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What Would Nature Do?

**Tom Tyrrell, Co-Founder, Great Lakes Biomimicry with Nancy Howell,
Member, Western Cuyahoga Audubon**

Introduction

Nancy Howell: Hi! I'm Nancy Howell with Western Cuyahoga Audubon Society and we've been doing a number of interviews and we have a fantastic person we are interviewing today. Tom Tyrrell, who is the CEO and Founder of Great Lakes Biomimicry.

What does that mean? Biomimicry? I'm sure Tom will tell us a lot more about it. So welcome, Tom, thank you so much for joining us here.

I think the first question is, let's learn a little more about you, your interests, and your background.

Tom Tyrrell: Well, I come from a big family and was the oldest and spent a lot of time in the outside, so spending a lot of time with birds and animals and I learned to love it. I've lived in eighteen places in the United States so I got a chance to see different regions and appreciate tremendously what we have here in northeast Ohio.

Most of my time was spent in the steel industry and then I transitioned into getting involved in regionalism and very much in the non profit area. I picked up on biomimicry about seven years ago when I found the word working on a major project for the Cuyahoga River Initiative.

I didn't know what it was and so I investigated it. I'm an entrepreneur and I've started twelve businesses, so as an entrepreneur I looked at that word and I went back and studied it and said, "This is a big deal!" and this is going to change the world and one, I want to be a part of it, and two, I think our region is uniquely situated from a blankspace standpoint, to be a center of education and economic development.

Nancy Howell: Absolutely, we've got a lot of organizations, museums, we've got a number of colleges and universities that would be interested in this. So, let us find out a little more, what is biomimicry?

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Tom Tyrrell: The word "biomimicry" comes from two Greek words, "*bios*" meaning 'life' and "*mīmēsis*" meaning to 'imitate'. Simply stated, it means 'to imitate nature'.

Nature is 3.8 billion years old and in fact, that's 3.8 billion years of research and development. We as a civilization, especially the last twenty years, have been antithetical towards nature and ignored it and in fact, done things exactly the opposite of what nature would do and today, we're paying the price like with global warming, etc.

What biomimicry does, is it brings you back into thinking about nature when you're looking at solving a problem, whether it be it a manufacturing problem or a production problem, an operating problem, or an organizational design problem. There are examples in nature for almost everything you would want to change.

It doesn't mean it's going to solve every problem. Our objective is to create conditions for innovation through biomimicry - we're not shoving it down people's throats. We're teaching them, we're training them, we're giving them the tools to do it and then we want them to begin using it themselves so we can move on and help other people work on that process.

The more people we are able to get to look through a biomimetic lens, and when they run into a problem ask, "What would nature do?" the more open it becomes to be used to solve some of the world's problems.

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Nancy Howell: Wow. One thing that pops into my mind is wetlands. I teach about wetlands and working with students and with how many wetlands we've lost or have been modified so they're not wetlands anymore - they don't do what they're supposed to. Wetlands are like a sponge to hold water and they won't allow water to flow fast and let things sink in.

We have a bioswale at the Cleveland Museum of Natural History that was just put in to go along with holding the storm water. Is that something like biomimicry?

Tom Tyrrell: Yes, very much so. What you said about wetlands is exactly what happens. It also does regenerate actively as far as environmental issues, it absorbs things and cleanses the areas its in.

To that end, we are involved in a project with the Cleveland Water Lines, the Ohio Department of Natural Resources, and an organization called, Biohabitats out of Baltimore which is the foremost organization in the country on the re-engineering and restoration of wetlands. And coming in to do a major project in the Cuyahoga River. Next year, they're going to take on the

south side of the south coast of Ohio on Lake Erie and be able to look at it for just what you're saying, but how can we go ahead and stop these flows through using soft and hard surfaces and much of it would be wetlands restoration.

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Nancy Howell: So for biomimicry, we're looking at big pictures like wetlands or forests, are we also looking at individual organisms? A certain type of plant, a certain type of animal?

Tom Tyrrell: Absolutely. There are many examples of how you can use nature. Things that are relatively simple and neat. For example, birds - and very interesting to your listeners - birds smacking into windows and break their necks and we all feel guilty and some feel more guilty than most do. I know my wife has problems with that.

A company named ORNILUX designed a window that has a spider web that's built into the window. Spider webs give off UV and birds never fly into spider webs. They embedded the same type of design giving off UV. You can't see it, you can look through the window like right over there and it looks normal but the birds see it and they never again fly into it. So putting this in flyways in major buildings will prevent the birds from smashing into them and save a lot of birds lives.

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Nancy Howell: That's interesting, because we are going to be screening a documentary about migratory birds and their plight and one of the major things is striking buildings and windows, especially at night. Wow! That's amazing, I will have to look into that one for sure!

So, we're thinking about things that are around now, plants, animals, habitats...but there were lots of things here long ago such as dinosaurs, prehistoric fish, coral. Are we looking at anything that was around a long time ago?

Tom Tyrrell: Very much so, both sides of the coin. Things that are present today and things that were present in the past. The ones we specialize in from the past, are things that didn't necessarily evolve and die because they weren't able to sustain their life from a natural standpoint. Many beings that we've had in our history were wiped out because of catastrophes. The asteroid hitting the earth and killing the dinosaurs, for example, is one case in point. Many people feel that if that had not happened, dinosaurs would be alive today.

Birds are the direct descendants of dinosaurs, and their exoskeleton system, a very lightweight structure, a high strength, low alloy type of process from my steel background, it's a direct derivative of what the dinosaurs were. So consequently, there is a field called, "paleo biomimicry" that people are getting into now.

We're working on this now with both the Natural History Museum and NASA which goes back into recorded archives and takes out beings that were killed by catastrophic means, fossil examples, and looks at those, and asks, "What do they have? What kind of manipulations did they have? What kind of motor affects did they have that will allow us to go ahead and use

them where we may not have that in beings that are alive today.

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Nancy Howell: So almost like looking at how things are moved along evolutionarily too? What made them better suited for a particular environment?

Tom Tyrrell: Very much so and anticipating with what we see today, what's going to take us to the next level of hundreds of thousands of years into the future.

Nancy Howell: Could you give us an example of a plant or an animal that has been used in designing something, using biomimicry?

Tom Tyrrell: I will give you an example and I'll try to stick to birds because I think that's kind of nice for your viewers.

Nancy Howell: Or a plant. Sometimes people don't even think about a plant. They are really important too.

Tom Tyrrell: I'll give you one of each then. One of our PhD Fellows started a company called Hedgemon. Hedgemon is working on designing a helmet structure that will prevent concussions. This is a big active area today.

There are several ways of looking at it: one, is Woodpeckers. Because of the thousands of times of day they hit that tree, that obviously if we were doing that we'd be driving our heads crazy. So they are studying a lot on woodpeckers to determine what prevents them from having concussive problems.

Another example, is using a hedgehog. The hedgehog, which is prey for birds in many cases, it will climb up a tree maybe thirty feet tall and if it sees an eagle coming in and it will roll up in a ball and fall off the tree and it will bounce from thirty feet high. The reason is, its spines intersect with each other, it rolls in a ball so it bounces and rolls and then they get up and move away. The concussive properties of that type of a fall with it being that size is significant from a process standpoint.

There are many examples in nature. If you go into a rainforest, if you're able to go into the Botanical Gardens, and you took a look at what the structure was, you'll notice that small leaves are at the top and very big leaves are at the bottom. What happens is, the small leaves get hit with lots of rain, they get what they need but much of it goes through, and there are increasing size of leaves that have a more difficult time of catching water, until you get to the bottom where you have big leaves with concave structures that can go ahead and absorb the water and be able to retain and hold it. So it's an ecosystem that's been built there to be able to deal with water.

There are many examples in nature. Another example is Moen, who is a shower and faucet manufacturer. They looked a shower heads and decided there is no good one out there. All of

them hit you in one place, they use way too much water. So they looked at nature and asked, What does nature do to handle water?

What they did was to look at a sunflower. A sunflower grows in arid regions, it rotates with the sun to get the greatest absorption of sun. What is has in there in the bud is a fibonacci pattern its called. It is the most absorptive thing in the world as far as being able to take, from the plant standpoint, and absorb moisture.

So Mohen designed the shower head with that fibonacci pattern and then they reversed it for water to come out. Not only did they make it very successful using less water, but they did it very inexpensively so you'll see it taking up a lot of shelf space at places like Home Depot.

Nancy Howell: I'm going to have to look for that. That's amazing! It's too bad the stores don't tout that kind of thing, "This was designed by nature!"

Tom Tyrrell: But its starting. This is a field that people are really starting to get a feel for and young people catch on very quickly.

The other thing is that, because we're doing a lot with education, and because of the creativity that's involved, this really appeals to right-brain thinking. So, we have real trouble in this county getting people into STEM education. In fact, 17% of graduating engineers in the United States are female, which is extremely low. More than 60% of graduating biologists are female. The reason is, it's much more creative on the biology side.

How do you blend those two together? How do you get that creativity and design into STEM? That's what biomimicry does. It gets in there so people are beginning to think about things, so inner city and underrepresented populations like the inner city and females, will be able to get much more involved in STEM education. We think what will happen, is not only will it broaden the STEM base, but it will begin to educate differently the people that are already there in STEM and don't have the creative and design side as part of their curriculum.

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Nancy Howell: So if I were to have a concern or a problem that I wanted to be solved using biomimicry, I want to design something or I see an environmental problem, what's the process to say, here's the problem, what do I see out there in nature? Is it that kind of approach?

Do you call someone and say, "Hey, do you have an idea about what to do about this?"

Tom Tyrrell: It's kind of that way. It depends on the level that you're at when you ask that question. For example, we have multiple training programs that we put people through. Things like the one-day program called, The Value of Biomimicry. And then we have the three-day program called, The Principles of Biomimicry. We have a program in the organizational side of development, that's a three day program we put people through.

But there's also a website put out by an organization that was really the start of biomimicry on

a formal basis. Biomimicry has been around for a long, long time, Leonardo da Vinci and the Wright brothers practiced it looking at birds. But they have a website called, AskNature.org.

And if you have a question like, ...Gee, I want to learn how nature moves fluids... you go in to AskNature.org and it will come up with an archer fish, and a skunk, and the heart, and the Redwood tree, etcetera, and you begin thinking about how can I use these in the design of my product?

Now, as you think about that, then you have really the skill set to be able to say, who can I go to who knows that being that I want to mimic? We're building a database of subject matter experts in the fields that are out there. Whether it be moving water or geko technology - the adhesives of geckos. We can go ahead and look at that site and then you say, "I need somebody who can help me." We can refer you to somebody and then help you in that process.

But, the other thing is, in educating you so you can do it yourself, we teach you the first time and help you to do that, and then we can teach you the skills to be able to do it yourself the next time in that process.

But there are people out there, such as Biomimicry 3.8, that is the originator of biomimicry in the United States. It does some major corporate product design programs. But there are many pieces, the AskNature.org is a great way to do it. Or come in and talk with us about the very basic training program which is a lot of fun! You walk out knowing a lot more than you did when you went it.

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Nancy Howell: So, it sounds as though a lot of this training, or professionals, or college or university students... what can we do for elementary school students? Can we start as early as elementary? Or kindergarten?

Tom Tyrrell: Our major objective is Pre-K through twelve. The reason is that - and you know it, you're a teacher and you teach at the Museum - kids get it quickly. When they pick up something they like, they drive it. I don't care if its a video game or a sport, whatever it may be.

The key is to get them in that early age to get them to think about nature. When you and I were growing up it was natural, we were outside and we were playing with bugs, we were playing with rabbits. We kind of outgrew that because society said, "That's not important anymore."

Well, society is now saying, it is important. And so we want to get kids who don't have the ability to go outside the way that we did, maybe kids from the inner city or kids that are playing video games, who can't really move themselves away to see nature. We want to get them in touch with nature and once they see and can get excited about it, all of a sudden it reverses the process and they begin to get outside and they begin to study it.

So we're looking at it in two ways: informal learning and formal STEM learning.

In the first process we mentioned earlier, we're in a region that has a plethora of formal and informal science centers and education institutions. But they don't work together. The Cleveland Metropolitan School District has a great nature program for all eight years of school where all they do is visit these various facilities.

Can you imagine if we integrate in a thread of biomimicry in that first program? The first grade process and then take it through second grade when they visit the museum and then fifth grade when they visit the Zoo and that thread goes all the way through so it becomes an inherent part of that process.

What happens if you do that, is we're pulling a generation talent development to be able to understand how to use biomimicry. At the same time we're working with corporations through Fellows to teach them to embed biomimicry. They're going to be changing and incubating new companies, attracting companies, and we'll have the talent base to fill those jobs.

We'll be the only place in the country at the moment that's really doing that. We're eons ahead of anybody else in that process.

The other side is the formal programs for Pre-K through twelve. We're working with the schools in Lorain County, we're working with the Cleveland Metropolitan School District here in Cuyahoga County, we're working with the Akron Public School District in the National Inventors Hall of Fame® Science, Technology, Engineering and Mathematics High School where we have PhD Fellows that are embedded with our project managers educating the teachers in how to go ahead and embed it interdisciplinary.

What's neat about it is this is not a bolt on. Teachers have said it makes it easier and more fun to teach and it makes it easier and more fun to learn. Once we get a teacher that gets to understand that, and we get them through our week long training program in the summer, then all of a sudden they will say, "this will change the way I teach forever." And you can see when you go and watch their classes that it has.

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Nancy Howell: That's amazing. I think that's a real important part of - even our Audubon - is getting the young people involved, getting them to look at nature, whether through biomimicry or just really appreciating what is out there in the natural world.

One more thing that comes to mind is, we're looking at animals, we're looking at plants, we're looking at ecosystems...we're losing a lot of plants and animals on this planet, we are losing ecosystems. How can biomimicry help with protecting areas, protecting plants, and animals so that we don't lose that four-and-a-half billion years of R&D? It's kind of frightening.

Tom Tyrrell: It's additive in many ways to some of the things being done in sustainability and environmental aspects. Those who try to stop it by not abusing the environment, by utilizing substitutes that don't contaminate the environment. Biomimicry is different in that approach in that it teaches you how nature solves problems.

Nature has to confront things, they have enemies who work together to solve a specific problem. What biomimicry does is it teaches collaboration, it teaches systems thinking. And that is different than what we think of as humans most of the time. And once we get our brains together on a cumulative basis, it's amazing what we can go ahead and solve.

And so you get people who are looking at biomimicry, and it's a cohort approach, we take scientists, biologists, engineers, designers, business people and they're in the same room learning at the same time to be able to look through that lens. So they're not learning from their own perspective, they're learning from the other person's perspective. So as they leave and they go back to their organizations, they're not only bringing their own science perspective, they're bringing what the creative person, what the designer said in that process.

It is beginning to look at the problem in a multiplicity of ways, instead of simply looking at it in one way that is sustainability in that type of a process. So that allows us to go back to look at what nature did to be able to solve problems, to be able to correct problems, to be able to clean up issues, etcetera.

I'm a diver so the warming of the oceans and the bleaching of coral, it scares me a lot. Because it's taking away many areas. We've got to figure out how can we go ahead and begin to turn that problem around. It takes more than simply the global environment and global warming.

You've got to go out and look at what does nature do in those types of circumstances? And there are answers out there if you get the right people together to spend the time to look at it from a systems basis using best and brightest from all areas.

Nancy Howell: I think starting from the Pre-K level and going up and having people appreciate what is out there in the natural world. We shouldn't lose this particular environment, we shouldn't lose that particular animal because it may have something that will help us.

Tom Tyrrell: Absolutely.

Nancy Howell: Well, this has been absolutely fascinating. I want to dive into it more! I really appreciate your time to talk with us at Western Cuyahoga Audubon about biomimicry.