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Clip from Episode 2: Origins of Life Transcript

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Guest: Michael Gillings, professor of molecular evolution at Macquarie University, Sydney, Australia

A Definition of Life

David Christian: This episode is about the mysteries that surround the idea of the origins of life. So, mystery 1 for me is what is life? What do we mean when we talk about life? What's the difference between a living organism and a rock, or a star, or an atom? Do we have a good answer to that?

Michael Gillings: That's a really good question. Now I'm a biologist. Biologists study living things, but surprisingly, defining what a living thing is, is a little bit tricky. You can point to a series of properties, things that living things have. So, one is reproduction, making more of yourself. The other is heredity. That just means passing on information so that your offspring look the same as you do or behave the same as you do. Living things have cells. These are like little soap bubbles with chemicals inside them, and they're the basic unit that reproduces one cell, makes two cells, makes four, etc.

David Christian: In all life?

Michael Gillings: In all living things that biologists study.

David Christian: Yes.

Michael Gillings: Right, those cells grow and develop so they get bigger, and they make things inside themselves. And when you have lots of cells, you might develop fingers or hair or eyes. They also, living things also respond to external stimuli, so external conditions, if you like, where it gets hotter, something happens inside the living thing. It recognizes that it's getting hotter, or that it's getting more acid or drier, or any of those things. The process of doing that response is called homeostasis. That just means keeping things the same. You and I have a body temperature that stays the same most of the time. If we get too cold, we die. If we get too hot, we die, and so that's homeostasis. And the way we accomplish homeostasis is through what's called metabolism, which are all of the chemical reactions that occur inside a cell. So, there's a list all of those words that I've just said are all characteristics of living things, but lots of nonliving things have those characteristics as well. So, for instance, viruses reproduce, they have heredity, they have some kind of metabolism, they can evolve, they can

respond to external stimuli, but they don't have cells, and they don't grow and develop. They assemble rather than grow. Crystals grow, and crystals grow in the same way that the parent crystal looks like, so they've got, kind of got heredity as well. They grow in development, but they don't have cells. And crystals can also kind of reproduce. You can take a salt crystal and throw it into a salt solution, and lots of crystals will appear. So, what we have to do when we're defining life is say, look, it's got all of these characteristics, and if you're missing one of them, you're probably not alive.

David Christian: But there's a fuzzy territory where you can fight with a biologist about whether it's alive or not.

Michael Gillings: It's difficult, it's surprisingly difficult, to actually define a living thing. It's more or less the same as defining a species. A species is the fundamental unit of biology, just as the atom is the fundamental unit of chemistry, and you know the protons and neutrons and electrons are the fundamental units of chemistry. But, if you ask different biologists what a species is, they'll all give you a different answer. And so, so it's one of those things that goes to the heart of this unknown theme that you're talking about is that we use these words—living thing, species—and we kind of know what we mean when we're talking about them, but if you actually examine the nuts and bolts of it, it actually becomes far more fuzzy than you think it is.

David Christian: Yeah, Michael, at the risk of getting involved in a fight with you, can I can I suggest one more possible quality of life that I know some biologists take seriously, but I suspect you don't, and that is the idea that living things, I mean, it's an idea I like.

Michael Gillings: Yes

David Christian: That living things, unlike, say, rocks, living things have purposes, intentionality. Now that work that word can be used metaphorically, but even a single cell, it acts as if it's trying to do something. It's trying to survive. It's trying to reproduce. So, would you add purpose to your definition of life?

Michael Gillings: I agree, from the viewpoint of an external observer, things appear to have purpose, but if you're a living organism, you don't necessarily have intention. There's a difference here between, I think, our different disciplines. From an evolutionary viewpoint, we never use design or purpose or intention, because that's not how evolution works and so we avoid those words because they imply some kind of designer, but we often use them colloquially, and I can see how, from an outside perspective, that living things appear to have a goal, but it's very again, this is, this is kind of contentious.