FREE FORUM with TERRENCE McNALLY - A WORLD THAT JUST MIGHT WORK

JANINE BENYUS – BIOMIMICRY: INNOVATION INSPIRED BY NATURE

Transcript – Conversation recorded 12-08-2025

TERRENCE McNALLY:
Hello, I'm Terrence McNally. Welcome to FREE FORUM: A WORLD THAT JUST MIGHT WORK. I'll be speaking today with JANINE BENYUS, biologist, author, innovation consultant, who in her 1997 book, BIOMIMICRY: Innovation Inspired by Nature, introduced a discipline that mimics nature's designs to create sustainable solutions.

On FREE FORUM, we explore the lives, the work, and the ideas of individuals that I suspect have pieces of the puzzle of a world that just might work. We look at politics, economics, environments, science, health culture - all based on the fact that I believe we can do better, and I want to find out how

The show Streams Weekly on the Progressive Voices Network on tunein.com and podcasts are available anytime, anywhere on Apple Podcasts, Spotify, most major podcast sites, and at my site, tererncemcnally.net.

After 3.8 billion years of **R&D** on this planet, failures are fossils. What surrounds us in the natural world is what has succeeded and survived. So why not learn as much as we can from what works?

I recall the first time I met today's guest in 1997 at a conference called Echo Tech, somewhere in the Bay Area, perhaps at Asilomar Conference Center, I'm not quite sure. A young naturalist from Montana had just published a book called BIOMIMICRY: Innovation Inspired by Nature.

Now I've long made clear that I do not consider myself an environmentalist, but rather that I work to move society toward a healthy relationship with the rest of nature. We are not separate. And I'd actually made a documentary back in 1973 about a Buckminster Fuller world game workshop. And though Bucky promoted man-made technological solutions, his vision and his work certainly included biomimicry, though as far as I know, the term was not yet invented.

All that is to say that I welcomed the chance to engage with these ideas and to meet Janine Benyus. We did our first episode together on Pacifica Radio in 1998. I checked back in with Janine every couple of years after that, tracking the progress of biomimicry’s use in the world, but the last time was in 2011. I've replayed and republished our early episodes from time to time over the intervening years, and I've collected a lot of info on biomimicry from many sources, including Janine's organizations.

Recently I realized it was time to reconnect and to get an update on the development and the impact of biomimicry as well as on Janine's personal journey. And I'm excited to have that conversation today.

I think one can make the case – imperfect as it may be - that we could afford not to notice or follow nature's principles or learn from its products and processes as a model for human behavior, and our production and our disposal…I think we could afford it in the age of agriculture, possibly even the first couple of centuries of industrialization, but that choice is no longer an option.

Nature - imaginative by necessity - has already solved many of the problems we're grappling with. Animals, plants, and microbes are the consummate engineers. They found what works, what is appropriate, and, most important, what lasts here on earth.

I wrote in 2008 introducing one of our conversations, "Something I learned from Janine is that in order to make things, humans usually beat, heat, or treat. That is, we either use intense pressure, intense heat, or powerful solvents to produce the chemical and physical reactions in our manufacturing processes. And it's usually to pressure, the heat, and the chemicals that produce the pollution. But nature seldom uses any of the three. So what if we could produce ceramics the way an abalone does, or cables the way a spider spins webs, or filter wastes the way so many creatures do?

Janine states it clearly: The more our world functions like the natural world, the more likely we are to endure on this home that is ours, but not ours alone."

JANINE BENYUS, as I said, is a biologist, innovation consultant, and author of at least eight books. She's evolved the practice of biomimicry consulting with sustainable business, academic, and government leaders. She co-founded the Biomimicry Guild, Biomimicry 3.8, the bio-inspired consultancy, and the Biomimicry Institute, as well as the web portal, asknature.org - all of this to further the work of biomimicry.

Welcome again, JANINE BENYUS to Free Forum: A World That Just Might Work.

JANINE BENYUS:
Thank you, Terrence. It's good to be with you again.

McNally:
Yeah, it's crazy. As I said before we went on air, it's crazy that 14 years have elapsed. Let me tell **listeners**, we're recording this conversation Monday, December 8th.

And, as you may recall, I like listeners to get a feel for the people, not just the work and the ideas we talk about. So I'm sure I asked this question in those earlier conversations - for you to tell us briefly how you see your path to the work you do today. And I assume, with time's passage, your perspective may have changed, so

please do so again, and feel free to go way back. Moments of inspiration, mentors, turning points, those sorts of things.

Benyus:
I have been on this journey for so long, Terrence. I was that little girl in the grass watching ants. I literally have always had this incredible fascination with the natural world, and watching it, over long, long periods of time. I grew up in New Jersey, so it wasn't like there was a wilderness, but there was a micro wilderness out back.

McNally:
It is the garden state.

Benyus:
Yeah. I first started in Cherry Hill when there were cherry trees, and now I go back and there's 12 lanes of traffic. But there was a ravine that was an oak hickory forest. It was just gorgeous, broadleaf temperate, with a little stream running through it, which was orange at times - which I realize now was probably toxic, but… And there was a meadow beyond there, and I knew all the organisms there, and I knew what they did all year long.

And so those naturalist roots led me to believe that, if we knew how amazing life was - because I was seeing it with my own eyes. No matter what kind of spring we had, life burst forth. And no matter how hard the winters were, it was unbelievable what I saw happening before my eyes.

And I thought, "Well, if people could see this and understand it, their respect for the rest of the natural world would rise so much - as mine has, even as a little kid - that right behavior would not have to be legislated. It would come out of that changed relationship with the rest of the natural world, and I think you and I have that in common, that belief.

I had written a lot of natural history books. BIOMIMICRY was my sixth book. I had wanted people to get out into the natural world. I'd written a few field guides, two with Simon and Schuster to the Eastern and Western United States, and they were field guides organized by habitat. So you'd walk into a habitat, and you would see who was there, who was evolved and adapted to that place. So I was always into adaptations. And I would get you into the mode of watching… in a cattail marsh, those denizens of that marsh, and how great they are at what they do.

So this was a long time coming, and even in college, my senior thesis… I was taking a full-on five-year forestry curricula and a full-on English literature curriculum, which is just nuts. And what I wrote about was… it was called *Man's Relationship to Nature as Seen Through the Canon of English Literature*.

McNally:
Oh, wow.

Benyus:
So I'd look at pastoral ages and transcendental… all through literature, all the way back actually to the Greeks. It was one lens, and I watched how our relationship would change, and how you'd get to the point where, in the early 1900's, as people were traveling on trains, they'd come through - when the trains were traveling by the Alps - and close the curtains so that you wouldn't see the hideous wilderness.

McNally:
Whoa.

Benyus:
Yeah, yeah. So I watched how Emerson and Thoreau and the transcendental painters,…There was this amazing romanticism and love of the natural world. And so I looked at everything. There was a time - and this is a long time ago - when there were two books that you were supposed to look at. One was the Bible, the other was the Book of Nature, because that's where you would find divinity by looking at that.

McNally:
And when you say that you were supposed to look at, this is sort of Western society's unwritten rules…

Benyus:
Yeah, Western society's unwritten rules - and not even unwritten. There was a time when the Book of Nature was something that you would look at, back when science was first starting, like 250 years ago. You were looking at nature and it was almost a sacred thing to do.

And then, all of a sudden, how do we get to the point where rich people in train cars are… the maître des are closing the windows? It's always fascinated me. And when I asked myself, after all those books… I said, who's looking at the natural world for innovations? Because these are unparalleled, incredible chemistries that are clean and friendly, and incredible physics… How is it that these starlings are murmurating all over the place? What's that about? And you watch a dolphin in the water and you got to understand there's drag reduction that's evolved for years. My first assumption was that solar cells were based on leaves.

McNally:
At what age are you beginning to ask that question? Even if you assume the answer is yes. Are we trying to learn from nature? Are we looking at its principles and its methods and so on? About at what point is that?

Benyus:
I guess I'm probably, what, 35 or something like that. I'm writing a book called Beastly Behaviors, which is a guide to animal behavior, and to get closer to these animals by understanding… It's kind of a *Berlitz Guide to Animal Behavior*. I'm writing that, but I am collecting for a book that I just know is going to be huge and important. And so I

literally am writing *Beastly* so I become a better writer, because I'm watching my file cabinet grow with these papers that I started to collect when I asked that question - are the solar cells based on leaves? And I realized they weren't. And then I found a scientific group that was studying leaves and talking to solar cell manufacturers. And that was new and that was shocking to me… that it

McNally:
…that it was new…

Benyus:
Yeah. That it was new. Right. I started collecting for the book in 1990, I guess, and then it came out in '97. So it was really a faint signal back then in the literature. I was scouring scientific papers for examples of biomimicry - There wasn't term for it…

McNally:
I was going to say that you were scouring for examples that you would label biomimicry.

Benyus:
Exactly. Yeah. I have no real keyword.

McNally:
No one had done that.

Benyus:
Right. Wes Jackson… Perennial Polycultures - agriculture mimicking the prairie. His was called Natural Systems Agriculture, looking at how organisms… They pick pharmaceutical products and heal themselves. That was called zoopharmacognosey. So they had names, but they just didn't roll off your tongue. They tripped off your tongue.

McNally:
So I'm learning a little more detail now, but as I knew, your books - this is prior to Beastly Behaviors - were, as you said, these field guides to east, west, a section of Montana, things like this. It's quite a leap for a publisher to say, "Yeah, that idea you have about biomimicry, let's do that one."

How did that happen? And did you come up with the term before you pitched the notion of writing it?

Benyus:
I did. My agent was Jeannie Hanson, who was a natural history writer kind of agent. She got it.

McNally:
She got it.

Benyus:
Yeah. But it was new. I was calling it “biomimicry” in the book and realizing I was naming this approach to design, and I wanted to call it *Echoing Nature* because I thought it was more poetic. And she went to a sales meeting, and the salesperson stood up and said, “I'd love to sell this book, but I won't unless she calls it biomimicry because she's naming a field.”

McNally:
Wow….

Benyus:
And I said, “They're the experts. I'm a writer, but they're the experts.” And how good is that that that happened, right?

McNally:
The interaction, right… The discoveries, the keeping the files, and then the professionals - not in nature or not in science, but in publishing and marketing - it becomes a collaboration.

Benyus:
Exactly. Yeah. Yeah, exactly. And everybody who saw it really had a role in lifting it up. I felt like I was lifted in a palm of people that realized what was there. Even before I did. I had no idea. I was writing my seventh book when the phone began to ring, and companies were calling saying, “Could you bring over biologists because we're inventing every day, and it's pretty awful… toxic and energy intensive - and we could use nature's help.” And so they assumed I had a company, which I did not. I did not. And they're like, “Well, can you send us students? Are you teaching?”

McNally:
You had a computer…

Benyus:
I was in my pajamas and writing my next book. So I was shocked actually. I knew it was an important book, and I basically just from behind the curtain, just threw the book out on the stage and said, “This is important. Hope you all look at it. There are some scientists who are doing this amazing work. We should emulate it, and I hope they get good research dollars from this.”

McNally:
Wow…At the point at which you and I meet in ‘97 at that conference, and the point at which you and I do our first interview - this is the birth, this is Infancy.

Benyus:
Totally. We didn't start what was then called the Biomimicry Guild, now Biomimicry 3.8… We didn't start the consultancy, Dayna Baumeister and I, until ‘98. It might've been a zygote-in-our-eyes kind of thing.

We realized that, in order to do this work - It's a field without a name. We have to train biologists. Now we have a Center at Arizona State University and the Master's course, and hundreds of students go through that. We have an undergrad course too. thousands go through that. But we said to ourselves, “We're going to have to just kind of make this happen… create the conditions for biomimicry to emerge. It seems to want to.

McNally:
I've met Dayna, I've spoken with Dayna. You were this naturalist writer who had an insight. What was Dayna up to at the time?

Benyus:
She was, believe it or not, a PhD student at the University of Montana, right up the road, about 45 minutes up the road from me in Missoula, Montana. And she was studying mutualisms and facilitation in the natural world, and working on her PhD. And she was in a class and she had just read my book, and asked the professor if he had ever heard of it. And he said, “Oh yeah, well, you know she lives down the road.”

So she left the class… She left the class, put a quarter - that's how long ago it was - put a quarter in the phone and called me. So I get this call. I'm in my pajamas working on my next book, and this woman says, “I just read your book and I shook for three days. I'm Dayna Baumeister. Yep. I'm Dayna Baumeister, and I am studying this particular habitat on the Rocky Mountain front and I feel like, if I don't do something more, it doesn't matter whether we study them, they won't be here.” She basically said, “I don't want to fiddle while Rome burns.” She said, “This is what I want to do with my life.”

McNally:
Wow.

Benyus:
I said, “What?” And she said, “Biomimicry.” And she said, “Can I come and see you?”

So she came down. I told Laura, “This young woman's coming, and she says she wants to do biomimicry for her life.” I have a whiteboard cause I’m a nerd and we need a whiteboard - and we sat in front of the pellet stove. Laura fed us.

We sat there for 14 hours and we drew on that whiteboard: What would need to happen for a biologist to be at every design table in the world - in anything we design, including decision-making and management structures, and things we design, and buildings, and cities?

And we said, “What do we need to do to have that happen?”

And we drew it as like, there's a lake up high, and that's biology and all our knowledge of the natural world. And then there's a flow structure coming down like a river to human systems design. And we have to create the flow structure because people who make our world in industrial design and processing and all, they don't take biology courses. They have no idea.

McNally:
They don't know that lake exists.

Benyus:
They don't know the lake exists. So see, it all goes back to me saying, as a little kid, “If they knew how nature worked, everything would be different.”

McNally:
But what you've just told me about Dayna and your first meeting. I mean, this is your first meeting. You sit for 14 hours and map it out. Well, you must realize how insane that sounds.

Benyus:
(Laughs) I know. Laura just kept bringing us meals. Now it's dinner. Now it's breakfast. And we were just absolutely convinced with an unshakable faith - and still are - that biomimicry would be the way everyone invents. The first thing you would do is say, “What in the natural world has already solved what I'm trying to solve?”

And we said, “Well, how do we get there?” Because that's what’s going…because she also wanted people to realize how beautiful the planet is. I mean, we share that….We just…it’s amazing…it's an amazing story, really.

McNally:
Somebody's going to do film or something on this. I've never heard it before.

Benyus:
Yes.

McNally:
And I'm so glad I asked this time because you had already said how you felt you were being carried and lifted by the agents of biomimicry that didn't know that's who they were.

Benyus:
And it totally starts with Dayna, for sure.

McNally:
It does.

Benyus:
And I was like, “I don't really like to be with people.” And she's like, “Well, alright, I'll do that part.” No, seriously. I was like, “I'm not going to go into an office. I'm a writer. Yeah, I'll run the research teams. But yeah…and this is way before, I think you saw me. Yes. Asilomar was one of the early things. I was like, “Why are people inviting me to things? Why are they inviting me to speak? I don't speak, I write.”

And Dayna was like, “I'll do it.” And so we basically realized that, in order to build out this incredible canvas that was blank right now, we would need to bring a lot of people in because we couldn't do it ourselves. And we would need to keep on giving these models as far and wide as possible.

And that our job was really to keep the integrity of the meme. We do that. Dayna was really, really good at teaching - is really good at teaching - and making design exercises for people. She is the major professor at ASU, and she said, “I'll do this,” because we have to figure out a methodology. How is biomimicry done?

McNally:
Right. What are the steps?

Benyus:
What are the steps? You're going to research in biological literature. You're going to make a taxonomy of the different mechanisms. How does life repel water without Teflon? Spoiler alert: No, Teflon.

So she said, “I'll do the verb, which is the how to do biomimicry. And you do the noun, which is what is the cultural implications? What is biomimicry? Following the field, representing it. I mean, we literally… And we've had that partnership for what, 20? How many years? Yeah, 20 years.

McNally:
Yeah, no, the secondary thing is that it isn't just that you formed that bond around that calling - which you probably didn't know was a calling, though she had an inkling it was - but that it has lasted. And I mean, it's just remarkable to think about the two of you looking back to, what was this, ‘98?

Benyus:
Yeah, ’98.

McNally:
27 years ago. That's a phenomenal story. But really to me, it says two things, Janine. One, this was a calling and that's why you were brought together and all of that. And second, I wonder how many things like this don't happen because that serendipity doesn't happen.

Benyus:
Oh my gosh. I don't know. I hate to think it's that serendipitous, but it sure felt, it felt that way. But the minute we met, we were just on a mission that we really haven't been off since then. And it's funny, we…cause now, one of the things in addition to doing product design with inventors, we also do, like I said, management design and…

McNally:
Process design.

Benyus:
Well, yeah. How would nature do a merger, say between two companies? And so we started to look into mutualisms, which are net positive, beneficial relationships and a tree and a fungus where both parties benefit

McNally:
Right.

Benyus:
And it's a net benefit. And so we've done some deep, deep research into the science of mutualisms because they're very ubiquitous in the natural world, very ubiquitous. In fact, they make the world go round. And many organisms… Most organisms have mutualisms, some have hundreds of mutualistic partners in their lifetime.

McNally:
Humans being one of them. Wouldn't it be true?

Benyus:
All those microbes, remember we didn't know about those. Well, those are all mutualisms - good for them, good for us. So when Dayna and I come up with the hallmarks of mutualism and teach that, we kind of looked at our own partnership and said, “Hey, a lot of this sounds familiar.” Most business partnerships don't last that long.

McNally:
That's right. I did some of my best work. I mean, I can say this, the work I did as a screenwriter and a producer in Hollywood was linked to a partner. And when that partnership broke up, that's why I'm doing this now. You know what I mean?

Benyus:
Interesting…

McNally:
Yeah. Yeah…

Benyus:
It is a good way to do something really, really big, and to look at each other and go,

“We believe this even when other people don't yet. The unshakeable faith. And there was many, many years when people kind of looked at us askance, shall we say. We were these biologists walking into corporate America where the things of our lives are made and talking about how nature would do it.

McNally:
Wow. I'm so glad we pursued that.

BIOMIMICRY: Innovation Inspired By Nature introduced the discipline that mimics nature's design, and we are now talking 28 years since the publication of that book. I have a feeling that subtitle to the book really in some ways defines biomimicry. But let me ask you a kind of funny - and this is sort of a taxonomic question. Is it a name? Is it a meme? Is it a lens? Or is it a practice? Or is it all?

Benyus:
All. Absolutely all. Yes. You know what it's not - a body of work that you download. It really is a practice - an innovation practice…

McNally:
And a lens…

Benyus:
Absolutely a lens.

McNally:
It’s the lens through which you look at the real world. And now that lens opens you to a practice.

Benyus:
That's right. That's right. It is a worldview, which thankfully, Donella Meadows told us in the leverage points when she talks about what… She's the great systems thinker - told us… What is it that you should spend your time working on if you really want to shift a system? And you can do laws and regulations, but that's not as powerful as worldview shift.,Worldview shift is the number one way to really change a society or a paradigm. You change your paradigm and then you change your society. That's the deepest thing.

So if people say, “I want to set up…” - as they do nowadays – “…I want to set up a business, and I want it to run more like a living system than a machine.” Well, that changes all of your design decisions. And we use a list of things that all organisms have in common, or most organisms have in common. It's called life's principles. And we use that as a North Star for our own company. But it's kind of like nature's checklist of how life does things, because those commonalities are, we believe, instructions on how to be an earthling.

And so we literally… We use that, both to scope projects - How would nature do this? - and then to evaluate them. Here we are making a wind turbine that works like a maple seed and goes in very, very low wind speeds. And that's terrific. But what are we making it out of? How are we manufacturing it? How is it being shipped and marketed?

If you're making it in a sweatshop and putting it on a freighter, belching fossil fuels, when does the biomimicry stop? So that idea - Can we make this locally instead? Can we make it out of a waste stream of materials the way nature would? How can we make right…

McNally:
By the way, you just added it there, but I was going to say to people - remember some of the distinctions between how nature behaves versus the way we do – though we are a part of nature. Nature does everything locally - by definition.

Benyus:
That's right. I mean, it does have global effects though. We now know that the Amazon… the moisture that is created in the clouds that are created over the Amazon basically travel… Well, half of the snowpack in the Sierras is thanks to Amazon forests.

They release a lot of water vapor, but even more importantly, they release these things called bioaerosols, which are bits of fungus and tiny organic materials as well as chemical materials. These nucleate the moisture up there into larger and larger rain droplets.

Here in Montana, there was a study of snow flakes, and a huge number of them - over 70% - had bacteria in the center of them because it nucleates the ice crystals, right?

The water vapor comes up. What's called the biotic pump creates a vacuum that pulls moist air in from the ocean. And then those clouds don't just water the Amazon rainforest. They travel. They travel to South America. They travel up to the Sierras. So yeah, they have global effects.

McNally;
That's right…

Benyus:
These are positive global effects. It's like yay, rainfall and snow in the Sierras.

McNally:
I think - just so we don't get to the end without doing it - it seems like the right moment to talk about the book you're working on now. It's about the universals, the principles…

Benyus:
It is. It's about nature's universals. And I'm looking at the common repeating phenomenon and patterns and principles across the tree of life. So what does a bacterium have to have in common with the blue whale? Because that's earthling instructions.

And so I'm looking at it across the tree of life, also looking at it at all scales, for instance. And I'm looking at it through seven realms of endeavor that humans are interested in right now. So there's a chapter on, How does nature heal from trauma? And a section on, How does nature grow and right size? …which is really important - scale and right size? How does nature self-organize for collective action? How does nature create and shape community through these mutualisms? How does nature circulate materials endlessly - the circular economy? And how is it that these ecosystems create such abundance and give it away like that Amazon rainforest gifting away that goodness?

I've watched ecosystems get more and more and more fecund as life creates conditions conducive to life. And now I'm understanding that those ecological benefits do not stay within the borders. They actually are benefits beyond borders. Polluted air can enter a forest, it leaves clean. Polluted water can enter streams, it leaves cleaner. Pollution goes down as water goes downstream. And so there's these connected beneficial flows that I'm very interested in these days.

The book looks at things I think are going to be interesting to people because I'm hoping it'll be a source book for biomimics and for anybody who is interested in… People mostly now are agreeing we should be acting like a living system. And then the question is, "Well, how do living systems learn and adapt? How do they heal? How do they scale? How do they create mutualisms?"

McNally:
Is this - I think it is, but I am not absolutely certain - Is this your first big book, first new idea, almost a new pursuit - since biomimicry?

Benyus:
Absolutely. Yes. For the last 28 years or whatever, I've been writing a lot, but I've been writing for people who are interested in questions like, how does nature repel water? How Let's create whole new filtering mechanisms. How does nature filter?

So I've been doing what we call amoeba-to-zebra reports and looking at the mechanisms and the behaviors and the strategies that life uses, which has been phenomenal. And we've created an institute and an online library of nature's strategies called Ask Nature. And trying to get this information out, I've realized that people really don't have biological literacy. If they did take biology or ecology, they took it a long time ago, and it's really changed in the last 25 years.

Our understanding of biology is undergoing this enormous renaissance because of all the big data, because we've collected all those “- omics,” the human genome being just one of many, many huge databases and knowledge happening now.

The physicist, Ernest Rutherford said that all science is stamp collecting except for physics. And so biologists have been in their stamp collecting phase ,- collecting all the diversity, collecting all this data, and now with that incredible windfall, general principles are starting to rise up. It used to be that natural selection was one of the only general principles.

McNally:
That's right. That'sYou could go through a biology course, at least a high school one, and think that everything came down to natural selection.

Benyus:
That's right. That's right. And now what's happening is people are standing up and going, “I think I found a new law here.” We're having our synthesis moment. And so it's time to put those principles out in a way that people can really readily absorb them. And that's what I'm trying to do.

McNally:
In the interim you've been doing application and practice, but it seems like this book where you're taking a step back, looking for principles and universals, ready for the next opening into potential wisdom about all of this - rather than just knowledge. It seems to me that this would be an exciting moment for Janine Benyus, the writer.

Benyus:
I'll tell you what. It is so much fun, I can't tell you. But it is overwhelming. I'm in such deep water. When you're looking at all of those fields I told you about… For example, how does nature heal? I'm looking at everything from, you cut your skin, with all we now know about the immune system. It's like, oh my God, what an orchestra that is. And then all the way up to Mount St. Helen's blowing up. And how did that ecosystem come back?

McNally:
Or a forest fire, right?

Benyus:
Right, exactly. And each one of the chapters is just like, holy mackerel. I feel like I'm looking into a stream and seeing the face of God.

McNally:
Are there moments, Janine, when you say, how about just a book on how nature heals?

Benyus:
(laughs) Yes.

McNally:
Which would be fine.

Benyus:
So true. Which would be fine, which would be fine. We'll see how it goes.

I'm hoping this book will open the funnel, open the aperture, and bring more people into this way of thinking. I was shocked at how many people had read a science book, and I think this will even be perhaps a book with wider appeal. Hopefully - because my goal has always been to make you close the book and go, "Oh my gosh, I live on such a competent planet and I am surrounded by absolute geniuses" and then go outside and never see the natural world in the same way again. And then to realize you're part of it.

McNally:
I'm going to ask you a big question and a very specific question. I'll go with the very specific one first, which is just for people to learn a little more. What is the Biomimicry Institute? What is Biomimicry 3.8? What is asknature.org?

Benyus:
The Biomimicry Institute is a nonprofit, and that's where we're really trying to democratize this way of innovating by creating all kinds of tools for people, like our public domain website, which is Ask Nature. You can put in any function - what am I trying to solve? And say, "How does nature self-organize for collective action?" and up will come actual nature strategy pages.

And this is really cool, Terrence, I think you'll be surprised at this, but since I last talked to you, we run something called the Ray of Hope Accelerator.

McNally:
Oh, I know that. I've been to Bioneers where the prizes are awarded, and I Interviewed Ray Anderson during his lifetime.

Benyus:
That's who it's named for - Ray Anderson. This accelerator is for bio-inspired startups. Last year we got 400 applications. The year before that we got 300. So this is growing, and interestingly, in the years we've been doing it, about five years now, we've recognized 49 companies and all of them are still around and getting added funding.

It's powerful to see 400 bio-inspired technologies, and I'll tell you about some of them. But first, let me finish telling you about our organizations. The Institute is our nonprofit, doing education and democratizing and entrepreneurship.

And then we have Biomimicry 3.8 - for 3.8 billion years of experience - our for-profit. And we work with companies to help them with their innovation processes. We do a lot now in the built world, where we're working at systems level. What does biomimicry do to improve building? All the way up to a city scale? And how does biomimicry work in social innovation? Things like management and networks. That's our for-profit consultancy.

McNally:
So Biomimicry Institute is the not-for-profit stimulator and wisdom generator. Biomimicry 3.8 is a consultancy, where you work with a company or an agency. And AskNature is a resource tool.

Is Ask Nature using AI at this point?

Benyus:
Yes. We have ChatNature, which we've just put out. Go to Chat-GPT and look at other GPTs, and you'll see Ask Nature. We're using AI to get us the papers that we need.

McNally:
Sure. If you're asking, how does nature do X? Obviously, AI can find more info, faster.

Benyus:
Right. And we're very, very, very, very careful about having the chat be trained on our work and on scientific papers. We don't want hallucinations. That's the last thing….

McNally:
So you limit what you show the AI?

Benyus:
Yeah.

McNally
Excellent.

Benyus:
Well, there's one more organization. We also have the Biomimicry Center at Arizona State University. And that's where we teach. So there's a way to take classes online and all the way up to a Master's.

McNally:
And let me just tell people. You've heard it here before, but Arizona State is a pretty unique place. I remember when they initially set up their Sustainability Institute. ASU's President Michael Crow set out to make the most innovative university there is. And as far as I can tell, he's achieved it and continues to do so.

Benyus:
You are absolutely right. Check out Michael Crow. He's one of those people who lifted us up. He was working at Earth Island Institute at Columbia, and he had read the book, and he was carrying it around with them and telling everybody about it. His wife told me this. He just kept saying, “You guys, we have to do this at Columbia. We have to do this at Earth Island.” And he couldn't get any traction. So when he moved to ASU, and did the incredible *The 21st Century University*, he called me up. He does that. He's pulled in amazing, amazing, amazing individuals that are not necessarily professors but have real world knowledge.

He pulled me in and took me on a walk around the campus. He basically said, “I've got like 15,000 biologists over there. I've got…” - because it's a huge school, I think it's the largest now - and he said, “…and I have these IT people, I have all this...” He said, “Bring biomimicry to ASU.” And I said, “Done.” Michael seeing that, believing in us, he made that happen.

McNally:
So I will to ask you my one big philosophical question. Then we’ll use the rest of our time for you to throw out examples of who's taking this to heart. And when you go to the example lightning round – give us products, processes, and systems. Nature produces products. Spider silk is a product. It produces processes, metabolism, for example. And it produces systems, like a forest.

But here's my big philosophical question. One thing that I find myself realizing and saying lately - the more we know, the more we know we don't know. What I mean by that is, that as we get greater and greater investigatory research and data and we get better and better at looking at what we're trying to figure out, we realize there are mysteries we haven't figured out yet. Do you find that?

Benyus:
Oh my gosh, yes. I mean, it's just every day. What was it…just last year that we figured out the interstitium, which is this connective tissue that runs all through our bodies - we had no idea - wraps around all our organs, and we didn't see it because of the way we dried samples…

McNally:
We didn't have the tools or the methods…

Benyus:
We didn't have the tools.

McNally:
One example - the agency in plants. I interviewed Zoe Schlanger about her book, *The Light Eaters*.

I think this is a phenomenal realization, that the more we know, the more we know we don't know. To me, it brings us both… We can have some pride in our ability, but some humility in the mystery. And it seems that's the rich moment. That's the rich identity for us.

Benyus:
Absolutely. Absolutely. Yeah. Wes Jackson always said that he wanted to have a conference and it would be the Ignorance Conference.

McNally:
Yes.

Benyus:
…because we're billions of times more ignorant than we are knowledgeable. And if we accepted that, it would do some things. It would have us pray for second chances, have us start small, always look for exits. Humility is absolutely at the heart of biomimicry, and that's the change to relationship from being dominators in Western industrial culture to being students as indigenous people have been forever.

McNally:
It's lovely to share about that sort of principle or insight with you. Now five or ten minutes of examples.

Benyus:
Examples. Oh my gosh. Well, I would love to talk about ones that are coming right out of the accelerator - small businesses that are starting right now. One I really like from this year is called Option V. Vanadium is a really critical mineral for energy grids. These folks realized that the amanita mushroom is really good at pulling vanadium out of soils, believe it or not. And it's not that we're going to use the mushroom. The difference with biomimicry is that you ask the mushroom for its recipe. So they have asked the mushroom for its chemical recipe, and its enzymatic power is 10 to the 13th stronger at pulling out vanadium than anything else that we've ever used.

So, instead of mining critical minerals, they're going to be pulling it out of industrial waste. And that's what we should be doing. Organisms know how to do this, and we need to ask them for that. So that's one I'm excited about, and that's a process one.

There's a company called EcoTune that has studied how leather is formed - what its molecular properties are, how it's springy, how it's smooth, and it's using bio-based waste streams to create a leather that's identical in its properties and its performance. So that's more of a product.

There's a company called Parsons Kinetic that has studied the ant tree. It's a tropical tree, but its seed has this beautiful, three sort of samaras coming off the seed, and it helicopters in the wind like a maple seed does, but does it in amazing, amazing ways. They literally have copied that onto a wind turbine as a turbine shape, and it's able to

harvest energy at very low wind speeds.

There's Bio-Renewables, which was also one of our accelerators. They studied owl feathers and maple seeds. Existing wind turbines lose a lot of wind power right at the center, in what's called a power cone. So they're retrofitting them with both owl feather serrations and a maple seed formation, and they're able to capture a lot more wind. I like it when we can take existing things and make them better.

There's another product that is amazing. Ruby Laboratories has been able to take CO2 - which we have a lot of right now - and put it together in the same synthetic pathways as a tree uses carbon dioxide to make sugars and starches and eventually cellulose. By studying that chemical process, they are making cellulose-like fibers out of CO2.

These chemical processes are a completely new way of doing industrial manufacturing, because they're done at low temperatures, body temperatures, the way organisms do when they make silk and shells and everything else. They're using life-friendly temperatures, life-friendly pressures, and, of course, no toxic materials. And that's really new.

McNally:
Janine, that goes right back to the introduction where I mentioned what you taught me about beat, heat, and treat.

Benyus:
That's right. Yeah, that's exactly right. And now we're seeing it.

The people who have been studying spider silk for so long. There's a company called Spinx, and they have figured out how to take again waste materials as a liquid, and they've built spinarets, which are the little nozzles that spiders use. They've mimicked that chemistry and that sheer force that happens, and they're making fibers out of waste materials. The chemistry's really coming along.

The one that I love - I love a lot of these as you could tell - but one is called Green Pod Labs. A chemist who came to the United States from India and studied plant chemistry, and he wanted to do something back in India. One of the major issues there is that… They're the second largest fruit and vegetable growers in the world but 40% of the harvest never makes it to market. Now you can imagine all the people involved in that sort of food waste. And the farmers are only getting 40%.

And why? Because the trains that take it to market are not refrigerated. So our normal industrial idea would be, “Electrify those trains and install refrigerators.”

And he said, “No.” He had learned that plants, when they're bitten, release volatile chemicals. When an insect bites them, they release volatile chemicals to beef up their defenses. And they do this even when a fruit is hanging on a tree. The tree will

tell an avocado, “Beef up your defenses” against microbes. And those signals are organics, and they go out to other trees, and they beef up their defenses. Then, when the microbe goes to rot that fruit or the insect goes to eat that leaf, it's less palatable. They're repelled. And so he realized that - I didn't know this - the fruits and vegetables are alive after they're picked. That’s mind blowing, they're still alive.

And so he's mimicked that alarm chemical that plants put out, and he's put it in little sachets, and he throws those sachets into a crate of say, avocadoes, and increases the time that they can last unrefrigerated.

So you see avocadoes 15 days later – rotten without this treatment, and avocadoes with it, completely fresh. It doesn't change the taste. The avocado packed with the sachets still has the ability to protect itself. He's tapped into that by mimicking how plants do it.

McNally:
Wow. The thing I love about that one, and I can see why you love it as well, is that the first realization and the capture of the plant's ability, that's sensational and cutting edge, but a sachet of that stuff seems so simple. It takes an amazing discovery and an amazing process, but then it allows you to do something so elementary.

And, if I'm not mistaken, looking at Paul Hawken’s book, DRAWDOWN - food waste was up in the top one, two or three orst things we do in terms of climate change.

Benyus:
That's right. Third.

McNally:
When you can begin to decrease food waste by 40-80%, I mean…

Benyus:
I know.

McNally:
That's my Nobel Prize.

Benyus:
Huge.

McNally:
We’ve got to bring it to a close. What I want you to do right now is just tell people, if this is fascinating them, how they can learn more. It's asknature.org. Correct?

Benyus:
Yep. asknature.org, and that's part of biomimicry.org, which is our institute. There's so many learning resources there. You can take one-week courses, one-day courses,

you can go to the Center for Biomimicry at ASU, and you can do up to a two-year course.

McNally:
Wow.

Benyus:
If you're a company and you're interested in product design or the built world design or the organizational design that I spoke of, our consultancy is biomimicry.net. There are so many cool learning opportunities out there now.

McNally:
And you can go to YouTube and watch 30 or 50 videos about it.

Benyus:
That's right.

McNally:
I went there and it is just full of great stuff.

Benyus:
That's right.

McNally:
The key book, the original, the OG in the whole field is BIOMIMICRY: *Innovation Inspired by Nature*, and it is a perennial. The websites she just went over.

And so for this conversation and many other interviews and articles, to join me in pursuit of a world that just might work, go to terrencemcnally.net or aworldthatjustmightwork.com. They're the same website. If you want to receive my weekly email announcement, telling you who's going to be on, what we're going to talk about, and links to 10 or 15 articles to flesh out the conversation, email me at temcnally@mac.com. You can sign up at my site or at most of those sites to subscribe to the podcast.

The archives are into the hundreds. As I said, my first conversation with Janine was in 1998, and you'll find years of podcasts at my site - Naomi Klein, Robert Reich, Michael Lewis, Van Jones, Bill McKibbon. You can follow me on Twitter @mcnallyterrence, thanks to Kiyana Williams in production, George **Vasilopoulis** at Progressive Voices, and most of all, you my listeners, please share this podcast widely.

And finally, thank you, Janine Bennis, and keep up your good work.

Benyus:
You bet, Terrence. Thanks for getting the stories out as you do. And you're absolutely right, these are pieces of the puzzle that will bring us the world we dream of. I agree

with you, and I'm glad you're doing this work. You've been doing it a long time - long before podcasts were even a thing.

McNally:
That's true.

Benyus:
You knew that conversations like this were important, so I thank you.

McNally:
Thank you, Janine.