to the molecular and quantum signaling level.

Dr. McCraty: Absolutely. Could you go back a couple of slides in your presentation? Just one more thing I'd like to just click on a little bit.

[Slide change]

That right there. So this is a rather profound experiment that you described. I know you went through it quickly, but I think in the original papers they even use the word "teletransportation DNA," if I remember correctly.

Dr. Ventura: Yeah, yeah.

Dr. McCraty: Yeah, this is profound, what you've said, where they had DNA in one test tube and just later a test tube with just water in it started vibrating with the same signature of the first test tube, and then when they added the -- just the components of DNA, not DNA in any way, shape, or form, just the molecular substrate that DNA formed that almost exactly duplicated the DNA in the first test tube. Is that correct?

Dr. Ventura: That's correct.

Dr. McCraty: That's rather profound when you think about it. And what I think it's illustrating, at least from one perspective, that ties into some of our other work with the Global Coherence Initiative is that the magnetic fields, and it's interesting they used exactly the same frequency of magnetic field that the earth is vibrating at as the carrier of that biologically relevant information that caused that teletransportation. Am I making sense?

Dr. Ventura: I absolutely agree, yeah. Makes lots of sense.

Dr. McCraty: So in a kind of an abstract way, it adds support to what we're saying on the Global Coherence Initiative work, that the earth's field acts as a carrier wave that connects us all. Right?

Dr. Ventura: And also, it raises the issue of non-local signaling, which is also very important.

Dr. McCraty: Exactly, exactly. So I think this is relevant. And you also mentioned earlier Dieter Broer's work, who we're also collaborating with. This is a subject very close to his heart, of course, who believes that the earth's energetic environment that we were talking about briefly here is important in modern days of helping expand consciousness, the changes that are going on. And I just wanted to mention that Dieter does have a wonderful DVD, a movie that he made called *Solar Revolution* and which you also mentioned. We have a relationship with Dieter where we're actually supplying -- giving those DVDs away for anybody who actually wants to help donate or fund to the Institute of HeartMath, can get a free DVD to help support the kind of -- the very kind of work we're talking about here and this kind of research that a current fundraising campaign that I know our institute is doing. So it all ties together.

Dr. Ventura: Wonderful, wonderful.

Dr. McCraty: So any last comments you want to make, parting comments?

Dr. Ventura: No. I'm fine, I'm fine. Thank you.

Dr. McCraty: Thank you. Thank you so much. I know it's late in the evening for you over in Italy, and very much appreciate your taking the time out of your very busy day and evening away from your wife. I know you're getting ready to have another child in the near future, to do this with us. And I did have the pleasure, and it truly was a pleasure, to spend a couple of days with Carlo at his lab, absolutely fascinating lab. I was really surprised to go in and realize

that your lab is in a building built in the 1400s, was it, with all the paintings on the ceiling and the walls that date back to the 1400s. It's just really is a very neat environment that you have to work in.

Thanks again, Carlo, and very much appreciate it.

Dr. Ventura: Thank you. Thank you very much. Thanks a lot.

Dr. McCraty: You have a great evening.

Dr. Ventura: You too, you too. Bye-bye.

[End]

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