

# OpenTheo

## Can a Scientist Believe in God? | Cullen Buie

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### The Veritas Forum

This program was recorded at a Veritas Forum event on Montana Tech in 2018. The original title was "Can A Scientist Believe in God?" and features Cullen Buie Professor at MIT. If you enjoyed this episode, please rate, review, and subscribe. And, if you're interested in more content from Veritas, check out our Beyond the Forum podcast. Visit [veritas.org](https://veritas.org) to learn more about the mission of the Veritas Forum and find more resources to explore the ideas that shape our lives.

### Transcript

Hi, this is Carly Riegel, the assistant producer of Beyond the Forum, a podcast from the Veritas Forum in PRX. The forum we are about to listen to is featured in Beyond the Forum's second season exploring the intersection between science and God. We interviewed Dr. Colin Bui, the presenter you're about to listen to, for episode four of our second season.

We talked with him about the role of curiosity in our work, and how the vocational practice of "following the river" can lead you down paths you'd never anticipate. You can listen to our interview with Colin for Beyond the Forum, wherever you listen to podcasts, and you can learn more about the ideas that shape our lives by visiting our website at [veritas.org](https://veritas.org). Thanks for listening and enjoy the forum. This is the Veritas Forum Podcast, a place for generous dialogue about the ideas that shape our lives.

This is your host Carly Riegel. When you've got about it or not, you have faith in a number of things. Maybe I'm thinking of the US government, or maybe a faith in the goodness of humanity, or maybe a faith that one day science will eradicate all the world's major problems.

Today, I'm sharing with you a conversation at a Veritas Forum event at Montana Tech in February 2018. The speaker you will hear from is Dr. Colin Bui of MIT, and he'll discuss his vocational journey and how he sees his Christian faith interacting with his research of bacteria. You can learn more about the Veritas Forum and events like these by visiting

veritas.org. I hope you enjoy this conversation.

So we're going to talk about science and faith, and I'm going to spend the first few minutes just talking about my science. So what do I do all day? And you don't need a PhD to understand this talk, so I'm hoping everyone will get a little bit of something out of this. So this work is definitely collaborative, so I've been at MIT for eight years.

I'm going to talk about two specific things going on in my group to spark your interest a little bit. All the people that you see underline, those are former students and postdocs that have worked on this. And Professor Gurgis is a collaborator from Harvard University.

But before diving in, I actually have to tell a personal story. And the personal story is this. It's interesting that me and Daniel will both send Nia for a little more for a little bit.

I was at Berkeley and then I actually spent a summer at Lawrence Livermore Laboratory, which is, you know, essentially right next door to send Nia labs and Livermore. And my PhD actually involved fuel cells. And shortly after I got to MIT, I started working in more biotech problems.

And one of the reasons for it is some tragedy that struck my family. So my sister, who was 35 at the time, I was actually visiting Lawrence Livermore Laboratory and talked to collaborators. About six months after I started my job at MIT, and I got a call from my brother-in-law just saying that my sister had passed away.

Now she wasn't sick. She wasn't, there was no chronic illness. This was just sudden.

So June 10, 2010, I got a call my sisters did. And it turned out that she had died from a bacterial infection from something known as sepsis. Anyone here ever heard of sepsis? It turns out the mortality of sepsis, even the United States is around 30 to 50%.

And my sister was a doctor. And this, like, after getting over the initial shock, this kind of captivated me that bacteria were still killing people in 2010. And so I started really just on my own personally, just looking up and just trying to understand more about bacteria.

And I learned a lot of things. And one of the first things I learned is basically the bacteria rule the world. And I really am not joking.

I think bacteria rule the world. One, they've been here longer than us. So we, if you think about life, life has been on the planet for billions of years.

Most of that single-celled organisms, we are like a blip at the end when you think about life. Think about resiliency. Now, you guys here, you guys are resilient.

But bacteria, they can live the deepest oceans, tallest mountains, high temperatures, hydrothermal vents at the bottoms of the oceans, low temperatures. They really set the limits, you might say, physical limits for life. Next, they're very productive.

Some of you may have just had dinner, so perhaps this is not that advertising. But in just one of your stomachs, they're more E. coli than humans that have ever lived. Just one of your stomachs, more E. coli.

And that's just one species of bacteria. There are actually thousands of species that live in your gut. And because of that, if you take all the humans and you take all the lions and all the tigers and bears on mine and everything from the lion king, you take all the animals and all the plants and you put them on one scale.

And then if you put them microbial world on the other scale, it's about 50-50. So because they're so productive, even though they're small and you can't see them, they're everywhere. They're massive.

So they have a huge impact on global processes, even though they're small. Now they don't just have an impact on big things, they also have an impact on us. Quick show of hands, how many of you have heard of the human microbiome project or the human microbiome? Okay, so the microbiome is essentially the realization that these bacteria and microbes that live in and on our body actually have a strong effect on our health.

They've often been called these organisms are often referred to almost like another, they're almost like another organ in terms of how much influence they have on your health. So for example, your body actually contains more bacteria cells than human cells and number of cells. So you are more micro, in terms of number of cells.

Now by mass, you're more human. By number of cells, you're more micro. There's a tremendous amount of diversity in the microbes that you have.

Even between your two hands, there can be an 83% difference in microbes on your hands. I joke people like to think, I think it's because they sample different environments. I'm often on my phone with my left hand and I'm often choking P sets out of undergrads with my right hand.

They just see different environments and that's why they have different microbes. There are also a lot of interesting correlations. So if they were to sample all of our stomachs today, they could tell us who was breastfed.

Even today, so signatures from those early stages of life are still remain in the microbes that are in and on your body. Now, there's a little secret and probably many of you don't know this, but most of the bacteria world is unexplored. So what do I mean by unexplored? So let's say this globe, this map of the globe represents all this surface area represents all the bacterial species in the plant.

It's estimated that there are around tens of millions of species of bacterial in the plant. So that's tens of the second. Now of those tens of millions of species, about 10 to the 4th have been isolated and characterized.

So that's way less than 1%, like 0.1%. So that's like, essentially, the area of Alaska. So imagine the whole globe, all we had explored was Alaska. Now, that's just what we isolated.

If you think about, to feel such a genetic engineering or synthetic biology, where we actually use microbes in order to produce useful things for humans, you need organisms where you can actually manipulate their DNA. Those organisms, it's around 10 to the 2th. So another 1% of the 1%.

So all of the advances you hear around genetic engineering of microbes is on essentially 1% of the organisms of the planet. That's like the air kinetic. Now this is interesting to be, this is interesting to be as an engineer, partly because if you just take one species, E. coli, you guys often hear bad things about E. coli, but E. coli actually produces a lot of useful things for humanity.

E. coli makes tens of millions of dollars per year in enzymes and chemicals for industrial use. So just one species. So as an engineer, I see all this space.

I think how many other E. coli like organisms could there be out there that we right now can't even get our hands on. So my group, my research group, looks at basically these two, you might say, 1% problems. The first problem, there are all these microbes on the planet that we can't even get a hold of.

How do we cultivate and get our hands on some of these organisms to learn more about them? And then of those that we can get our hands on, how do we make more of them amenable to manipulation and genetic engineering so that they can use more useful things for mankind? So on that first problem, this is a well known problem of microbiology. It's called the Great Plate Anomaly. So typically when you cultivate bacteria and you streak them on plates, these plates basically give them food where they can grow.

And it's been known for a long time that 90 to 99% of the bacteria you might see in an environment do not grow on these plates. Now one of the reasons for this is that microbiology is a field that has largely grown out of necessity in the sense that it's grown from our need to understand infections. And the beautiful thing about infecting bacteria is they grow very easily and they grow by themselves.

They grow like weeds. You don't need to do special things to get equalized and staff-oriented to grow. That's actually one of the things that makes them, that make them pathogens, that they grow very easily.

And they also grow by themselves. The problem though is that in the environment, I talked about all the millions of species, you almost never find them by themselves. But all of our techniques for finding microbes rely on isolation.

So in the environment, they're all in communities. But then all of our techniques in the lab isolate. And I thought about this with a colleague and if we kind of came to the conclusion, you know, maybe we just don't have them in the right type of environment for them to grow.

Maybe they need community. And you know, I thought about it like when I arrive in isolation, if you'd suddenly put me 50 miles east or west of here, I'm probably going to die. There are a lot of things I need to live.

I need Whole Foods, for example. I need the police because I might be, you know, I'm not a small person but I can't protect myself. I mean Google.

I need information. Sometimes useless information. But I need information.

So I need a community to survive and bacteria are very similar. So one of the things we did in my lab, we created these devices that essentially allow bacteria to live within communities. So what you see, this is an artist's rendition, where you see these micro-scale chambers where we can put essentially one cell and these cells are physically isolated from one another.

But the walls of the chambers are porous. You can almost think of them like prison cells. The bacteria can talk to one another.

They can't touch. And so because they can talk to one another, they can exchange metabolize. They can exchange goods.

They can exchange food. But they can't touch. So if they grow, we still have an isolated strength.

So we have a physically isolated strain. But they can communicate chemically. So an example of this is shown here.

Here we're exploiting something called quorum-sensing, where these red cells, or the red that you see, those are fluorescent bacteria. There are thousands of them, which is why you see it just blanket white, bright red. And so those fluorescent red bacteria, when they reach a certain population density, they start secreting a molecule.

The green bacteria, they only fluoresce green when they sense that molecule. So essentially when they sense this communication. So when you see the green and the red, they're actually talking to one another.

And we're visualizing that communication using these colors. You can almost think of it like a social networking platform for bacteria. Bacterial Facebook, maybe.

So let's say I look at the orange organism. It can talk to the green one. It can talk to the blue one.

But you see that yellow one is kind of isolated. And so we're using this to try to understand how bacteria relate to one another in communities and to grow those, you know, 99% of the organisms that are currently difficult to grow using isolation alone. So earlier I showed this picture.

I want to talk briefly about the second problem. So that's something we're doing to get more of these organisms to grow. But what about making more of them amenable to processes like genetic engineering? So genetic engineering is already changing our world.

So here I'm showing numbers for market sizes for genetic engineering using microbes and bacteria. These are already multi-billion dollar markets. Therapeutics, chemicals, and in biofuels.

And there are new frontiers where there's a lot of investments such as synthetic biology. We're here I'm showing just last year about a billion dollars was pumped into new companies that are trying to leverage synthetic biology for genetic engineering. Now there's another problem here.

The problem is that genetic engineering is not deterministic. It's unpredictable. So who here has an Android or an iPhone? Okay, submitting you.

So when you bought your phone, you buy your phone, it's got some software loaded and some hardware. But if you need a ride, if you need Uber, you actually have to download an app. You can download this app.

That app is software code. That code interacts with the hardware software already on your phone. And now your phone has new functionality.

Now your phone, you can be anywhere all over the world and use this ride sharing app to get where you want to go. That's precisely, I think that's a great analogy for what we want to do in genetic engineering. In genetic engineering, you want to take foreign code, genetic code, and you put it into a cell, that foreign code interacts with the native code and native hardware and software already in the cell to give you new functionality.

Now the problem though is that when you get out, isn't deterministic. So software engineering were far better at engineering or code that will lead to our desired output. In genetic engineering, it takes a lot of trial and error.

So this trial and error process is known as the design build test cycle, design in the sense that you design your code, your genetic code that you believe will yield the output that you want. You build it, you take that code and then you put it into the cell, that's the, you put it into the machinery. You didn't test it because you didn't know what you're going to get you up and test it afterwards to see what you got.

And then you learn from what you, you learn from what you see. Now there have been advances in recent years in three of these areas. So in the area of design, the cost of DNA synthesis has been plunging rapidly.

So now it's very cheap to synthesize DNA. Because it's cheap to synthesize DNA, you can test a lot of different code. So that allows you to do test a wide array of code so that you can figure out which code is going to lead to your successful genetic engineering project faster.

In the area of testing, there's high throughput testing, things such as FAST that allow you to take the results that have come from your cell and figure out which ones are giving you the output that you like. And then in the area of learn, there's been many advances in bioinformatics and machine learning that allow you to take all this data and figure out what is happening inside the cell. However, this build step that I'm showing here at the top right, they're essentially doing many of the same technologies that they've done 30 or 40 years ago.

So everything else has been advancing, but the speed in which we put things into the cell has been about the same. One of the ways this is done is something called electroporation. So an electroporation, you have a cell and you have electrodes.

So here I'm showing a cell, the two black bars are electrodes. You apply a potential and the cell polarizes and the surrounding media polarizes, but there's going to be a potential drop across the membrane. So essentially, you have a disproportionate accumulation of charge inside and outside of the cell.

And so the cell actually feels some stress because of this charge difference. It turns out that when that charge difference leads to a potential that's around one volt, the cell will actually open pores to relieve the stress. So you apply an electric field, the cell feels this electrical stress.

When that stress gets high enough, the cell opens pores because opening pores allows ions to move through and lower the stress. Now when you open those pores, not only ions can go through, but things like DNA or CRISPR constructs or other things that you get into the cell that you want to do for your genetic engineering. So I'll skip these two.

Basically, that's what I said. Once the potential gets around to vote, these pores open up and allow things to travel in. Now this process of electric operation, unfortunately, is very slow and tedious and involves a lot of manual pipe heading.

So even today where we have automated liquid handling robots and we have bioinformatics, when it comes to electric operation, generally speaking, is still very manual. I went to a company that's trying to leverage automation in order to do high throughput genetic engineering. And they have 96-volt plates automated, moving all

around their lab.

But when it comes to electric operation, they take the plates off the vine. They have two PhDs, pipes heading back and forth and hitting a button to do the electric operation. So even now, this state of the art, they can do maybe 2,200 samples per hour.

And so when people want to do high throughput electric operation, they usually try not to because it just takes too long. I think this problem has been articulated well by a 20th century philosopher, Sweet Brown. Anybody got time for that? So we were looking at this and we thought, well, could we do any better? So there have been advances in all these other areas.

How do we make this faster? So when we've done, we've taken what normally happens in those qubits and we put them inside of a pipette tip. So that entire electric operation process that used to happen in a cuvette and bromol involved a lot of pipetting, we actually put it into a pipette tip. So now the very instrument that's doing the liquid handling can now do the delivery of the foreign DNA.

So it turns out that this is about 10 times faster than what you can do using the manual process of pipetting. It's more efficient because of the way we're delivering the electric field. But we can also scale this up very easily to 96 or 384 experiments in parallel.

Ultimately, this process will be about 10,000 times faster than what people can do. So to put 10,000 in perspective, that's like the difference in speed traveling by rocket to the moon versus a racehorse. So 10,000 times faster.

So this is just some data. The main point of the data is we're better than the state of the art. That's the main point.

Here I'm showing the number of, here we were looking at E. coli, the number of E. coli that we were able to genetically transform or change compared to the state of the art. And this is just on a single channel. So this is not 96 in parallel.

So we're already a couple orders of magnitude faster just using a single channel in terms of our ability to deliver DNA to cells. So being at MIT, we actually founded a company to try to leverage this. And we were funded by a new ecosystem at MIT called the engine.

So when you look at the back right, that's me on the far right. That's Paul LaGracias, my co-founder in this venture, where we're looking to really make this even faster and apply this broadly. And to give you some perspective, I talked a lot about bacteria, but it turns out that this is also useful for mammalian cells.

And some applications that we're looking at now involve cancer immunotherapy, for example, where they want to take your immune cells and engineer them to find your cancer rather than giving you chemotherapy. So I'm going to end the research side of



the talk, but I feel like I wanted to let you guys know I am a real scientist. They didn't just find me on the street.

Well, they did find me on the street, but I happen to be a real scientist. A lot of this work has been funded by gender support from government agencies and tax dollars. In a set, I'm a big proponent personally of funding federal research because it impacts my livelihood.

But we've started this company and that company actually grew out of NSF and DARPA funding, which is taxpayer dollars. So those taxpayer dollars are ultimately moving towards something that's going to be commercial and will be hopefully for jobs. So with that, I'm going to change gears a little bit, and I want to talk about our subject, which is, can a scientist believe in God? So can a scientist believe in God? And to get into that, I think we're really talking about faith.

So in the introduction, you know, we faith came up like our faith and reason are those things incompatible. So I think we first need to talk about what is faith. So if any of you are like me, I want to make sure we're on the same working definition.

If you go to a subject for the first time, what do you do? Google search. I'm actually pretty sure some of you probably Google search me. If you Google search me, this is the type of stuff that you get.

Unfortunately, my name is very unique. And so when you Google me, everything you see is me. So I can't hide on the internet, unfortunately.

Now, thankfully for us, just like LeBron James and fake news and the Black Panther movie, faith actually has a Wikipedia page. So you can look up faith on Wikipedia. So I'll give you the Wikipedia definition of faith.

And it's this, faith is confidence or trust in a person or thing or a deity or in the doctrines or teachings of a religion. And they also be believed that it's not based on proof. Now, you'll notice here from this definition that faith is firstly a trust in a person or a thing.

Now, you may not think you have faith if you don't believe in God, but the fact is all of us have to have faith every day just to live. You may not have faith in God, but you're putting faith in other things just in your daily life. For example, you go to a stop, how many of you go to a stoplight and the light turns green and you start going before looking.

Do you look both ways to make sure no one's running the red light? You actually know. So where are you putting your faith? You have faith that the other drivers on the road are going to obey the laws. So even if you are a skeptical person, many of you, many of us, exercise faith every day.

So now I'm a parent and as a parent, you learn a lot of things. And one of the things that you learn is that when it comes to parents saying everyone is just making it up, particularly these days, everyone is just making it up like no one's ever been a parent before. And there are all these new, new, new fads and new things that people are doing to raise their kids.

And recently we ran into this. We have a daughter who's two years old and my wife was going back to work and we were looking for a nanny share. So in a nanny share, you have two or more families that are going to pay for a nanny and share the cost.

So it's usually a little bit cheaper. It's kind of like in between between a daycare and just having your own private nanny. It's a little more personal, but it's not quite as expensive as having a nanny by yourself.

So along the way, now we were lucky enough to find a family, but along the way, the nanny that we found, she told us about an experience she had with a previous client, which I thought was hilarious. This family had some pretty strict care conditions for their six-month-old. Now the first thing, they wanted the baby to be in a new activity every 15 minutes, all day long.

So let's say the top of the hour you're reading a book, then 15 minutes later, you're playing with dolls, then 15 minutes later, you're listening to music, 15 minutes later, you're playing with toy trains, all day long, and it had to be different things. And the parents actually kept a stopwatch. One of the parents worked from home and kept a stopwatch to make sure the nanny was changing every 15 minutes.

Now unfortunately, that was not the worst part of it. The worst part of it was that the parents insisted that the child had to be fed on one of these. So the nanny had to sit on one of these bouncing balls and feed the baby.

Like a six-month old? Like they're all squirping and they're it's bad enough as it is. So they wanted the parents, they wanted the nanny to sit on this bouncing ball and hold this six-month old. I mean, I could just imagine there would just be just applesauce, applesauce everywhere.

Like not in the baby's mouth. It's like a horrible idea. Now where did they come up with this? In fairness to them, everyone's just trying to do the best they can.

Maybe they read somewhere that, you know, switching activities was good for babies, brain development. I think it might lead to ADHD. But maybe they read somewhere that this was good for the child and maybe the bouncing they felt was soothing, but they don't know how that's going to turn out.

They don't know if that's going to lead to a student, you know, lead to someone that gets into Harvard one day or leads to a college dropout. They don't, they think it's going to

lead to good outcomes. They're exercising faith.

There's no way someone has done a study on sitting on a bouncing ball with a six-month old to see how that projects out to a future life. Right? They're operating using faith. So what is faith? And my, my definition of faith, so when I talk about faith, faith is believed in a person or thing with incomplete evidence, incomplete evidence.

So I don't actually ascribe to the Wikipedia definition of no evidence. It's incomplete evidence. So when I talk about faith, I'm talking about having incomplete evidence in the situation, but still acting based on that incomplete evidence.

Now, as I've already talked about, I'm a professor at a university and my job involves two things, involves teaching and research. Now the teaching, I just take within a textbook, I take no knowledge and pretty poorly delivered to students. So I take what's known and delivered to students so that they can use it later on in their lives.

Now in research, we actually are at the frontiers of knowledge. So we don't know what we're going to find. We don't know, you know, where we're going.

We often will take a hypothesis, but that hypothesis is based on faith. If we knew what was going to happen, it actually wouldn't be research. When you know what's going to happen, that's what's in the textbooks.

The boundary of what you know is research. So scientists actually have to conduct research using a whole whole awful lot of faith. Like if you were going to be a top-notch researcher at the frontier, by definition, you have to exercise a lot of faith because you don't know where you're going.

You don't know what is going to happen in the end. So I'd like to give some examples of people in science and including myself that exercise faith at various points. Now when I went to Stanford for graduate school, and when I first got to graduate school, I was tasked with designing a new type of fuel cell.

So a fuel cell, you can think of it like a hybrid between a battery and a combustion engine. So a battery takes chemical energy, converts it directly to electrical energy, which is one of the reasons they can be highly efficient. But an engine takes fuel, combusts it, and turns that into mechanical energy ultimately.

In a battery, you have a finite amount of charge or a finite amount of chemical energy that you can use. And then once you've used it, you have to plug your battery back in or switch out to battery. For a combustion engine, as long as you have fuel, it keeps running.

I say a fuel cell is like a hybrid because a fuel cell also, like a battery, converts chemical energy directly to electrical. But like a combustion engine, it runs on a fuel that you

continuously bring in. So you don't charge a fuel cell.

A fuel cell has a fuel tank. And so as long as you have fuel in your tank, you can continue to derive your energy. Now in particular, I was looking at low temperature fuel cells.

And in these fuel cells, we were taking hydrogen and air and getting useful energy, waste heat, and water. The problem in these systems is that the water is low temperature. And so some of the water is a liquid phase, is liquid water.

But we have these gaseous reactants. So as you build up this liquid water, it actually can prevent your gaseous reactants that want to react at the electrode. But you have these, you also have this liquid water, which is building up, which is a product of the reaction.

So you have to be able to get that liquid water away in order to have an efficient fuel cell. And so what my task was, was actually to design a fuel cell that used these pumps that have no moving parts. So what I'm showing at the top, that's actually a pump.

So what you see moving in and out is liquid water. And these pumps use something called electro-osmosis, which I know sounds a very complicated word. Essentially, we apply an electric field and upon application of electric field, with these really small channels, that pump consists of several small micro-channels.

When we apply an electric field, charges in those channels move and pump the liquid. So we have this pump with no moving parts that we can integrate into a fuel cell. Now when I was first tasked with this with this research, there were two PhDs, so two postdocs who have been working on this for six months and were unable to get into work.

In fact, my PhD advisor gave me this project and one of the postdocs moved me to the side and said, "That's never going to work." You might say ye of little faith. But in spite of that, in about six months, with a lot of long hours and a lot of effort, I actually derived the fuel cell that you see at the bottom, which ultimately led to my PhD. So ultimately, I got this thing to work.

Now, in all those long nights, what was the evidence I had? The evidence I had was, well, I knew these pumps worked and I knew fuel cells worked, but no one had ever integrated them. And in fact, the two postdocs who had tried before me had both done so unsuccessfully. Now, what was it that kept me going? I didn't have any examples to say this was going to work.

It was faith that I was ultimately going to be able to make this happen. There was no way I knew that it was going to happen. Now, in a lot of cases, for any of you, many of you in science, and including myself, I've had faith that ultimately turned out to be unwarranted, the ultimately that they didn't work.

But yet still, what keeps you going in those moments, in my opinion, is faith. You have

this incomplete evidence that you think something can happen and you keep pushing through. So I want to give some other examples.

Another example is the story of the light bulb. So who knows who's this? Thomas Edison. So Thomas Edison is credited with inventing the light bulb, though he had a huge team to help him do this.

So the story of Edison actually began to, well, before he actually invented the light bulb, because several other people had actually invented incandescent light bulbs before Edison. What Edison did was make one that was lower cost and slightly better efficiency and lasted longer. So he made a lower cost, more durable light bulb, you might say.

Now, Edison was a pretty interesting character, and he was so sure that he actually started working on this project to make a low-cost light bulb, to make gas lamps obsolete, and he actually pronounced victory before he had it. So he actually came out and said that gas lamps and other types of lighting were going to be obsolete, and two years later, he still had nothing. Now, could you imagine if Apple announced an iPhone, and two years later still didn't have one, that that wouldn't be a good look.

Now, in spite of those setbacks, Edison had a lot of critics as you could imagine, but in spite of those setbacks, he kept coming forward. It turns out that one of the key elements that he was missing was the right filament material for the incandescent lighting process. Over several months, his team tested over 6,000 different filament materials, 6,000.

Then, and when they ultimately found a suitable carbon material, in 1881 at the Paris exhibition, they debuted their new light bulb, and the demonstration was a huge success. Now, I have to imagine that along the way, maybe material 5,000, they had to think they must have had some doubts, yet they continued to work. They had doubters, they were losing money, they were the press and the media was all over them.

There were probably many chances where they could quit. What keeps someone going to get to that 6,000, to get to that actual material that's going to work? I would argue that that thing is fake. Now, there are other examples, so let's pick a more modern day example.

Who knows what this is? The collider. So, this is the large head-drawn collider at CERN. So, I would say, I wanted to pick this example because one of the things that's come out of this large system has been the discovery of the Higgs boson.

So, this particle, which was postulated by several scientists, including Peter Higgs, had eluded particle physicists for many decades, roughly 50 years. Yet, they believed that they had the right equipment, mainly this collider. They could ultimately find it.

Now, this collider costs \$10 billion, with a beat, \$10 billion. Now, using this system,

several groups have actually believed they found the Higgs boson. So, the question I ask is, why would a community of scientists spend five decades and count this billions of dollars in search of a particle whose only evidence was theoretical? I would say that's fake.

Now, perhaps it was fake themselves or fake in their theory and equations, but it was fake nonetheless. So, what have we talked about? I gave a personal example. I gave the edited example.

I gave an example of CERN. Now, I'm going to assume that there's still some skeptics out there. So, I'll give one more authoritative voice, Lord Voldemort.

Now, towards the end of the final Harry Potter movie, when everyone thinks the chosen one, Harry Potter is dead. Now, I'm not even going to get into the fact that, you know, here you have this chosen one, and he dies and comes back for his friends. I won't get into the parallels with that in Jesus.

But, if we just talk about what he says, Voldemort tells Jenny Weasley when they think Harry Potter is dead. I'll do my Voldemort voice. Harry Potter is dead! From this day forth, you put your faith in me.

Now, notice that he doesn't question the existence of faith. Just where it should be put. Even the dark Lord knows we all have it.

So, why do I bring up these stories? It's because I think, as mentioned earlier, a lot of people would have you believe that faith and science are like oil and water. And that just isn't the case. I would actually argue that faith is critical to science.

Not just something that can be tolerated by science. Faith is critical to science. Many of the greatest minds in history employed faith to advance frontiers in science, and those same people, many of them also have faith and job.

Some examples include Max Planck, who was a pioneer in quantum mechanics, and Francis Collins, who led the Hebrew Human Genome Project, and is currently the director of the National Institutes of Health. And if you ever visit MIT, I can actually introduce you to dozens of faculty, like myself, who have their faith firmly placed in Jesus. Now, the faith that you put in people, that's closer to what I mean when I say I have faith in Jesus.

You might say it's similar to the faith that I have in my wife. I can't prove to you without a doubt that she's trustworthy. Nobody can, how could you prove someone it's going to be trustworthy.

But I know her well enough to place a lot of confidence in her and to believe that she's worth safe sharing my life with. Now, for the young people in the room, if you wait until you have all the evidence before getting married, none of you would be here. Your

parents wouldn't have gotten together.

I mean, you bet your dad. You know you're dead. If your mom would have waited until she was sure about your dad, you wouldn't be here.

So we don't live in some world where some people employ faith and others do not. Everyone exercises faith. The real question is not if you exercise faith or if you're a person of faith.

The question is where is your faith? So faith is not some purely religious construct. It's really essential to human flourishing. Without it, it'd really be impossible to make it through life.

What do you thought about it or not? You have faith in a number of things. Maybe have faith in the US government or maybe have faith in the goodness of humanity or maybe have faith that one day science will eradicate all the world's major problems. Now, it's possible that some of you in this room have never thought about things in this way and you really have no idea where you put your faith.

Now, if you're curious to find out, I'll give you a quick test. Look for your hopes and your fears. Your hopes and your fears are all the pointers to where you put your faith.

So, for example, if your biggest hope is finding a good job, then perhaps your faith is in financial stability. Your faith is in money. Or perhaps your biggest hope or your biggest fear is of living alone.

Then maybe your hope or your faith is in human relationships. So look at your hopes and your fears. Those are all the pointers to where your faith is.

Now, what I would suggest for everyone in this room is that you identify where your faith is and test it. Just like you would any scientific hypothesis or theory. Now, how else would you know if your faith were in the right place? So, everyone has faith.

You need to find out where your faith is and now I'm saying that I think you need to test it. So, the next question is, well, how would you test it? Now, thankfully, life actually provides all the tests that you'll ever need. This world is full of many challenges to setbacks.

And my question to you is, can your faith handle them all? There's some forms of faith that are adequate at good times or in a small subset of life circumstances, but can they handle everything that you might encounter? Every time you encounter a new challenge, what I would recommend is you should ask yourself, how does my worldview or my faith account for this situation? Does your faith provide adequate answers to all the questions in your mind and your heart? And if not, you might need faith in something else. So, as I mentioned earlier, my faith is in Jesus Christ, but it hasn't always been there. I didn't

grow up in the church.

I actually became a believer in Jesus in college. Went to the Ohio State University and through a relationship or friendship with a roommate, I really admired what I saw from his life and it made me curious about Christianity. And I started going to church and ultimately gave my life to Jesus.

So, it was through a relationship later in life. It wasn't the way I grew up. But I will also say that though it came to me later in life, that faith has definitely been tested.

Now, one of my most vivid tests is something I already mentioned and it's the passing of my sister. So, my sister, a 35-year-old mother of two young boys, had suddenly inexplicably passed away. I had been a Christian for about 10 years at that point.

Now, it's easy to say your faith is in Jesus Christ or in science or anything else when life is going well. How does your faith hold up when you have to call your parents and tell them that their firstborn child has just died? Now, my wife and I were expecting a baby. But I couldn't get over the fact that my son would never meet his aunt.

I had a lot of questions. Many of you have been through situations like this and maybe you've asked some of these questions. If God is loving, why does he allow tragedies like this? Was this punishment for something that I had done or that she had done? Now, interestingly, I'm a scientist and last time I checked, the mortality rate is 100%.

Death is the most natural process of all. We all know we're going to die and see others die, but why does it still feel unnatural? Death, like I said, might be the most natural thing of all, but any of you, however, ever had a very close loved one die, there's something just not right about it. Now, I must confess that I never got an answer to many of my wide questions, but what I did get was something better.

Now, all the questions I had about my sister really boiled down to one. God, how can I believe you love me if you allow so much pain? The answer is this, through Jesus and really only through Jesus, do you have a God that endured pain? Jesus came and suffered so that we wouldn't have to suffer alone. There are many faiths and many religions out there, but none of them purport to have a God who comes down and enters our world, sorry, comes down, enters our world and suffers with us.

The question of suffering comes up often when people try to have counter arguments for Christianity and they say, for example, the question usually goes like this, how can there be a loving God when I see all this suffering in the world? And my answer is always the same. I don't believe in a general loving God. So I'm just a benevolent God that's kind of mystical.

I believe specifically in Jesus, because Jesus, as depicted in the Bible, is a God who came down and suffered with us. He suffered with us. So it doesn't tell you why we suffered,



but it does tell us why not.

It's not because he's not good. It's not because he doesn't love us, because he suffered with us. Think about it.

Anyone who you love, you've suffered with. Anyone you love, you've suffered with. So I can believe in a good God, and I can believe in a loving God, because Jesus suffered with me.

If Jesus didn't suffer, I couldn't believe. I couldn't have made it through my situation with my sister and still believe in a loving God if that God didn't suffer. So to close, my question to you is not if you have faith, it's where is your faith? Where is your faith? And when you locate an I suggest you test it, and you look and find out, doesn't really answer all the questions that you have about life.

And if not, I suggest you explore and find something that will. Thanks. Thanks, Dr. View.

That was a great presentation. And we were talking before this, you know, generally, you would become professors, just like to talk. And so, if two of us could talk probably five hours, we have about 20 minutes, like we said.

I'm going to ask you a couple of questions. Turns out we have some of the same, most of the same people, one of my friends, Professor Virginia Tech, and does electric racing for a lot of years. A lot of questions about that.

Maybe I'll talk to you a few weeks later on. But I mean, we have some high school students here. There's some college students and some community members.

And so, you know, you mentioned that you mentioned the story about your sister, a great touching. And you became a Christian in college, right? In a high. So, you have to look at that, that whole timing of events, and I think that maybe that was like God might have touched you before your sister passed away so that you could do what you're doing now.

Yeah, I absolutely believe that. And I feel as if God has had his hand in and all my life, my whole life. It's not just that I became a Christian and started developing a relationship with Jesus and made it from then on.

It's really, there's, God was working on me my whole life. And so, I absolutely believe that, I guess I believe, to try to say it succinctly, my life has a purpose. And everything happens for a reason.

There are no accidents. And so, the order in which things happened was very deliberate. It had to happen that way for God's purpose to be ultimately fulfilled.

And even the bad things that happened in this world can fulfill an ultimate good purpose.

And so, I believe that they had to happen that way. Even the tragedies.

Yeah, I think that's a probably the right response. Do you think that, like when you think about before you became a Christian and look at the troubles you had, he was sharing a story with me. I was talking about basketball.

I was, I watched the Warriors last week when I was in the Bay Area. And Dr. Dewey is a fan of the Cavs, right? So, he may not like the Warriors much. We started talking about shoes and how, he had one pair of shoes that got taken from him, but Zeeber, when he was younger, right? How would you deal with someone who takes your shoes as a kid, right? Maybe you lose a lot more.

You fail a test. You get a speeding ticket. Some bad things happen.

How does a non-Christian deal with trouble in their life versus someone who actually is a Christian? Yeah, that's a good question. And I've now been a Christian for most of my adult life. And prior, I think I was, I'm in life with a lot of anxiety.

I think that's just, there's no way around it. And growing up, I just had a lot of anxiety. I was anxious about a lot of things.

And didn't really feel a lot of security in life. So, things really, things really brought me down. In the sense that, if I got a B in a class, it wasn't that I thought I had a B in a class.

It was like, well, I must be a B person. I'm a B person. Or when bad things would happen, I often question like, well, I probably deserve that.

I had very low self-esteem, extremely low self-esteem. Not everyone deals with things this way, but me, pre-Christianity, I beat myself up. Something went wrong, it was my fault.

I should have done that. Maybe I deserved it. Even things that I didn't need to beat myself up about.

My parents got divorced in high school. And a lot of people can't relate to this. I blamed me.

A lot of people do that. And I was very good at blaming me and had very, very low self-esteem. And God has been working on me for the last couple of decades to still work in progress to get me out of those bad thought habits.

So now, when those anxious thoughts come up, I have verses that I go to, such as, do not be anxious about anything, but in everything through prayer petition, present your request to God. And the peace of God will transcend. And the peace of God will forgive me.

Anyways, Philippians 4:13. I have scripture that I can go to to tell myself a new truth compared to what I would do before. When I was younger, I told myself a different truth or different lies you might say about myself.

So now as a scientist, as an engineer, mechanical engineers, eventually sometimes become scientists. That's a word. At least we have friends who are scientists.

So when you approach a setback, and I like that you persevere, that's a great trick to have no matter what walker like. You are a Christian, not Christian. How do you deal with problems? And I guess it comes into this whole thing about faith and doubt and those two things that intermingle with everyone, Christians have that too.

So can you talk about faith and doubt and how you approach problems, especially as a professor working with the smart people, some future engineers and some colleagues? How does that faith and doubt play into the work that you do when you're solving problems and engineering, science, biology, this whole combination of what you did? How does that fit in? Yeah, I think the way it fits in for me is probably on the surface, I don't know that my work looks very different than other people around me, but I would hope that the people closest to me can see a difference. And I'll try to give a couple quick examples. One is, I'm sorry, I recently got tenure and the whole way working up to tenure, I did my best to work as if I already had tenure.

That's really hard to do, psychologic, because you know you don't have it. But at the same time, if what I, it was really a test for me of my faith in the sense that if I believe what the Bible says is true, which is that the Lord of the universe sent his son to die for me so that I could have communion with him for the rest of my life and throughout eternity, what could MIT or anyone else take away from me that could possibly compare to that? If I really believe that, how would I live my life? And so for example, the way it played out practically is, you know, my wife and I, for example, and I don't mean for this to sound Judge Venno, but we didn't wait for example to have children. We had a lot of, I have a lot, a lot of people that I know and academia and other places, they put their family on hold for their career.

But for me, my family was more important than my career, and one of the ways that played out is I didn't make them wait for tenure, partially because what happened with my sister, my sister died at 35, I'm 36 right now. How would I, how do, you know, it just kind of put life in perspective in the sense of, you know, a lot of times people put things off and say, oh, I'll do this when I get there, when I get there, you're not guaranteed to get there. You're only guaranteed today.

You don't have to be sick to die. You don't have to be old to die. And the Bible teaches that very same thing.

So I worked, you might say, is if I had tenure, the phrase that I wouldn't say to people is

if I had tenure in heaven, God, and not a tenure that I earned, but a tenure that Jesus earned for me, that no one else can take away. If I really believe that, how would I treat my students? How would I treat my family? How would I, how would I treat my colleagues? How would I pick my research problems? I was a bit more in some ways ambitious and took some risk partly because, you know, I tried to, I tried to live that out. It wasn't perfect, but that's how I tried to live out my work.

Yeah, great. So one of the things that always comes up when I was asked to, you know, I see this, you want, well, the scientists and engineers, and a lot of these people were scientists and engineers and, and all, you know, they did everything it wants and mechanics. A lot of the equations that we actually referred to were the fundamentals and textbooks.

A lot of these, these people were Christians, right, and you go back and, and they basically tried to get closer to God by understanding the nature, right, his creation. And, and so, you know, things have changed somewhat from those times, you know. What are your thoughts on that? Like the reasons why that's happened in the, you know, the scientific community that it's, you know, there's been maybe fewer, fewer scientists that are driven by, you know, they're not Christian, Christians at all.

And, and it's basically, you know, God is kind of out of, out of the picture. And so what are your thoughts on that? Like, how did, how did other scientists in the community get to that point? What do you think it'll go in the future? Yeah, I think there, there are a couple of reasons. I'm not an expert at this though.

I am very fascinated by the question. I think one of the reasons is that there's been a lot of skepticism and antagonism, like between the church and science. So you had many cases of the church persecuting scientists who were Christians themselves.

So those very unfortunate historical events, I think have started, started driving wedges between the church community and the scientific community, where as you say, it used to just be one, right? People were, people viewed science as a way of worship. People viewed their scientific work as a way of worshiping God. You, and that's, and that's how, that's how I view it.

In the sense that I read Genesis and I read that the world was created. And I think the personally, I, when I read Genesis, what I read is why the world was created. Like the world was created for God to, to, to enjoy, you know, the first day God said, let there be light and there was light and there was evening and morning.

God said there was good and then there, it repeats. And God said, and it was, and God said it was good evening and morning. It's like a poem.

It's like a love song that God has for creation. And as a scientist, and particularly as an

engineer, I feel like in some ways we are like reenacting. We're like being, we're doing creation with a little sea, right? Where we take, you know, you think of our teaching, we take a young mind and we, you know, create or we foster the ability to think different ways.

And we get, we get enjoyment out of that activity. We take a problem and we come up with a solution that leads to a higher quality of life or leads to others to solve new problems. And we get enjoyment out of that.

And I really think one of the reasons that scientists and engineers, we enjoy that, is when we do that, we are, we are mimicking our creator and we are, we are worshiping. So I think one of the reasons for the drift away has been kind of skepticism of the church for science. There's this thought that, oh, scientists are trying to explain away God.

And so we don't want to have scientists around. And that has kind of put up this, in my opinion, a false barrier between church and the scientific community. Because it's not, there's no word in the Bible that suggests that, you know, man should explore the creation of anything.

What I see from the Bible actually encourages that exploration, not discourages it. That's a good point. So when, when you go around and, and you were sharing, this is probably the smallest school he's been to recently.

Although you were, what was this small school he went to recently? Cold day, maybe? Cold day, but he was really big school. So when you go around and spread in your faith, you know, I mean, you might see some small things in people who have kind of challenged you a little bit. What's your thought though about as a scientist and, you know, truth versus hypothesis and trying to back up that hypothesis and how does, how does Christianity stand up to screw it? When you come out here and then you as a scientist, the facts are the facts.

And, and how do you see that play out terms of Christianity being challenged over all these years? Yeah, I think that that's a great question. And to me, it, it all kind of starts and ends with Jesus. In the sense that I believe that Jesus is real.

Make it was real person who was God who lived all this earth at a real point in time, affected real people's lives, really died and really was resurrected. I believe there really was a resurrection. I believe Jesus is real.

He taught some idea. I believe that's a historical fact. And so what it points to then you might ask, well, what are the evidence, what's the evidence for that historical fact? If you look at others in history, a great example I've heard is Alexander the Great.

And the writings on Alexander the Great were like four or five hundred years after he lived, yet they're considered authoritative. The writings of the apostles and the gospels

on Jesus were 40, 50 years after he lived. Like relatively speaking, that's like Twitter for the ancient work.

And Paul's writings are even sooner. Paul's writings, his letters to churches, which some of the very clearly lay out the gospel message that Jesus lived. He was God.

He died for our sins and was resurrected. Paul's writings were just a couple decades after Jesus lived. So for people of that day to spread lies about Jesus would have been like us today saying lies about Bill Clinton when he was president.

So Bill Clinton was president, you know, ended at 96 or so or George Bush when he was president. You couldn't make up a story that didn't happen with so many people around who were there, still alive. And so I believe that Jesus was a real historical figure.

And if he was real, and if he is real, then you just have to deal with it. Right? It's not a matter of opinion on, oh, do I want to believe in him or not? It's like, well, he's real. Then what do I do with this information? This man who said he is the way the truth and the life who died and was resurrected.

Like I have to, I have to take his writing seriously. And then a lot of other things flow from that. Jesus quotes a lot of the Old Testament.

Jesus believed in the Old Testament. So Jesus was real that Jesus really was God. And he believed that the Old Testament was inspired by God as well.

Then that's what I have to deal with that as historical fact. It becomes no longer a matter of opinion. It becomes, well, what do I do with this truth? I could just deny it and assume that it's not there.

But, you know, I've chosen to to live in accordance with that truth. Okay, great. Dr. Skidam, maybe one final question for this segment of evening.

Okay, we'll give it to my husband. So I guess there's some students here, and there's some, you know, do you have, do you have some, maybe some advice as they go on and try to pick some colleges and go out through life? And I know there's some people from central and a lot of people have faith in the room. Can you talk about that faith, that decision, you know, to be a Christian? And how they might expect, things they might expect as they go out there and interact with the broad outside of the puke, the broad community, the scientific community.

And maybe some advice for them so that they might be maybe less shaken as they experience life. Wow. I think, I think the Bible, for example, I think the Bible can be viewed in some ways.

This is a stretch of an analogy, but like an engineering textbook. So if you look at any

engineering textbook, let's say you're, I'm teaching Thermodynamics at the moment. So let's say you're in a chapter on the second law of Thermodynamics.

A lot of theory is presented up front. And then at the back of the textbook, they present problems, right, for you to work out how that theory works in practice. You actually don't know the second law until you've worked out the problems.

It just reads the theory isn't enough. And I believe wholeheartedly, being your Christian is the same way, and actually is the same way with whatever your faith is. You need to put it to the test and you need to work it out.

So for example, the Bible that has many promises, you need to work those things out. When things come up, you need to go to it and use it. And that's the only way that it actually is alive in your life.

I think a lot of people profess faith, but don't actively use it. They profess a faith in Jesus. But then when real trouble or when real decisions come up, they act like everyone else, which is why a lot of Christians have been a bad witness.

Right? The world looks at us and they see, they see murder, they see bigotry, they see hatred, they see racism, they see all kinds of unfavorable things. They think, well, why would I become a Christian if you guys are doing all this bad behavior? I think we need to use our, we need to actively use it. And to be clear, I will say I will say this, that it works, but it did.

It's not true because it works. It works because it's true. So it's not true because it works.

It works because it's true. But then you also you need to have a definition of what does works mean. Works doesn't mean you always get your way.

Works doesn't mean my sister doesn't die. My sister still died. I have three children.

One of my children has a genetic disease where his life expectancy is his early 40s. Works doesn't mean that he isn't born with that genetic disease. He was a Christian when I was a Christian when we had him.

Works is how I deal with that life circumstances. How do I approach life? How does he grow up? What is the witness we have for the world in spite of those circumstances? So to be clear, works doesn't mean life goes your way all the time. But I think my advice is really to work out your faith and to work it into your life.

Don't just pay lip service to it. But really live by it and try to have your actions consistent with your words. First, I just want to say thank you for making the trip out here for your wonderful talk.

But I guess my question is this. You talked a lot about faith starting with your definition

of faith being incomplete evidence. So in research and in science, a lot of times there's conflicting evidence.

And in our society and faith a lot of times we run into people who claim conflicting evidence regarding faith. So how do you deal with people and ideas both in research and in faith that are directly conflicting? Yeah, so I think that's a good question. So I'll give one maybe faith example.

A faith example will be I have some friends who are Muslim and something that they'll say occasionally is, "Oh, I believe Jesus was a good guy." And like there's a belief in Jesus and even some following on some of his teachings. And I actually don't believe Jesus was a good guy. I kind of believe it's a bi-modal.

Either Jesus was God or he was crazy. Like the stuff that he said, I don't know that it actually leaves a bunch of them all around. And so I think it sometimes takes some, I actually don't have a problem with conflict.

Conflict actually I think can lead to truth. I think a bigger problem these days is more apathy where it's doesn't matter. It's not "Oh, was Jesus real or not?" It's doesn't matter that he was real.

Like I can't we just live in his spirit or like why does Jesus have to be the only way? I think that's a bigger danger. I see at least on the faith side. It's not that people have conflicts.

It's much more so that there's this thought, "Well, you can have your faith and I can have my faith and this person can have their faith." And it doesn't matter what that faith is. I think that's a, it basically, it basically is saying that what you believe doesn't matter regardless of what it is. Just kind of like a watering down of spiritual life, which I think is a bigger issue than our conflicts.

When we have conflicts, they have two people that have passion and actually believe that it's important. I can have a great discussion with someone who's passionate from a different angle, agnostic, atheist, Judaism, because we coming from a point of passion, we both believe this thing matters and I can actually relate to that a lot more than the belief that, "Oh, it doesn't really matter." Now on the science side, conflict is interesting because you see a lot of, sometimes you see some pettiness come out of conflict. I don't know if you've seen this.

No, I have not. I mean, we like to think of scientists as being objective, but I'll never forget talking to a colleague who was proposing a new theory in an area that wasn't his. He was a physicist and he was getting into something in biology and he was not a religious person.

But what he said was that the way of people attacked him was very dogmatic and



almost, and almost persecution. Like they had a belief in their theory and then when he proposed his new way of thinking, which had evidence, people vehemently attacked him within science. And there are lots of examples of that within science.

We'd like to think of scientists as these benevolent, purely rational people. But we're just people. We're really just people.

And some of the same problems you see in other areas of the world, you see in science. So even amongst rational thinkers, you see often there's a lot of reluctance to accept a new theory. There's a lot of revisionist history in science.

And we make it think like it's just that there's linear progression. But I'll give one quick example. Sorry, I'm like talking too much.

You guys need to ask questions or I'll just talk a night. But I heard a talk by Richard Feynman or Richard Transcriptive will talk by Richard Feynman. One thing he talked about was something called pathological science, where you get an idea in your head and then you take your hypothesis and you look at it as real and then you look at all your data through that lens.

And then you basically get the answer that you wanted. So an example of this was the elementary electronic charge. And so Milliken and around the turn of the century, turn of the 19th century, got like 95% of the way to the fundamental electronic charge.

And then it took the scientific community 70 years to get the next 5%. So he did all this work and got 95% of the way there. And it's because people as they would do their data, if they were too far from Milliken, who had a Nobel Prize, then well, there must be something wrong with me.

Right? Because it must Milliken was right. So the charge was crept up for 70 years until they got it. Because people didn't believe data that was too far from what Milliken had.

And that was, that was scientists. What would be your viewpoint on science, the information for like the formation of stars and ideas or like evolution, like I saw from some of the organisms as opposed to like chemistry and the eyeball. Yeah, I alluded to this a little earlier and I will admit I am not an expert on astrophysics and theories of the early universe.

What I will say is this is that I'm eugenicist as certainly the first couple chapters of Genesis, not all of Genesis. But the first couple chapters of Genesis are more, in my opinion, telling us why the world was created, not how. And so there are a couple examples of this.

One is, let's say if we take the creation story, I should probably just read it, but let's say

we take the creation story, and God said that there be light and it was good and it's like evening and morning the first day. But the sun isn't created for like a couple days. So how did you have a day before the sun was created? It's like, and so then the question becomes well, why is it conflicting itself? Well, I think it's because it's not talking about a day in our sense.

I think it's talking about a time period, it's indicating some period of time or passage of time. I don't think it's a I don't think it's depicting our day. But all that said, I don't think the point of it is to tell us how.

I think the point of it is to tell us why the world was created. It was created for God to enjoy. God loves the world.

He enjoyed it. He celebrates and dances over the world. And this world is created, thus this world is good.

This world isn't an accident. I read, I actually was reading a book around creation and Genesis from a, actually from a particle physicist. And this particular gentleman was Jewish and he pulled out some old writings.

There was a Jewish scholar who like a thousand years ago essentially postulated the big bang. And it was totally based on his exposition of Genesis. And with the way the characters were written and the way Genesis is set up, he wrote like a thousand years ago that the universe expanded from something no longer than a buster seed, which is a very tiny seed with a tremendous, you know, explosion of energy.

He actually describes the big bang long before Einstein, long before relativity, long before any of that seven. He gets it from the Bible. So I don't know.

I don't, I think the Genesis is one of those things where it's not really meant to push for the details. I think that it's not supposed to be a scientific treaty on how the world was created. Think of who, who wrote it.

It was, you know, written thousands of years ago. But that person, if God had said, let's, let's say, let's say hypothetically, if we said that the big bang theory is correct, how would he have explained it? How would God have explained that to a man thousands of years ago? So anyways, I don't see, I don't see any issue anymore. Like when I actually first became a Christian, this was maybe my biggest anger.

When I first became a Christian, I believed that Jesus was real. And I believed that there was a historical Jesus. But when I read Genesis, it just didn't make sense.

Like how was this, how was the world created in an X number of days? It just didn't really sit well with me. And it took a long time of stewing over it before I came to where I am now where I feel perfectly comfortable with what's written in Genesis and my scientific

beliefs. So I'm a student in mechanical engineering and a doctor's skin is one of my professors.

So, sorry about that. Before I ask a question, I want to take a hand to this golden opportunity and say this in my favorite professor. Anyway, this question is open to both of you.

But going along the lines before definition of faith, I have to trust that you have faith with Bible's truth over conflicting religious texts. So what do you see as evidence in favor of the Bible over texts of say, the Quran with Muslim religion? So I'll give a quick caveat. And this caveat is that this is a tough question because I haven't studied the Quran in depth.

And so I'm not an expert on the Quran. I'm a layman with the Bible. Like I've read the Bible, grew, covered, or covered many times.

But at the same time, that doesn't make me an expert. Like I haven't read it in a subregional language. I haven't seen the original scrolls that they were transcribed from, which some people have.

So my caveat is one, I'm kind of a lay expert in the Bible. And I'm not even that in the Quran. But what I will say is this, one thing to me that makes the Bible unique is that reading it all the way through many times, there is a common story.

And there's a common story that is revealed by God to man over millennia. And let's for example, if you think of Exodus, Exodus, the story of the nation of Israel being being liberated from bondage in Egypt, and then thousands and thousands of years later, when you read about Jesus, when he's transfigured on the mountain. So there's a sea in the gospels where Jesus goes upon a mountain.

Peter, James, and John see Jesus' face shining bright like the sun, and they see Moses in Elijah. The original, when in some of the texts, what it says is that Moses in Elijah, they're discussing Jesus' exodus with him. And it's specific that they use the word Exodus because that Exodus from earlier in the Bible is not just about the liberation of the people of Israel, it's pointing to Jesus.

Everything is pointing to Jesus. And just that unifying thread throughout the whole Bible just makes it so compelling to me. And every time I read it, I just see that thread born more.

And it's whereas, for example, with the Quran, the Quran was inspired to give it to one person. The Bible has dozens of authors all weaving together into the same message. It's kind of like if one person were to come and tell me something, I would say that's interesting.

I would consider it, particularly that person were very trustworthy. But if five dozen people come and tell me the same thing over many millennia, that would be more compelling to me. So I can't say the, you know, I can't speak to the accuracy of the Quran, but the way the Bible is revealed to many different authors over millennia with a common, very common thread and message is pretty compelling evidence to me that it is inspired by God.

I feel alluded to, we talked about the hell going to have columns who work in the human genome. And as I recall, he is an agnostic. And because if you're in the work of the genome, he saw a feeling that he said, oh, this couldn't possibly be my chance.

It has to be a problem. So my question to you is, in your scientific work, if you're going across the situation, where a white bulb came on, he says, this can't possibly be my chance. It has to be a problem.

Well, what I would say is this, I don't think I've discovered or worked on anything quite as significant as the human genome. But what I would say almost weekly, something happens, or I see something in the lab. And what I will, I don't know if I'll say there has to be a God, but what I will say is I have marvel at the beauty of creation.

Like when I was talking about the bacteria, I really am fascinated by bacteria. The fact that there are so many different types, all the things, so there are bacteria that live in our gut that appear to respond to, and in some cases, stimulate neurotransmitters. So there are bacteria in your gut.

So there's some people that joke that, you know, do you want a cheeseburger or do the bacteria in your stomach want a cheeseburger? And just thinking of the complexity of life, I will say, like I said, in my work, I see a lot of things, like we've done some fluid mechanics work of droplets and brain and we've seen some beautiful images. And when I see those things, I think, wow, this creation, this world is so beautiful. Like it doesn't feel like an accident.

But I will say, maybe my biggest realizations of God, some of them have just been person-like with my children. Like if you witness childbirth and you witness pregnancy and you see all the things that have to happen to ultimately get a healthy baby to see how often it goes right to be as a miracle, because there's so many ways you can go wrong. There are so many different steps that you can go wrong.

The fact that it ever works to me is like a miracle. So I would say, yes, maybe not in my own work to the level of Francis Collins. I hope that one day I do something that's so profound that it will be very compelling evidence for the existence of a creator, an intelligent, you know, design or plan behind the world.

But what I will say is a lot of my work, I look at it, I think, wow, this world is amazing. It's

amazing that the world works like this. It's so beautiful, so intricate, and so ordered.

And it's further evidence to be that, or further reinforces my faith, I guess. Yes, earlier you challenged us to live the Bible. And I think part of that is evangelizing.

Do you find it appropriate or when you find it appropriate to evangelize, whether in school, campus, or at work? Yeah, that's a great question. I so I'll try to make two quick points. Anyone here seen Black Panther yet? You can be honest.

So so a few people, a few people have seen the movie. Anyone here love backup? Anyone here ever seen a great movie of any sort? What do you do after you see a great movie? You tell people about it. It's actually, I've heard it argued that you can you can you can think of it this way.

You haven't really enjoyed it till you told someone about it. Like if you had a great meal in town, like if you go to part two seventeen, right, you have a great meal, you're like, you want to tell people about it. Like you actually haven't really completed enjoying it until you told people.

So in some ways, I feel like evangelism is just a natural, it's just going to be a natural, um, result of really experiencing Jesus. Like if you if you realize that like I said, the Lord of the universe loves you individually so much that he was sent his own son to die rather than live in a world where he couldn't have a relationship with you. Like that is such amazing news.

It would be really hard to keep to yourself. Now that said, who would you tell it to? I I think it's it's often not that not that uh, you know, street evangelism and other things are wrong, but it's kind of easy to do what it relates to. Right.

It's like when you have when you've already established with someone that you care about them and you're not just telling them this and it's clear there's no ulterior motive. And it's also clear that if they don't believe that you're still going to be friends. I often think that that's a great place of evangelism is through relationship.

So they kind of started relationship with people and just as you would, you know, tell a friend about a great movie you saw or a great deal you had, even more so you would think that if they're living in close community with you, you're going to tell them about about your fate. And so I think part of it is having friends, friends that are not of your fate, like not just talking to people that, you know, don't believe what you believe, you know, in passing, but like make friends in class, right? Make friends deliberately make friends with people who disagree. And you'll probably learn some things about yourself because they'll teach you some things.

And you'll be in a better place, in my opinion, to evangelize what they do. You care about them for them. Not just, you know, you're not just telling them this and then you're going

to walk out of their life.

So in your journey of evangelism, I think you might have faced some challenges. So do you help give us some of the examples or some of the challenges faced and how you dealt with them? Yeah, I think, so honestly, I haven't had that many challenges. And I'm not sure what that means.

I do have plenty of colleagues that are not the levers. And maybe they just tolerate me. I don't know.

But maybe I need to be out there more. Maybe I'm not out there enough. Maybe if I were out there or I would, I would experience more or challenges.

I will say, I do remember a couple of instances where, for example, before ever giving one of these talks, I had two different senior colleagues, not at my university, but people I would consider mentors at other universities, tell me, you know, you shouldn't do things like that. Because you don't want people, like when you're going to pretend you're, you don't want people to be able to look online and find out potentially controversial stuff about you. Like maybe they're not a Christian or you just don't want people to find stuff like that.

And to me, doing that would have been saying that, well, Jesus isn't Lord, tenures Lord. So tenures Lord, and then everything else must be subject to that. And so you still have to be wise.

Like I did like, you know, go to my department head and like, you know, say you need to go to church or you're just going to hell. Like I was, you know, you could be savvy about it, but at the same time I did, I didn't hide it. So how did that feel after ten years? They told me that.

I didn't tell, I still haven't told him that. And I wouldn't tell him that. I wouldn't tell anyone.

That's not good news. That is part of the Bible. That's not the gospel.

It is part of it. That's not the, that's not the good news. I would hope that I could share the gospel with him.

But he would listen, not that he would, I, who knows what he would do. But a lot of my colleagues know that I'm a Christian. I don't hide it.

So I'll be in a meeting and I, I was in a meeting two days ago talking to junior faculty about, about funding. And I shared with them, I'll share this story. So I was, can I share another story? I have lots of stories.

Maybe four years ago, so right in the middle of the tenure process, I went through a very

severe funding draft, where for about a year to a year and a half, literally every proposal that I wrote did get funded. And it wasn't like I wrote two or three proposals. This was 15 to 18 proposals.

Over a year, year and a half did get funded. And I was very distraught. Because it's easy to think, well, I need this funding in order to hire students.

I need students, you know, so my group had published journal papers and I need to publish journal papers if I'm going to get good letters. Now, I know I need good letters. I'm not going to continue.

That's like where my mind went. And I've had a group of faculty that meets roughly every month or so to pray. And I remember distinctly meeting with the group kind of throughout this period, one particular meeting just really laying it out like, hey, I really need prayer for this.

Because while I know that I am saved and while I know that I am loved, I still want to do well on my job. And I don't want to be a failure at this. Like help my heart wrestle through this.

And I actually shared this with the junior faculty all of the story. And so it's hearing all the story. I was sharing the fact that I'm a Christian.

And now it turned out that for whatever reason, reasons I'll never, I'll never explain. I, you know, I remember after praying with this group of faculty that when I got home and prayed more about it, I really came to peace with the fact that what I really wanted was God to bless my plans. And I had to reevaluate if God wasn't feeling some of my plans that that mean that I wasn't but.

So I thought I knew how I was supposed to get tenure and how my life was supposed to go. And that's what I was really just trying to about. It wasn't that God was doing anything wrong.

It was that I had this plan. I thought I knew how things were supposed to go. And it wasn't going my way.

And so I was just strong. And once I realized that, I actually got a great deal of, I maybe you might say peace from it. And literally the next day, a grant I had read got funded.

Like literally the next day. And I shared this story with the junior faculty partially to tell them that you could have you you might have troubles and struggles, but it could be all right. But then also to share my faith and kind of what helped me through that situation.

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