

Quantum Violin —Diana Beresford-Kroeger in Conversation with Kika Thorne



From a single pot on the patio to guerrilla actions on the roadside commons, from backyards to national parks, scientist and author Diana Beresford-Kroeger's proposal "The Bioplan," developed in *A Garden for Life* and *The Global Forest*, lends us a scalar approach for assisting the ecosystems within which we live. Her training in classical botany, molecular biology, mathematics, and medical biochemistry forge a type of "consilience," Edward O. Wilson's term for the unity of knowledge. Her book *Arboretum America* reveals the medicinal capacities of key tree species and their relationships with the plant, animal, and fungi communities that trade with them. Beresford-Kroeger's capacity to witness the flows of chemical exchange beyond instrumentality can be credited, at least in part, to her early training as the child of Druids, an ancestral line of Irish scientists. Among the many attributes of this secret knowledge, she credits the Druids with teaching her how to love. It is this *gnosis* that fuels her quantum slide across the borders of disciplinary science, as she draws on Indigenous, Druidic, and shamanistic ways of knowing. She has parsed time-honoured observations—what many call "folklore"—though contemporary research found in *Nature*, *The American Heart Journal*, and her private research gardens.

Scapegoat asked me to meet with Diana Beresford-Kroeger because my practice—listening to the oak and walnut, the nettle and dandelion—is filtered through sleep, and the just-waking, to produce forms both tensile and magnetic, geometries akin to the pictograms of chemistry.¹

Kika Thorne The way your work weaves together the disciplines is almost pre-modern, although you often return to certain contemporary terms, such as “quantum change,” which is certainly not commonly associated with botany. Could you let us in on this promiscuity?

Diana Beresford-Kroeger My interest is in chemistry, and in particular what is known as the “chiral” structure of chemistry.² Within quantum physics—and let’s leap between quantum physics and organic chemistry—we have, within the scientific community, knowledge of three-dimensional structures, of enzymes and amino acids, and proteins. I see and understand the geometric form, and geometric positioning, in a sense the architecture of the cell, and each cell in its communication with another cell, and this cell in communication with the skies and the earth. I see it all as a form of architecture.

Let us take, for example, the hydroxyl group, which has an oxygen and hydrogen tail. It is soluble in water systems, and is possibly one of the most important chemical structures within the living world. It is a substructure of water, sugars, and amino acids, which means it has the structural stability to build cell walls. All of these things with oxygen tails can become soluble, in water, in the soil, and in the sky. So, they are crucial for agriculture! It’s important to have the architecture of the chemistry straight in your mind because then you understand everything down to an atomic level. And when you get a very clear picture of what is happening, you can easily visualize pollutants: they are foreign compounds, sometimes having no ability to read into that hydroxyl group, and therefore run into our nervous tissue and become neural toxins.

The idea of chiral structure relates to the idea of molecules with many sets of interactive tails. It is the capacity of these tails to react with other molecules that allows the material from trees—the aerosol molecules from trees—to float in the air, get caught with the water vapour, and act as a seeding system for the atmosphere. This is how weather is born!

So when I talk about quantum physics, and when I talk about quantum activities,

I am talking on the molecular level. The first Western artist that came into this conversation is Bertram Brooker; he showed the molecular structure of crystals in his art, and if you want to look even further, the molecular structure of some protein-type interfaces. When you look into it, you see multi-dimensions. This is what we are finding in physics now, that the electron can go to the right or it can go to the left, and if you are thinking of electron movement and valence structure, and valence movement, when you look into the valence torque of electrons, you can see Bertram Brooker’s paintings. So the artist was ahead of our physics—the hunch of the artist *feeds* the hunch of the scientist.

KT You use the term “quantum change” to describe the action of the flavonoid *quercetin*, when the oak absorbs the high energy of the light spectrum and resonates an excess.

DBK In North America, we have a unique situation. On the whole green mattress of Gaia, if you want to think about it that way, America, both North and South, has a long, long face. It has the unique ability to pick up 20 per cent more solar exposure than any other place in the world, and by solar exposure I mean that it has 20 per cent more ability to pull light out of the air. So we have a simplistic situation going on: we have the living earth, which is Gaia, our earth, Mother Nature. And, in Mother Nature, we have a long streak of a teardrop, which is the continental surface. The sun produces these massive flares, and the flares for us are something which are life-giving. They are called photons, and one photon coming from the sun would be about equivalent to one electron of energy on earth. The photons come in a straight line from the sun, but they also come in the form of a wave—a sine wave (sinusoid). Einstein thought that he understood the straight line running from the sun, but he could never fathom the sine-wave movement. The sine wave is the wave of the sea: just think of a sea, an ordinary, choppy little sea. That photon comes from the choppy little sea of the sun, down to earth.

Well, we have a set of circumstances on earth that is totally unique. In the evo-

lution of 400 or 500 million years, the earth in its great knowledge managed to produce a thing called a tree, and out of this system evolved an oak tree. The greatest number of oak trees in the whole of the world exists in North America. Oak trees are extraordinarily smart creatures; they have a genome which is greater than you or I, probably even greater than Einstein, but who knows? The oak tree, *quercus*, has over time done something extraordinary—it has evolved two compounds called *quercitrin* and *quercetin*, which are known as aromatic compounds. They are five-ring structural compounds that live in the skin of the tree, called the cambium layer. (I believe the skin of the tree is not the skin of the tree; the skin of the tree is equivalent to your brain matter. This is complex cambium tissue.)

So *quercetin* and *quercitrin* live there in skin of the tree. And the tree faces the sun, the tree lives by the sun. The tree has a set of leaves, and the leaves move by means of petioles, and they wave toward the sun because that tree is harvesting photons, from morning to night. The tree is in a system harvesting the energy from the sun for the world, turning that energy into thermodynamics, a form of energy we call food.

So the tree takes the photons, in the presence of carbon dioxide, splits the carbon dioxide into water and a little bit of oxygen, and gobbles up the carbon, and makes even more muscles, more sclerenchyma, more tissue, growing year by year, spring by spring, summer by summer, into something bigger, from carbon out of the atmosphere.

What happens is this unique turn of the tides—the photon comes out of the sun and goes into the chloroplast, and the chloroplast contains chlorophyll, it tick-tocks with time and pulls that carbon into itself and then it manufactures these two unique chemicals, *quercitrin* and *quercetin*. The tree, in order to survive in North America, has to manage an over-exposure to the solar conditions. So, what the tree manages to do is to make this series of aromatic compounds; what it does is pull all the excess electrons into itself; it swings the electrons out of the sun, and out of the tree, and into a form of electron known as a “pi” electron. The pi electron bumps around the ring-form

structure of *quercetin* and *quercitrin*, just long enough to form a cascade and jump that electron into the life of the tree. And there is your quantum change. It will pull it out by van der Waals forces; it will pull it out by other forces, into the life-body of the tree.

In other words, the tree has its face toward the sun, but it is using the *quercitrin* and *quercetin* it produces as a form of sunscreen. Just as if you are exposed, you put on para-aminobenzoic acid or something like that. It’s a similar compound: it mops up the spare electrons and rushes them off your skin. The tree does the same thing, but it feeds off those electrons and it takes those electrons and puts them into other places where it needs them.

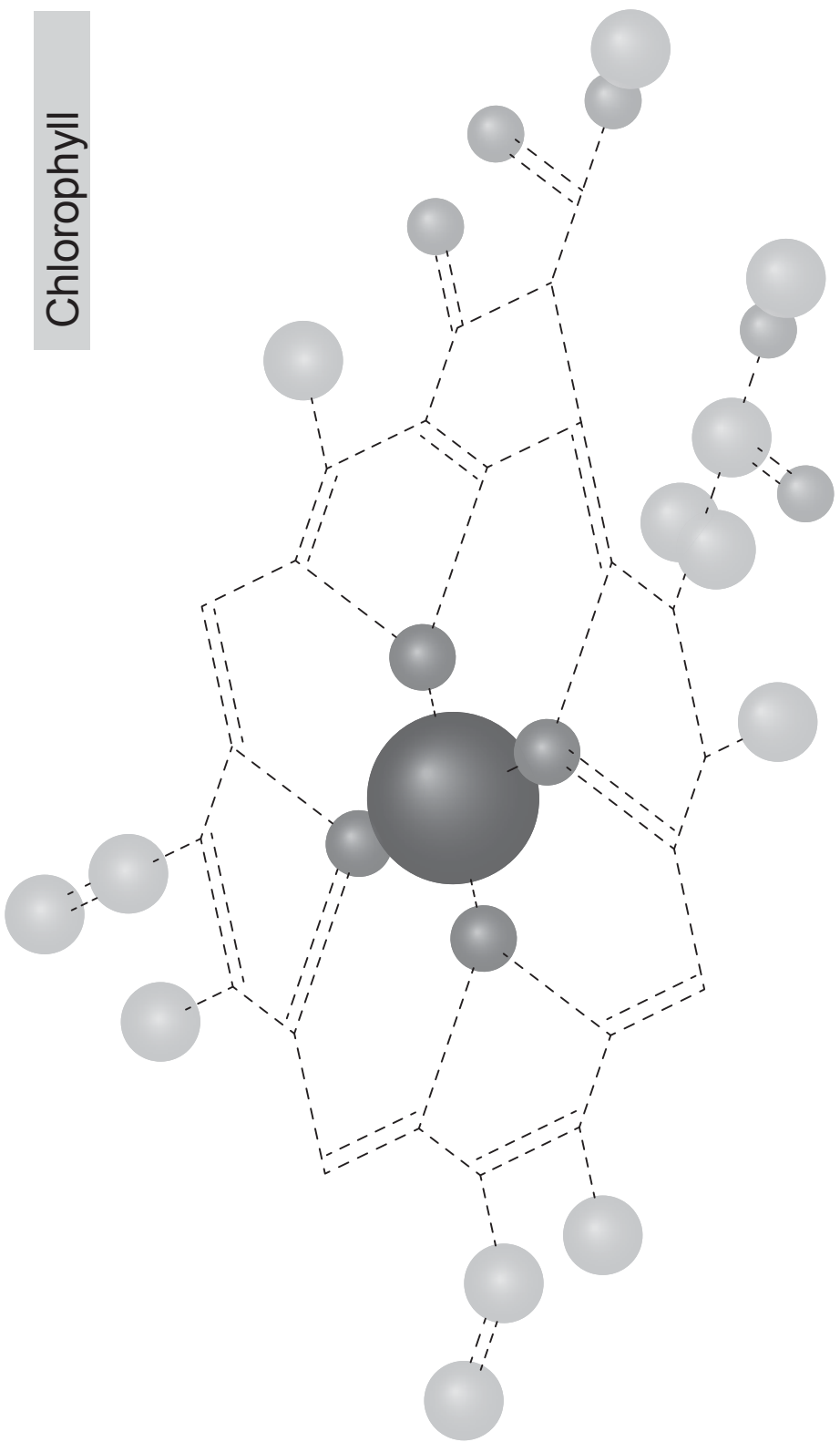
KT One of the actants in this narrative is the chloroplast, and its chlorophyll... can we follow the chlorophyll? I’d like to understand its architectonics.

DBK The structure of the chloroplast is based on genetic material that is provided by the genome of the tree. Your human genome holds the knowledge to produce haemoglobin, and the genome of the tree holds the knowledge to produce chlorophyll. They are almost identical. In your blood, you have four porphyrin structures that are holding all kinds of other bits and pieces around them, making them soluble. But the four porphyrin structures hold a molecule of iron, which is capable of going into two or three quantum states. In other words, it can look like you, or it can look like your shadow—and you tick-tock, you into your shadow. Now, in the tree, you have the same porphyrin structure, but at the centre of it, instead of iron, there is magnesium; the magnesium can also shift between two quantum structures, the tree or its shadow. The shadow is just as real. And it tick-tocks.

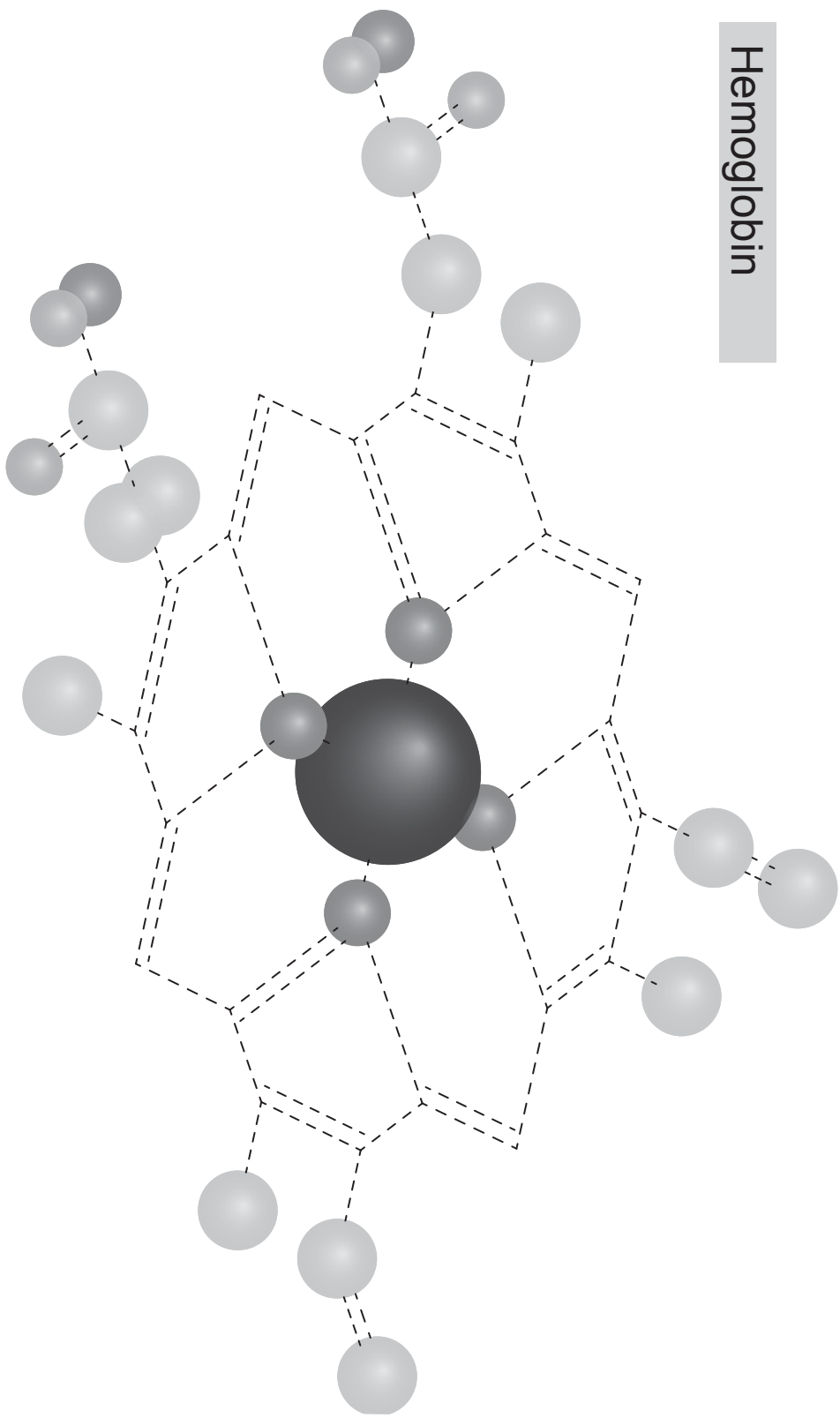
What you have in the haemoglobin is the presence of an electron; only one electron in blood will cause it to shift its valences. In the tree, in the chlorophyll, there is a photon, equivalent to an electron, and it too will shift valences.

That molecule, it’s a beautiful flat plane, like a gorgeous solitary ring—in the centre is the metal. And, the metal there,

Chlorophyll



Hemoglobin



that single atom, governs everything on the planet. That metal is the most extraordinary thing in the world for the tree, and the most extraordinary thing in the world for all mammals, all creatures, all butterflies, all birds. It harvests electrons for you, it harvests electrons out of your food, and your food depends on trees, and for the tree it harvests the sun. What I am saying is that the tree can survive without you, but you cannot survive without the tree.

KT Can you talk about the moment when the chlorophyll comes into contact with the haemoglobin? What happens?

DBK Within the chloroplast, you have this wonderful, flat planar molecule called chlorophyll, the magnesium in the centre, the pyrrole ring structures, the four of them around it. And this is what Einstein simply did not know; he did not know the implications of the photonic energy that came in this wonderful sine wave all the way down from the sun, all the way to this flat planar structure of the chloroplast. And it jumped and it jumped and it jumped, because it hits it, it hits that flat planar structure, and so it makes contact, because it has a very narrow plane to make contact. That's called plasmonics! It's the dance of the sun on the green leaf, and it's that short dance on the chlorophyll that makes the contact. Because if it was a straight-line vector, it would be just too long; but when you have dance movement, dance movement, tick-tock, tick-tock, that is how the contact occurs.

The sun dances on the world. It is something we never see, but now we can understand it by way of quantum mechanics. It is an extraordinary thing, the most important equation of energy on earth, $E=mc^2$, happening on a leaf. And everyday you look at a leaf, every time you eat a bit of spinach...that is the life-giving force of the planet, which happens to be called a thermodynamic reaction. Because the thermodynamics, the energy force, the energy phase of that electron, that photon, is transferred into the tree. It is a very small energy, but it's like the hairs on your head. Your hair, your coiffure, looks beautiful because it consists of many millions of hairs, and the same

thing is true with the tree. The tree feeds off of these billions and quadrillions of photons to make the tree a living species. It is the most extraordinary thing that we have creatures on earth that would actually harvest the sun just like a farmer harvests his fields.

KT Then you eat the spinach...

DBK And then you eat the spinach...and it descends into your alimentary canal, down into your stomach and then we have got a whole other set of circumstances in your stomach and in your small intestines and then again in your large intestines. We happen to have a habitat, an ecology of bacteria, and so if you think you are only made up of cells, of Diana cells for me, and Kika cells for you, well, no, you've got assistants in every way possible. You have the yeast in your mouth, the right pH in your mouth for the maintenance of your yeast and the maintenance of your teeth, and all of the bacteria in the digestive juices that come out of your salivary glands. These start breaking your spinach into a bolus of matter that goes down into your intestines and then what happens is that all the different bacteria in your intestines take the first choice of what is in your food; that is probiotics, really, because it's a helping hand. They take what they need—electrons to keep them going. They produce Niacin, they produce B1, the different B bacteria, which your body actually needs. When your body calls for these vitamins, then they go across the abdominal wall. Without your intestinal flora you would not be very healthy, so then all of the spinach goes into your system and it really gets degraded, cut into carbon fragments, into oxygen fragments, into hydrogen fragments, which go up into your respiratory chain and out again as carbon dioxide.

KT So is there any moment when the chlorophyll meets the haemoglobin?

DBK Oh, the chlorophyll doesn't meet the haemoglobin. The chlorophyll is broken down in your gut by the assistant bacteria. In a lab, you can get the chlorophyll to meet the haemoglobin. That actually could happen, they could look at one another as twins and say, "My god, you look

like me." They are *doppelgängers*. But, it is really the hand of the genome, because there is no excuse in nature, nature jumps in everywhere and uses every single fragment of energy for the manufacture of everything we can ever even think about, or not think about as the case may be. This is the case with black matter, or dark matter, because we don't even know how to touch that—no matter what the Higgs Boson says—we don't even know how to imagine what dark matter is. But, if you go back to your haemoglobin and your chlorophyll, that is what makes the planet function, that is what makes us a living planet. Just those two molecules, really, those two molecules functioning efficiently within each system.

For me, it is an act of divinity; for me, it is an act of the sacred. I think the ancient people on earth had some knowledge of this. They had some observational, intuitive, instinctive knowledge coming from the art of their eye, the art of seeing. Because these people had to survive by what they observed, they were very clever in what they saw. We don't use our eyes today in the way they used their eyes. They saw and almost smelled by way of their intuition that there was something very important happening in trees, that there was something very important happening in nature, and they got close to our scientific understanding.

KT The sun dances on a leaf. There is an excess of energy, too much solar power, and on the one hand you describe the mopping up of excess electrons, but there is, on the other hand, also the release of those electrons. I am wondering if that is one of the forces, or if that is *the* force, used to manifest infrasound?

DBK The generation of infrasound comes from the size of the structure, I think. The size of it, like an elephant, and the force of movement of the tree itself... the size of the tree and its movement through air. We really don't understand. We can measure infrasound. Infrasound is used as a measurement for meteorites coming close to earth. These are very large objects. Infrasound is not absolutely understood in the sense that you are talking about. You are talking about very

low, very small energy levels of hertz, a registration.

I am just making a theory here, now: the structure of a tree is made of a giant polymeric form of carbon, and this polymeric form of carbon is a unity for the whole of the tree; the tissue is called sclerenchyma, and the sclerenchyma of the tree is equivalent to your human bone structure. It makes the tree rigid and therefore able to grow to, if necessary, about 360 feet. Sometimes the ancient trees were 400 feet tall. To hold a structure, and transport water and food from the roots up to the top of the tree would mean they may travel 600, 700, maybe 800 feet from the tip of the roots to the top leaves. Now, if you are playing a violin string, if you are playing something that has tensile strength in that polymeric structure, you get a resonance of pi electrons. You get a resonance, a movement of resonance, a connection of electron resonance, from one structure into another, and it's like music being played on a violin.

KT In each cell?

DBK No, it would be in the connection of cell to cell. Cellular structure, the *lignans*, the cell-wall structure, which gives the rigidity to the tree, is almost like a violin; it is like the tuning of a violin in its great height. And, if you think of slight movements in the sway of the canopy, then you get a tensile strength movement, as if stringing a house like a violin, stringing the house from the top of the house to the bottom, you get some tip movement against that. The mathematics is complex. I honestly don't know if this has ever been studied by physicists, but I don't really think so. It's the acoustics, the energy acoustics of the electron movement. I really don't think it has been studied. But that is what infrasound is producing. It is heard by animals, it's heard by some humans; it is felt as a very strong, dense feeling in the chest, and of course we are built like a cello, so we can receive those sounds. Dogs can, monkeys can, bees can too. Because there are many bees together and they function as one unit, thousands and thousands of bees together function as one animal, except they are all separate little animals, but

they go into that formation when they know there is danger coming. I think it's a very ancient form of the registration of trouble to all creatures on earth.

KT When humans experience this sound, do they register it as trouble?

DBK Some people feel it as oppressive, some people hear the infrasound when they attend a very large string orchestra. They actually hear the lower notes of the music, the infrasound of the music, as a heaviness in their chest. Other people describe it as a feeling of ecstasy, or an out-of-body feeling, but I honestly think we all feel that, or I think we are all *capable* of feeling it. I think that some of us block these things out. I think that children feel it very strongly. Most children are born with a knowledge of infrasound and an infrasonic connection to the world itself.

I think that children have extraordinary gifts that are dismissed by society; society makes children throw these things away, but they are probably the most valuable things we have. People who are artists have to keep them, and people who are writers like me have to train that feeling back into their body. I think that people who are working on the land get the song of the land. That long movement of the land that you hear when you are alone, there is a beat that comes off the land that you can hear—it's a sacred song of the land. I know there are people who can hear that. I think that people who are trained to listen to silence can actually hear the infrasonic tonation of everything.

KT When you spoke about the Druidic knowledge and telepathy of the trees, I wonder, are we talking about the same thing here?

DBK No...for ancient telepathy, for the ability to be telepathic, you have to train your mind into unity. You have to train your mind, to target and focus your mind on one single thing. It is the same as in Tibetan Buddhism—you have to take all your thoughts, and let's say I train all my thoughts on the chair, or all your thoughts on a god, or a pantheon of gods, or all your thoughts on some one thing. That is very, very difficult to do. To take the unity of

who you are and train it into absolute focus. A focus like on a camera! A focus as in reading. You are reading the words and the words have meaning for you, you are focusing your mind—it's the same kind of thing. And, what you do when you have that kind of telepathy, you have a great acquaintance with silence. The silence within yourself. You take the silence from around you, put it into yourself and then you focus your mind into meditation. And it is then you can hear.

KT There is the same thing in art, one can have a hunch...

DBK Aha, it's the same thing!

KT One moves toward knowledge with that hunch.

DBK One moves towards truth, and beauty is truth.

KT Let's say so, but I am going to avoid those terms, as they induce too much debate.

DBK Well, not for me they don't...

KT The hunch produces a question and one moves toward the question...

DBK You are in an out-of-state body when you are in a hunch. When you allow yourself to separate yourself from yourself, and you run with a hunch, you run with something that is outside of yourself, and you are disobeying the box which is yourself. You have jumped outside of your box and you need to have the courage to look at yourself and say, "This is my hunch." I am running with that hunch and nobody can interfere with that one thing because you are running outside of yourself, you are running outside of your capacity, who you are. And, you will find very often, if it is as strong as that, if that hunch is correct, it will bring you to a solution. It will bring you to a solution in science, in art, and in life.

KT In art, there can be a problem: if I am driven by a question and I find the solution, the energy that produces an art experience vaporizes. So, for instance, if we actually knew why

telepathy works, if we understood this connection, this capacity to communicate with plants and animals...This is a crazy question, but is that our responsibility, to maintain the mystery?

DBK When you are running with a hunch in science, it evolves into an answer, and there is immense satisfaction in it. When you are running with a hunch in writing or in art...I can talk about art because I used to paint. What happens, and it is the same as with science—the hair stands up on your arms, the hair stands up on your head, you know you are on to something. It is there, it is a gut feeling, it is there right deep in you, and when you swim, it's almost like swimming in a spiritual world, to come up to air, to come up to the answer, it is when you say, "I got it!" It all comes together, "I got it right this time." You may have had a thousand times when you were wrong and you didn't get the hunch, but you got it right this time. It is beautiful.

KT I am thinking about the conceptual artist Robert Barry. In 1969, he did a series of works about the invisible. He started off with sound waves, but he had to label them, and people got distracted by the labels. He let noble gases into the air, and the photographs of the event became the object. Finally, he made a piece called *Telepathy*, in which he sent a thought into the future. I think we just heard it! What is this phenomenon? You have said that Druidic telepathy is cultivated by the silence in you, but is there something about the hertz...Can you think it through radio dynamics, the electromagnetic frequency? Are you developing that conversation?

DBK Let me just say one thing before we continue on that question. The sacred space is in the Koran, the sacred space is in Islamic writing. You can see this wonderful featherlike writing in the Islamic buildings, on the tiles. The sacred space is there within the letters. It is Mozart being played, but in the silence between the notes. It is within the silence that you hear music within the notes. Music

makes itself heard to the ear by silence.

KT We collaborate with plants, too, to make music, whether it is the harp, pipes, guitar, or sitar. Is the tree still speaking through the instrument? What I mean to ask is, when we go out into the woods, some people can actually hear the plants...

DBK Yes, we can, they speak to us in non-verbal communication, and never forget, the plants are full of serotonin. Those are your receptors. Those are the receptors that the brain uses in the reception of sounds. The plants are full of them—serotonin, tryptophol, tryptamine—all of those compounds that make up the complexity of our neural pathways are within the plants.

KT So we are mirroring? Are we in a transmission-receiver communication system?

DBK We may very well be. I can honestly say, now I am a scientist speaking here about something that is a puzzle to me, that I don't have the answer. I do know that if you want to have a lot of serotonin tomorrow, you eat a banana. Bananas, of all fruits, have the highest serotonin levels in the world, and the banana comes from a tree. The fruit and the nuts that you are eating are very high in serotonin. Why would that be? Serotonin is also related to the gibbane structure in gibberellic acid, so there is a relationship there. And, in the gibbane structure of gibberellic acid, it is almost like a tiny violin, a molecular violin, a quantum violin; that is the compound that hears you singing to the tree. That makes elongation. I think that the trees hear the song of the earth through the gibbane structure in gibberellic acid, the universal growth hormone of the vascular world of plants. This is the compound that causes the leaf tips to elongate, and this is the hormone responsible for fruiting and seeding. That compound is very similar to your sexual hormones. Your progesterone and your estrogen are like your flat plane structures, like that chlorophyll molecule with all the little bits and bobs on it. The tree has different little bits and bobs on its sexuality, the gibbane

...Conversation with...

structure, which is very close to your estrogen and your progesterone, and your male carries the estrogen and progesterone, in different ratios, and androsteroids in different ratios, but that similarity is there, and you hear through those structures in your body.

I could give a simple example. I wrote a special piece for *Archangel* when I was doing the Somatic Cloning Project; I was asked to do very complex piece of writing in a very short period of time and I went out to my Elm tree and I sat at the base of the Elm tree and I said, "I have very little time, I have 10 minutes to get this written, to get it on air, please help me." And I sat there, I went blank, I don't know what happened. And I came in here and I had a magnificent piece of writing. I don't know where it came from.

KT Magic...

DBK But it isn't magic, it is understanding. I come from Ireland, and the Celtic people had the Druids, and the Druids were the scientists, and the scientists were people who passed their knowledge from generation to generation to generation. This is how Stonehenge came about, and Newgrange came about, and all the ancient knowledge. The trees were considered to be the sacred species on the landscape. And, each tree was given a certain symbol, and those symbols became the Ogham script, also known as the Celtic Tree Alphabet, a phonological root of Gaelic. Traces of this are found in the language we share today. ✕

Endnotes

- 1 Eds. note: *Scapegoat* is interested in how Diana Beresford-Kroeger's hybrid practice provides a model for architects and landscape architects approaching questions of excess and ecology today. We are very grateful to Diana for accepting our request for an interview and visit to her garden, and to Kika for sharing this interview with our readers and preparing the text for publication.
- 2 "Chiral" means of, or relating to, an organic molecule that is not superimposable on its mirror image; the chiral will not have an identical twin.

Images

p 65, Diana Beresford-Kroeger's drawing from Kika Thorne's notebook.
pp. 68–69, diagrams by Jared Owen Hemming

Bio

Jared Owen Hemming received a B.S. in Architecture from Washington University and an M.Arch from the University of Michigan, where his thesis focused on architecture's relationship to ecologies of the American Corn Belt and potentials for agency within that diffuse territory. Professionally, he has worked for HOK in San Francisco and Roderick James Architects in Totnes, England.