

Episode 3: Going to the Dark Side

Announcer: Hello and welcome to Science... sort of.

Patrick: Alright. Hello and welcome to Science... sort of, episode 3. He's Ryan.

Ryan: Hello.

Patrick: And he's Justin.

Justin: Hello.

Patrick: And we're the Paleo Pals. The purpose of our show is to discuss things that are science, things that are sort of science and things that wish they were science. The theme of this week is going to the dark side. Ah, yeah, so, the article I picked for this week is, having seen so much about it in the popular press, actually, I can't think of much. But it's come out in the last few weeks in *Proceedings of the National Academy of Science* which is a pretty top notch journal, and it's by Brian G. Fry et al and it's talking about the possibility of venom in Komodo dragons. Well, actually he's pretty sure that they have venom in Komodo dragons but it may or may not be important to them..

Ryan: So, the popular wisdom is that Komodo dragons do not have venom, rather they have very strong bacteria that causes massive infection if you get bitten by them.

Patrick: Yeah, basically, that you die either from bleeding to death or you get this horrible infection.

Ryan: He's saying that it's not actually a bacteria, it's actually a venom that they produce.

Patrick: Right. So, the bacteria, so, they tested, they swabbed different Komodo dragons...

Ryan: That's a fun job.

Patrick: So Brian, yeah, Brian G. Fry, I mean, can you guess what nationality he is?

Ryan: Australian?

Patrick: Yep, he's an Australian scientist.

Ryan: Like, who would have a name like that and stick their hand inside a Komodo dragon's mouth. Oi!

Patrick: He's into Komodo dragons but he's also into this idea that, that lots of reptiles are actually venomous and just we have done a poor job of detecting it. Or they are not venomous at levels that are dangerous to us.

Ryan: Good.

Patrick: But in any case, we'll move, so, yeah, they swabbed lots of Komodo dragons and tried, you know, cultured these different bacteria. And they have, they all have oral bacteria but they don't all have the same oral bacteria. So, out of, I think they did like 25, I might be making that number up. They did a number of Komodo dragons and they've got and they can't find the same bacterium common to all of those which is not good evidence that this, you know, maybe that's not what's doing it.

Ryan: Wait, humans all rely on their own gut bacteria to digest and process food and no two people have the same gut bacteria but it all functions the same way.

Patrick: Um, I...

Ryan: Not a good analog?

Patrick: I, I don't know because I assume...

Justin: There are a lot of hereditary links, there's a big paper on this recently where, ah, and it really seems to depend on, you know, your first moments after you're

born. You know, who you're born to, whether you have a c-section, whether you were born in a c-section or not, ah...

Ryan: Is a c-section better or worse?

Justin: It just changes the biota of the bacteria in your skin so I'm wondering did he mention at all...

Patrick: That's skin bacteria, though, not...

Justin: Well, yeah, so did he mention if these Komodo dragons have any kind of hereditary bacterial links?

Patrick: Ah, I have, this paper doesn't concentrate upon that but there is a lot of literature that talks about, um, that traces evolution through the parasites and through the microfauna that you're housing yourself. But this paper doesn't discuss it.

Justin: Right, and other mammals, I guess, get their gut bacteria from eating the dung of their mothers?

Patrick: Yeah, sometimes you'll eat, that you'll eat, you'll be coprophages, you'll eat poop as soon as you're born. Um, and I guess for, rabbits are huge coprophages and I guess, you know, that's really important if all you eat is stuff with not a lot of protein, that's hard to break down, you've got to have a good gut, a good gut flora. And I don't know if you've ever, even for humans, you know, some people are into fasting for long amounts of time to cleanse their intensities or whatever.

Ryan: Uhhuh.

Patrick: They always recommend these people eat yogurt as one of the first things back, to get, to introduce bacteria back to the gut.

Ryan: Or you could just not starve the gut bacteria that have been keeping you alive your entire life. That just seems cruel. What did they do to you.

Justin: I think about them a lot, I'm usually pretty concerned about what they think.

Ryan: I like to take care of my gut fauna because we're in this together. I am nothing if not a giant robot for them, to walk them around this world and introduce to them, to new and interesting foods.

4:58

Patrick: That's pretty much true. I think, didn't they just quantify the number of bacterial cells that are in your body outnumber your own, your own cells?

Ryan: I believe they outnumber your own cells by orders of magnitude. Ah, but the problem...

Patrick: That's interesting...

Ryan: The size difference between prokaryotes and eukaryotes, all eukaryotes are at least 10 to 100 times bigger than prokaryotes, so. I think you could still take them, just by mass.

Patrick: I see.

Ryan: Even though you are outnumbered. Fortunately, I mean, your intestinal track is almost not really inside your body, it's almost it's own system that exists between the mouth and the butt. It's almost, it's more connected to the outside world than people take... I don't know, I've had physiology teachers that have said that they actually considered most of your intestinal track, or gastrointestinal track, to be outside the body.

Justin: Hmm. Essentially, you might as well be on your hands.

Ryan: Right.

Patrick: Another reason that venom may be a player in Komodo dragons is that they don't have, if you've ever seen a Komodo dragon skull, they, um they're really lightly built. Especially if you compare them to another reptile of the same size, something like an alligator or a large caiman, or crocodile, those, the skull is much more heavily built, the bone is much thicker whereas Komodo dragons, most squamates actually, so most lizards and snakes are lightly built.

Ryan: A lot of fenestra.

Patrick: Yes. A lot of fenestra and just thin bones in general. They use a lot of, this is actually, I wonder if these words are related. They use a lot of finesse when eating. Snakes unhinge their jaws and things whereas mammals especially, they just pile-up bone and just clamp down on something...

Ryan: And chew.

Patrick: So, at least, yeah, and chew. Exactly. So chewing is not something that things other than mammals really like to do very much.

Ryan: I had a huge fight with an ex-girlfriend of mine's mom who was convinced that those little beta fish, like a little Siamese fighting fish, and she was convinced that when she fed it, it was chewing And I, she would not believe me that really, nobody besides mammals tend to chew.

Patrick: Yeah, it's not a common thing to happen outside of mammalia. Anyways, um, it's so lightly built, in fact, and that is part of, they go on further in analyzing the muscles and things. Part of the evidence that they have is poor bite force. So, their bite is actually not that strong for how large they are, if you compared it to something like a crocodile which has pretty good bite force. And at least in mammals bite force is related to how big a prey you can pull down.

Justin: That's surprising to me because I wouldn't necessarily equate bigness with, with requiring, you know, just harder, just this up and down force that bite force would deliver. And seeing that there are lots of other things that would be a lot more important or more equated with body size.

Patrick: You're thinking of lions.

Laughter.

Justin: Well, no, even...

Patrick: Cats are unusual in that they use their claws. Most everything else brings down prey solely with their...

Ryan: Don't speak so soon. Wait for the next topic Patrick.

Justin: Yeah, so, but even so, you know, I mean, if you think of, ah, I don't know, I guess that makes sense but it's just kind of surprising.

Patrick: Well, anyway, so, Komodo dragons, not mammals, crocodiles not mammals, but Komodo dragons seem to bring down prey that if they were mammals, they should not be able to catch prey this large if bite-force was the predictor of how big of prey they could bring down.

Ryan: So, they're using venom or other methods.

Patrick: It seems like another method is, it's likely that another method is involved. If they were a mammal another method would have to be involved. They're not a mammal but it still seems, at least, somewhat likely that another method is involved.

Ryan: And they don't use their claws or anything like a cat? They don't jump up and grab things before biting them?

Patrick: I don't think so. Maybe we should YouTube some Komodo dragon videos but I don't think that's the case.

Justin: Yeah, they're pretty much, they grab the prey with their mouths and then just shake it. And they're...

Patrick: They just rake their, or, I think, if it's a deer they just rake their mouth down the skin.

Justin: Patrick, are their teeth, are they serrated, do they have serrated teeth?

Patrick: Teeth are serrated which has been, has, well, they're slightly serrated which has been part of the bacterial thought before. Is that oh, these bacteria live in these pockets. But they have actually found venom glands in these Komodo dragons

and it seems like, and there's... So phylogenetic trees are like talking about the family tree for lizards and snakes has been contentious for awhile.

10:01

Patrick: And I don't know why it's so hard to figure out who's related to who but in this group it is. It's difficult to figure out who's related amongst the lizards and snakes. So, snakes are basically just a specialized kind of lizard. The snakes nest within other lizards, so, nest within four legged things. So, they are, snakes are more closely related to some lizards than those lizards are related to other lizards if that makes sense.

Ryan: Huh. Do snakes have a single common ancestor?

Patrick: Yeah, snakes do have a single common ancestor. As do the group lizards plus snakes.

Ryan: Okay. Cool.

Patrick: They have a single common ancestor.

Ryan: Yeah. And so, so Komodo dragons, you keep comparing them to things of comparable size like caimans and crocodiles but evolutionarily they are not really that close to them. I mean, they're also reptiles but...

Patrick: Yes, so, they're all still reptiles. Yeah, lizards and snakes are much more closely related to each other than they are related to alligators and crocodiles or to...

Justin: Turtles.

Patrick: ...amphibians. Yes, turtles or amphibians like frogs and salamanders.

Ryan: Cool. And um, what do you think about the theory that the guy proposed that gave the talk awhile ago that Komodo dragons have experienced island dwarfism.

Patrick: Um, so, I'm almost hesitant to break that news. So, they are closely related to...

Ryan: Oh, should we not...

Patrick: ...very closely related to, ah, we'll talk about it a little bit. They are very closely related to a Pleistocene, so something in the neighborhood of 1,000 to a million years ago, that's the Pleistocene. Or, sorry, 10,000 to a million years ago, they are a really large, essentially, a Komodo dragon that's threeish times as big, maybe more than that. It was wandering around Australia.

Justin: Up until pretty recently right?

Patrick: Yeah, so, it coexisted with humans on Australia. So, something like, so, humans showed up on Australia, I think about 60,000 years ago. So, up until, yeah, I don't know exactly when it went out but...

Justin: I think it went right out after humans arrived.

Patrick: Right at 10... Really?

Justin: Maybe it was one of the first things to go...

Ryan: We killed it.

Patrick: It's possible I guess that we killed it.

Ryan: Well here's what amazes me. So, you've got homo floresiensis running around, these tiny little three foot humans, right. So, they're, well, you know maybe, half the size of modern humans. And then you've got a Komodo dragon that's three times the size of a modern Komodo dragon.

Patrick: At least three times. I've see the skulls.

Ryan: Can you... that would be so epic.

Justin: Like pez.

Ryan: Have all these little homo floresiensis hobbits running around, fighting giant lizards. I mean

Justin: They're not fighting giant lizards, they're like popcorn.

Ryan: 1 million BC would not have been that far off from, I think we need to re-think Raquel Welch's role in pre-history.

Patrick: I think she had a pretty big role in pre-history.

Ryan: According to that movie.

Patrick: The furry bikini was huge man.

Ryan: Yeah.

Patrick: Ah, so, but, yeah, island dwarfism. So, if you were large, typically, and you wind up on an island somehow, typically to survive you tend to get smaller and smaller and smaller. If you are small and you wind up on an island you tend to become larger and larger and larger. So, islands sort of act as like a filter and filter for one size. And if you're small you get bigger towards that size and if you're big you get smaller towards that size. So, we've seen that with rats and with rodents tend to get bigger on islands and things like mammoths tend to go pygmy when they get trapped on an island. So, the thinking is if you've got this enormous varanid lizard and Komodo dragons and megalania, lots of other of these monitor lizards are in the genus Varanus, and they are called varanid lizards. If you're a varanid lizard and you were huge and you were wandering around Australia, what do you think would happen if you were stranded on Komodo island? Well, what we know about biology tells us you would likely become a dwarf version of what you were. So, it could be that Komodo dragons are not a larger version of a monitor lizard, they're a smaller version of what they used to be.

Justin: And how far...

Patrick: Which is kind of mind boggling.

Justin: Patrick, how far is ah...

Ryan: Terrifying.

Justin: Is Komodo or Flores or any of these islands that, ah, dragons live on, how far is that off the coast of Australia?

Patrick: Ah, it's a, it's much, it's closer to Malaysia than it is to Australia but I don't, I can't tell you exactly how far off the, sort of, how far off the mainland it is. So, the long and short of it is that Komodo dragons have venom glands and they have identified the venom. They have even done some of the protein work on this, the neurotoxin that they have. But what's not clear is if they are able to inject enough of it to actually do any good. So, we're still not sure if Komodo dragons just gash their prey and then they sort of bleed to death or if this toxin is actually working its way into the system...

Ryan: Sounds like we need to go on a field trip.

Patrick: ... causing shock. Yeah, my brother was on Komodo island recently. Maybe we'll call him and see what he has to say.

Ryan: Get a report. I want to go though.

15:00

Patrick: I, yeah, I don't blame you. We should go.

Ryan: Okay, we should go.

Patrick: Um...

Justin: David Quammen in his book, *The Song of the DoDo* has a couple really interesting chapters. He actually goes, I don't know if he goes to Komodo, he goes to Flores and Komodo dragons are there too. But, it's pretty interesting stuff.

Patrick: Yeah, fair, I mean, all those islands, I mean, you know, that's where, where Wallace basically arrived at the same conclusion that Darwin did. So, it's like going to the Galapagos. It's biologically rich in history and romance. We should all, we should all visit, it's required.

Ryan: Okay, can we get Paul to pay for it?

Patrick: Ah, it seems unlikely.

Ryan: It's in the name of science.

Music

Ryan: So, we're starting this week with odd man out which is a segment where two of us absorb some form of media and the other one doesn't and we just leave them out of the conversation as much as we can but they try to get back in with questions. So, as the listener would were the listener participating. And Justin, what did we pick this week.

Patrick: Why don't you start by telling us who's in and who's out.

Justin: Who did we pick? Or are we doing the...

Ryan: Well, Justin and I are in and you're out Patrick. If you have to, it's one of those things, if you have to ask you know you're out.

Laughter

Justin: Well, I guess, I mean if we're picking up where we left off we'd be doing *Oceans*, a graphic novel by Warren Ellis, Chris Sprouse and Karl Story.

Patrick: A graphic, it's a graphic novel in that there's lots of vice and sex?

Ryan: As much as Warren Ellis could get away with at the time. He likes to put this stuff in there. Ah, the basic premise is that U.N.'s weapon, a U.N. weapons inspector in the future has to go to Europa because they found something under the layer of ice...

Justin: Europa being a moon of Jupiter.

Ryan: Yes. So, it's basically straight up sci-fi. It's, um, there's no super heroes in tights or anything like that. It's just good old fashioned science fiction. And what did you think of it Justin? What were your impressions.

Justin: Well, I really like the premise of the story. Ah, you know, again, they detect something under, and remember the ocean, Europa is this planet that is has this thick ice crust and they think there is an ocean underneath that crust. And, um, so, it's been ignored by the scientific community, whatever it is...

Patrick: What year is this set in?

Justin: I think it's, no, I do, it's 100 years in the future.

Ryan: Yes.

Justin: So, it's a very, ah, glass is half full view of the space program. Um...

Ryan: It's cool.

Justin: It's very cool. And what they find is ah, hundreds and hundreds of sarcophagi floating in the ocean underneath the ice.

Ryan: And giant guns.

Justin: And giant guns, yeah. I guess that's an important plot point.

Ryan: Which is why they are sending a weapons inspector.

Justin: Right. And I really like the departure from the tights. I get tired of, you know, as much of a fan I am of superheroes, I get a little tired of spandex. And, um, it was nice just to have a classic sci-fi story without any of the rest...

Patrick: Okay, so they find guns and sarcophagi on Europa, that's where we are, is that right?

Ryan: Yes, we should probably point out that there's going to be massive spoiler warnings for this book when we talk about it. We're not going...

Justin: Yeah, otherwise Patrick wouldn't even be able to be in the conversation.

Ryan: Right. So, we're going, we will be spoiling what happens but hopefully you've already read it or are planning on reading it because it's worth it.

Patrick: So, how did they find... remind me, I think, but how do they know that, initially they thought there were guns on Europa, is that right?

Ryan: No, no, they have, they were sending probes under the ice.

Justin: They were already on Europa. They were going for other reasons and they just happened to find this stuff.

Ryan: There's ah, it's just a basic science research station orbiting Europa.

Patrick: So, there's basic science in the future. This is the glass half full.

Ryan: Yes, yes. Well, the only other satellite out there is a satellite operated by Doors which is the...

Justin: Rock band of, oh...

Ryan: ... Windows analog in the future. It's like the operating system mega giant, Doors.

Patrick: Instead of Windows.

Justin: It's the evil corporation the part they are playing.

Patrick: Windows, doors, I got it.

Ryan: Yes.

Patrick: Ah, clever, very clever.

Justin: And I didn't get that until the ending.

Ryan: Yeah. Well, one of the things I really like about this is ah, Warren Ellis is, ah, very quickly gives you a lot of information without being very heavy handed about this world and what's going on.

20:03

Ryan: The way he sets the scene, it's just, it's very, like, everyone is holding out, everyone is actively using their cell phone as they walk around. This book actually came out a couple of years ago so that was a pretty, I don't know how bad the culture of cell phones was at the time but it's pretty accurate to have everyone not even paying attention to where they are walking, just all looking at their cell phones. And styro-foam cups that disintegrate as soon as they hit the ground. And flying around in very UFO looking spaceships.

Justin: What were you guys saying? I'm sorry. I was tweeting on my iPhone.

Ryan: Like, the main character is reading a book and people were like, oh, what's that? Oh, it's a book. Oh, I've heard of those.

Patrick: Kindle.

Ryan: No, it's not a Kindle but I think that's the point, it's retro. He got it from his dad when he was a kid. Yeah, and he goes up to Clark's Walk which is an orbiting space station above Earth, which I like an Arthur C. Clarke callout.

Justin: You're all about the allusions.

Ryan: Well, yeah, you know, I'm a big sci-fi nerd so, half the reason we're doing this show.

Justin: So one of the, one of the things that I thought was a little strange was um, you know, into the story a little bit and again, spoiler warning, but they find these, inside these sarcophagi are humanoid shapes and somehow they are able to date these, these things...

Patrick: Is this where the necrophilia comes in? Oh, sorry, I thought, wrong dating.

Justin: ... to billions of years ago.

Ryan: I thought it was just 1 billion.

Justin: Yeah, so they are billions of years old...

Ryan: I thought they were...

Justin: They are humanoid and they are supposed to have been some kind of distant relative to humans.

Ryan: They are 99, they're more closely related to us than chimps.

Justin: Right, right. And if they were placed there billions of years ago...

Ryan: It was just 1 billion.

Justin: Unless there is this time traveling aspect, well, okay, even 1 billion years ago, unless there is some kind of time traveling aspect to the story, that's kind of hard because a billion years ago, what were we? We were proto-cellular things.

Ryan: Did they have eukaryotes by then? I think they had eukaryotes.

Justin: They might have. It was definitely before the Cambrian explosion.

Patrick: ...trying to embarrass us by...

Patrick: I think, ah, people settle on cellular life...

Ryan: Basically

Patrick: ... at 3.4 billion.

Ryan: Right. So the, the...

Justin: It was relatively simple. It was not quite humanoid yet.

Ryan: The geologic record is a little, is played fast and loose in this book and Warren Ellis clearly didn't have his time scales on him when he wrote this because he talks about the Earth a billion years ago still being a molten rock cooling which it absolutely was not.

Justin: I was going to look up to see what they thought Jupiter, what the Jupiter system would have been doing a hundred, or a billion years ago and whether or not they know if the moons had formed by then.

Patrick: I'm sure they had, it had to be.

Ryan: I thought the solar system was relatively stable by about 4 billion years ago.

Justin: Although I don't know...

Patrick: Yeah, I don't know, I guess it would have been. Well, I don't know, I guess Jupiter could have still been collecting, it's big enough that I guess it could still collect things. I don't know, we need Charles for this.

Ryan: Or we just...

Justin: I guess the moons had to be formed but um, but they might have been, they might...

Ryan: To me that's a minor point that I can look past and still enjoy the book if he got his...

Justin: Absolutely. And there could be a time travel, you know, piece of the story. They could have been future humans still closely related to us that have gone back in time, put their sarcophagi...

Ryan: I think the ideal was that they are our ancestors and they seeded Earth with human, or with the life needed to become humans.

Justin: Oh, yeah, I forgot the seeding part of the story.

Ryan: Yeah. So, the whole point of the, and they've got these giant guns and they start to decipher the language that they were using, that they had written. Because computers can decipher alien languages at this point.

Justin: That's another problem. If your going to be seeding the Earth a billion years ago...

Ryan: Right, how would you seed it with something you know is going to evolve into a human? That's ridiculous. Um...

Justin: Yeah, how would a close, the closest related ancestor seed Earth to eventually result in it's closest...

Ryan: You'd have to have some pretty good algorithms for how the genes are going to mutate over time and really set that system in motion. Ah, and hope for the best, but... yeah, I agree with that as well. Um, but they managed to decipher the language that these beings were using and the idea is that as eskimos have multiple words for snow because snow is something that is important in their culture, these beings have hundreds of words for murder. And they're a completely warmongering, destruction-based species. And, you know, but, they're our ancestors and we came from them...

Justin and Patrick: Bum, bum, bum!

Ryan: And the Doorish people are trying to get access to the weapons so they can be evil.

Patrick: Oh, there's also gates. Oh, I just realized that Doors also build gates.

Ryan: Oh, if they want a gate, yeah.

Justin: Very good, very good.

Patrick: I like it even more.

Ryan: Well, they had some cool, they had some cool sci-fi tech with the whole doors thing. They go to the doors satellite and everyone working on the satellite, um, it's kind of like *Paycheck*. The story that Phillip K. Dick wrote where these people sign-up to work for a given number of years and they have their own consciousness suppressed and basically an operating system put on their brains so they are automatons.

25:07

Patrick: Who's an automaton?

Justin: Yeah, that's a cool element of the story.

Ryan: All the people that work on the Door space station except the manager.

Justin: Well, even he's plugged in.

Ryan: He's plugged in but he has more autonomy because he has to manage the...

Justin: Right.

Ryan: ...the more complex elements. But he's, the, his, his neural web or whatever has driven him insane so he's going, he's starting stuff. Trying to power up the weapons and point them at Earth... just being a lunatic.

Justin: Another element I liked was the ah, there's a couple creative ways to have guns on a space station that they go into in the story and one being, ah, instead of bullets they have acid pellets that, ah, apparently don't dissolve metal or hulls or anything like that. But, if they hit a human they, they don't just dissolve the human, it's almost like a, it spreads over the skin so that they, so even if it hits a part of your body it will eventually spread over the whole of your body and just melt you to a pile of goo.

Ryan: So, the problem is it's a guaranteed lethal shot even if...

Justin: Even if it's a glancing blow, yeah. But a cooler invention that they describe were, um, smart bullets and these bullets were able to change shape in mid-air de-

pending on whether or not you had them set on the space setting. So, if you have it set on the Earth setting then the bullets just behave as bullets and don't change shape and go right through the person. Ah, if it's on space setting as soon as it detects that it's coming close to a wall it spreads out like a disc and slows down that way.

Ryan: So it doesn't punch a hole in the station.

Justin: Right.

Ryan: And he's also got bullets that he can just throw and they ignite and fly apart.

Patrick: But they shouldn't slow down if they are in space.

Ryan: Well, they have artificial gravity.

Justin: Yeah.

Ryan: It's the old sci-fi trope of people can still walk around. They can control the gravity and how it's oriented. There's a fight scene where the guy's calling out how he wants the woman in control of the ship to change the gravity...

Patrick: I'm still not sure that gravity equates, well, I guess, so they breath. They're not wearing space suits at all. So, there's artificial atmosphere.

Ryan: No, no, all this stuff is happening in space stations.

Patrick: Got it. So, obviously I wouldn't know that so I had to ask.

Ryan: Right. So this is why you're doing what you're doing.

Justin: Given the fact that you are not privy to all the information.

Ryan: The whole point of the exercise.

Justin: I also like that the space ships, the ship that they used to puncture the ice on Europa was shaped like a flying saucer.

Ryan: And coated with diamonds to punch through the ice.

Justin: And coated with diamonds. An expensive space station.

Ryan: The art was really good. The art in the whole book was really good I thought.

Justin: Yeah, I enjoyed it.

Ryan: All the ships had cool designs and all the people looked different. You know, that's one of the things that...

Patrick: Are there multiple, are there other races involved other than humans? Or is it just humans and...

Ryan: No, just humans and these ancient European things.

Patrick: So, does all this come to a head at some point or just...

Ryan: Um, the guy who was running the Door space station tries to power up the weapons and...

Patrick: Point them at Earth I guess you were saying earlier...

Ryan: ...so the sarcophagus guys start to wake up.

Patrick: Or you said earlier...

Justin: I think they were...

Ryan: Yeah, I think they...

Justin: ... to point them at Earth.

Ryan: Well, there's also hypergates under Europa so you can travel through wormholes and one of the wormholes, they think, is going to come out in the asteroid belt which would put you a lot closer back to Earth.

Justin: I thought it came out at the Moon.

Ryan: No, it came out, I thought it came out at the asteroid belt.

Justin: Because they go through this warp and at, well, I don't want to ruin, completely ruin the story, but at some point they go through this warp and ah, emerge around Earth.

Patrick: And then what happens?

Laughter.

Ryan: Then, well, that's actually kind of the cool thing because the book that the main character is reading at the beginning, I think his name is Nathan. Yeah, the book

that Nathan is reading at the beginning is about the early space program and about Apollo and all these things and he's talking about how they used to just have ballistic trajectories like firing a bullet at the Earth and just falling in the ocean and hope they survive and how barbaric that was.

Patrick: Yeah.

Ryan: And because all their systems get damaged in the scuffle with the Doorish people they have to, basically do that same thing reentering the Earth's atmosphere in this UFO shaped craft and hope they make it though and land in the Atlantic Ocean. Talking about doing it old school like their parents did but how, you know, they don't have to do everything their parents did in reference to the war like nature of these aliens.

Patrick: So, humanity has gotten much more peaceful in the next 100 years.

Ryan: Supposedly.

Justin: Except for the close relatives, not so nice.

Patrick: Yeah, but, but the recent, that's contrasting with, in general, humanity's peaceful nature a hundred years from now.

Justin: Not really though. The, because this Doors corporation is pretty evil and there's a murder attempt at the beginning of the novel and so, it's definitely more of a gritty, futuristic look. At least out in space it's more of a cowboy atmosphere but, maybe down on Earth things are ah...

30:05

Ryan: Because they are completely cut off once they are out on Europa. It's, you know, so, there's no Calvary coming, they're kind of helpless.

Justin: Right. Because it's only a hundred years in the future so that's pretty close to the absolute boundaries in terms of, there's only research stations out there. There's no populations of people nearby.

Ryan: Right, there's people on the moon and places like that but not as far as Europa. And they do come out of an asteroid in the asteroid belt but in the next page they're already back at Earth, so...

Justin: Oh, okay. So, they're just coming out really fast.

Ryan: I guess so. So, overall, did you like it Justin?

Justin: I give it two thumbs up. I really enjoyed it. It was different enough...

Ryan: Do you think Patrick would like it? Do you think we should make him read it?

Justin: Yeah, I think he would enjoy it given his Star Trek... His fascination with Star Trek and ability to quote ...

Ryan: How far in the future is Star Trek?

Justin: Ah, that's like 2300, right?

Patrick: Well, I can't remember...

Justin: We figured this out at some point.

Patrick: Yeah we did, we did some work on the timeline at some point.

Justin: 2330.

Patrick: It's not as far, really, as you think it would be. It's like...

Justin: I think it's two or three hundred years.

Ryan: Minus 40.

Justin: Right, minus 40.

Ryan: In the future of 1960.

Justin: Right.

Patrick: Well, no, that's the beauty of saying three hundred years in the future. No there is an actual start date, numbers...

Ryan: This book had no actual star date. It just said a hundred years.

Patrick: That's beautiful. That's the way to do it.

Ryan: It keeps it relevant, no matter when you're reading it.

Patrick: Yeah, until we have space stations around Alpha Centauri...

Ryan: But I mean, look at 2001, it's laughable.

Laughter.

Ryan: Well, I mean, it's an awesome book, it's one of my favorite books but...

Justin: Now that we're 10 years past the date I guess it's laughable. Back then it was probably...

Patrick: Man, I swear, right up until 2000 or 2001 people thought it was going to be radically different in four years or three years.

Ryan: But in 2001, ah, *The Space Odyssey* not the year, they had a moon base that was established in 1994 so by 1994 you're already behind

Justin: I think we were behind after 1974

Ryan: Yeah.

Justin: So, as soon as we pulled out of the Apollo program and started designing the Shuttle we were behind.

Ryan: Stopped giving, well, yeah, I heard interviews with Apollo scientists that said that they, had they been given enough funding we would have been on Mars in the 70s which would have been awesome.

Patrick: Maybe.

Justin: We went from the, ah...

Ryan: Maybe?

Justin: From the Earth to the Moon to the, ah, from the Earth to the area just outside of the Earth.

Ryan: Yeah, it's basically the equivalent of going into your backyard and getting scared and just standing on your porch the rest of the...

Justin: Right.

Ryan: Instead of going all the way back inside your house.

Patrick: We can't even handle that. We keep, after Apollo 13, and then we started killing astronauts in our own orbit.

Ryan: To be fair, astronauts, well, no, I don't think anyone has ever died in space. They always die in the atmosphere.

Justin: Although there, apparently there was a Russian disaster that I was reading about a couple days ago where, I'd never heard of this, I think it was like Soyuz 7.

Ryan: Is this the lost cosmonaut story.

Justin: No, it's not the, well, there's one where the cosmonaut crashed to the ground because his parachutes did not come out but there was another where three died because their craft, once it was in space, became open to the vacuum and I'd never heard that.

Ryan: I didn't hear about.

Justin: I'd never heard that before either but it's, ah, Soyuz, I think seven.

Ryan: Well, there was one cosmonaut that landed, because the cosmonauts, back in the 60s had to land in Siberia because Russia didn't have ocean front to use to land their crafts like we did. And there was one time when a guy was attacked by wolves while he was waiting for the recovery team. That was pretty funny. You're an astronaut, or a cosmonaut, and you've just come back from space, the most dangerous thing a human being can possibly do and now you're being attacked by wolves. Only in Russia.

Patrick: Putin wasn't there to put them down.

Ryan: It's almost like this needs to be a whole topic on its own.

Patrick: Ah, we should review the cosmonaut program at some point.

Justin: Yeah.

Ryan: Alright, we will. So, Patrick, what did you think? What did you think of our discussion as the odd man out?

Patrick: I'm still left wondering do we ever meet these uh, these other beings with a taste for murder? Do they, at some point...

Ryan: They kind of start to wake up but then don't because when they go through, I think when they go through the hypergate it shorts things out and stuff explodes. I assume...

Patrick: That seems like such a loss. I'd love to read the book where we're faced with at least a few of these things that, murder is, there's so many words for it. Yeah...

Ryan: All they do

Patrick: Well, I don't know... It just would be interesting to see, their, you know, there's so much to be, you know, such a mirror to hold up to...

35:02

Ryan: I'd like to know where they came from because they couldn't have evolved that level of technology and sophistication on Mars before, you know, before multicellular life was even available on Earth.

Patrick: Well, we've already agreed that the timeline is botched.

Ryan: That's true.

Justin: And they could just go back and restart the series like Star Trek.

Ryan: Well, they are, um, they are working on a movie. I know the rights have been sold. I don't, I think it's been in development hell for awhile.

Patrick: They'll probably change it. We'll have to...

Ryan: I think we'll be seeing it

Patrick: Would be cool to meet the monster...

Ryan: Well...

Justin: Yeah.

Ryan: You know, that's the thing, it actually does have a satisfying ending. I have no desire to go back and see what happens with this world. Because I feel like I got

this cool story and the world itself was set-up really well and I learned a lot about how this place in the future works without having to have it...

Patrick: I got it.

Ryan: Beaten over the head.

Patrick: Yeah.

Justin: Just to clarify the ah, the whole cosmonaut thing. It was Soyuz 11 where the three cosmonauts died and they are the only people to have died in space.

Ryan: That the Chinese have told us...

Justin: That the Chinese have told us about, exactly.

Ryan: I suspect that years from now we will find out that many Chinese, what are the Chinese astronauts called?

Justin: Ah, taikonauts.

Ryan: Taikonauts. I have a feeling that we're going to find out that some taikonauts didn't do so well.

Patrick: Yeah.

Ryan: I think I saw an Onion article where China launches first voluntary person in space.

Laughter.

Justin: The question is how many did they get to space before...

Patrick: A lot of hate mail when everyone hears this thing.

Ryan: Right.

Justin: Right.

Laughter.

Justin: But that happened in 1971 so, some time ago.

Ryan: Interesting. Yeah. Man, what a way to go. Yuck. I mean, died in space.

Announcer: Hey y'all, it's trailer trash talk.

Patrick: Alright, so, this week we're going to review where the wild things are and this movie is supposed to come out October 16th which is just about a month away so it's coming out soon. We watched, what, you guys said it was trailer 1...

Ryan: Yes.

Patrick: So, not the teaser... Not the featurette if you're on the movie site and I think it's one of the only one's available if you're on the Apple site.

Ryan: There's two trailers available and the exclusive featurette. We watched trailer one.

Patrick: Excellent. So, What'd you guys think?

Justin: I'm excited for this movie. I remember seeing it on Reading Rainbow, I don't know how long ago. 15 years ago? Reading Rainbow, actually, just...

Patrick: You were watching Reading Rainbow at 15 Justin?

Ryan: I love Reading Rainbow.

Patrick: Yeah, and you know what, their last episode just aired a week or two weeks ago.

Ryan: Oh, I'm so sad.

Patrick: They're a victim of the crunch and ah...

Ryan: I'm following Lavar Burton on Twitter.

Patrick: Yeah, I was about to say Jordie has nothing to do now that...

Justin: No, he's filming *The Physics of Star Trek*

Patrick: Oh, that's good.

Justin: For PBS.

Ryan: And doing, I guess he's doing some theater work, plays.

Patrick: No doubt. Yeah. Off Broadway.

Laughter.

Ryan: Don't laugh at Lavar Burton.

Justin: Star Trek

Ryan: That man changed my life with his books. I could sing the theme song right now.

Justin: Reading Rainbow. The musical.

Ryan: Take a look, it's in a book, Reading Rainbow (singing).

Justin: Reading Rainbow (singing)

Justin: But I think this...

Ryan: Awesome show.

Justin: This trailer is awesome. Their choice of music, I don't know what song...

Patrick: It's the Arcade Fire...

Ryan: It's Arcade Fire.

Justin: Oh, okay, okay.

Patrick: Jeeze Justin.

Ryan: Come on man.

Justin: I don't know the names of the music, I just know the song.

Patrick: Okay. That's like saying I'm really good at remembering faces but not names.

Justin: That's exactly what it is.

Ryan: I mean, I like Murray Sendak but I like his early work a lot better.

Patrick: What is some of his earlier work?

Ryan: Oh, I was just pulling the whole Indy music snob thing for children's books.

Patrick: Okay, excellent. Ah, so, a little trivia. I believe the original book was only ten sentences long.

Ryan: Really?

Patrick: So, I'm hoping...

Ryan: Was it?

Patrick: Yeah, I think, so, that's what I read in doing my research for trailer trash talk.

Justin: Ten sentences?

Ryan: Wow.

Patrick: Yes, so definitely, it's essentially a comic book, right.

Ryan: No, it's not a comic book. It doesn't have word balloons, it's not sequential art. Veto.

Patrick: It is sequential art. It doesn't have word balloons but so what?

Ryan: It's sequential from one panel to the next. Are there panels?

Patrick: There's pages.

Ryan: Yeah, that's different.

Justin: Big panels.

Patrick: What?! If you posted it on a poster it would be sequential art. It's a large format comic.

Ryan: It's a children's book. That's like saying *Family Circus* is a comic. It's not. It's one panel every time.

40:00

Patrick: Children's books are...

Justin: Patrick, I don't think you're going to win this.

Patrick: ...comics. You're saying children's books are comic books.

Ryan: No, I'm saying children's books are not comics, they are children's books.

Patrick: Okay.

Ryan: And in the words of Mitch Hedberg, every children's book, or, every book is a kids book if a kid can read.

Justin: It looks like they're staying pretty close to the ah...

Patrick: It does not look that way! I don't know if you've read this lately.

Laughter.

Patrick: It's only ten sentences long Justin, come on.

Patrick: So, you never get to find out anything about Max's home life.

Ryan: Yes, that's new.

Justin: Well, I guess I was referring more to the visual aspect. All the...

Patrick: Oh, okay...

Justin: All the creatures look the same...

Patrick: The creatures look the same...

Justin: Max looks pretty similar.

Patrick: I'm pleased with that aspect, yes.

Justin: Right. You can't tell the story line from the trailer.

Patrick: You can't but I'm worried we're going to have a two hour movie for something that was a ten sentence book.

Ryan: Well, um, so they are releasing a new book which we will link to on the website, um, that's written by, who's it written by? I want to say, ah, man, Dave Eggers or Dave Barry or some of those, satirical humorist writers, I cannot find the book for the life of me right now.

Patrick: Isn't Dave Barry dead now.

Ryan: Ah, I don't know.

Patrick: I don't know if that's true or not.

Ryan: I don't know. I'm botching this factoid. The point is that, um, some contemporary humorist author wrote a long form, novelized version of *Where the Wild Things Are* and that's the storyline they are using for the movie and they are going to release that as it's own novel.

Patrick: Oh, okay. I thought Spike Jonze, well, I don't... Well, he's directing the movie, I don't know where the screen play came from so I should shut my mouth.

Ryan: But, it is an extended story that they're...

Patrick: Yeah, it definitely is because otherwise it would be ten minutes. That would be stretching it out.

Ryan: It's Dave Eggers, I was right. So, it's where the *Where the Wild Things Are* and it's a full length book, it's 300 pages, of just the novel. And it's all, it's based loosely on the book and it's the screenplay that he co-wrote with Spike Jonze. So, they, you know, there's different source material that's based on the original work.

Patrick: Okay.

Ryan: We'll link to that in the show notes.

Patrick: So, I have to say that um, had I never encountered the concept of *Where the Wild Things Are* before I would probably give this trailer a thumbs up. Having kind of been a big fan of it as a kid, I'm, I fear for it. So, I think I'm going to be split on this one. One up, one down. What do you guys think?

Ryan: I'm also split because I feel like the trailer itself is already overhyping the movie and ah, people are getting really excited. I don't have that strong of a connection to the source material. I remember reading it as a kid but it never was one of my favorites. The way they did the trailer with the music, ah, and the scenes they chose, it's very emotional for a trailer. It really tugs at the heart strings so I would give it a thumbs up if the goal of the trailer is to get you interested in seeing the movie this succeeds magnificently. As for how much I actually want to see the movie, I'm actually less convinced. I'll give it a tentative thumbs up.

Patrick: Okay.

Justin: Yeah, I think, for me I have to give it a thumbs up. I was a big fan of the book growing up. I had all the stuffed animals, for all the monsters. And it seems like, just judging from the trailer, they, the take, the way they're handling the material

seems pretty, ah, within the vein of the feel of the book. So just going on feeling alone I think it's going to be a good one and I'm excited to see it.

Patrick: Alright, ah, well, I guess how I'm going to handle this is Justin, you seem pretty much all thumbs up, is that right?

Justin: Yeah but I don't have to much pallet for a movie. Most movies I'm excited to see.

Patrick: Yeah, that's true. And you're generally pretty happy with them after you see them too.

Justin: Yeah, yeah, it's hard to disappoint me with movies.

Ryan: I wish I could be that way.

Patrick: You know I was before I worked in a movie theater.

Justin: I'm an anti-snob.

Ryan: You're an anti-snob?

Justin: I'm an anti-snob.

Ryan: Don't you mean everyone that saw *Transformers 2*.

Justin: I haven't see that so that might...

Ryan: I'm one of the four.

Justin: ...might break the pattern.

Ryan: *Transformers 1* was the closest I've ever come to walking out of a theater. No way I was going to see *Transformers 2*.

Justin: That was pretty awful. Yeah. I guess I didn't like that. There are some...

Ryan: Good, good.

Patrick: See, there you had a connection to the source material, am I right? That's what makes me fear for this movie.

Ryan: I was more of *Beast Wars* fan than a straight up *Transformers* fan.

Justin: Just wait till the *Thunder Cats*... that's what I'm looking forward to.

45:00

Patrick: You're showing your age.

Ryan: I know, I am. I could totally do a podcast on *Beast Wars* and may one day so keep your eyes out.

Justin: Come on...

Patrick: We could do He-Man.

Justin: *Thundercat. Thundercat.*

Patrick: Maybe Justin and I will watch a He-Man episode and do an Odd Man Out with it.

Ryan: I was on the edge, I was on the cusp of He-Man. I remember He-Man, I had some He-man toys.

Patrick: We should definitely do this.

Ryan: I think, an Odd Man Out.

Patrick: There's a YouTube, there's a He-man YouTube channel now so I think Justin and I will.

Ryan: Good. Well, at least I don't have to watch it.

Laughter.

Patrick: Alright. I personally am going to buy some stock and short some stock. To hedge my...

Ryan: We're going to do both?

Patrick: I'm going to do both on my account so, I don't, what do you guys...

Ryan: What about the Science... sort of account...

Justin: How are you going to weight your...

Patrick: That's the Science... sort of account. Because I'm one thumb up, one thumb down on my different criteria, I'm going to hedge my cut...

Ryan: Our, our losses.

Patrick: Our losses. I'm going to try to hedge and cut our losses or, potentially, gains by buying some and shorting some.

Justin: The same amount? Are you going to weight one more than the other?

Patrick: I sort of buy shares for each of us so in case somebody doesn't like it or does like it I figure we can, we don't have to reach a consensus. I buy shares for each person.

Ryan: But here's the problem. Opening weekend for this movie is going to make or break it because if it's not true enough to the source material that the die hard fans are happy the negative buzz is going to be so huge and the backlash is going to be so significant.

Patrick: There are that many die hard fans? I don't know?

Ryan: I think so. The way people have been talking about this trailer. I mean this has been the most talked about trailer that I remember for a long time. As someone who follows the trailer buzz.

Patrick: Yeah I don't know too many of us. I guess I'm now grouped in that category.

Laughter.

Patrick: Since I've started this podcast.

Ryan: Yup.

Patrick: Okay. So, just, I'm trying to figure out if you guys are 100% thumbs up or split or 100% thumbs down here.

Ryan: I'm definitely not 100% thumbs down. Just judging the trailer alone I'm mostly thumbs up.

Patrick: Okay, so I'll buy long on your account. And you Justin?

Justin: Yeah, I think I'm both thumbs up.

Patrick: Okay, account is a confusing word. I will, here's how I'm going to handle it. I will, I'm going to buy, I don't even know how this is going to work. I'm going to buy 4/5 long and 1/5 short.

Ryan: Okay, cool.

Patrick: And we're up 6% at this point by the way. Based on our *The Men Who Stare at Goats* and our two Wolfman trailers, *The Wolf Man/Twilight* although *Twilight* is hurting us a little bit.

Ryan: Yeah?

Patrick: The fact that we shorted it. It's gone up but that doesn't mean anything, right? It could still open poorly or not make so much money...

Ryan: Oh, it's going to open well in the tweener market.

Patrick: It's going to open well but it may, remember it's a four week, it's based on a four week take so we could still come out okay in the end. I told you, it's trading at 230, estimated \$230 million over the first four weeks so that's serious cash.

Music.

Justin: So, there's a cool paper that came out recently on dark matter and ah, more importantly where they think it's coming from and what things they have to invent in order to reconcile it with modern physical theory. But, they honed in this, this strange discrepancy that they are finding with some of their satellites analyzing particles in space. And they're basically finding lots of really highly energetic electrons and lots of really highly energetic positrons.

Patrick: Positrons being?

Justin: None of what we really know about can account for that many high energy particles.

Patrick: Okay, tune us into positrons. I think, we've talked about electrons on the podcast but positrons, some people have never heard of.

Justin: So, positrons are the same thing as electrons only with a positive sign instead of a negative sign. So, negative, electrons are negatively charged. Positrons are their exact opposite.

Patrick: What keeps them from being protons.

Justin: Ah, protons are larger. Ah, protons fall into a different category of particle. Um, they have the same opposite charge as an electron. So, the same charge as a positron, they are just more massive. In our everyday experience, we don't experience positrons at all because, ah, I think they are fairly rare...

Ryan: Are they antimatter?

Justin: ...compared to electrons on Earth. It's ...

Ryan: Or are they regular matter.

Justin: Yeah, I think it's anti matter, I think every piece of matter has its antithesis.

50:00

Ryan: Or, it's good that we're not running into positrons because they would destroy us.

Justin: Yeah. Or, basically, if you hit an electron with a positron it cancels itself out and it releases energy.

Ryan: It's like, it's like $-1+1=0$.

Patrick: Yes.

Justin: Yeah, plus energy.

Ryan: Plus energy. Where does the energy come from?

Patrick: So, you can't destroy matter without making...

Justin: Um, that mass. Right. So, electrons and positrons both have the same amount of mass. That mass, I think, gets turned directly into energy when they collide. I think. I'm not a physicist so...

Ryan: What??

Patrick: Played one on TV? Played one on the internet.

Justin: I just, I play one on the internet.

Ryan: I've got to stop asking you those questions. I thought you were a physicist.

Justin: Take everything with, take everything I say with a grain of salt.

Ryan: I thought it was weird that you were in the biology department but I didn't...

Justin: Take everything I say with an electron and a positron.

Laughter.

Ryan: With a grain of subatomic particles.

Justin: With a grain of subatomic particles. But basically, ahh, we know that there is dark matter in the Universe because when we look out into space and see how things move, all of the matter that we can account for doesn't account for those motions. So, the only way that we can detect dark matter is from our absence of ability to detect it. In other words all that we see of dark matter is its gravitational ripples. Mapping out all of those ripples, ahh, physicists can back-calculate how much dark matter there is in the Universe.

Patrick: How much matter we can't see.

Justin: And it turns out, 90, what is it, yeah, 90% of dark, or, sorry, 90% of matter in our Universe is dark.

Patrick: So, you know, some people might say well doesn't that just mean your wrong, that your flat out wrong? Like how can...

Ryan: You have to come up with invisible substances to make your theories work.

Patrick: Yeah, for 90% of your theory to work.

Justin: Well, when you look out in the Universe...

Ryan: That's like saying, that's like saying ghosts exist we just can't detect them.

Justin: Well, it's, it's more like saying ghosts exist because you see things being tipped over and there's no other possible explanation. So, you...

Patrick: I like that analogy.

Ryan: You did a good job, way to diffuse that point I just made.

Justin: But, basically you're looking out into the Universe and ah matter emits electromagnetic signatures and from those signatures you can back-calculate what kind of matter is actually emitting those things. And, ah, dark matter doesn't emit any ah, electromagnetic waves and people know it's there because there's these gravitational ripples that pull things in different directions. So, there's something out there. They're not saying what it is, they're just saying that there's something there pulling these things that we can't account for with what we know about matter. Chew on that!

Ryan: You can't chew on that. I only chew on things that have electromagnetic signatures Justin!

Patrick: It's not...

Justin: You don't chew on dark matter?

Patrick: It's not bouncing back light in the visible spectrum, is that...

Justin: Or any spectrum.

Patrick: Right, not...

Justin: It doesn't emit light in any spectrum.

Patrick: I got it.

Justin: So, whether you're hydrogen or strontium or calcium you emit some kind of electromagnetic signals. So, these, so these guys have, ah, come up with a new theory of what dark matter actually is.

Patrick: These guys being Douglass, Think, Biner et al

Justin: Yeah. Those guys.

Ryan: Think Biner

Justin: Think Biner.

Patrick: Think Biner.

Justin: I don't know, is he German?

Patrick: Think is definitely an important prefix in science. I think that proves that you are serious about science if you've got think in your name.

Ryan: He's at Harvard, he's not German at all.

Patrick: He might be.

Justin: Not German at all? Well, if he's from Harvard.

Ryan: He went to Berkeley, Princeton and Harvard. What kind of Kraut would do that.

Justin: Well he must...

Patrick: Yeah, he'd be at the Max Planck Institute for dark matter.

Ryan: Oh yes.

Justin: But he's come up with a new force to describe this dark matter, that's what's different.

Patrick: it's the dark side.

Ryan: Tell us about it.

Patrick: Lay it on us .

Justin: Well, we only have, we have four forces. Ah, we have gravitational, electromagnetic, strong and weak forces to explain all of the interactions that we can detect and...

Patrick: Can you briefly hit strong and weak forces.

Justin: Ah, they're, ah, forces that happen within the nucleus. So, they're forces...

Patrick: Nucleus of an atom.

Justin: So, they're forces that we don't have any... nucleus of an atom. Forces that we don't really have everyday experience with.

Ryan: Except that they are holding us together at our very core.

Patrick: Sort of, yes.

Justin: Right. But we only experience the gravitational and electromagnetic force.

Ryan: What's your favorite force Justin?

Patrick: Strong and weak happen.

Ryan: Justin, what's your favorite force? Of the four.

55:02

Justin: My favorite force? The new force.

Ryan: The new? What? In that what you're going to tell us about?

Justin: The fifth force, yeah, that's what Think Baur, Think Biner, That's what, Think Biner proposes. He proposes a new force to explain dark matter. And, I don't think he named it but he ah...

Patrick: A fifth force. He should call it the Think Biner

Justin: He claims that it reconciles

Ryan: The Think Biner Force.

Patrick: Your just missing that opportunity: gravitational, electromagnetic, strong, weak and think biner.

Justin: Well, there you go, there you go.

Patrick: Great radio.

Laughter.

Patrick: Tell us about this fifth force.

Justin: Well, I don't know anything bout it. You took me to read the whole paper?

Ryan: You sound like a congressman talking about the health care bill.

Patrick: Something about an electron and a positron.

Justin: Yeah, really. This thing's a thousand pages.

Laughter.

Justin: It can't possibly hold anything of substance.

Ryan: How could anyone know what's in there.

Justin: How could anyone know.

Ryan: So, wait did you.

Justin: It's like the Congo rainforest, anything could be in there.

Ryan: Like a giant Brontosaurus. Ah, Justin...

Justin: Like a giant Brontosaurus.

Ryan: So did you try to read the paper.

Justin: Yeah I read parts of it. I mean, it's pretty deep in the theoretical physics. I don't have the ability to tease things apart but um, basically what he's doing is inventing this new force that accounts for, that seems to explain dark matter and also a lot of other disconnected problems. And he, it's a good paper in terms of, you know, he acknowledges that this is kind of a crazy thing to do and it might not be right and he proposes a bunch of experiments that could be undertaken to either prove or disprove the theory. So, he's pretty cautious in laying things out. You know, the way he models this force and this kind of unites what I was mentioning at the beginning in terms of all this, all these crazy high energetic electrons and positrons out in space. Um, when he applies all the characteristics that he gives this force to his theory when dark particle, or dark matter particles collide, they emit high energy electrons and positrons. Which would account for these things that they are seeing in space. So, it's a theory that actually matches some of the things that they are seeing with these deep space satellites.

Patrick: Alright.

Ryan: That's cool.

Patrick: Well, it's something to keep our eye on in the future I think. Right?

Ryan: My thinking is that there's still a lot we don't know about gravity, um, I was, I was debating a creationist one time and they, I pointed out. They pulled the, evolution is only a theory argument out on me and I fired back with well gravity is only a theory

and then they disagreed and said gravity is a fact and I had to spend an hour explaining why gravity is still just a theory. And we still never found, you talked about, Justin, you mentioned that all electrons have positrons and all matter has an opposite and all forces have an opposite. And we haven't yet found the opposite of gravity yet, so, I wonder if it's...

Justin: Right. There's no gravity particle.

Ryan: There's no gravity particle and there's no anti-gravity force. Gravity is only...

Patrick: Apparently there's only 10% opposite of dark matter...

Ryan: So, maybe...

Patrick: ... find the other 90% of the opposite of dark matter.

Ryan: Maybe this new force is just some form of gravity.

Justin: The Large Hadron Collider in Switzerland, ah, they might be able to detect some of the signatures that they think gravitons might emit so um, they might be able to find or lose support for the graviton.

Patrick: Or just make a huge black hole and destroy the world.

Justin: They're making dark matter. It's also published in *Archive* so the ah manuscript is free for anyone to download if they so choose.

Music

Ryan: Um, yeah, so velociraptors jumping out of trees which is a far cry from the picture Dr. Grant paints in the beginning of *Jurassic Park* when he's trying to scare the children. Um, there's an article, article that was published that was arguing, um, what's the title of the article, um, *Biomechanics of Dromaeosaur Dinosaur Claws Application X-Ray MicroTomography - Nanoindentation and Finite Element Analysis* from the *Anatomical Record Journal*, ah, the most recent issue and the first author is Phillip Manning and what he's arguing is that the Dromaeosaur and theropod dinosaurs which include the dinosaurs that are very closely related to birds like velociraptors

may have been arboreal or climbed in trees and then jumped out of trees to attack prey. It's an interesting idea to say the least. Did you guys have a chance to read any of the articles on this?

60:00

Patrick: Ah, I read, yeah, I read the popular press summary.

Ryan: What did you think?

Patrick: Um...

Ryan: I'm not convinced.

Patrick: Well, no, I'm skeptical and, but, they did interview Peter Mackovicky who says that, probably ancestors of Dromaeosaurs may have arboreal but it's hard to imagine a Velociraptor sized animal or even harder to imagine a Utahraptor sized animal climbing around...

Ryan: So I thought about that argument because I, that was a thought I had as well of, I believe we talked about this before, but Velociraptors are not as big as people think based on *Jurassic Park*. Um, they were smaller, more comparable size to a leopard or something like that which does climb trees but leopards don't attack from trees.

Justin: So, one of the first things I thought about was that the stiffened tail that most Dromaeosaurs have and how that would really be a hinderance in the trees. So, you know, leopards have a limp tail, monkeys have a prehensile tail, I think a stiffened tail that's sticking straight out behind you would really be a detriment to your tree climbing and stalking...

Ryan: Have they found, have they found the ossified tendons that they would need to show that they definitely had a stiffened tail.

Justin: Well, um, I don't know about the ossified tendons but they have these interlocking what are called zygoapophysis in vertebrae. I think it's pretty well established that at least the first 25% of the tail, the tail, 25% closest to the body was...

Ryan: Which is a good adaptation, it's a good adaptation if you're a running, right.

Justin: Yeah, for balance in general but probably not for climbing around in...

Ryan: Right.

Patrick: And it seems like the claws on the toes, I mean, that's only I half the story. The other story has to be up in the front. The arms of the body, you know, just in terms of, you know, I would think that you'd have to have really strong upper limbs to support...

Justin: This article discussed, it was an analysis of the biomechanics of the hand.

Ryan: Right, so it's actually spending more time looking at the hand and not the foot and I felt like the popular press was just blowing it out of proportion by talking about the giant claw that we're all so used to seeing.

Justin: So, were their arms long enough to support their body weight in terms of holding up the upper part of the...

Ryan: I don't know about long enough and strong enough, they were certainly very dexterous. They had a lot of, they have what is called a semi-lunate carpal which is a bone in the wrist that gave them a lot of maneuverability. And the whole, they could open doors thing is not completely implausible. They could have grabbed a door handle and pulled it so it's also conceivable that they could have grabbed a branch and pulled it.

Patrick: I mean, dogs open doors.

Justin: So, what would they really have gained by...

Ryan: Well, we know that the velociraptor...

Justin: What, it seems like there'd have to be some really strong pressure

Ryan: Well, we know they have feathers, ah, full grown velociraptors had feathers. So, a study came out last year that showed that they...

Patrick: So what, that doesn't...

Ryan: Ah, the theory that this guy is proposing is that they would have been able to jump out of the trees and fall more slowly with these feathers kind of guiding them down and they jump down on things from above and attack that way and that the, and that the giant claw was used for piercing and grabbing on to prey like a cat uses their claws for and not slashing them open. So, it was a piercing attack and not a slashing attack.

Justin: Okay, I still haven't, I still don't hear any evidence for...

Ryan: Yeah, it seems a little weak.

Patrick: And the fact that, you know, people, discuss this ad nauseam but nothing has, we have no evidence for anything evolving powered flight when you start as a glider. So, it's much more plausible that you evolve powered flight from the get go, not have an intermediate glide...

Ryan: So, I think we should probably, breakdown, a little bit, so Dromaeosaurs are very closely related to birds and birds are now considered to be living dinosaurs and birds obviously are capable of flying so the big debate in paleontology is were, were they, did birds start flying by being dinosaurs that jumped out of trees or did they start flying by being dinosaurs that ran along the ground and used feathers to lift off the ground. And those are the competing arboreal versus cursorial theories of flight evolution of birds.

Patrick: Good review.

Justin: I was, ah, I was traveling recently and we were riding on a motorcycle through a small farm area in Africa and there were chickens all over the place just roaming around, they weren't in pens or anything. I was thinking about this problem and um, we were, nearly running over a lot lot of chickens. Ah, but the way that they were getting out of the way was to use their wings as a horizontal, for horizontal momentum and it was really, really affective. They can run pretty fast without using their

wings but at the last second they have to get out of the way and they just open their wings and just give an extra flap and...

65:04

Ryan: They've done

Justin: They shoot forward pretty fast. And it seems pretty likely to me that, you know, a predator, chasing a prey, would find that really useful.

Patrick: Well, I think these were generally... Okay, Steve Gatesy at Brown has some compelling evidence that, of, ah, similar to what you're talking about. Birds that are generally flightless, when they start running up an incline will use their wings to help them move and I think it's pretty similar to what your saying, like a last minute sort of, extra burst of momentum. So, I could see either way. Running up, you know, something that lives on the sides of cliffs running up that way and using wings to help them get that last burst to get up this near vertical slope or you're chasing something and you need a little burst of energy to catch up with the...

Ryan: Well, also, if you think about it, in terms of your velociraptor here chasing after a small piece of prey and you reach out to grab it with your forearms and you miss and you have to pull those forearms back and those forearms are feathered you're going to get a slight boost from that.

Well, or you manage to slap, if you're chasing insects you manage to slap those down or into your mouth or something if you have feathers.

Ryan: Right. So, I think we're all fans of the cursorial theory I guess, it seems like?

Patrick: Well, I nev... it...

Justin: There's nothing scary...

Patrick: It's certainly a cool thought but I don't see any compelling evidence. It's a cool story that he uses to, I mean, he finds things that exist to support his story but it

seems like science should happen the other way around where the evidence should point you in the most logical direction not the lack of counter evidence.

Justin: Yeah.

Ryan: I do like the idea of using the six inch killing claw as a piercing weapon and not a slashing weapon. I think that makes sense, um...

Justin: Well, he has a little evidence to back that up.

Ryan: He's saying that the way the claw was attached to the foot it probably couldn't have withstood the shearing force of a pull through flesh but it could have withstood just piercing in and hanging on. And that makes sense in terms of things like modern cats which do exactly that.

Patrick: Right, but they're not hanging on to trees so much as they are hanging on...

Ryan: That's what he's saying he was doing is grabbing onto the prey and piercing into the skin and just hanging on like that.

Patrick: Right. I buy that a lot sooner than I'd buy the, you know.

Ryan: Yeah. And you talk about micro-raptor, and I mean, that's such a smaller animal, I could see that climbing a tree...

Patrick: Yeah, that's much, much smaller. Yeah.

Ryan: Yeah. Or something like you said, something like a Utahraptor and an Achillobator would be too big and would probably just fall but I don't know, big things climb trees sometimes. So, who knows.

Justin: So, Ryan, in this paper, did they talk at all about primate literature in terms of, there's been tons and tons of work on morphology of primates and whether or not things were arboreal or not. Because that's one of the big debates in human evolution, were human ancestors arboreal at some point or weren't they.

Ryan: No they didn't...

Justin: ... application with this or are humans just so different.

Ryan: They didn't talk about that at all but I have done a lot of my own reading on that because that's a topic that I'm really interested in. Um, and it seems like with humans, ah, pretty early on we were out of the trees and into the prairies because that's what forced us to a bipedal lifestyle. I think the current working theory is that, ah, it was kind of, it started off as a crouching, shuffling maneuver so we would be holding seeds or something in our hand that we had collected in the prairie.

Justin: People love to fight about this.

Ryan: Yeah, I mean, people love to fight about this too but as far as I understand, you start with holding something in your hand that you don't want to put down so you have to locomote with just two legs and eventually that becomes walking and then it actually took a couple, I don't know what, maybe millions, or it could just be a hundred thousand years to evolve running. So, running and walking actually developed separately.

Patrick: Well I'm more talking about the adaptations for arboreality because there's, you know, very definite morphological adaptations...

Ryan: Yeah, humans are, evolved pretty quickly because humans as apes are evolved to run.

Patrick: Right, but, yeah, I, but, but, did they talk at all about the things, the morphological adaptations, ah, for arboreality to compete with velociraptors.

Ryan: No, not in this paper.

Patrick: Because it looks to me like there's a lot, there's way more adaptations for running in a velociraptor than for climbing.

Ryan: Right.

Justin: Yeah, yeah. Starting with walking on two legs...

Ryan: Yeah, the other thing, the other thing they were trying to argue, the other thing they were trying to argue is that the velociraptor foot would have been capable of perching, like, adaption that we see in modern birds which is interesting but I'm again, not convinced having seen these fossils. It's not, it doesn't look close enough...

70:01

Ryan: ...it looks, you know, you can see where it's going in an evolutionary sense but that reverse facing digit doesn't seem low enough to the actual rest of the foot or strong enough to give a true perch.

Patrick: And the thing is...

Justin: It's such a stretch.

Patrick: ...that's what's called a plesiomorph or something that we got from, or that velociraptors got from a common ancestor rather than something they newly evolved for some...

Ryan: Right.

Patrick: ...specific purpose.

Ryan: And its possible that they could have evolved an arboreal...

Justin: It's such a stretch. Where was this paper published?

Ryan: Ah, it was published in...

Patrick: Yeah, where was it published?

Ryan: In *Anatomical Record*.

Patrick: *Anatomical Record*.

Ryan: Yep.

Justin: Really? I'm, that's surprising.

Patrick: There was a whole Dino-issue apparently.

Ryan: Yep.

Justin: Huh. It's just surprising that they would, I mean, I don't know. I totally don't buy it.

Ryan: Maybe we need another field trip but this time to the Cretaceous.

Patrick: I'm on board for that. I think Paul would pay for that.

Ryan: Paul would pay for that.

Justin: If we had a time machine were would you guys go?

Ryan: If we had a time machine we'd have to go to the Cretaceous.

Justin: If we had a time machine where would we go. Cretaceous, that would be the one.

Patrick: Might go...

Ryan: No, I got to go the the KT Boundary and see what actually killed the dinosaurs and then we would have enough funding to go wherever else we wanted for the rest of our lives.

Patrick: Yeah.

Justin: Yeah, that's probably right.

Patrick: I've always wanted to see the Permian.

Ryan: Yeah, but, I mean, that's just not as sexy.

Justin: That would work well too.

Patrick: Well, it ought to be but it's not.

Ryan: Right. So, we have to go back to the Cretaceous.

Patrick: Well, you don't have to come. I want to see the Permian...

Ryan: I want to come, I want to see the Permian, I'm just saying if we want to get, if we want the big bucks we got to go to the KT first and then we'll have the rest of our lives to go wherever else we want.

Justin: Right. We've got to get video of the ah extinction...

Ryan: Yeah, if we can survive it ourselves. Make sure we're in...

Justin: Just send a video camera back.

Ryan: Make sure we're not in Mexico when we go back in time.

Patrick: Yeah. I don't know where you want to be. At the KT boundary. That's, you've got to make sure you can get out really fast.

Ryan: Yeah, maybe, I'm going to go to Sweden. We should go to Sweden.

Justin: Some big mountain.

Ryan: Then you're far enough away...

Patrick: I'm going to go Moon and film it from there.

Justin: Ooh, that would be cool.

Ryan: I guess if it's getting hit by an asteroid.

Patrick: Yeah.

Patrick: Although we can't even go to the moon in the present, so.

Ryan: Yeah. But, I mean, if you build it, if...

Justin: So, here's a question. When ever you see the recreations of the KT extinction event its always, it always happens during the day.

Patrick: Well, it's dark at night.

Ryan: It's artists' intpretation.

Patrick: We can't even figure out the time of year.

Patrick: Although there is a paper trying to say it was summer, it was spring/summering time.

Ryan: Huh.

Patrick: We should, yes.

Justin: Yeah, yeah. To celebrate the rise of man.

Ryan: No, man was already doing pretty well by the KT Boundary, that's a common misconception.

Justin: No, they would have never...

Ryan: When I was ah...

Justin: From under the thumbprint of dinosaurs.

Ryan: When I was TA-ing dinosaurs in the spring, um, the students had to turn in a research journal article about a topic that we handed out during class and one girl got the topic of Jurassic mammals so she had to turn in a paper on what the Jurassic mammals were doing ah, which is the time period before the Cretaceous. So, the height of the reign of the dinosaurs. And um, she turned in a paper from a creation science journal about how Jurassic mammals were more diverse than previously thought and therefore they haven't been evolving because they were more closely related, more similar to modern mammals back then.

Justin: Yeah.

Ryan: Ah, she didn't do it on purpose, she just didn't read the article. So, she lost some points. But it was pretty funny. I was reading, I'm like, really, this is, alright. For awhile I thought I had a creationist in the class who was trying to sneak through her literature but it turned out she was just a less than stellar student who hadn't done the assignment. I, for a long time, have been an advocate, and I want to start a movement online. Velociraptors are an incredibly intelligent. We have done the EQ, ah, studies, which is the encephalization quotient which is the ratio of the theoretical brain size to body mass index which is ah, it shows that velociraptors are well within the bird/mammal range of intelligence. Um, and that's cool. And now we know that they had feathers and they weren't as big as we thought so they were probably very cute and I, if, I want to clone a velociraptor and then domesticate them like the study in Russia with foxes and make pets.

Patrick: I could see that working.

Ryan: Would you want a velociraptor as a pet?

Justin: So, could they reconstruct the bite force of a velociraptor?

Patrick: Well, it's really hard to, so, I bird sat a parrot this past week that bit the bleep out of me. Um, so, I'm not...

75:05

Justin: I still have a scar on my finger, actually, Patrick.

Patrick: Well, so do I. I've got multiple ones. So, I'm not sure how well that's going to go but I applaud your attempt at...

Ryan: Well, that bird, the bird is not a domesticated animal, its just an animal that's been plucked...

Justin: First.

Ryan: ...from the wild and put in a cage whereas dogs are genetically distinct from wolves because we have been domesticating them for ... years.

Patrick: Right. I'm pretty sure a chicken could bite the shit out of...

Ryan: Yeah, but they're not domesticated to be pets, they're domesticated to be food.

Justin: So, Ryan, I think we need to do first is reconstruct the bite force of these things and then back calculate the body mass of their prey.

Patrick: I'm sure that's...

Ryan: I'm sure it's comparable to a dog or a wolf.

Patrick: So, if you fall within the body mass of their prey then you might not want to have it.

Ryan: But, yeah, but don't humans fall within the body mass of index of a wolf? I mean, wolf packs take down bison, they could take down humans if they really wanted to. We still domesticated them.

Patrick: Yeah, I really wouldn't want to have a wolf.

Ryan: You have a dog because you domesticated them which is what I'm...

Patrick: A domesticated wolf.

Ryan: I'm going to domesticate the velociraptor so you're going to get something that is a juvenile velociraptor but in an adult form.

Patrick: I'm pretty sure that the parrot didn't have a bite force that was able to bring down humans but nonetheless I am, I am nursing...

Ryan: A beak is completely different than a mouth of razor sharp teeth. Can we, I mean, people get their cats declawed, you could just get your velociraptor declawed. This is all just about marketing. Marketing the velociraptor as a viable pet. You guys need to support me.

Patrick: I think it's a good idea. I think it's a good idea. I'm on board.

Ryan: It would really help cut down on velociraptor attacks if you had your on guard velociraptor.

Patrick: Alright. That wraps it up this week

Justin: Feel free to send us a tweet or an email if you have ideas for show topics.

Ryan: And join us next week for more science... sort of.

Announcer: Thanks for listening to Science... sort of. Our show notes are available at Sciencesortof.com which will have links to all the stories we talked about today. You can follow us on Twitter at twitter.com/sciencesortof. You can get in touch with us at sciencesortof@gmail.com or on our Facebook fan page. A great way to support the show is by subscribing to our feed on iTunes and writing a review so other people have better chance of finding the show. And if you have a friend who you think might be interested tell them to give us a try. That's all for this week. Thanks for listening and see you next time on Science... sort of.

Ryan: La la la la la. Doing some vocal warmups.

Patrick: Rubber baby bumper Rubber baby bumper Rubber baby bumper

Ryan: The human torch was denied a bank loan.

Patrick: Ah, is that science?

Ryan: Where are your show notes?!