

TRANSCRIPT

An Undeceptions podcast.

John Dickson:

The Undeceptions Podcast. Today's episode is a good example of why this show exists. There are some very confident viewpoints out there held by very smart people that are, on analysis, junk.

Audio:

Welcome to StarTalk. Your place in the universe, where science and pop culture collide. StarTalk begins right now. This is StarTalk, Neil deGrasse Tyson, you're a personal astrophysicist. And the topic today is science history specializing in a part of human history though, and nobody thinks any science happens at all, me included. And that would be medieval history. That is the benchmark for anyone's concept of where no science touched anybody's life. I got Matt Kirshen here to help me out as my co-host. Matt-

John Dickson:

That's Neil deGrasse Tyson, an astrophysicist and longstanding critic of all things religious. He loves describing the medieval period, roughly 500 to 1500 as the dark ages, characterized by ignorance with a side order of mysticism and miracles.

The period 500 to 1500, the Middle Ages is in fact one of the most lively periods of world history. I'm not just talking about what was going on around the Mediterranean Basin and the Middle East, one day, we have to do an episode on the Byzantine Empire, the best kept secret of human history. Even in Europe in this period, right in the so-called dark ages, it wasn't all flat earthers and biblical literalists. In fact, there were very few such people. There was a rich tradition of rational, even scientific pursuit. But this tradition is almost entirely sidelined by expert scientists like Neil deGrasse Tyson, and plenty of others. It's not because they're not great scientists, they are. It's because they're not trained in the only relevant discipline, which isn't science, but history. A professor of science is usually no more competent to tell you about the history of science than a brilliant modern musician is able to tell you about the history of music. This is why so many popular histories of science begin with the Renaissance in the 14th century.

Carl Sagan, in his multimillion copy, best seller, Cosmos, included a timeline that showed a few Greek philosophers, like Pythagoras and Plato at the beginning, followed by a wide blank space marked the dark ages that didn't end until the 16th century, with the arrival of Leonardo DaVinci and Christopher Columbus and all the gang. The basic thesis was that the Greeks and Romans were doing some mathematical and sciencey stuff. But when Rome fell in AD 410 or 473 or 493, depending on which event you choose to date the fall of Rome, that's another episode, Producer Kaley, the Fall of Rome. Yeah, cool.

Anyway, this catastrophe of the fall of Rome, whenever it happened, ushered in an age of ignorance and superstitions, so the story goes, that lasted roughly 1,000 years. Quick chime. When we cover the Byzantine Empire, I'll explain why people living in Greece or Turkey or Egypt, even in the 10th century, still thought they were living in the Roman empire and they weren't wrong. Can't wait for that. Anyway, apparently in the west, the dark ages, only started to come to an end with the Renaissance of the 14th century and finally with the enlightenment of the 17th and 18th centuries. That's when humanity could return to its love for art, reason and science. Yeah. Nah. I'm John Dixon. And this is Undeceptions.

Undeceptions is brought to you by Zondervan Reflective, the beauty chases by Timothy Willard. Each episode Undeceptions, we explore some aspect of life, faith, history, science culture, or ethics, that's either much misunderstood or mostly forgotten. And with the help of people who know what they're talking about, we're trying to undeceive ourselves and let the truth out. And if this hour of undeceive isn't enough, join the Undeceptions Plus community for a lousy \$5 Aussie a month. That's US \$3.45 or two pounds, 83 pence if you're in the UK. You'll get extended interviews with my guests, bonus episodes and tons of other extras. Undeceptions.com/plus.

I'm at the wonderful Cambridge University, one of the finest academic institutions in the Western world. And I'm meeting with Seb Falk, a specialist in medieval history, and the history of science. I'm meeting him at the labyrinth that is Girton College, a college specifically for women. I've been in many Oxbridge colleges over the years, but this one looks more like a hospital than a university college. There's a reason for that, and Seb Falk can't resist doing a little bit of a history lesson with me as we wind our way to his office.

Seb Falk:

... staircases. And the reason it was designed by the hospital suppose, was because if the education of women didn't work out, that they could then easily convert it into a hospital or a mental institution, I believe, was that alternative, because the idea that one might be able to comfortably provide higher education to women was thought to be dangerously untested. So even then-

John Dickson:

The myth about women's higher education has been happily busted. The myth about medieval higher education, somehow persists, and Seb is the one to talk to us about it. Dr. Seb Falk is part of the faculty of history at the University of Cambridge, where he researches and teaches about medieval science, mathematics, and medicine. He studied at Oxford University and was a research fellow at both Girton College and the Bavarian Academy of Sciences and Humanities, and he's also worked at the Whipple Museum of the history of science, also in Cambridge. Apart from his bunch of scholarly articles, Seb is also the author of *The Light Ages*, the surprising story of medieval science. Medieval science, it's an oxymoron of course. Can you describe for me the popular cliché, your book is really set against?

Seb Falk:

So I guess I have, in my mind, a scene from Monty Python and the Holy Grail where King Arthur comes up and the peasant is digging in the mud, and challenges king Arthur on the notion of monarchy and presents himself as a member of an autonomous collective. I don't know if you're familiar with the scene.

Audio:

What I object to is you automatically treating me like an inferior.

Well, I am king.

Oh, king, a very nice. And how'd you get that, hey? By exploiting the workers. By hanging on to outdated imperialist dogma, which perpetuates the economic and social differences in our society. If there's ever going to be any progress-

There is some lovely filth down here. Oh, how do you do?

How do you do good lady? I'm Arthur, king of the Britains. Whose castle is that?

King of the who?

The Britains.

Who are the Britains?

Well, we all are. We are Britains, and I am your king.

Oh, now you're the king. I thought we were an autonomous collective.

You're fooling yourself. We're living in-

Seb Falk:

But it's this idea that the film is parodying in a way, that medieval peasants were uninterested in the world around them. They just spent their lives digging around in the mud with sticks. And more than that, that even medieval scholars knew nothing about nature, and more than that had no interest in nature. And so my book is aimed at undermining cliches like everybody in the Middle Ages thought the world was flat. The medieval church stifled science and stamped on any kind of free thinking, and that people simply had no interest in the world around them. And also that there was no communication. It's often thought medieval Europe and the Islamic world and India, were completely disconnected. And one of the things I wanted to show in my book was how medieval Christians depended on ideas from other cultures as well.

John Dickson:

So yes, the caricature is of dark ages. Where does this language of the dark ages come from?

Seb Falk:

So this is something that's kind of evolved gradually over time, but basically there have always been times, or there have always been writings where people talked about a previous period as being a dark

age, or sometimes even their own period as being a dark age, and people are nostalgic for previous golden ages. Golden age, dark age, sort of sometimes go together. But the reference of the Middle Ages as a dark age comes out of the Renaissance really, where the thing that was being reborn in the Renaissance, of course, that's where the word comes from, was the glory of ancient Greece and Rome, and so they wanted to show that the-

John Dickson:

The earliest reference to an age of darkness is found in the writings of Francesco Petrarca, an Italian scholar and poet of the early Renaissance. He was a huge fan of the great men of antiquity, especially people like Cicero, Virgil and Seneca. And in a letter of 1359, Petrarca wrote about how he wished the great Cicero from first century BC could look down the corridor of history and see how people like Petrarca and others were reviving Greco Roman literature, and learning. Cicero would rejoice to see the end of the darkness and the night of era, he wrote, and the dawn of the true light. Boom. Petrarca had coined the dark ages.

Funny thing is though, Petrarca was a devout believer in Jesus Christ and the church. He was also friendly with the pope of the day. Not for a second did he blame the church for the dark ages, he blamed the barbarians and the goths who sacked Rome in the fifth or sixth century. The other funny thing about all of this, is that the next group to popularize the dark ages myth, were also devout Christians. My mob, the Protestants, who thought this would be a really cool way to take a swipe at the Catholic period.

Seb Falk:

And that was given kind of added boost by Protestant historians, particularly during the enlightenment of people like Edward Gibbon, trying to denigrate the Catholic church and basically saying anything that was touched by the pre-reformation Catholic church was ignorant and was beholden to some kind of authoritarian papacy. And that they were sort of trying to set themselves as kind of enlightenment figures, not anti-religious per se, but anti-Catholic church that this was an age of superstition and dogma and slavish obedience to kind of authority.

John Dickson:

You even find that Martin Luther describes the previous period as dark, particularly in that sort of religious Catholic sense. Is the term dark ages used in scholarship anymore?

Seb Falk:

Not really. I've been picked up on this in my book, because my book focuses quite a lot on the later Middle Ages. And some people say, "Well, nobody really calls the later Middle Ages the dark ages. They're really talking about the period before the year 1000." And the simple defence... In a sense they're right, because it is usually used more for the early Middle Ages, but you do still hear people talking about everything before 1500 as a dark age, specifically when they're talking about science in

particular. But elsewhere, you do still hear, but not in the scholarship. It's completely gone out of the scholarship, so people would just talk about early medieval.

John Dickson:

It's really worth pausing on this point. The expression, the dark ages might still be popular amongst the general public, and especially those who want to criticize the church. But in scholarship, like the relevant scholarship, the expression isn't used, for the simple reason that it's an inaccurate piece of propaganda. I can't resist offering you one of my all-time favourite passages about this propaganda. It comes from the pen of theologian historian and philosopher, David Bentley Hart. And it's so fun. It deserves our Undeceptions' house voice actor, Yannick Lawry.

Yannick Lawry:

Hence modernity's first great attempt to define itself, an age of reason emerging from and overthrowing an age of faith. Behind this definition lay a simple but thoroughly enchanting tale. "Once upon a time," it went, "Western humanity was the cosseted and incurious ward of mother church. During this, the age of faith, culture stagnated, science languished, wars of religion were routinely waged. Witches were burned by inquisitor, and Western humanity laboured in brutish subjugation to dogma, superstition and the unholy alliance of church and state. All was darkness. Then in the wake of the wars of religion that had torn, christened them apart, came the full flowering of the enlightenment. And with it, the reign of reason and progress. The secular nation state arose, reduced religion to an establishment of the state, and thereby rescued Western humanity from the blood steeped intolerance of religion."

This is, as I say, a simple and enchanting tale, easily followed and utterly captivating in its explanatory tidiness. Its sole defect is that it happens to be false in every identifiable detail. This tale of the birth of the modern world, has largely disappeared from respectable academic literature, and survives now principally at the level of folklore, intellectual journalism and vulgar legend. Atheist delusions 33 to 34.

John Dickson:

So what are our main historical sources for the medieval period and particularly for what you're calling medieval science?

Seb Falk:

Well, the kinds of things that people held onto in terms of documentary sources, written sources, were legal documents, administrative documents, records of disputes or judgements, and then chronicle sources as well. So essentially historical accounts that were written either at the time, or by people looking back, and then sort of biographical or hagiographical accounts of important people, which again sometimes were written at the time and sometimes were written a little bit later.

John Dickson:

Hagiography is just highly laudatory, biographical literature, usually of some great hero or saint. Hagiographies tend to be wildly biased, but they almost always contain some genuine historical memory.

Seb Falk:

And those can all be sort of rich sources for scientific knowledge, rich resources for historians studying the history of science, particularly where an abettor, a monk or a scholar was an important religious figure. I'm thinking for example, of Robert Grosseteste who became Bishop of Lincoln in the early 13th century, but also was a great writer on scientific subjects. And we know quite a lot about him because he was Bishop of Lincoln, but he also wrote these texts. So there are also quite a lot of scientific texts that survived. Now, the trouble is of course, anything that happened 1000, 1500 years ago, survival as a matter of chance, and particularly with all of the kind of historical vicissitudes that have happened in between. I'm thinking in this country of things like the dissolution of the monasteries. The monasteries had some of the greatest libraries in this country, and many of their manuscripts were sold off at the dissolution or just used for all kinds of things like starting fires and so on.

And also, even at the time, people weren't necessarily very good at preserving information that they considered to be superseded. You've got precious parchment. You might as well scrape off the ink and rewrite on it, or as I say, there's no point storing it if it's not useful information anymore, although they were pretty good about storing things. And then of course we have archaeological evidence, particularly instruments, but also architectural evidence in terms of the way the buildings were constructed and so on. But we have to be a little bit careful with that because survival can be biased, in the sense of when things are really used, they get used up, and medieval people were extremely good about recycling. So when something gets broken, they don't just leave it for a later historian to find. If it's metal, they melt it down and recast it into something else. If it's wood, it might get put on the fire or whatever it might be. So sometimes, we have to wonder whether the instruments that survive in museums today were actually ones that were less useful. So there's a little bit of problem with that.

John Dickson:

There's a lot of evidence missing. I guess it's a bit like that with almost all periods of ages passed. And some seize upon this absence of evidence, or at least limited evidence, as evidence of absence, as proof there was no good medieval science. In 1988, Daniel Boorstin's book on the history of science, *The Great Discoverers*, labelled the medieval period as the great interruption to humanities advance. In 1993, William Manchester's *A World Lit Only By Fire*, described medieval times as quote, "a melange of incessant warfare corruption, lawlessness obsession with strange myths and an almost impenetrable mindlessness." In 2002, Charles Freeman wrote in *The Closing Of The Western Mind*, that it was hard to see how mathematics, science or their associated disciplines could have made any progress in this medieval atmosphere. So I had to ask Seb if he's just being a quarrelsome gadfly, especially giving his book the title, *The Light Ages*.

Histories of science usually start with the 16th century. This is something you point out in the book. Are you just being quarrelsome, wanting to push it back a few more centuries?

Seb Falk:

A bit. I think there are certain people when they say, why is the Renaissance a mistaken picture? What's wrong with this idea that modern science or modern culture starts in the 1500s or in the 1600s? And then they say, "Well actually, I think modern culture started in the 1100s." Well, in a way, they're just playing the same game. Then the people from the ninth century say, "Well, what about the Carolingian Renaissance?" And you end up with successive renaissances. And so I suppose the big-

John Dickson:

Oh, I can't resist. Sorry guys. The Carolingian Renaissance is one of the other best kept secrets of history. And yes, Producer Kaley, please write that down, pen in hand. I can't see you doing it. Okay, great. Excellent. Thank you. Carolingian is just the word for the period created by Charles The Great Charlemagne, the ruler of Southern Europe in the late 700s and early 800s. He wasn't the sharpest tool in the shed. He tried to learn to read and write, but apparently wasn't awesome at it, but he had the wisdom to gather up all the brilliant scholars of the day, bring them to his court and set them loose on the public of Europe to establish schools focused on seven subjects, grammar, logic, rhetoric, arithmetic, geometry, music, and astronomy. Only then could people move on to the advanced subjects like theology, law, philosophy, medicine, and so on. By the end of his brain in the early 800s, there were literally hundreds of schools across Europe. It's the beginning of modern education. And that's partly why they speak of the Carolingian Renaissance. Okay, back to Seb.

Seb Falk:

... renaissances. And so I suppose the bigger point is to say, well actually, yes there are periods in history when there have been profound change in both technology, but also in the ways that people think. But that doesn't mean that everything that came before is worthless and it doesn't undermine the overall picture where change is extremely gradual. And not only do we find the seeds of important ideas in earlier centuries, but also ideas that we might think get superseded, actually have a long afterlife and carry on being believed. I'm thinking, for example, of humoral theory in medicine, or astrology. These are ideas which you might think are discredited by discoveries that are made during say the 17th century and 18th century, but actually carry on being believed by large numbers of people.

John Dickson:

Humoral theory, by the way, goes back to the ancient Greeks who reasoned that someone's temperament was influenced by the four liquids; humour is Latin for liquid, the four liquids that were in the human body, blood, phlegm, yellow bile, and black bile. The Greeks thought that the ratios of these liquids in our bodies determined our personalities. We get the personality description of someone as

sanguine from this. A person who was cheerful had strong doses of sanguis blood. Anyway, because humoral theory was in all the ancient textbooks, people believed it for centuries, not unlike the way some personality theories are still popular, even if somewhat debunked. The medieval church did assume the truth of humoral theory, but only because it was in the long-standing textbooks. People believed in a stable eternal universe for centuries as well, until big bang theory called that into question. Okay. But isn't there something more fundamental about the medieval mind that hindered the progress of natural science?

Seb Falk:

No, it's the short answer. Of course people have priorities. So often people make much of this quotation by Totali and the church father, who said, "What does Athens have to do with Jerusalem?" In other words, the provinces of philosophy and the provinces of theology should be separate, and each should respect the other, or certainly the philosophers should respect the theologians. First of all-

John Dickson:

But you only got to read a little bit of Totali to realize he's citing the previous philosophers left right and centre. He's an expert in the rhetoric of the time.

Seb Falk:

Yeah. Yeah, absolutely. Well, and the church fathers were very clear on this, that pagan knowledge could be, and that it should be put to use for Christian purposes. And of course, sometimes it needs to be made to fit, the obvious example being Aristotle's idea that the universe was eternal, it had no beginning and no end. And it obviously didn't fit with Christian belief. So some little subtle changes have to be made. But the basic point is that it's often stated that the church was entirely uninterested in studying nature. And that's a complete perversion of the truth, because the purpose of any kind of knowledge gathering by Christians was to understand the mind of God. And it was commonly stated that God had spoken of his purpose for mankind in two books, the book of scripture and the book of nature. And thereby by studying nature, you could understand God's purposes for the world. So Christians had a direct motivation for studying nature.

On top of that of course, there's this idea that the Bible has, within it, certain ideas about creation and about the structure of nature. And it behoves Christians to think about those things a little bit, and where they kind of conflict with ideas that other people are putting forward to think about those things and to be rational about them. And again, theologians were very clear about being rational in their responses to ideas about nature.

John Dickson:

Who are the people in the earlier period who are doing something like science?

Seb Falk:

Well, something like science is the question. The big figure, the early Middle Ages, the Anglo-Saxon period is based, up in the North of England in Jarrow, who did really important work on the calendar and time reckoning. And that's kind of, I think, an important-

John Dickson:

Yes, we are going to do an episode on the venerable Bede. We're gearing up to talk to a top Oxford professor about him. She's fabulous, and I can't wait for you to meet her. Anyway, Bede lived in England in the late 600s and early 700s. He's one of those polymaths who proves to contemporary historians that we didn't even have to wait until the Carolingian Renaissance in the next century, to have academics, clergy who were academics, who had expert knowledge of languages, observational astronomy, and certainly in Bede's case, an encyclopaedic knowledge of previous history. He wrote the first history of the English people. And it is a treasure trove of facts, real live facts about battles, economy, customs, religion, and language of the Romans, the Angles, the Jutes, the Saxons and the Celts. It's amazing.

Seb Falk:

And that's kind of, I think, an important thing to base a study around, because I think the Christians who were doing science in this period are really interested in calculating the date of Easter in the chronology of the Bible and working out what year we're in, essentially. And in order to understand the date of Easter, of course, because Easter is essentially a commemoration of something that took place in the Jewish calendar, and the Jewish calendar was luni-solar, you need to understand the cycles of the moon and the sun. So that then leads people to the understanding of all kinds of phenomena in nature. But also Isidore of Seville should probably be mentioned as being very iconic in the sense-

John Dickson:

Even earlier than Bede, is it not?

Seb Falk:

Yeah, sixth century, writing his etymologies, which does mean the same as what etymology means today, but it's an encyclopedia essentially of knowledge going back a bit further-

John Dickson:

Isidore of Seville was a Spanish scholar and church cleric. And his book Etymologies was a vast encyclopedia of knowledge about anthropology, cosmology, architecture, history, and agriculture. It appeared in 20 volumes, and it lays claim to being the longest lasting reference book in all of human history. One of Isidore's colleagues, another brainiac cleric of the period named Baldo of Zaragoza described Isidore's work as a compendium of practically everything that is necessary to know. Where do

you place someone like Alcuin of York in that transition from the classical learning to the modern period? Yes folks, I slipped Alcuin of York into an episode.

Seb Falk:

He's sort of alongside Bede in many ways as being someone who is within this kind of post-Roman Christian tradition. But also interestingly, because he's kind of part of the Carolingian Renaissance, thinking in terms of education and the value of education and who gets to be educated. And I think this is a sort of key feature about learning, being spread even slightly outside the monasteries and into schools, and that monarchs should be appropriately educated and so on.

John Dickson:

Not that they were very successful with [inaudible 00:29:58].

Seb Falk:

Well, they did their best. But also Alcuin of York is kind of a good example of somebody who travelled as well. And this is something I think that people often forget that medieval scholars, of course not everybody in the Middle Ages could travel widely, but medieval scholars had the opportunity to travel from-

John Dickson:

Yeah, from York to Rome and back, extraordinary. From Alcuin, you often get this reference to the seven liberal arts, and you write about them in your book. Can you tell us? Lots of people have no idea what the seven liberal arts are, let alone the idea that they were being studied in the eighth century and before of course.

Seb Falk:

Yeah. So the liberal arts is certainly to kind of... I'm not sure how the university setup is in Australia, but certainly in America, they still kind of form part of university life, this idea of kind of liberal arts course, which sadly actually in the UK, we don't kind of do so much, but they came out of essentially late Roman curriculums, liberal meaning suitable for a free person to study. And the arts of course, were not the humanities narrowly defined as we would today, but kind of really any subject of study. And there was some argument about what they included, but essentially they were narrowed down to seven, three arts of speech and argumentation, namely grammar, rhetoric, and logic or dialectic. And then the four arts of number mathematics, which were arithmetic, geometry, music and astronomy. And music was seen as a kind of application of arithmetic in terms of the way it-

John Dickson:

How harmony works and so on. Yeah.

Seb Falk:

Yeah, exactly. And astronomy was seen as an application of geometry, so they sort of come in two pairs. And those were the of core of the schools' curriculum and the way that monastery structured their learning up to and through the foundation of the universities in the 12th century. And then it gets a little bit distorted by the arrival of Aristotle's many books, which were structured rather differently. And so, although that said, the universities kind of slightly keep their divisions into these seven arts and Aristotle is sort of slotted in where possible for quite a long time.

John Dickson:

What came after the seven liberal arts? Let's just say you were a very successful student. What was the next subject or the one after that?

Seb Falk:

Right. So in the universities, the basic structure, although I think this is sometimes a bit oversimplified, is that there was an arts faculty. So everybody studied the liberal arts, and then that was what most people did, and then they left university and they went on and did something else. But if you carried on, you could move into one of three higher faculties, namely theology, law and medicine. And those were basically the three subjects. Law of course was useful for administrators as well as actual lawyers and judges and so on. And theology of course prepared you for a career in the church, and medicine obviously to be a physician. But the arts that were learned were carried on in those later faculties, for example, as astronomy would've been quite useful for a physician, the arts or grammar and rhetoric would've been extremely useful for a theologian and so on.

John Dickson:

By the way, I'm excited to say that I'm moving; I'm right in the middle of moving to a university that proudly continues this tradition of the liberal arts. Wheaton College, just outside Chicago, has appointed me to the Jean Kwame distinguished chair, my professor thingy as Darling Buff describes it, where I'll get to join in with the work of Alcuin of York, Isadora of Seville, the venerable Bede and the rest of the gang, in helping students think about how all the disciplines of knowledge, from Latin grammar to cosmology, illuminate and are illuminated by Christ and his kingdom. It is such a privilege. And Wheaton College is encouraging me to keep this little podcast thingy going. So that's what we'll do, after the break.

This episode of Undeceptions is sponsored by Zondervan's new book, *The Beauty Chases* by Timothy Willard. We asked him to put it in a sentence. What's the book about?

Timothy Willard:

When I looked around the church, and even in my own life, I looked at how wonder has kind of dissipated from the church. And this is, I think, a big problem in the church, and it can be even in people's lives. So *The Beauty Chasers* is about a lifestyle change of bringing worship and wonder back into your life.

John Dickson:

What does he hope readers are going to take away from the book?

Timothy Willard:

There's a physicist named Alan Lightman, and he was on both faculties of humanities, both at MIT and Harvard, the only person who's ever done this. And he's brilliant. And he's even a poet and a novelist. And he gives this story actually, when he was on vacation, watching the birth of ospreys from the back deck of his vacation home in the summer. And so he's watching these, ospreys take their first flight. And they fall out of the nest, and then the one just opens its wings and comes down and shoots out right at him, and is looking right at him. And he said in that moment, he looked into the eyes of the osprey, and he says, in that moment, he didn't really understand what he was experiencing. And this is a physicist, he's a natural, he's a physicalist, a materialist. And so he believes there're answers for everything, but he didn't have an answer for that feeling that he had when he saw that baby osprey look him in the eye and then shoot up past him and take flight.

And so he talks about this luminous, almost haunting nature of beauty in this flight of the osprey. And what's really interesting is Alan Lightman is an atheist. He's somebody who doesn't believe in God. I wouldn't say he's a militant atheist at all, but I think he leaves room for wonder. And you find all kinds of people doing this. They look at these things that seem like natural phenomenon or just everyday wonders and beauties.

And when they really get deep into it, they go, "You know what? There is something here, and I want to leave room for that." I think those are the kinds of things that allow us to ask questions and go, you know what? If the world is filled with so much wonder and things that we don't understand, unanswerable questions like Alan Lightman calls them, then I feel like that people who are searching, or maybe who are on the fringe or whatever, might find in this book, something they can look at and go, "Oh, okay. I see what Tim's kind of getting at. And maybe if I can get out into nature myself and look and take the time and slow my pace, maybe I'll find what Alan Lightman seems to be finding."

John Dickson:

Timothy Willard's new book *The Beauty Chasers* obviously fits right into what we're talking about in this episode. It's another great book to go and check out and dig deeper into this subject. You can order it at Amazon right now, or head to zondervan.com for more.

In Tanzania, over a third of girls are married before the age of 18. It's often because there aren't many other options. Almost 70% of children aged 14 to 17 in the country aren't enrolled in secondary education. And in a culture that doesn't highly value women, school is a really low priority for them. It's considered much more useful for a girl to be managing the home than traveling the often long distances to go to school. So they're pushed to be a homemaker as soon as possible.

Anglican Aid is working to prevent this with local Christians, in Tarime in the Mara region of Tanzania. What they're doing is offering local young women an alternative. They want to build the Tarime Girls Secondary School, which, when complete, will offer places to about 800 girls, giving them the opportunity to complete their secondary education, keeping them at school and avoiding young marriages. You can help Anglican Aid in this important work, valuing women and championing education. It's an organization I really trust. Go to anglicanaid.org.au to give today.

Audio:

Within these walls, men come to seek God. He has come to seek a killer.

We found the body overly mutilated, under a window which was-

Which was found closed.

Somebody took them.

A man of reason in a world of blind faith.

Yeah. Small blood here.

You mean that he committed suicide?

John Dickson:

You're listening to the trailer for a film that perfectly captures the tension between church and science, that the dark ages apparently represented. Based on the novel by Umberto Eco, *The Name of The Rose* stars Sean Connery as a friar famous for his reasoning powers, who's sent to investigate a death in a famous church library. It turns out monks are being murdered because they've been reading a book by Aristotle on comedy. And the saintly librarian who's killing them, believes laughter undermines faith in God. It's a really moody film, recommended for that reason, but it's almost entirely wrong about the medieval church's approach to both learning and laughter. We'll have to do something on ancient and medieval comedy another time. It is a big area of research. But Seb Falk says there are learned church figures of this period that we really ought to know about. Can we talk about some specific figures, Richard of Wallingford and his clock? What's the significance of him in this story?

Seb Falk:

Richard of Wallingford has been described as the greatest English astronomer of the Middle Ages, or even just by some people, the greatest English scientific figure of the Middle Ages. He was a monk. He was born, I believe in 1292, something like that, at the very end of the 13th century, and he died in 1335. He was an Abbott of St. Albans, which was the wealthiest monastery, one of the wealthiest monasteries in England at the time, just a day's walk North of London and in the sort of triangle between London and Oxford, Cambridge, the sort of centres of learning and wealth in Southern England. And St. Albans was patronized by monarchs throughout the Middle Ages. So he's a key kind of monastic figure.

And while he's a student at Oxford in the 1320s, he writes some really important astronomical treatises, one in particular on the Alban, which was a scientific instrument to kind of astronomical computer. And a lot of astronomical ideas in this period were really driven forward and shown and calculated through instruments. So instruments were more than just devices to find out new knowledge. They were also ideas to demonstrate knowledge, ideas to... They were instruments. They were tools for teaching and they were tools for demonstration and calculation as well as observation as we would think of them.

John Dickson:

The medieval era was an incredibly inventive period when it came to mathematical computations. The drive to create evermore accurate tables of the mathematics of the planetary bodies, led to the setting of our modern calendar, known there in medieval Britain, but resisted by many other nations right up until the 18th century. And Richard of Wallingford had a particular interest in measuring time.

Seb Falk:

So he was a very interesting character, born the son of a blacksmith. So not from a wealthy background, but spotted at an early age, educated, became Abbott, and then made this fantastic clock for the Abi, which was seen as a kind of great wonder of science, both in the period and for a couple of hundred years afterwards before it was almost certainly destroyed at the dissolution of the monasteries again.

John Dickson:

Was it pretty accurate? Can we tell?

Seb Falk:

We can't tell for sure, because none of the clocks survived. These early clocks were not very accurate in our terms. They didn't show seconds or anything, and didn't even show minutes in fact. But what they showed was the motions of the planets. And what the Wallingford clock did that was so amazing, was it was much more than telling the time. In fact, it told the time in three different ways. It told the equal hours as we used them today that we would be familiar with. It told the unequal hours, which was an older system, but it's still a very useful system in the period where there were always 12 hours between sunrise and sunset, and then there was always another 12 hours between sunset and the next sunrise. So that the hours, the daytime hours were longer in the summer and shorter in the winter. And that was very useful because most of what you had to do, you did during the day. So it makes lower sense.

And then a third system that this clock showed was the system of true time that even clocks today don't show, and most people are unaware of the fact that actually the days are not all 24 hours, because of the tilt of the earth's axis, and also the fact that the earth goes around the sun in an elliptical orbit, the hours can vary in length by up to about 30 seconds per day, and those differences can accumulate to a difference in time of about 15 minutes certain times a year. So his Wallingford clock showed that true time. And as far as we know, it did so quite accurately.

John Dickson:

Then there's John Westwyk, who was born the son of a peasant, but who was eventually educated by the church and went on to do some incredible science in the 1300s.

Seb Falk:

So John Westwyk was not a household name, and that's kind of the point in my book, because one of the things I wanted to show was that science doesn't proceed as this kind of parade of great men. It's much more about kind of incremental contributions by often forgotten and often nameless figures. So John Westwyk was an ordinary monk. He was among [inaudible 00:44:58] St. Albans at the same Abbey that Richard of Wallingford was abbot, but a couple of generations later. So he would've been born probably sometime in the 1350s. We don't know a huge amount about his life, but he had a fairly eventful life by the standards of most monks, who of course took this vow of stability, where they were supposed to stay in the monastery most of the time. But he probably studied at Oxford university because many of the monks of St Albans did, and he clearly obtained quite a high level of education in astronomy, but he also went up to Tynemouth on the coast, overlooking the North Sea, just down the river from Newcastle, which was a daughter house, a dependent house of St Albans.

But either way, he was very keen to leave because he signed up for this disastrous 1383 crusade, which didn't go to the holy land, it went to flounders. It was a sort of an episode in the 100 years of war between England and France, and the crusade was a complete disaster. And then we find John Westwyk in London, 10 years later in 1392, where he wrote instructions for an astronomical instrument. So for me, he was a very interesting character because he is a monk, he's, as far as we know, a reasonably ordinary monk, although he had this fairly eventful life, and he writes these instructions in middle English, the kind of growing language of Chaucer at the time, for how to make an instrument to compute the positions of the planets, to find where the planets are for any time, past or future.

John Dickson:

Someone like him is going way beyond just trying to work out accurately when Easter is. What's fuelling his scientific energy?

Seb Falk:

That's a great question, and in a way we'll never know the answer to that question. You might say, as people have, this is just the simple scientific desire to find stuff out, to be ever more precise. And we do see that in some of his tables that he computes, for example, which are just extraordinarily precise, far more precise than is necessary. So there's kind of a drive and urge just to get the right answer.

John Dickson:

The calculations John Westwyk employed to work out the apogee of Saturn, the point at which Saturn is furthest away from the earth, are astoundingly accurate. Here's Seb Falk describes it in his book.

Yannick Lawry:

Slowly though, the apogees moved. Their locations underpinned all planetary motions. And the slow drift of the apogees, like everything else, was measured from the baseline root values. That is why underneath the main table, John wrote out a smaller table of these radices for easy reference. Its title in the Latin John continued to use for his table headings, is mean apogees at the time of Christ at London. You might well wonder why any astronomer would care to calculate these apogees down to the level of sexadecimal ninths. These are unimaginably tiny fractions. The 37 that appears in John's column of ninths for one day's motion of the apogees, is equal to 198 quadrillionth part of a complete circle.

John Dickson:

That's 98 with 15 zeros after it.

Yannick Lawry:

It would take approximately 750 billion years for these daily 37s to accumulate to even a degrees difference in the longitudes of the apogees. Such precision clearly does not reflect observational accuracy, but it came from calculations carried out by standard methods in accordance with Tonomeic theory.

John Dickson:

The math that people like Westwyk are doing in their heads is mind blowing. There's probably also something spiritual behind it.

Seb Falk:

Then there's what you might say, although we don't see it ever explicitly in his writing, but because of the genre, you wouldn't expect to, that there may be a kind of devotional motivation here, that this is seeking ever pure understanding of God's earth. And as I say, I don't have kind of direct evidence for that, but one wouldn't expect it in the genre in the same way that religious scientists today don't put God into their writing, but you've got to say that it's perhaps there in the background.

John Dickson:

Let's press pause. I've got a five-minute Jesus for you. Jesus talked a lot about wisdom. In fact, in Luke seven, he even identified himself as wisdom. Mostly, he meant skilful insight into how to live in God's world. The genius of the creator is imprinted on the creation. So it makes sense that there is a genius way to behave in the world. But the wisdom tradition he stood within, as a Jew, was much broader than that. Skilful knowledge of the world itself was wisdom. If the divine intelligence is imprinted on the world, then knowing about the world matters. Way back in the Old Testament, we're told, repeatedly, that the world functions not in a haphazard manner, the way the pagans thought, but in accordance with deep rational

principles from God's own rational mind, which by God's grace, our trained human wisdom can discover, at least in part.

The pinnacle of this tradition, in the Old Testament, was Solomon, King Solomon, around the 10th century BC. And it's fascinating that Solomon is described not so much as ethically wise, he ended up being quite an ethical disaster, but he was described as wise in the sense that he studied the creation itself, in order to know the mind of the creator. So in 1 Kings 4, we get this strange statement about Solomon studying nature. "God gave Solomon wisdom and very great insight and a breadth of understanding, as measureless as the sand on the seashore. He spoke 3,000 proverbs and his songs numbered 1,005. He spoke about plant life, from the cedar of Lebanon to the hyssop that grows out of walls. He also spoke about animals and birds, reptiles, and fish. From all nations, people came to listen to Solomon's wisdom, sent by all the kings of the world, who had heard of his wisdom."

Now Jesus himself refers to all of this, when he says in a passage in Matthew 12 and Luke 11, quote, "The queen of the South," maybe Ethiopia, "came from the ends of the earth to listen to Solomon's wisdom. And now, something greater than Solomon is here." This wisdom theology, in the sense of searching out the genius of creation, because it reflects the genius of the creator, was hugely important for the later church's approach to learning. In practice, it meant that learning about God's world, is in itself an act of worship, because it's searching out the signs of God's own wisdom that are imprinted in the physical creation. So learning about the motion of the planets, about animals, logic, and even musical harmony, was seen as a holy task.

Far from stunting intellectual curiosity, the ancient and medieval wisdom theology propelled people like Isadora of Seville in the seventh century to learn and write about practically everything that is necessary to know. The modern world has reaped the benefits of that old wisdom theology. Even though many today scorn the very intellectual framework that first gave us what we now think of as science. You can press play now.

You write in your book, and I'm going to quote you back at you, of the important role of monks in the story of science, and how science and religion in this period went hand in hand. Now that's going to strike some of my more sceptical listeners as bizarre and implausible, and completely contrary to what we all know.

Seb Falk:

Well, monks had the opportunity and the motive to study science. We've already talked about the motive. They wanted to understand the mind of God and they may have had, like all people, monks are extraordinary in some ways, but they're still people, they wanted to find stuff out. They were curious, they wanted to know things. That's not specifically a religious motivation, but they have that motivation like other people. And then they had the opportunity, and the monasteries were far from all wealthy, but many monasteries were very wealthy. Most monasteries had a library of some sort. And of course the main books in those monastic libraries were religious books, but they weren't exclusively religious books. They often had scientific books. Monks loved to produce books, that was their main job, apart from

praying, was the production of those books. And sometimes, those books were not very much read, but sometimes they were. And so I wouldn't say that all monks are interested in science. No, not at all, but certainly some monks were very interested in science. And we get the production and the copying.

And then if you get copying of books, then you get commentary on books, so ideas are kind of developed, not in the same way perhaps as we would today, because we don't have so much... If you want to read a book, you don't copy it out, but that was very much kind of what happened in the Middle Ages. So a large amount of monks' work, when they weren't praying, because they can't pray the whole time, particularly in wealthier monasteries where they had people to do the kind of day to day work for them, the production of food and the maintenance of the buildings and so on, which in perhaps the earliest days of [inaudible 00:55:09] would've been done by the monks themselves, they were done essentially by lay employees, a lot of the time. And so the monks have more time for studying, more time for contemplation. Again, most of that studying is for religious texts, but there's still room for studying science.

John Dickson:

And it turns out a competition between different arms of the church actually provoked advances in education. The Franciscan and Dominican orders of the church lived out in the communities among the people. The Franciscans were all about helping the poor and the Dominicans were about opposing false teaching. Both were great supporters of education, because their friars needed to be good preachers. This posed a little problem to the other great team of religious men, the Benedictines, probably the most influential group of all in their first 1,000 years. Benedictines were, at first sceptical of the universities, because young higher students were in danger of being corrupted by the gambling and drinking and worse that goes on at the university, even in the Middle Ages.

But the Benedictine soon realized they were going to lose out to these other teams of friars because the Franciscans and Dominicans were offering a better path to higher learning. So this spurred on the Benedictines to strengthen their ties with the universities, and they began to see that university-trained monks could bring back valuable knowledge to the monasteries, not just theological learning, but the latest advances in medicine, arithmetic, anything the universities had to offer. Thanks to religious competition, the medieval period saw a church-sponsored education race that had far reaching implications for the world of science. You've mentioned already two instruments, but I want you to try and... Is it possible to describe them in an audio broadcast, the astrolabe and the Albion? Can you help us picture what these were meant to be?

Seb Falk:

Yeah. So the astrolabe is the kind of classic instrument of the Middle Ages. It's a multifunctional device. Basically, it's a brass disc and it fits into the palm of your hand. They vary in size from about 10 centimetres, which would genuinely easily fit into the palm of my hand in diameter, up to about 30 centimetres or one foot in diameter. And it's a brass disc with a ring on one side that you can hold it by

and hold it up so that it hangs vertically. And over that disc, you have a sort of cut out design of kind of intricate brass swirling figures and shapes and pointers. And then over that, a ruler. So the whole thing is pierced through the centre with a hole and then a pin is put through that hole and everything pivots around that centre.

So you've got this brass circle and then all of these moving parts moving around the centre of that brass circle, just like a clock of course. And there's a reason why an analogue clock, of course, if listeners are still familiar with those things, there's a reason why clocks look like astrolabes because clocks descend from astrolabes. So one of the main functions of an astrolabe was to tell the time, but it could do much more than that. It could help you locate stars, it could tell you when the sun was going to rise on any given day or when a certain star would be at a certain point in the sky. So it was really a model of the heavens. So in those terms, it's much more than a practical device. It's also a kind of like a little globe, but portable and multifunctional.

It could also, with an astrolabe, if you knew what you were doing, you could calculate the height of a building. You could, in principle, tell the depth of a well. There's a lot of different things you can do with it, but all around functions of geometry and astronomy, which were really valuable, and also of course important as I've already said for physicians to understand the motions in the heavens. So it's a kind of tool of knowledge, and it's also a symbol of knowledge. So for many people, it becomes a kind of status symbol, something that people use to show off. Everybody wants the latest astrolabes. And you see that they have kind of designs included in them, which reflect fashions in archaeology or jewellery making and that kind of thing. So a lot of the best astrolabe makers were also goldsmiths. So you find little motifs of animals or tulips or whatever it might be.

John Dickson:

And what about the Albion, or the all-by-one?

Seb Falk:

The all-by-one, yeah. The-

John Dickson:

It's not something you can carry in your palm of you had.

Seb Falk:

No. Well, the Albion was designed by Richard of Wallingford, and it's the ultimate astronomical compendium. So it's kind of a slide rule and an astrolabe, and a calculator that computes the positions of the planets. But it's much more about doing calculations geometrically, whereas an astrolabe, is sort of a model of the heavens. It's a bit like what a map is to a globe. An astrolabe would be to a planetarium or an orrery, if people are familiar with those things. The Albion is much more about sort of a calculating device. So you couldn't really look at it and see the heavens in the same way as you can when you look at

an astrolabe, if you know what you're doing, but it was truly multifunctional. And a lot of astronomers used instruction manuals for these instruments, wrote instruction manuals for these instruments, as ways of showing their knowledge, ways of showing the theories and the ideas that they had about the motions of the planets, which were extremely complicated of course, because in a world where everything goes around the earth, you need to account for multiple motions.

John Dickson:

And here's an important point. The medieval astronomers, the church astronomers, were wrong about the earth being the centre of the universe, and the sun revolving around it. But in another sense, they were still right.

You touched on a point just then that I think a lot of listeners will want to be asking. They were fundamentally wrong. They hadn't caught on to a heliocentric universe, solar system. So what's the value of all this, when their basic operating principle that everything revolves around the earth was just flat out wrong? How is this a step towards science?

Seb Falk:

Yeah. Well, the first thing to say is that astrolabes and other devices like that still work. Even though they're modelled on a geocentric cosmos, you can still use them today to accurately tell the time, in the same ways you can still use a sundial to tell the time. And many people have seen a sundial out and about, or even have one at home, and be able to tell the time with it, because they are measuring relative position. They're measuring angles. They're not measuring distances. And so whether the earth is going around the sun or the sun is going around the earth, it makes no difference to the angles. So it's still useful knowledge.

And then to answer your bigger question about what does all this lead to, well, it leads to people asking more questions, greater precision, greater measurements. The middle age is a period of great refinement of ideas and in instantiation of ideas. So they build these instruments to try and model these ideas and then they try and make the instruments as good as possible and as a user friendly as possible. And then they say, "Oh, this doesn't quite work. So do I need to tweak my ideas?"

John Dickson:

They all knew there was something funny going on, didn't they?

Seb Falk:

Well, there was always... Partly the problem is that a lot of these motions are incommensurable. So in other words, the cycle of the moon doesn't fit precisely into the cycle of the earth and the sun. So how are you going to kind of make that as precise as possible? But then they all were also-

John Dickson:

There's a ton more about the mathematics and the astronomy of the Middle Ages. We'll make the full interview with Seb Falk available in the Undeceptions Plus stream. But the key idea is that intellectuals, from the time of the Greek astronomer Ptolemy, had sort of added a fudge to the maths, to allow for their failure to fit the planets into circular orbits. The point is medieval scientists knew it was a fudge. And so they kept on searching for the true model, pushing further and further, until they got there with Copernicus and Galileo.

Seb Falk:

So there's lots of interesting work that's done there. But fundamentally, they do more and more observations, the observations get more and more precise, they come up with new instruments above all really monumental size instruments to measure shadow motion. So there're the motions of the heavens that you can sort of observe by looking at the shadows moving, to really, really find degrees of precision and start to notice that the models need a tweak. And then the kind of geometrical ideas I've been talking about are really useful. So when you come to Copernicus in the 16th century, you see he's using observations going back a long time that were made by people throughout the Middle Ages and before, as well as geometric ideas, some of which appear to have come from further East from the Islamic world, possibly via Jewish intermediaries.

And so all of these... This is what my point about science not being a parade of great men, all of these contributions are incremental. They all add something of value. And Copernicus has the kind of genius insight that, "Oh, you know what? I think this should be around the sun rather than around the earth. And I reckon I can make it work better." Now in a way, that's the least important part of it because that's just a sort of momentary flash rather than a lot of work.

John Dickson:

The fact is, a historian of science like Seb Falk sees what many in the contemporary world don't see. The church of the Middle Ages was the great storehouse of knowledge, not just knowledge about theology and canon law and stuff like that, but about astronomy, music, rhetoric, logic, and much more. And there's no way you can drive a wedge between the monks, Christian faith and their passion for knowing stuff about the world. To these medieval zealots, these are the same thing basically. Love for God fuelled zeal to know God and zeal to know God's works in the world. It's all worship. Whatever one makes of religion itself, this is just the fact of medieval history, even if historians like Seb have a difficult time convincing the modern world about all this stuff.

I have a final question. It might be my most difficult. So you're at a dinner party with friends and acquaintances, and one of them, after the second or third Chardonnay mouths off about the ignorant dark ages. Have you developed a pithy and polite response?

Seb Falk:

Not really, certainly not polite. I think the number one point that I always want to make to people is, not that I think everything was brilliant and wonderful in the Middle Ages or that people in the Middle Ages were all kind and generous people, or that the church never got anything wrong, or that Christians couldn't be bigoted and dogmatic about things. The number one point I want to make is that we shouldn't look down on people in the past, because they thought things that we now think to be wrong. There are many, many, many things that we now think that future generations will believe. And probably even our own children in five years time will think we are incredibly wrong and foolish about.

And so I think it's not morally right. I think it's selfish and it's super serious to look down on other people just simply because we think they're ignorant, but it's also not productive, because it stops us from seeing our own faults. It's a sort of a narrow-minded assumption that we know everything there is to be known. And too much history of science, certainly too much popular history of science, presents present understanding as the end point. But no scientist would ever say that science is finished, science is done. So I think that's kind of the point. I suppose if at a dinner party, people say people in the Middle Ages were stupid, well think about all the things that we thought about just a few years ago, from stomach ulcers being caused by stress to, "Oh well, put lead in petrol. That won't cause any problems," to all kinds of things that are still being worked out, and will continue to be worked out forever.

John Dickson:

Thank you so much for joining us.

Seb Falk:

Well, thank you for inviting me.

John Dickson:

If you like what we're doing here, please head to Apple Podcasts and give us a review, and let your friends know about our episodes. While you're there, send us a question, and I'll try and answer it in an upcoming Q&A episode. Just head to the show notes and you'll see where to send them, either a voicemail so we can play your lovely voices on the podcast, or you can just send us an email. While you're there, you'll see the links to Laurel Moffatt's beautiful reflective podcast, Small Wonders; and also Michael Jensen's and Megan Powell du Toit's excellent With All Due Respect. Both of these are part of the growing Undeceptions network. See ya.

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