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“Big Questions About the Human Being: Bioscience and Islam in Dialogue”

Episode 6: Are Humans Unique in the Universe? The Question of Extraterrestrial Intelligent Life

Dr. Aasim Padela:

Welcome everyone. You're tuned in to *Big Questions About the Human Being: Bioscience and Islam in Dialogue*. This podcast series brings together perspectives of Islam and bioscience on fundamental questions about the human being. I'm Dr. Aasim Padela and in this podcast we will unpack the realities of the human being through honest conversations, lived experiences, and critical reflections. So let's get started.

Jennifer Wiseman:

I grew up in a rural area in the middle of the United States. I loved walking around and exploring forests and meadows and lakes and streams. It was a beautiful area, but also we could see the night sky clearly. And I remember just looking up in awe at the night sky and imagining myself, if I could just blink my eyes and go to that star or that planet and what that would be like. One thing I love about astronomy is just that amazing sense of humility that we glean from looking up and recognizing that we are a small part of something magnificent and very large beyond our imagination.

Dr Aasim Padela:

Welcome back to this final episode of our podcast. We will focus on the following question: Is extraterrestrial intelligent life out there? A discussion on human uniqueness. You just heard a clip from astronomer and astrophysicist [Dr. Jennifer Wiseman](#). She studies the formation of stars and planets in our galaxy using radio, infrared, and optical telescopes. If you're like me, I imagine you have had the same experience gazing up at the night sky and being humbled. For eons, human beings have looked up at the stars and wondered how vast the universe is and whether we are alone in the cosmos. As we've yearned for connection, our imaginations have run wild. We have imagined celestial beings washing over us and controlling our lives, little green men living on Mars, and arachnotype monsters from other galaxies who one day will come and take over the Earth.

If I were to guess, at any time in any major movie theater across the world, there is at least one film running that depicts a universe in which there is extraterrestrial intelligent life. While notions of there existing beings like us outside of terra firma are prevalent in our popular culture, religious teachings on the matter are quite divided. Certainly, Greek and Norse mythology held there to be beings like us in other places around the universe, but Christian, Jewish, and Muslim sources are not as clear. What does science and scripture tell us about the possibility of intelligent extraterrestrial life, referred to as ETI? How would the existence of such life impact our notions of being unique and special? In this episode, we will venture into these discussions with leading philosophers, scientists, and theologians.

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To start, let's hear views on whether human beings are the only form of intelligent life in the universe. [Professor Monica Grady](#), Professor Emerita of Planetary Science at The Open University in Britain, offers the following.

Professor Monica Grady:

Gut feeling, no. Gut feeling is: Are we the only intelligent civilization in the universe? I can't give an answer to that, because on a statistical basis, it's like, well, it's bonkers to think that we're the only advanced civilization, but where are they then? I would be really, really happy, I think, I hope, to be convinced that we aren't the only intelligent civilization, but I don't know.

Dr. Aasim Padela:

Astrobiologist and theoretical physicist, [Professor Sara Walker](#) of Arizona State University, nuances her view.

Professor Sara Walker:

Currently, I think yes, but it depends on what you mean by unique. I think in the sense that evolution might construct complex things that can think very deeply about the world, we might not be the only such entities in the universe. But I think there are a lot of things about us that make it such that I think humans only emerged on our planet, and only will have emerged on our planet.

Dr. Aasim Padela:

But how do we set about determining the likelihood of there being intelligent aliens elsewhere? Back in 1965, an astrophysicist named Frank Drake, who taught the famed Carl Sagan by the way, wrote an equation to indicate all of the terms that would be needed to estimate the probability of extraterrestrial civilizations existing in the universe. That equation probably used up a lot of chalk and space on Frank Drake's blackboard. Fortunately, for the non-physicists like you and me, Sara Walker is on hand to guide us through what that means.

Professor Sara Walker:

Frank Drake's approach was to break down all of the probabilities that we might try to look at to try to constrain how many civilizations there are. So he thought about how many stars there are in a galaxy and how many of those stars might make planets. So that becomes the first term is how many stars around them have planets. How many of those planets are earth-like? How many of those earth-like worlds have an origin of life event? How many of those that emerge life have complex life evolve? And how many of those that have complex life evolve into a technological civilization that might be communicating, that we could actually identify? And so there's a sequence of probabilities, all of them unknown, when Frank Drake wrote down the equation that allow us to at least try to estimate each probability

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independently and then say something perhaps about the likelihood of extraterrestrial civilizations.

Dr. Aasim Padela:

The Hubble Space Telescope is an amazing technological marvel. Launched in 1990, it marked the beginning of a revolution in our ability to make observations further and further into space and thus, deeper and deeper into the history of the cosmos. Thanks to continuing advances in space telescopes, we can now begin to put at least some numbers into the Drake equation. And these numbers are big. Very, very big. Dr. Jennifer Wiseman shares her experience of getting a glimpse into the sheer scale of these numbers.

Dr. Jennifer Wiseman:

One of my favorite images is called the ultra deep field from the Hubble Space Telescope. And by deep field, what that means is that the telescope was pointed in a direction of the sky that didn't really have a lot of nearby stars to dominate the picture and just collected faint light over several days so that the faintest things in that direction of the sky would show up in the image. And the result is this collection of little smudges of light, which are not stars. Every little smudge of light in this image is another galaxy. So, you know, we now understand that a galaxy contains hundreds of billions of stars and that our own sun is just one star in our own galaxy, which we call the Milky Way. But we now know there are hundreds of billions of other galaxies, each containing billions, sometimes hundreds of billions of stars.

Dr. Aasim Padela:

So we've learned that the number of galaxies in the universe is breathtaking in scale. But does that get us any nearer to a number of probable alien civilizations?

Professor Sara Walker:

I think the overall answer to Frank Drake's equation is still bounded between none and an awful lot. But that being said, we have constrained at least some of the probabilities. So we do now know, which we didn't then, that most stars have planets around them. And that was just discovered in the last few decades, how many planets there really are around other stars. And we are also getting better at estimating how many of those planets are Earth-like. And so we now estimate almost every star has planets and many of those planets might be Earth-like. So the first couple astronomical terms are actually becoming much more precisely defined. So that helps a lot. And in some sense, people become very optimistic that the likelihood of intelligent life is high, because we know there's so many planets out there. But the rest of the terms in the Drake equation, the ones having to do with life, starting from the origin of life and the evolution into complexity, are still fairly unconstrained. So we don't know, even if there are abundant Earth-like planets out there, how many of them are inhabited.

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Dr. Aasim Padela:

So with billions and billions of stars and billions of Earth-like planets, that suggests a higher probability of ETI. But Jennifer Wiseman tells us there's a problem.

Dr. Jennifer Wiseman:

It seems that most stars that we've detected are smaller than our sun and they tend to be much more violent, meaning that they have a lot of flares and just really powerful outbursts that would actually obliterate, over and over again, the atmospheres of planets that were in the habitable zone around those stars. Those stars are less bright overall than our sun. So to have a comfortable environment for life, the planets would need to be a little closer to their parent star than our Earth is to our sun. And yet these planets that are close into their parent star are getting basically pummeled by energetic flares from their parent star over and over again. So it's very unlikely that there would be the stability in those planetary systems for life, advanced life, to even exist and certainly to thrive. So that's a problem.

Dr. Aasim Padela:

For scientists approaching this question within an evolutionary framework, this poses a problem. Because evolution is quite slow and evolution of intelligent life takes a long time. Professor Paul Davies, a theoretical physicist at Arizona State University, introduces us to one of the biggest unanswered questions in science.

Professor Paul Davies:

We don't know how life on Earth began. You know, what was it that turned non-life into life? Attempts to do this in the lab, cook up life in a test tube, really haven't got very far. You can make the building blocks of life easily enough. For example, there are amino acids, the building blocks of proteins. And these days, you know, high school children can do this for themselves. But how those building blocks were assembled into the astonishing complexity of even the simplest living things, we really haven't a clue. And when people say, aha, this stuff is easy to make, we can make these building blocks so life can't be that difficult. I think it's a bit like saying, well, we finally figured out how to make a brick and actually it's not that hard. So therefore, we can explain London because it's just more of the same. There's lots of bricks. Well, of course, it's not what London is made of. It's how the bricks were assembled into the complex and organized structures. And that assembly part, we don't know.

Dr. Aasim Padela:

Professor Walker adds...

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Professor Sara Walker:

That's the problem. If we knew the mechanism for the origin of life, we could estimate that probability. But because we don't know how life arises from non-life and we haven't observed another example of life, we actually don't have any constraints on the frequency of life emerging on planets. We don't have any constraints on that parameter.

Dr. Aasim Padela:

So it seems that even if we did know how life began on Earth, it's just a sample of one blue planet, not something from which we could draw statistical conclusions. With this crucial missing piece of knowledge, how do scientists assess the chances of even simple life existing on other planets?

Professor Sara Walker:

I am unsure about whether there's life in the solar system or not because we don't have any evidence for it. And it's very unclear at this stage with what we know about life, whether we should expect that it could persist in any of the other environments in our solar system or not. So we have a few good candidates like fossil life might be found on Mars because the early Martian environment might have been suitable for life. Or we think some of the icy moons like Enceladus, which is a moon of Saturn, or Europa, which is a moon of Jupiter, might have conditions under their ice shell where they have a liquid ocean that alien life could be living there. But we don't have any direct evidence in the solar system. And in fact, personally, I think exoplanet searches for life are more promising despite the technical challenges of remote detection of life. So I think that actually, the solar system is great, but there's just not enough real estate for us to really make inferences about how common life is. And there's the issue of panspermia too. So if we find life in the solar system, it might be the same original life just because material can be exchanged between these planets. I mean, we could even be Martians, for what we know as far as the planetary exchange of material.

Dr. Aasim Padela:

So even if we do find evidence of primitive life on Mars, or on the icy moons of the giant planets in our solar system, it may not represent a second genesis, an independent origin of life. Nevertheless, Professor Davies thinks it's worth looking. And he thinks that might even exist here on Earth.

Professor Paul Davies:

If we've got a second genesis, we just have one more example of life, we've got two forms of life, surely it can't be that hard to make. So that's the great hope is that we will find some sort of microbial life. Actually, it doesn't even need to be on Mars. It could be right here on Earth. There could be what has become known as a shadow biosphere on Earth, that we might find among that vast population of microbes that there are some funny ones that don't fit in onto

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the tree of life that we know. And these would represent the discovery of a second genesis. So if we found just anywhere, Earth, Mars, anywhere else in the universe, one microbe that was life, but not as we know it, the point would be made. And then we could expect the universe to be teeming with it.

Dr. Aasim Padela:

That's a fascinating account of how the discovery of even one previously unknown life form with its own origin could radically transform our ideas about the potential for life in the universe as a whole. So let's turn our telescopes towards some of these newly discovered Earth-like exoplanets, in the search of life. Dr. Wiseman says it's about as easy as trying to study a firefly caught in the beam of a dazzling searchlight.

Dr. Jennifer Wiseman:

We can study the atmospheres of these exoplanets by looking at the light that comes through that atmosphere from its parent star, as that planet crosses between us and the parent star. And we can see what wavelengths of light are absorbed by the atmosphere of that planet on its way to our telescope. And that tells us something about the composition of the atmosphere. And of course we'd like to know if any of them are habitable for life or harbor life. We don't yet know, but we're starting to develop the techniques of studying more explicitly what's in the atmospheres of these exoplanets and could they indicate biological activity going on, on the surface of that planet. So if we look at an atmosphere of an exoplanet and we determine that its composition is compatible with biological activity that would be really interesting.

Dr. Aasim Padela:

And as it happens the news broke very recently of a provisional but promising result yielded by investigations of an exoplanet prosaically called K2-18b. Professor Grady explains the significance of this result.

Professor Monica Grady:

The astronomers who are reporting the result from K2-18b have found two specific chemicals in the atmosphere of this planet. They've used the James Webb Space Telescope to look at this planet orbiting a distant star. And they've found that in the atmosphere there is a chemical called dimethyl sulfide, or DMS, and they've also found dimethyl disulfide, DMDS. These chemicals you know they don't sound very exciting and there's not very much of them but on Earth they are produced by microorganisms and so they are taken as a biosignature on the Earth. There are other ways of producing them which don't require biology but it's an exciting signal that, hey maybe there's some biology going on on this planet.

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Dr. Aasim Padela:

So these are some intriguing signals which could possibly be signs of a form of life outside our solar system. The dominant scientific view based on neo-Darwinian evolution, which we discussed earlier in Episode 2, asserts that primitive bacteria and algae existed for billions of years before larger and more complex and intelligent animals emerged. So how big is the gap between simple organisms and complex conscious ones, from algae to alumni? Professor Walker shares.

Professor Sara Walker:

It's quite a big step. It takes four billion years to go at least on our planet to go from the origin of life all the way up to intelligent thinking entities like ourselves. And so we have a tendency to argue that that process is rare, because we're the only species that has achieved human-level intelligence. But from my perspective you think about the evolution of the planet as a whole and all the diversity of life it's generated you know the real interesting question is: Is it likely for a biosphere when life emerges on a planet to achieve something like us through its evolutionary process? And I think there's no evidence to suggest that if we hadn't evolved, some other species might not have evolved comparable intelligence. So I think in some sense I feel like the evolution of life is a constant experiment in building more and more intelligent systems. And so it takes time to do that, but I think it's a natural consequence of what evolution is doing.

Dr. Aasim Padela:

All right I know some of you listeners might want to chime in and challenge Professor Walker's matter-of-fact type assertion, that the origin of human life was via evolution. This is a topic we covered earlier in the series. In Episode 2 we heard that many of our bioscientific claims are grounded in frameworks that take evolutionary accounts of human origin as their starting point. These truth claims build upon each other. But, as critical consumers of scientific information, it's important to get to know the different accounts: first to recognize them, then to tease them apart and finally, to critically assess their claims. That said let's continue on and probe the possibility of extraterrestrial intelligent life. Since space is so vast that we can't go out to other star systems and see and meet any intelligent aliens, at least not yet, we have been using our ears. And this search for life is depicted in one of my all-time favorite movies, *Contact*, which was adapted from a authored by the famous Carl Sagan I mentioned earlier and took inspiration from a real life program called SETI. Professor Walker is one of those scientists who tunes into the universe to listen for signs of life.

Professor Sara Walker:

SETI is the Search for Extraterrestrial Intelligence and that research program has been focused on trying to detect signatures of alien technology. So the idea being that we won't have direct evidence of intelligent aliens out there. What we will first interact with is their technology. And the technology that's most likely to be transmitted over interstellar distances

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is radio signals. And so SETI as a field developed in the 1960s. They really were targeting radio signals from extraterrestrial civilizations as the first target of how we might search for life in the universe. And that research program has been ongoing for many decades. Some people might argue that it's been a failure because we haven't found anything, but of course the search space is rather huge and we don't really know how many extraterrestrial intelligent civilizations are out there that might be communicating. And so we've been proceeding along, looking for these signals, for many decades haven't found them but of course there's a lot of territory to cover. I'm also really excited about exoplanet science interfacing with the Search for Extraterrestrial Intelligence.

We have all these planets that we found in the last several decades. They give new targets, because we actually now know that we're pointing our telescope at a planetary body, and not just in some region of the night sky. And I think that there will be some things that are quite promising. They're opening up new territories for what are called technosignatures, the signatures of technology on other worlds. So astrobiologists will look for biosignatures which are signs of biological activity on a planet, but we can also look for technosignatures, which are signs of technological activity. And there are a lot of proposed technosignatures that we might look for in the atmospheres of exoplanets.

Dr. Aasim Padela:

Yet even if those technosignatures exist, and could theoretically be discovered, there is that last term in the Drake equation: How long will they keep transmitting? Civilizations may fall silent for benign reasons. A civilization may all switch to quiet forms of communication—just like this podcast is likely coming to you via a quiet fiber optic system. More dramatically, they might destroy themselves or their sun may be unstable and destroy them.

Professor Sara Walker:

Well I think the real power of the Drake equation, in some sense philosophically, has been the self-reflection humans have gotten to do about our own cosmic context and thinking about our longevity as a civilization. And so I think the most interesting things about those terms are where they intersect our conversations about existential risk and our own longevity. I think it's very hard for us to reason about the possibilities for alien life at the current moment, because we don't really have a good foundation for what life is. And for me, solving the question of what life is as a universal phenomenon in the universe is the same as solving the mechanism of the origin of life. So I tend to not over-interpret those terms unless I'm actually being purposely anthropocentric and really trying to do a self-reflection on ourselves. I think it's quite hard to reason about life generally but I think no matter what the living system is, there will be a finite lifetime to the biology or technology that it transitions through. So any signal we might expect to have a lifetime but any expectation of what that lifetime is for that particular signal, is quite difficult.

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Dr. Aasim Padela:

If the universe were teeming with life we might expect to see it in every direction that we look. But we don't. That paradox was first noted by physicist Enrico Fermi and bears his name. It is frequently invoked and disputed in debates about the existence of ETI. Dr. Anders Sandberg, a philosopher and researcher at the Institute for Future Studies in Stockholm, who we heard from in Episode 4, has written a critique of it.

Dr. Anders Sandberg:

Given the number of places where intelligence could have emerged and made itself visible, if you multiply that with some reasonable probability, you ought to see a night sky full of alien activity. And the problem with that way of thinking of it, that paradoxical tension, is of course a reasonable probability. What is that? I actually believe that the real answer is we're pretty lonely. I don't think we're alone actually. I do think that the universe is so ridiculously big that we do have neighbors, but they might be billions of light years away. But that means that we're pretty unique. Then I can try to bolster that argument by some palaeontological evidence, looking at hard steps in the evolution of life on earth but it's all very probabilistic. It could be that if you just leave a puddle on a planet for 10 minutes under the right conditions you get life, or it could be that it's a really unique miracle that is not repeated over many observable universes.

Professor Sara Walker:

The Fermi paradox is really fun to think about. It was obviously proposed by Enrico Fermi when he was asking at lunch one day, where is everybody? And we are pretty perplexed by the fact that aliens haven't been obvious. And for me, through my career originally, I thought, oh yeah, if aliens are out there they should be completely obvious and we should immediately recognize them if they're there. But the more I think about this from the approach of science, and in particular thinking about fundamental aspects about the nature of reality, it seems to me that it's not really clear that it should be obvious to recognize aliens.

Dr. Aasim Padela:

Paleobiologist Professor Philip Donoghue wonders if we would recognize aliens as creatures broadly similar to ourselves if we encountered them - if they actually exist.

Professor Philip Donoghue:

Lots of people like to think that there's a high probability that we're not alone, that there is intelligent life elsewhere in the universe and it probably would be quite a lot like us. And their reasoning is that if you look at the living biodiversity we see lots of organisms which are very similar to each other even though they descended from very very different ancestors, and that's a process that we call evolutionary convergence. And there's lots of great examples of this if you compare for instance the evolution of mammals, so the split between the

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marsupial lineage and the placental lineage that we're derived from, that those are two effectively independent evolutionary experiments that are descended from an ancestor that had the equal obviously evolutionary potential and yet they produced very similar organisms. There's a placental wolf that most people are familiar with in the northern continents and then there's a marsupial wolf as well. There's a rabbit that we recognise and a rabbit-eared bandicoot that looks quite similar. And similarly there's a mole and a marsupial mole and these organisms look similar because they're trying to solve the same problems and their body plans are honed towards the same solutions by that directionless process of natural selection, but although the process is directionless it's constrained by the environment in which they live. Obviously moles look like they do because they have to burrow through soil and so it's inevitable really that other mammals that try to solve that same solution will end up looking a bit like a mole.

Dr. Aasim Padela:

Professor Walker agrees that evolutionary theory points towards convergence. But for her, the question of chemistry presents a stumbling block to the idea of life on other planets converging to resemble life on Earth.

Professor Sara Walker:

There's lots of layers to the evolutionary process and I think once you have certain forms they can converge, right? So you might expect wings for flight just because there's only so many physical solutions you have to flight. The question that I really have is more at the base level about the emergence of life itself. And if you think about the number of molecules, the chemistry a planet can generate, it is an enormously large space. And so questions about convergence at the biochemical level are actually quite hard because we don't have another example of life. So the possibility space for evolution is huge, but the solution space is maybe small. And I think we don't know generally how those things will interact. So I don't want to make a firm statement about human-like forms because I think that's so downstream in the evolutionary process. It's really hard to make that kind of conjecture, but my intuition is right now, based on the way that we're understanding mechanisms for the origin of life and proposed evolutionary models for other planets, that the evolutionary trajectory of life on Earth is unique to Earth, and we shouldn't expect things to be radically similar elsewhere.

Dr. Aasim Padela:

So the search continues for biosignatures or technosignatures through powerful instruments like the Hubble and James Webb Space Telescopes and the radio telescope arrays used by SETI. And if we did ever receive a clear signal from intelligent aliens, how would it impact life on Earth? Professor Davies chairs the SETI group that will be tasked with making such an announcement.

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Professor Paul Davies:

I've thought long and hard about the effect of discovery of extraterrestrial intelligence. Would it turn our society upside down? My feeling is that it would be a sensational bit of news, as you might imagine, and that for about a week it would dominate the headlines and then people would go back to cricket or baseball or politics or whatever it is that most interests them. And it would be comparable, I think, to the discovery that the Earth goes around the Sun or the discovery that humans had evolved over billions of years from precursory organisms. All of these things totally transformed our world view but they didn't cause riots. It would depend a little bit: if we discover extraterrestrial intelligence because a flying saucer landed on the White House lawn, you know that of course would be pretty dramatic.

But if what we're talking about is that on the basis of careful analysis we think that, some object 200 light years away was either a signal from aliens or was some sort of bit of technology that couldn't be explained any other way, so Seth Shostak at the SETI Institute expresses it very well. He says, people aren't going to wake up and read such a thing in their newspapers and then say, well I'm not going to bother to go to work today. I don't think it would change. Where I think there would be a long-term impact is in the great world religions because pretty much all of the world's religions, certainly the monotheistic religions, places our species homo sapiens in a pole position in the way that the universe is organized. And if we discover that we are not alone, then that may be threatened.

Dr. Aasim Padela:

Given what we've heard so far, how would religious theology be impacted by the finding of intelligent life in the universe? We will be getting to our exploration of the religious, particularly Islamic, views shortly. But before we hear from theologians, let's get the final word from our scientists. So let me pose the question, are we unique in the universe?

Dr. Jennifer Wiseman:

Of course we may be surprised someday and encounter more advanced life and that would be really exciting. From a scientific perspective, I just don't know if it either exists, the advanced life, or whether we would have a realistic chance of encountering it, even if it does exist.

Professor Philip Donoghue:

I don't think Earth is unique in terms of a harbour or indeed a cradle of life. It must be extraordinarily unlikely that life has not evolved on other exoplanets. Whether it has achieved intelligence is another matter altogether and my view is that bacterial grade life is probably very very common but the next step to evolving nucleated cells is such an unlikely event in evolutionary history that maybe life elsewhere is indeed restricted to bacteria and their kin.

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Professor Monica Grady:

I've no idea. I don't know, I think there might be loads and loads of microorganisms and you know, there must be other instances of evolved life but I don't know. I'm probably not going to live to live to see it.

Professor Sara Walker:

I think there are a lot of things about us that make it such that I think humans only emerged on our planet.

Dr. Aasim Padela:

All right, let me recap. From the bioscientific perspective we have heard about the search for life, both simple and complex, in the cosmos. We've searched through space telescopes looking for signatures of complex bioproducts. And by means of large radio telescopes on Earth we listen for sound signals from other civilizations. We were introduced to the Drake equation, which estimates the probability of there being ETI civilizations elsewhere in the universe. And how technological advancements are beginning to enable us to fill in some of those variables in that equation. We also heard about the search for a radically different form of life here on Earth which might suggest a second genesis, and that life is not as unique as we assume. As the scientific investigation progresses the reality is we have no definitive signal of there being ETI elsewhere in the cosmos. So it's certainly possible according to the science but the likelihood of such is still within the realm of speculation. Now let's hear religious perspectives on the question of ETI life and our place as humans in this wondrous cosmos.

Before we get to our focus question about ETI from an Islamic lens let's take a step back and consider the rich history of Muslims exploring questions about the cosmos. Indeed, the Islamic civilization made a wealth of important contributions to astronomy. And among those contributors were women scientists. Let me just mention one. The astrolabe, a navigational instrument used to measure time and the position of the sun and stars, was perfected by Muslim scientists, including a Muslim woman named Maryam al-Ijalyiyah also known as Maryam al-Astrulabi. Born in Syria during the 10th century, she took the craft of building astrolabes to the next level. The design of astrolabe required Maryam to work with complex mathematical calculations and with precision. And her work is recorded in the annals of scientific history. That said, let us examine the specific religious impetus for seeking knowledge of the skies. For me, a Qur'anic verse speaks to this imperative.

Qur'anic recitation

سَنُرِيهِمْ ءَايَاتِنَا فِي السَّمَاءِ وَفِي أَنْفُسِهِمْ حَتَّىٰ يَتَبَيَّنَ لَهُمْ أَنَّهُ الْحَقُّ ۗ أَوَلَمْ يَكْفِ بِرَبِّكَ أَنَّهُ عَلَىٰ كُلِّ شَيْءٍ شَهِيدٌ

We will show them our signs in the universe and within themselves until it becomes clear to them that this is the truth. Is it not enough that your Lord is a witness over all things? (Q 41:53).

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Dr. Aasim Padela:

The idea of God placing signs that indicate His existence and providing insight into the purpose and meaning of our lives in the cosmos and within our bodies deeply resonates with me. As a physician, I get to see the intricate and complex workings of the human body on a daily basis and it inspires awe and wonder within me. At the same time as, you probably now know, I'm a sci-fi enthusiast and greatly interested in space medicine. Let me share with you listeners a little known fact about myself. I spent time working at NASA's Kennedy Space Center on a project that was related to resuscitative capacities aboard the International Space Station. And I participated in disaster drills – actually I wrote them out – while I was training in emergency medicine. So considering the mysteries of the universe and how human life could live in space is profoundly interesting to me. This verse provides me with inspiration. And has provided countless Muslims with motivation to pursue science and to reveal truths about the universe and ourselves through that pursuit. For some that pursuit has a more specific religious purpose.

Speaking to this purpose is [Dr. Ahsan Arozullah](#). Dr. Arozullah was a key member of the working group of bioscientists, theologians, and educators behind this project. As I mentioned in Episode 1, with funding from the John Templeton Foundation our group designed, implemented, and tested a *Bioscience and Islam* curriculum that addressed fundamental questions about the human being in two countries. Having successfully tested the curriculum we've been conducting teacher training workshops, authoring academic papers and books, and creating resource materials to spur teaching and discourse at the intersection of bioscience, Islam and the human being. This podcast series is part of that mission. Now back to Dr. Arozullah. Aside from being a team member, he is a physician and is currently a pharmaceutical executive and a member of the [Al-Amin Ethics Institute](#) at Darul Qasim College.

Dr. Ahsan Arozullah:

We pursued astronomy from the perspective that for every Muslim they have to understand what direction to pray. The Qur'an speaks about the stars being used as navigation tools, navigation of the seas, navigation by appreciating that the stars had a map that you could orient yourself on the earth based on where the stars were, orient oneself at night versus orienting oneself during the day. So when we as Muslims when we determine the times of prayer in a given day, so much of that is based on the time that the sun rises, the time that the sun reaches its zenith, the time that the sun sets and so on. Even in the timings that we pray the month of Ramadan, the identification of the beginning and the end of the month is based on the sighting of the moon, the new moon. So there is this inherent connection with celestial existence, this connection to celestial realities.

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Dr. Aasim Padela:

When Muslims peered at the celestial sky using the tools of science, they also considered questions of a more theological nature. Here is [Bilal Ali Ansari](#), another key project team member, and a seminary-trained theologian and presently chair of the Department of Hadith Studies at Darul Qasim College. We listen to him as he speaks about the topic of ETI in Islam.

Bilal Ali Ansari:

I had always assumed that the first exploration of the idea of ETI was coming more from astrobiology or from the exploration of space in the last century. And so I came across a number of verses in my study in seminary that introduced the idea of multiple earths. There's a particular verse in the Qur'an, *اللَّهُ الَّذِي خَلَقَ سَبْعَ سَمَاوَاتٍ وَمِنَ الْأَرْضِ مِثْلَهُنَّ*, that God created seven skies and earths of its like, or in its likeness of the Earth. Some scholars interpreted that to mean that as complex as the skies are, and by skies we might interpret to mean the layers of space. Some scholars meant that what this verse is alluding to is the incredible complexity of the universe and that a similar complexity, like a microcosm of that, exists on our earth. And so they didn't assume the multitude of earths.

Dr. Aasim Padela:

Those are quite intriguing interpretations speaking to the multivocality of scriptural texts. But they also provide some basis for inquiry into the cosmos, and here on Earth. Indeed, it nicely dovetails with the verse I previously mentioned about science in the cosmos and amongst ourselves. I'm sure the idea of seven earths is quite fascinating to the listener.

Bilal Ali Ansari:

One of the really interesting reports you come across in the commentary of that verse is provided by the young cousin of the Prophet Muhammad, (صَلَّى اللَّهُ عَلَيْهِ وَآلِهِ وَسَلَّمَ), Ibn Abbas, who made a statement, a very fascinating statement, in the commentary of that verse. That this verse is alluding to seven earths, and seven in Arabic could allude to just plentitude, and so, many earths. And on each earth is a prophet like your prophet, an Adam like your Adam, a Noah like your Noah, and Abraham like your Abraham. And so this idea was then investigated by the Hadith critics or historical critics as to the veracity of the report and the implications of the report.

Dr. Aasim Padela:

Fascinating! So if I understood him correctly, Islamic scholars did not find evidence of ETI in the skies, but rather in their own scriptural texts. These discussions by Islamic scholars, which continued for more than a millennium, give us a fascinating glimpse into their thinking about ETI. They can also show us how scholars applied an epistemological framework to this question, and how that Islamic framework gave them infinite scope for exploration. For those who haven't already heard Episode 1, Dr. Omar Qureshi gives a detailed introduction to

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Islamic epistemology there. But for this episode, Maulana Bilal Ali Ansari describes the framework for us.

Bilal Ali Ansari:

Amongst the Muslim theologians there is an acceptance of at least three sources of sound knowledge, the first of which is transmitted or revelatory knowledge. And oftentimes when we think about knowledge claims within religion, we think solely from that perspective, that what does revelation state. But we also recognize that reason or rational knowledge is also a sound source of knowledge, and can also lead to certain conclusions. And then of course sensory or empirical knowledge is also a potentially sound source of certain or probable knowledge. It's so interesting that before human beings were able to develop empirical means by which they could determine whether or not the existence of ETIs was within the realm of probability or certainty, the scholars of the transmitted revelatory sources were already talking about this and debating them. I remember the first time I came across this hadith, I was also coming across popular media presentations of the multiverse, and the idea of parallel universes, and I was thinking along those lines, and thinking what do these earths represent? And that then made me think about hadith scholars, or scholars of revelation, as almost explorers on their own.

That if you look at the stars, and if you don't have light pollution, you're able to look out into the sky, you see stars within stars. And as scholars are suggesting today, that we don't know the vastness of the universe. And the farther that we look the more galaxies we're discovering. And within these galaxies you don't just have thousands or hundreds of potentially inhabitable planets, you have much larger numbers, and you have, 200 billion trillion potential planets. And so you're seeing existence of evidence within evidence. You have like the obvious stars, and then you have stars beyond them. And then you have a similar phenomenon taking place in hadith scholarship or revelation scholarship, where scholars are identifying realities beyond the obvious verses, and they're exploring them and finding even more evidence. And so the more that I looked into it, the more details I found, and it was as fascinating as looking at a beautiful night sky and finding that there are stars within stars.

Dr. Aasim Padela:

Truth be told, that is a splendid metaphor. Both the world of objects, like the sky and stars, and the world of texts, in this case religious texts, can be explored scientifically, and we can discover details about the reality and universe around us within both. In the Islamic paradigm, both have the same source, God. Hence there exists a primary unity of knowledge and possibility of integrating various types of knowledge into one. We then also have a powerful intellectual resource, another star in the firmament, if you like, to illuminate the meaning and importance of that knowledge, in the epistemological system we heard about in Episode 1. Returning to Maulana Bilal, what implications do present-day scholars identify that the existence of ETI might have on ideas of human uniqueness?

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Bilal Ali Ansari:

Looking at the question from an Islamic theological lens, one of the main considerations, or the main aspects of human uniqueness, is not biological so much as it is intellectual, that the Qur'an speaks about human virtue or human uniqueness in the context of the intellect and capacity to not only reason but also to receive and transmit revelation. In also Qur'anic evidence, we find mention of human uniqueness in the context of divine honor or veneration. That God honored Adam by ordering angels to bow before him and that He created Adam with his metaphorical or figurative two hands. A third aspect of human uniqueness is the idea of moral agency and moral accountability, which sets us unique as human beings from other potentially intelligent beings like angels because they are not accountable morally speaking, nor do they have free will. And then I think one really interesting idea of human uniqueness that is mentioned also in Qur'anic verses is the idea of what we might call a cosmic subjugation. Or the human being as a microcosm of the universe, and that God says that He has made creation subservient to human beings which is tied to moral responsibility. And that affords human beings a privileged place in the cosmos. This is a really interesting idea that suggests that human beings might be unique in the sense of responsibility to care for that which has been subjugated to them. So from a theological perspective, this is one of the ways that we look at human uniqueness.

Dr. Aasim Padela:

So would the discovery of ETI impact these theological understandings? Maulana Bilal shares some context to the Qur'anic descriptions of the unique role of humans. Perhaps surprisingly, this uniqueness does not seem to require humans to be exceptional or alone.

Bilal Ali Ansari:

In fact, the Qur'an speaks so much about other creatures and the vastness of the universe in the same context of this responsibility, that God has subjugated the earth and the skies to man. What's very interesting is to find that early Muslim theologians, commentators on the Qur'an and hadith scholars, were suggesting some really bizarre ideas about the existence of creatures on other planets and proposing that there could be a variety of humanoid creatures, there could be of course angels and jinn on these planets. And they were very comfortable with that because they recognized that this vast universe potentially is not void of life.

Dr. Aasim Padela:

Now, astronomer and astrophysicist Dr. Jennifer Wiseman, whom we heard from earlier in this episode, reflects on the possible existence of ETI from her perspective as a person of faith in the Christian tradition.

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Dr. Jennifer Wiseman:

I believe in God. I believe that the universe is operating and even changing under principles of physics and chemistry, but those principles of physics and chemistry are part of God's creation. I do believe that the universe is wonderfully made by its creator and it has grown more hospitable to life because of the fundamental forces that God has put into play. We're seeing that with astronomy. And so I look at what God has enabled on planet Earth, the variety of life and how life on Earth is able to change and adapt to different environments to thrive and to be stable even when environments change. So I think that God loves life. We can actually see it in Holy Scripture that God is responsible for a variety of life forms on planet Earth and seems to take delight in that life. And so we can too. And therefore, we should love all these creatures on planet Earth and do our best to be kind to them and be good stewards of the planet so they can thrive along with us.

I would imagine that that same generous God would be honored and glorified by there being life on many other planets as well, at least what we might call simple life. When it comes to advanced life, you know, I don't know the answer to that because it does seem that, at least on planet Earth, humans have a special place which we can use and have used for great good or for great evil. But we do have a dominion. And I don't know if that means that there are no other creatures with that sort of capability on other planets or whether the universe is full of these advanced civilizations. And it turns out that people have been thinking about this for centuries. This is actually an ancient question.

Dr. Aasim Padela:

For some ancient historical context, Greek philosophers like Epicurus anticipated present-day astrobiologists. They theorized a vast universe would logically contain a multitude of worlds and life forms. Maulana Bilal emphasizes that the discovery of ETI would not pose a problem in relation to an Islamic understanding of human uniqueness.

Bilal Ali Ansari:

I think it's important to appreciate that Muslims do not attach divinity to humanity. We attach divine honor and veneration to humanity, but we do not believe that God existed in human form. Muslims didn't really feel like there was a conflict, because we didn't believe in a physical anthropocentrism. If humans are unique in the universe, it's not because they're physically located at the center of it. It has more to do with divine responsibility and divine honoring. God says that We created man in the best of forms, but then we also reduced him to the lowest of low. The implication here is that human beings have the potential to be the most unique and virtuous of God's creation, but also the potential to be the worst. And so it's the potentiality that is the central aspect of human uniqueness, which is more of a reminder of our responsibility than an ability to sit back and simply depend upon our virtue as God's beloved creation, without actualizing that in the form of good action.

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Dr. Aasim Padela:

Okay, so the existence of ETI doesn't pose any problems theologically. But how do we assess it epistemically?

Bilal Ali Ansari:

What's interesting is that some evolutionary biologists and astrobiologists do suggest that the idea of evolution is so potentially complex that despite the vastness of the universe, it's still potentially true that we're the only planet where life was able to form just because it requires so much like perfection of circumstances for life to come about. But certainly, it seems like it is a possibility. And that's where then the framework that Islam provides of these three main agreed upon sources of knowledge, the empirical, the rational, the revelatory. If we were to look at how we're supposed to interpret evidences that exist within each of these spaces, what would we conclude about this possibility? And so if we looked at it rationally, I think the existence of such human-like extraterrestrial intelligent life is, it's neither necessary nor is it impossible. It's certainly a rational possibility. Secondly, if we were to look at it empirically today, the vastness of space and exoplanetary systems suggest the possibility, but offers no conclusive proof, of such creatures. And then if we look at revelatory sources as well, we find suggestions, right? So we have these verses that I mentioned that, you know, this verse in Chapter 65 verse 12 that Allah or God created seven heavens, and of the earth they're like.

Qur'anic recitation

اللَّهُ الَّذِي خَلَقَ سَبْعَ سَمَاوَاتٍ وَمِنَ الْأَرْضِ مِثْلَهُنَّ يَتَنَزَّلُ الْأَمْرُ بَيْنَهُنَّ لِتَعْلَمُوا أَنَّ اللَّهَ عَلَىٰ كُلِّ شَيْءٍ قَدِيرٌ وَأَنَّ اللَّهَ قَدْ أَحَاطَ بِكُلِّ شَيْءٍ عِلْمًا

It is God who created seven heavens and a similar number of earths. His commandment descends throughout them. So you should realize that He has power over all things and that His knowledge encompasses everything (Q 65:12).

Bilal Ali Ansari:

This is not conclusive evidence that there are multiple earths, but it certainly suggests the possibility of other earths that are inhabitable. And then we have on top of that more suggestive evidence, a report that has also been criticized and it is not agreed upon, but the report of Ibn Abbas that suggests not only the existence of human-like creatures, but the presence of prophets and other Adams, though its authenticity is probabilistic. And it's really interesting to find that some of the scholars, in order to avoid a potential theological conflict, they have mentioned that these prophets are not actually prophets, but sort of representatives of prophets, or warners, who take the message from this earth. And so they are like the warners who represent Noah and Abraham, etc. We also have another verse in the Qur'an where God says that He scattered creatures in the heavens and the earth. The word *dabba* is used.

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Qur'anic recitation

وَمِنْ ءَايَاتِهِ خَلْقُ السَّمٰوٰتِ وَاَلْاَرْضِ وَمَا بَثَّ فِيْهِمَا مِنْ دَابَّةٍ ۗ وَهُوَ عَلٰى جَمْعِهِمْ اِذَا يَشَآءُ قَدِيْرٌ

And among His signs is the creation of the heavens and earth and all the living creatures He has scattered throughout them. He has the power to gather them all together whenever He wills (Q 42:29).

Bilal Ali Ansari:

And the word *dabba* linguistically refers to walking creatures. So there's this idea that perhaps if God says that they're in the heavens and the earth, and this is not referring to angels because angels don't move like *dabba* but they wouldn't have been described as walking creatures or even crawling creatures, so the conclusion through our framework is that it's certainly a possibility but not a necessity. And is this question remains within the realm of curiosity, which I think is very comforting. Because the first time I brought this question up to a colleague, it seemed like they were concerned. Like, what are the implications? What does this mean? And I said, I don't believe that we need to be concerned, I think we should be excited. We should be excited about these conversations. And certainly because Islam is an evidence-based faith, our faith and our creed is based on evidence, our empirical findings are proposed and challenged by virtue of evidence, and our rational conclusions are also evidence-based. Why wouldn't we want to entertain this as long as the framework is sound?

Dr. Aasim Padela:

So it seems we're left with three knowledge sources: empirical, rational and religious—or in the words of Dr Omar Qureshi, transmitted—giving considerable weight to the possibility of ETI. Well maybe that explains why science fiction is so popular and that most blockbuster movies are about intelligent aliens. I think James Cameron should consider a Muslim actor or a Muslim tribe in the next Avatar movie. And if any of you listeners have a connection to him, let him know that I'm happy to be the medical and theological consultant on that film. Back to the matter at hand, I wonder if there are ethical considerations to the quest of discovering ETI? Maulana Bilal considers this question through an Islamic epistemic and ethical framework.

Bilal Ali Ansari:

There's an aspect, a very practical aspect, to this question and that is, how do we utilize our resources given the nature of this inquiry, that it is speculation? How do human beings take on that responsibility, the moral responsibility, of asking questions and how far do they take it? So we see that of course certain questions that human beings are asking today require an incredible amount of investment; how did the Muslims look at this question for the last thousand years and how in the present would they look at it? And that's where we have to appreciate two frameworks. One is that this question exists within the realm of probabilities and not certainty. We may never know in our lifetime or in the lifetime of many generations

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whether there is life on other planets, and we have to be comfortable with that. The second is, are we even permitted to be asking these questions? And if so, to what extent?

And so I think Islam answers the first question that yes, there is permission to ask these types of questions, as long as the question and its answers are placed within the proper framework, and then the utilization of resources is appropriate as well. And we find that there are at least two voices within the Islamic intellectual tradition that speak to this question of speculative inquiry. The first is the cautionary voice which existed very early on like the companions of the Prophet who would warn against what we might call idle hypotheticals.

When sometimes some companions of the prophet would be asked a question that was of a legal nature, and legal questions tend to be much more practical, they would warn against them and say, has it happened yet? And then you had permissive voices from the early centuries like Abu Hanifa for example, who not only permitted speculative inquiry, but they saw value in it for intellectual training and in preparation for the possibility of future events.

I think it's a little bit troubling that we find that young students of natural science, theology as well, they are very disturbed by questions of little practical value. And so they sort of harp on these questions and, "I need to know the answer, and if I don't have the answer to the ETI question, my faith is in question, my life is in question." And I think that's where then the more cautionary voices should be heard that maybe there's something a little bit more necessary for you to focus on and prioritize in your life, but keep this question within the realm of possibility. And then to also allow them to recognize that even if we were to come to a conclusion, it would remain speculative. And the impact of these conclusions would not challenge the theological ideas of human uniqueness and the finality of prophethood.

Dr. Aasim Padela:

Dr. Wiseman also comments on this idea. She emphasizes the value of investigating speculative questions, and points out that faith perspectives can inspire scientific curiosity and inform ethical uses of knowledge.

Dr. Jennifer Wiseman:

There's a Psalm in the Bible that says the heavens declare the glory of God and the skies proclaim the work of His hand. Day after day they pour forth speech. Night after night they pour forth knowledge, but they're not using words. And it goes on to say, and yet somehow people all over the world get a message from that. And then of course religious faith also can order the way we use knowledge so that we hopefully use it not selfishly but we use it for good. And knowledge of the universe doesn't always have an immediate practical use but it can be used, I think, to lift our spirits, to inform to enrich our faith and our understanding of God and God's power and God's beauty and God's creativity. And it can also help us be curious and to unite. And you know, there's nothing like the study of science and in particular the study of space, that can bring people together from different cultures, different countries, to want to work together to explore space to learn more to realize that we share citizenship on planet earth. That we are related and to treat each other with mercy and in ethical ways. So

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religious faith can also inform and enrich that way of shaping how we use this knowledge of the universe and of space—and of anything we study in science—for the benefit of others.

Dr. Aasim Padela:

Thus far, we've been examining the ETI question as a hypothetical. But what happens if we discover observable ETI? Would it be worrying or would it be exciting if ETI were discovered? How would this impact us? How should we respond? Maulana Bilal offers the following:

Bilal Ali Ansari:

I think a lot of questions excite me. And that's where I think we take comfort, in those permissive scholars, who thought that if there is a function to this type of inquiry we should invest accordingly. In terms of the practical utility, are we going to be able to cure cancer? From a materialistic lens, our major concerns would be what resources would we be able to benefit from, from these civilizations? What concerns might we have in terms of defense? But one of the interesting theological questions that first came to mind with our team when we were exploring this was the theological implications and moral obligation question: that if there is life on other planets, have they received the message? This comes from this imperative in the Qur'an that humans are tasked with the responsibility of carrying on the work of prophets. That you must carry on the message as far as possible. So if there is ETI, the first question I think from our theological lens would be, how do I fulfill that duty of conveying the message of truth to them? What if they are in fact ahead of us in that respect? What if they've come to us to convey the message as well. There certainly are some practical implications of this question but I think the first theological question would be the question of spreading divine truth. So this is where then the ethical framework is very helpful. Number one, that we have a sound epistemological framework. Number two that we have a sound scientific ethical framework by which we answer these questions, and then one can be very comfortable, and then like me to be very excited by these questions and have a cup of coffee with some friends and discuss the possibility and what would these other prophets on other earths look like, and where are these earths? Are they layered or are they within—are the different universes or can we actually reach them?

Dr. Aasim Padela:

And on that question Dr. Ahsan also chimes in with the thought that perhaps we could learn from aliens.

Dr. Ahsan Arozullah:

Primarily it would be, for me at least it would be, how could we benefit from that interaction from the knowledge that that civilization had created? So we have significant problems on the earth: food supply, waste, global warming, the list goes on and on of problems that we're trying to solve to help human beings live a better life, a more comfortable life without as much

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turmoil. I think sometimes a solution that comes from the outside sometimes might be received better. Human beings have their inherent biases: if somebody who looks like us, talks like us, gives us an idea, our tendency is not to want to take it. And you never know, if an alien comes up with a great solution, maybe human beings might be more amenable to it.

Dr. Aasim Padela:

As we've heard, Islamic sources place the human being in a uniquely honored place in the cosmos and amongst the creation of God. But the same sources also emphasize that the specialness comes with the responsibility to act morally. Does this understanding of humanity's place in the universe help to create a mindset of epistemological humility and give us a balanced perspective of ourselves within the vastness of the cosmos? Maulana Bilal Ali Ansari:

Bilal Ali Ansari:

I think it's a wonderful question because it speaks to I think the lesson that we find in these verses: That God created seven heavens and of the earth they're like, and that He scattered creatures or walking creatures in the heavens and the earth. They all suggest the same idea, that the vastness of the universe, there's like a moral to it. And it's a continuous reminder and symbol of our smallness. And then therefore also the need to appreciate that if we have any virtue it comes from that divine favor. And then lastly, it's a reminder of the need for an epistemic humility, to be humble enough to stay in my lane and say that, yeah I recognize that empirically, rationally and revelatorily there's no way for me to confirm this idea with any certainty. And in science I think that's a guiding principle that's lacking oftentimes there's a need for certainty in everything and there's also a need to be able to establish truth through a very very reductionist lens: that if I cannot prove something through through naturalism, through this reductionist science which only allows for conclusion through empirical evidence, then I'm not comfortable with truth and falsehood. That there is no truth there's no falsehood there's no good or evil. And I think that's fundamentally flawed from our epistemological framework.

Dr. Aasim Padela:

Dr. Ahsan describes how natural observations lead him back to the creativity of the Creator.

Dr. Ahsan Arozullah:

For the Muslim scientists it's not to stop at the understanding of the creation, but to appreciate the architect, the One who created all of this. So, God is never late with the sunrise. He's never late with the sunset. He's never late with the rising of the new moon or the waning of the moon. There are verses in the Qur'an that tell us to look to the heavens and the stars to gain that inspiration, but then also to look within ourselves. And this is where as a physician, even when we look microscopically on a moment-to-moment basis, the incredible things that allow us to be alive. It is quite overwhelming. And then the appreciation of who is actually

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managing that on our behalf. For the Muslim scientists is always bringing us back to the Creator. We don't ignore the creation in that process, but we don't stop at the creation.

Dr. Aasim Padela:

The final word of this episode goes to Maulana Bilal Ali Ansari. He encourages us to explore the big questions scientifically. And then, take a moment to look at the natural world and reflect.

Bilal Ali Ansari:

I think in the modern day of technology we don't look up at space at all. I used to do when I was much younger, just sit on the roof and look at space. Imam Ghazali talks about the idea of reflection, that Islamic civilization was a civilization that was integrative, and it recognized that everything is tied together. And so when you look at the cosmos, or you look at even your everyday life, you look at the, you know, the leaves falling from the trees, you are able to connect that to the afterlife. You're able to connect that to the metaphysical.

Dr. Aasim Padela:

This might just be my favorite episode of the series. And those closing reflections by Bilal Ali Ansari, so simple yet so profound, remind us to pause and to wonder. To consider both the human being and the cosmos as mysteries. And to use the tools of science and religion, not in opposition but in dialogue. That spirit of discovery, that fusion of awe and inquiry is something we desperately need in our lives and in our societies. I hope this series has sparked that curiosity in you and I hope it has given you a few intellectual tools to continue the journey.

Now, I can't help myself but as we close I'm reminded of a different kind of wisdom, from the world of Harry Potter. Do you remember the inscription on the golden snitch Harry holds near the end of his journey? That's right, it said, "I open at the close." And I hope that's what this podcast has done for you. As we close this series, perhaps new paths have been opened, new ways of thinking about the relationship between Islam and science. New approaches to crafting a professional identity that integrates religious and scientific sensibilities. New questions to carry with you as you contemplate the mystery of being human.

And because every ending is also a beginning, I want to share some next steps. We've curated additional resources to help you continue this exploration: an entire course on bioscience and Islam along with teaching modules, reading lists, and links to articles and books that build on the conversations you've just heard. You'll find it all on our project website medicineandislam.org If this series has moved you, challenged you, or helped you see things in a new light, I encourage you to stay connected. Follow the *Initiative on Islam and Medicine* online, share this podcast within your networks. And if you're able, support our work – your investment helps us in creating resources like these. That's all for now. Thank you for journeying with us and until next time wishing you, and the entire world, peace. *Ma'assalāma*. Signing off, Dr. Aasim Padela.

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Big Questions About the Human Being: Bioscience and Islam in Dialogue was presented by me, Dr. Aasim Padela with Dr. Raudah Yunus. This podcast involved a lot of hands and we owe gratitude to everyone who made this possible, several of whom deserve special mention. The producers are Kirsten Dwight and Martin Redfern, and this was a Beacon Hill production. Moez Masoud, Mohamed Darsha and their team from Acamedia Global and EMC media LLC were consultants and dissemination partners. The John Templeton Foundation generously supported this podcast. And we note the following organizations who walked the journey with us: The Medical College of Wisconsin, The Initiative on Islam and Medicine, the International Islamic University Malaysia, Darul Qasim College, High Quality Education Consulting and the Islamic Schools League of America.

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