

Susan Crockford 011824

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Introduction and Guest Presentation

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Susan: that narrative just isn't flying anymore. And, you know, they've, um. They've fallen on their faces, um, for it, and they need to move on. And they're, I think they're finally realizing that that's true.

Tom: My guest today is Susan Crockford, back again for a second time,

Susan: I'm a zoologist and, um, I'm a special specialist in evolution and Arctic ecology. Um, and I've been, um, writing on a blog called Polar Bear Science since 2012.

Recent Developments in Polar Bear Research

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Tom\_AI: So what is new? Uh, anything new in the whole polar bear, a controversy, whatever, since we talked last or in the last year or so,

Susan: one of the big ones that's been most recent is the surveys, um, on Western Hudson Bay and Southern Hudson Bay Polar bears to try and get us a sense of numbers.

Um, and so those reports came out in just in the fall of [00:01:00] 2022 is when they were released. I didn't get a hold of them until this year, um, and I ended up having to go to the government of Nunavut to get those because they just haven't been released. Um, and what happened was that the results from the Western Hudson Bay survey, um, were released to the media.

So, somebody sent out a press release.

Discrepancies in Polar Bear Population Reports

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Susan: To the media, and there were stories all over the world about polar bear numbers in Western Hudson Bay dropping by 27%. So the, you know, big headlines on that, but, you know, buried in these stories were was the detail that they actually couldn't tie this decline to climate to, um, reduce sea ice.

And so that was a bit of a revelation, um, [00:02:00] but I really wanted to see the actual report to see what was going on. But one of the, when I did get the report, what they said was that, in fact, that that decline over the previous 5 years. Wasn't statistically significant. So, and in fact, it wasn't even statistically significant to the previous one.

So over 10 years, even though they were recording a decline each time over 10 years, that wasn't a statistically significant decline. And one of the reasons. I think is because they couldn't explain why they couldn't say whether, you know, they, they were seeing a reduced number of females and young bears.

Um, but they couldn't account for where those had, why they had dropped off. There was no, no starving animals there, um, was no reduced [00:03:00] sea ice during that period. Um, so it was really left in a bit of a, uh, you know, hands in the air kind of thing. And then when I did finally get the report, I discovered that, in fact, the survey had been done in southern Hudson Bay.

Um, and it turned out that population had increased by 30%. Now, those two reports had been released at the same time, like the government had those and the people, the polar bear. Specialists who were presumably feeding this information to the media knew that this report had been produced and they said nothing about the fact that this Southern Hudson Bay population had increased by 30%, which in fact, it appears was statistically significant.

So they were keeping that information to themselves. And gee, I wonder why, you know, and it just because it doesn't go along with their narrative. These [00:04:00] are populations that are living side by side.

#### The Impact of Climate Change on Polar Bear Populations

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Susan: And are being exposed to virtually identical ice conditions, so they try and make the argument that the Western Hudson Bay population is declining because of lack of sea ice.

And yet this other one population right next door, um, is having an increase. And so I think really the there's two potential issues going on here. And one is the possibility that in fact, some of those bears are are moving around Hudson Bay. There are, you know, there's another population living to the north.

And all of them come together on the sea ice of Hudson Bay over the winter. So they all use the ice of Hudson Bay to hunt during the winter. Um, and then they go to sort of separate corners over the

summer. Um, but there is either the [00:05:00] possibility that, um, those bears are crossing the boundaries more, more than they anticipated.

## Challenges in Polar Bear Population Management

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Susan: Um, and if that's the case. Then it's undermining all of the, um, assumptions that are being used to, uh, manage those polar bear populations and to count them and all of those things. So, it actually is a much bigger deal than they would like you to think. The fact that they got these different results in these neighboring populations.

Uh, what

## Historical Perspective on Polar Bear Populations

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Tom\_AI: is your thought in the bigger picture on how many more polar bears we have now than at the very minimum? Maybe the 1960s or so. Do you have about the

Susan: late 1960s? And, you know, there's now I have this battle with these polar bear special about specialists about. Whether there's any number that you can use and I use 10, [00:06:00] 000 as a plausible, um, estimate, um, based on, um, experts at the time making estimates, um, the U.

S. Fish and Wildlife Service in 2008, they used a number of about 12, 000 for the late 60s. And when they were adding polar bears to the endangered species list. Um, so even if you go 10, 000 12, 000, the latest official estimate is about 26, 000. So even using those estimates, numbers have at least double, um, but I, I really think that the numbers are much higher than that, that they could be as high as between around 32, 000 and 39, 000.

With with some large margin of error, of course, because there there is there is [00:07:00] problems with counting the bears, but a lot of what these specialists are doing is every time they get a new estimate coming in, they lowball it as much as they can to make it seem like, you know, nothing's happening. And their 26, 000, um, at population estimate for the global population, um, hasn't changed since 2015, even though there have been, you know, numbers that have increased since then, maybe not by huge amounts necessarily, but they're just refusing to change that global.

Population estimate because they say it can't be used to, um, say, whether the population is going up or down, which I just don't

understand the logic of that. If they're trying to say that, you know, the, the climate is having this huge impact on the bears. Then, um, and then to say that we can't use these numbers, [00:08:00]

Tom\_AI: but is there any way that they can fudge the numbers at both ends enough to make it look like there's less polar bears now than there were in the 60s?

### The Politics of Polar Bear Research

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Tom\_AI: They can't that can't be done

Susan: or can it? No, no, no, it really that that is, um, um, those are, those are the, the boundaries that really they have, they have set. And I think that there are their, their favorite argument is that we have no way of knowing that there were only 10, 000 bears. What they would like to say is that there were maybe 20, 000 bears then.

And so the population has grown by a little bit, but not by very much. And that it is lack of sea ice that is keeping them from growing any further.

Tom\_AI: Uh, what do you think is the lower bound of what, uh, how many there were in the 60s, uh, reasonably?

Susan: Well, I, I actually do think that 10, 000 is a reasonable guess.

I mean, there, there were, um, estimates as low as [00:09:00] 5, 000. Um, but I think that, that those estimates were not necessarily taking into account. Um, bears in Canada, um, that was based on a Russian estimate and, um, it, it really was, um, I think limited in its scope. So I, I do think that 5000 is too low. Um, but that, um, 15, 000, which is the upper level may have been too high considering how.

Low, um, the numbers went in some critical areas because we know, for example, like all this worry about Western Hudson Bay bears that their numbers, um, went way down. And the reason that an international treaty was established in 1972 is that all of these Arctic nations could see that bear numbers across the Arctic.

We're in serious trouble. So, you know, 15, 000 just doesn't seem low enough for, um, [00:10:00] the, as being the impetus for putting together this international treaty. And, um, so I think that it, it's plausible. It makes sense in terms of all of the information that we have available. So we do hear

## The Role of Indigenous Knowledge in Polar Bear Research

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Tom\_AI: a lot about, we should listen to, uh, indigenous people about what they're saying and what, what are they saying about polar bear

Susan: numbers?

Well, in a lot of areas, they're saying the numbers are up. And when, when the polar bear specialists are saying they're declining and, you know, there is a bit of, uh, there's a dispute over that. And because this polar bear specialist, they're saying, oh, well, you're just see, you're seeing more bears, but that's just because they're being forced onto the ice because the sea ice is.

They're being forced onto land because the sea ice is disappearing, but, you know, I, um, in, in this instance, I would trust the Inuit because they're not going just on what they're seeing on land. They're, they're going out on the ice the way that the bears do, [00:11:00] and they're seeing them in lots of different contexts.

And they also have the experience, you know, 1960s wasn't that long ago. It's within my lifetime. And. They, they know that within their own communities in the 1960s, they weren't seeing hardly any bears and now. Whether they're coming on land or not, they're seeing a lot more bears than they're used to seeing and it means that they are not able to go out on the landscape and do things that they used to be able to do.

When there were hardly any bears around, like going camping in the summer and doing things like that without being bothered by bears. And now they're trying to do some of these traditional things going hunting in the summer and finding that, you know, bears are a real problem. So. You know, that that is also a confirmation that there are more bears.

And even if you've got an [00:12:00] estimate that the number in a certain areas between 500 and 1000, my guess is that the real number is closer to the high end rather than the low end. Whereas the polar bear specialist would look at it and say, well, You know, it's at the low end. And so, you know, that's where the difference is in perspective.

Tom\_AI: Okay. Do you have a sense, uh, globally as to, uh, how many polar bears are, uh, killed by hunters either legally or illegally? Any rough idea of that?

Susan: I believe it's in the neighborhood of around 600. Um, and, um, you know, not all, and that would be primarily between Canada, um, Alaska and Greenland. Because Russia no longer permits hunting, um,

Norway, um, for small bar does not permit hunting.

So, um, Canada and Greenland, um, are the primary ones that are still actively hunting. But it's controlled, you know, [00:13:00] there's regulations in place. Yeah,

Tom\_AI: and I think you said elsewhere that most of them that are taken by hunters are males. They don't shoot sows with cubs or anything, right?

Susan: And that was part of the, the agreements for the, for this 1972 treaty that they, um, don't shoot, shoot females with, uh, cubs anymore.

And so that's made a big difference and allowed the population to grow. And you know, it's just. It's logical. You stop killing animals by the tens of thousands and their numbers are going to increase. And certainly that's a pattern you have seen in every, um, species that has been overhunted. As soon as you stop doing that, their numbers go up.

And we see that in polar bears as well. All right, as you,

The Consequences of Speaking Out in Polar Bear Research

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Tom\_AI: uh, as you go about your daily work, do you think that there's less interest in using the polar bear as an icon for the climate scam now than there was at the peak around the 2000 whatever 7 or 8?

Susan: Yeah, well, certainly, [00:14:00] and, and they've even been trying to make this argument publicly that, um, that they're, that, that, uh, if you're looking at climate change, you should be looking at the impact on people and not polar bears and, uh, but my take on that is that really it's because their narrative.

Of using polar bear as an icon for climate change has failed that they made predictions that the sea ice was going to decline faster than it has that the lack of sea ice was going to impact the bears much more profoundly than it actually has. And that, because, you know, some of the work that I've been doing, the work that you've been doing and talking to people.

Um, has made a difference, and it's just that that narrative just isn't flying anymore. And, you know, they've, um. They've fallen on their faces, um, for it, and they need to move on. And they're, I think they're [00:15:00] finally realizing that that's true.

Tom\_AI: So are you seeing that within the polar bear research

community, that there's more realism now and they're not all in on blaming CO2 for everything?

Oh,

Susan: no, I don't think so. I think within, within that community, there's still, um, uh, a real strong commitment to using, um, using it because if they, as long as they can keep The bear on the endangered species list. It means more research money for them. And that's pure and simple. And it's, uh, I think it was the, um, motivation for them trying to get the bears kept on, um, on the list in the, in the 1st place, um, because.

It's built, it's built into the act in the U. S. that if, if you were, if an animal is placed on that list, that research has to be done. And that [00:16:00] means, you know, work for them and and their research group and their students and whatnot. So, um, in order to keep all this going, they have to, uh, keep the narrative ramped up at least at least within that community and maybe not necessarily within the used as a climate change icon, but certainly within their own community.

The rhetoric is as strong as ever. So

Tom\_AI: I'm thinking if you're a young person out of college, you wanted to go into polar bear research, you couldn't probably get a job if you wanted to, uh, just research the bears and, and not, uh, push

Susan: the climate part. No, if you didn't, if you didn't spout. You know, all the narratives that that they're looking for, um, you just wouldn't be chosen.

That's all. And they've already, um, I think, as I think, you know, they, uh, ran polar bear expert, um, Mitch Taylor. Um, they basically ran him out of that community because he was raising [00:17:00] questions about, you know, the legitimacy of some of the arguments they were trying to make and they considered him a problem.

And they do make all of their decisions based on consensus. So they insist that everyone in their group holds the same viewpoint. And when he refused to, you know, spout all the same things. Um, they basically pushed him out and that was in 2009. I believe he, um, was dropped from the, um, polar bear specialist group and, and now, and they disparage him any, any time he tries to speak up, um, they speak of him in disparaging terms and dismiss his, um, credentials, but he worked with them and he worked in the Arctic on polar bears for 30 years.

You know, it just. Quite despicable behavior. [00:18:00] Did you

Tom\_AI: lose a job yourself because of polar bear and or climate

realism at some point?

Susan: Well, I was an adjunct professor at the University of Victoria, um, for 15 years. And, um, in 2019, um, I lost that adjunct status. Now, this is not a paid job. It's, um, uh, so I have to be, I have to ask to be.

Considered as an adjunct and this has to be approved, but it had been approved for 15 years and I had been. Writing my polar bear science blog since 2012 and speaking publicly about polar bear issues for quite some time. Um, so it seemed a bit of odd timing. Uh, for 2019 for all of a sudden, um, they, they decided that, uh, I, I didn't belong there [00:19:00] and so it was, that was a big blow for me because, um, without a university affiliation, for example, um, I, I couldn't go on and be a member of a research team.

Looking at some of the other evolution issues that I'm interested in. And so, even though it wasn't a paid job, it was a big loss for me. And I think a big part of that was a paper that was written by 2 polar bear specialists and Michael Mann and a number of other climate change researchers. People who, um, got together and wrote a very disparaging, um, paper and I think that was used as ammunition by people within the university system to make sure that I was no longer affiliated.

Tom\_AI: He wrote a paper, I'm mentioning you by name.

Susan: Oh, yes, yeah, and in very disparaging [00:20:00] terms and, you know, diminishing, like, not even mentioning that I have a PhD, for example. Um, and, uh, things like that. It was called, uh, Internet Blogs. Polar bears and climate change denial by proxy. So it wasn't just my blog, it was others, other blogs.

Um, but I was identified as the main problem because, uh, I was, um, feeding misinformation to other people on the Internet. And, um, it also resulted, it was also then the ammunition that they used to, um, get journalists not to speak to me. So that before that time, I was, you know, on occasion, not regularly, but on occasion, contacted by, um, by the press to, to give, uh, an opinion on these things.

But [00:21:00] once that paper came out, they used it and they would write to, to these people or email them and say, listen, this, this proves she's not dependable. And, um, then if they talk to me, then, then they would go after those press members. So, it just meant the press just couldn't afford to, um, have any conversations with me.

Tom\_AI: Wow. So I really admire your courage in speaking out for the truth all this time. I think it's fantastic. Hopefully you'd do it again if you had the chance to do it again. Oh, absolutely.



Susan: Absolutely. I mean, I've learned a tremendous amount. And, you know, it's, uh, and met so many interesting people. And, uh, you know, I just I have to stand up for the basic, uh, precepts of science is that, you know, you, you can't just ignore research that you've done in the past because it no longer, um, matches the narrative you want to put out today.

And that's really all I've done [00:22:00] is, is held these polar bear specialists, um, to account for what they're saying and, um, to make sure that the public understands that. Yes, I'm

Tom\_AI: really happy that you had the guts to do this all these all these years. Thank you for doing that.

Susan: I I do think that it's a good thing that they're they're backing down from using polar bears in their climate change rhetoric, but It I I do believe that you know, keeping keeping it at the forefront is important Because the Example of what has been happening with the polar bear, um, issue has made a lot of people understand.

What the issues are, and so it's kind of a small microcosm of what's been going on in the climate change movement, you know, in particular, and when you can see [00:23:00] all the little ways that things can be manipulated. Then you understand, and it, I think it's allowed. Or encouraged a lot of people to think more critically when they're presented with, um, stories or, or facts that really don't quite make sense and.

Encourages them to do a bit more research before they make up their mind about whether they're going to actually believe this new narrative. Yeah,

Tom\_AI: I think that's a great point that if they're misleading us here, what else are they misleading us about? I think there's a lot of that.

## Exploring Polar Bear Evolution

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Tom: Then you have a new book out called Polar Bear Evolution, A Model for How New Species Arise. Want to talk about that at all?

Susan: Sure, yeah, no, that, it's, it's really my, it's my passion, um, topic. Because evolution is really the thing that's interested me my entire career. Just, you know, to, to show people that there is, [00:24:00] um, physical as well as, you know, behavioral and physiological differences between polar bears and their ancestor, the brown bear. And this slide just shows, um, there's differences in the confirmation of the skull and the teeth and also, you know, well, we

know the coat color, but if you look at the bottom of the bears feet.

There, there is, um, real significant differences in, in how they're constructed.

And all I wanted to say here was that, you know, I, I came at this topic because I was really interested in the process of how a wolf might turn into a dog. And, That got, that got me really into thinking about how similar that process must be to how wild [00:25:00] species transform from one to another.

And so, in, in the process of doing that, that was the topic of my, um, PhD dissertation, um, was trying to come up with a theory for how that might work and like looking at all the literature. Um, in evolution, all of experimental, uh, research that's been done and then tried to apply that same concept to, um, trying to explain what might have happened from going from a brown bear to a polar bear.

Okay. Yeah. I

Tom: have your book on Kindle. It's over 500 pages, I think, on Kindle. But it's super interesting. I'm thinking, uh, you think evolution in some of these cases happened way faster than other people, right? Just

Susan: not very long. Well, absolutely. And that, yeah, and that's the, that's the real, um, surprising thing, I think, for some people is that, um, we're [00:26:00] mostly, uh, taught in school that evolution is a very long process.

You know, lasting, you know, tens of thousands or hundreds of thousands of years to go from one species to another. But, um, it really is fairly widely accepted now that in order to be effective as a response, especially to things like environmental change, that speciation has to happen quite quickly, like, within, within the timeframe of, 20 generations, in order for the new species to actually survive in a, in a new habitat that's very different.

And so, um, that's really what I was working with is trying to explain how you would get that kind of, um, rapid change going on. Because it doesn't seem like gen, genetic mutations can really [00:27:00] account for all those things. You have too many, um, physical and behavioral and physiological features changing at the same time.

Tom: You want to talk yet about that Russian fox farm, which is a great example. Sure, yeah.

Susan: I mean, you were mentioning, um, that, that, uh, an experiment I described in the book about, um, Russian foxes in the 1950s. Um, and it was actually 1 of the studies that really caught my attention

because it seemed to me that it was the 1st time that anyone had really looked at. That transformation, that domestication process in a scientific way and what the Russians did, they, in the 1950s, um, foxes, uh, silver foxes from Canada and the U. S. were being farmed in a lot of places across the world, but very much so in Russia for their furs. But, um, the, the [00:28:00] foxes held in cages until they were, you know, old enough and big enough to harvest their furs, um, were not happy with being caged, and that they, they were actually going, um, having, um, Just freaking out all the time.

And it was very unpleasant place for the foxes and for the people that work there that even if their cages were approached, they they would start screaming and yelling and and just freaking out. And so, um, a Russian geneticist, um, looking and thinking about actually the process of domestication wondered if you could make these animals a bit more uh, Amenable to human contact if it would make things easier for everyone.

And so he started an, um, a selection experiment where he went through, uh, the population. I believe it was around 10, 000 animals [00:29:00] and they just tested them with, um, uh, by inserting a hand, a gloved hand into the cage to see how the animals reacted. And most of them did their usual freak out thing, either cowering in the back of the cage or attacking the, the hand, but, um, a few of them actually were curious and would come up and like sniff the hand or, or at least not panic about it.

And so what he did then was use the animals that he called, um, fearless. Um, and use them as the start of a breeding population. And so every year he bred the animals of those, uh, those ones together. And then did the same selection process for any pups that were born. And went through this generation after generation and for foxes, that would be like one year litter per year.

So, [00:30:00] um. He was able to see some changes very quickly. And interestingly enough, 1 of the 1st changes that they saw within only a few generations, um, was this white spotting they called it. And and so they were getting animals that were. Marked instead of being black all over with a white tip on the tail.

They were marked like a border Collie With, you know, the, the black and white muzzle and, you know, white feet and a bit white on their chest. And as time went on, the animals became, they saw more and more changes, they saw changes in behavior, so that the animals became, um, much more amenable to being around people.

And they also saw changes in the timing of their reproduction. So instead of being ready to mate in March. They were ready to mate in January. So, and in fact, the, um, [00:31:00] the fellows, people who were, um, running this experiment, uh, Belayev, he was really

perplexed about what was going on. He didn't understand it.

He was a geneticist and was coming at it from, uh, the perspective of genetic mutations causing these things. And he really didn't understand how you could have So many changes happening at once and seemingly in concert with each other over such a short period of time. And, but the thing is that he, it wasn't really what he was after.

They, you know, they, they, he was after getting animals, um, that were, you know, black all over for these Fox farms and having animals that were black and white, like a border Collie was not, not their intention. And so, even though his experiment, um, Um, Didn't, didn't produce really what [00:32:00] he had in mind. He understood that it was an important result and, and wrote it up and it appeared in the Journal of Heredity in 1979.

So, when I came across that, I started thinking, okay, there's something else going on here, and what, and started looking at what was it potentially that could link all of those features that were changing in his foxes. Okay, so

Tom: it wasn't just their behavior changed. I have, uh, they were unafraid of people.

They would crawl in your lap, but they got to like curly tails. Their

Susan: fur changed color. Yeah, the curly tails and their ears started flopping down instead of being perked up right. And, um, even the skull sizes change. Yeah,

Tom: so they changed kind of mostly into a dog in, uh, not that long, right? It didn't take them 10,

#### The Mystery of Animal Transformation

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Susan: 000 years.

Yeah, and, and very much dog like behavior, [00:33:00] um, in, in an animal that we actually wouldn't expect to be seeing that kind of transformation. And you definitely don't see that in the wild, that kind of transformation. So, um, it, it really did catch my attention as being kind of a critically important experiment.

#### Debunking Genetic Mutation Theory

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Tom: Okay, and I don't want to steal your thunder here, but you don't

think it was mutat genetic mutation that

Susan: caused the change? Well, they actually did a whole bunch of, um, tests and whatnot, and follow up, and in fact, for decades afterwards, they, I mean, and in fact, that experiment has continued. Um, into today and they have been doing, um, work trying to identify genetic mutations and really are not finding very much.

And so it, it's, they're not finding any big, you know, sort of smoking gun in terms of a [00:34:00] genetic mutation that would explain all of these things happening together. So what do you think it was?

### The Role of Thyroid Hormone in Animal Transformation

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Susan: That's just showing you how many things I came up with when I looked at all of the things that were changing in the foxes and the things that change between wild and between wild species when they change, found out that the common denominator is thyroid hormone.

And so critically thyroid hormone, um, effects. Embryonic development and gene regulation in the sense that what it can do is that a change in the way the thyroid hormone is produced can actually change how a gene functions rather than the gene having to change itself. So, it's another way of changing, um, the output of a gene without having the gene mutate. [00:35:00]

If that makes sense. And so, but then we've also got it affecting, um, metabolism, like general metabolism. It's what, um, keeps you, um, regulated to hot and cold, like when you're cold, your thyroid, uh, production has to ramp up to keep you warm. It controls reproductive timing. Um, fetal and postnatal growth. So all growth hormones are controlled by this, um, the stress response, um, through adrenal hormones.

And that's where, um, this fear, fear, fearlessness of, uh, Belyaev's foxes comes in. So that's the stress response. And also, when we're looking at the, um, the actual physical appearance of these animals, um, the hair, hair. Production and growth and also skin and hair pigment is also controlled in part or totally by thyroid, um, [00:36:00] production at the core.

So, it's, it's kind of a conductor, if you will, like, it's the, it's the central control mechanism and there are. Um, hormonal, um, connections between that and, and these other things that it affects, but it, when you look for the common denominator, that's where it lands is with the thyroid gland. My, um, hypothesis for how this works, um, as quickly as I can.

## Understanding Hormonal Rhythms

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Susan: And the idea is just that what we know about all of the hormones for animals and for humans is that they're produced in a pulsatile manner. And that is that, you know, they're, the hormone is released in bursts of various lengths and intensities and that that changes.

Over the course of the day, and it also changes according to the season [00:37:00] and according to age. So, as we age, these rhythms change and as, like, young children and young animals are growing, those, those rhythms change. But what I've got on this screen is, it's not actually thyroid hormone, but it's, um, another related hormone, and it's, these are just, um, a daily sort of, uh, graph.

Of the rhythms of 3 individuals, each of 2 very different. Um, types of rats that they use for experiments. And the only point I'm using here is that. The, the animals on the left hand, um, column of the screen, they all have this low point in the middle of the day. In this hormone production, and the all of the 3 individual animals on the right don't have that same.

Rhythm so, and the [00:38:00] idea is that, um, that these. Graphs in my theory represent what, um. Individuals within different, uh, within a species. That the overall pattern will be relatively. Similar, but that individuals will have slightly different. Patterns and so the concept is.

## The Hypothesis of Hormonal Selection

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Susan: And say, to explain how, uh, the lie of got the results he did with the foxes is that if you choose a trait.

Like, um, fearlessness and select it. That those animals will have a particular pattern of this hormone production. And if you select them, then, then you actually take, take it out of, um, the, the other options that are available for that [00:39:00] species. And because you're selecting for a particular rhythm, you can get changes happening within a new population very quickly.

Because the other options that are available from other, um, other individuals just don't exist in a new population, like the Fox selected population. They're actually removing it. And it's the interconnectedness of this, um, thyroid rhythm that that rhythm that's showing up is showing up in the fearless behavior, but it's also

collect connected to things like the reproductive timing, the fetal growth and and the hair patterns.

And so by selecting that one, one feature, you actually select other features at the same time. Does that make sense?

### The Theory's Reception and Testability

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Tom: Yeah, this is incredibly [00:40:00] interesting. I don't know. Um, is this a new theory that you came up with rather than it's not accepted yet

Susan: right there. Well, no. And I, as I said, this was the basis of my, um, PhD thesis in 2004.

And I also wrote, um, there's a couple of, um, peer review papers that I wrote on it as well. And it actually got has gotten, um, A fair amount to my mind of support. And in fact, there are still people working on, um, trying to see if they can find, um, the, the actual, um, generate the experimental results that would either prove or disprove what I have presented and the.

Important thing about this theory is that it is testable [00:41:00] and that's really our criteria for doing science is that you have to come up with a hypothesis and show how it can be tested. And then it needs to be tested. So at this point, it hasn't been tested, but it is testable.

### Challenges in Measuring Thyroid Hormone

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Susan: The difficulty is that thyroid hormone is very difficult to measure in very small amounts.

And that's what we're looking at. Um, some of these other hormones, like the one that I showing on the graph, they're easier to measure in very small. But thyroid hormone is more difficult for that.

### Potential Testing Methods and Future Research

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Susan: And so what I had proposed is that what we need, um, is something like, um, uh, an insulin pump, but reversed. So instead of, you know, injecting insulin at in.

incremental times over the day, [00:42:00] it would be drawing blood

samples, just tiny blood samples over the course of the day. And then we could look at what was actually going on in terms of those rhythms between individuals and also between species. Okay,

Tom: uh, if I understand you correctly, then we don't really have the technology yet to rerun the Russian Fox experiment and, uh, test them.

We

Susan: don't have that. Well, I think rerunning that would be horrifically expensive and I don't think anyone would even attempt it. But certainly at the time in the 1970s, there were several other experiments that were run that were similar, that got also similar. Results, so they were actually able to basically replicate his results.

Still, none of them could explain what was behind it and what we need now is the technology to [00:43:00] be able to go and see, um, measure what the hormone levels are between individuals within a species. And then individuals within another species. And what I had proposed is to look at one of the things we know is that there is a living population of brown bears that is very close genetically to polar bears, and they live in Southeast Alaska.

Well, I happen to be able to track down, um, three, three bears that are being held in a zoo in the US. I forget now what zoo it was. Um, and but they're captive animals already, and they came in as cubs. They are still there. So they're used to being handled and that kind of thing. There are bears held in zoos polar bears held in zoos as well.

And so, to, to my mind, that's, [00:44:00] um. A real open invitation to look and see whether. Um, samples could be taken from those animals, um, to see whether there actually is a difference in their, um, thyroid hormone metabolism.

Tom: Very interesting. So, in a perfect world, it might be possible, I guess, this would have to be in a perfect world, if you had access to enough brown bears, you could do this Russian fox experiment with them and try to turn them into polar bears.

Well, I

Susan: mean, I I don't know, um, if the, I think the actual experiment itself that was done doesn't need to be repeated. What needs to be done is the, um, investigation into the hormonal basis of that. But yes, The difficulty is that it's, um, it's the measuring of the thyroid hormone in small amounts that you would need [00:45:00] to be able to tell whether these rhythms that I'm proposing, um, are there.



In, in the ways that would make sense for the way I've proposed the theory. So, um, and there, but there are a number of Russians who are working, um, on fish and closely related fish species to look at the thyroid hormone levels in relation to growth rates and changes in the bones in the skull, for example.

And so there are a few people still in the world that, um. Our understanding that this is potentially a useful line of research, and it's just going to take time. I think before it happens, I'm not I'm not a bench scientist. You know, that's it's not what I do. Um, but all I could do is. You know, write the, the theory down as in as [00:46:00] much detail as I could and present it.

And so I, it is in my thesis. Um, I, I did write, um, another book in 2006 and the most of that book actually is, is in this polar bear evolution book. So the, the middle of the polar bear evolution book is really the, um. Uh, the, the core of, of my, um, thyroid hormone book that, that came out of my thesis.

#### Exploring Polar Bear Evolution

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Susan: And then the first part of the book and the last part of the book deal specifically with Um, polar bear evolution and, and how, like, if, if we have, um, an idea of, um, how it happened and that it happened very quickly, where did it happen?

And when? So those are also questions that are up in the air as far as I'm concerned, going through the literature.

Tom: Yeah, in your book, it says that the polar bears likely arose somewhere between [00:47:00] 185k years ago and 450k years ago. Uh, is that kind of accepted in the scientific world?

Susan: Well, yeah, and that's really the kind of range that has been proposed.

And so what I did was go through and looked at, for example, the um, cycles of glacial and interglacial Periods, um, with the assumption that, uh, a bear that is, um, specialized to live on sea ice would have arose during a glacial period rather than an interglacial period because it to me just makes sense.

So, um, looking at Um, what has happened in terms of the, um, glacial and interglacial periods. So my logic, I just went through it and said, what's the most plausible?

I mean, we, we don't have any proof for this. This is, is just saying [00:48:00] we've got certain kinds of evidence and what makes the most

sense if you put all the pieces together, because what, what I have found in looking at, um, the, the estimates made by geneticists, for example, is that they don't take the fossil record into account.

Or that, you know, and often whether or not it was a severe glacial or not. And so I, my assumption was that this event would have happened during a severe glacial, um, and this graph is from the Greenland ice core. So we're looking at, um, glacial periods are, um, even numbered. Inter and at the, at the bottom and interglacial, warm interglacial periods are near the top of the graph and they're odd numbered.

So we're looking at a possibility for polar bears as arising that in [00:49:00] marine isotope stage is what the MIS states stands for from marine. Um, isotope stage 16, 12 or six. So, those are the real, um, logical and plausible, um, options because before MIS 6. The glacials just weren't that severe and it doesn't seem reasonable that they would be severe enough to have impacted.

You would have had glaciers, um, moving down on, um, land masses, but the animals would have been able to escape just by moving south rather than being pushed out on sea ice. On the left, the global distribution of brown bears.

Both, um, uh, living and, the fossil record and on on the right is polar bear. [00:50:00] So we're looking at a completely different distribution and look, but looking for where the possibilities, where were their brown bears and where could this possibly have happened and. Looking at that in combination with the results from genetic studies, um, gives us the, uh, most plausible option of Ireland, which I think might surprise people.

Um, but there were brown bears in Ireland, um, by about 190, 000 years ago. And, but they weren't there before then. So, if Ireland. Was the source of this speciation event, then it couldn't have happened earlier than that. So that would have put it the event at about 140, 000 years ago. And with the idea that the glaciers from the Arctic came and [00:51:00] overrode.

Um, pretty much all of. Great Britain and then pushed some of those brown bears out onto the sea ice, but using the idea that it worked similar to what happened with the foxes in the sense that animals that were curious. And, um, not afraid of new situations that they would be the animals that would explore a new habitat that was available to them, but more fearful ones would would stay behind and just compete with the animals for resources that were there.

And so what that does is essentially split the population into what, what in biology, we call a founder population of animals that are. Um, curious and, um, fearless, really, and that, like the fox experiment, it puts [00:52:00] into the new founder population, um, uh, a group of

animals that have a similar hormone makeup, and when they interbreed with each other over a few generations, that that generates changes very quickly.

Tom\_AI: Okay, I think I read in your writings that there have been some brown bears that have got out on the ice and have hunted seals successfully.

Susan: Is that right? Yes, yes. And so, um, it, it's one of the things that shows us that brown bears are actually capable of, um, and understand that, that it's an environment where they might actually find some food and the, the bears that have been spotted there, um, as far as I'm aware, are primarily adult males.

That have just come out of hibernation so adult male brown bears come out of hibernation before females do and [00:53:00] usually around March or so. So that they're coming out at a time in the Arctic tundra where there's very little for them to eat. But it's also the time where there's lots of ice. The ice is at its, um, most extensive in the Arctic.

And so they just walk out over the sea ice, up into the Arctic, and they are walking into polar bear territory. And, um, often what they're doing is finding the remains of polar bear kills. That they're then scavenging. So, it, it actually is a successful strategy for them to, um, to go out and find food.

They're apt to find more food then.

Tom\_AI: Alright, I'm just going to read one sentence from your book that I thought was super interesting here. Uh, quote. I contend that within only a few generations of colonizing ice dominated habitats, founder populations of brown bears destined to become polar bears must have included some individuals with a white spotted coat.

You want to talk about that?[00:54:00]

Susan: , the idea of, um, early polar bears being white spotted is, um, analogous to what happened with the Russian foxes, and that is the first part of that process of speciation, um, can often include, The popping up of this white spotting, which means that then taken a bit further and allowing natural selection that what you end up with is the polar bear being essentially one big spot.

So they're not albino, but they are just taken that white spotting to an extreme. But what happens, I think, is that, um, if you had animals who were white spotted. In the early stages, but animals that had more white were better hunters than they would be the ones that would survive better. And so then you can push [00:55:00] the white spotting to more more of an extreme.

Okay, very

Tom\_AI: good. Um, when Darwin did his origin of species, did he specifically say that he thought that mutation was the reason or they had any evidence for that? Well, no,

Susan: because the whole concept of genetics wasn't around in those days. And so we didn't have that concept until the 1940s. So he was, he was really going on.

Um, just what he could see and looking at patterns in the natural world. Um, but, you know, he, he was able to describe things in, um, a really, um, understandable way, in a way that made sense. And that was his big contribution. Um, but for him, he worked a lot, for example, on trying to understand, um, different dog breeds.

He didn't look at the transformation from a wolf to a dog, but he was using, in [00:56:00] fact, dog breeds as kind of, um, a proxy for, um, species. Which I thought was an interesting concept, and it's kind of one of the, the, um, what, one of the directions I went to in my theory of you saying, okay, if you look at how different, different dog breeds can be, they are as different from each other in many ways as species are to each other, and just looking at the parallels between, between those systems.

Tom\_AI: Are there still people or is there a thing where they're, uh, looking at the DNA of ancient animals and modern animals and figuring that mutation must be the difference? So then they model it and decide how many years it took for that change to take place,

Susan: or no? Well, yeah, it's a lot of what's been going on with the research in, uh, polar Bear evolution is that it's being, um, addressed with genetics and a and there's a lot of, [00:57:00] um, new techniques that are coming up.

In genetics that are being used where they can look at, um, nuclear DNA and, um, and larger sections of mitochondrial DNA. Um, but the problem is that those are also come with assumptions. And how you interpret what kind of results that you get. And so there aren't any, any people as far as I'm aware, who are looking at, um, the, the thyroid, um, or hormonal component of, um, polar bear evolution.

Tom\_AI: So, as you're talking here, it reminds me of, uh, Ed Calabrese was on my podcast a time or two, and he was saying that there were people that were trying to induce mutations in bugs, and they were just turning up, they were cranking it up, uh, the radiation to incredible levels, and they couldn't make mutations happen.

They expected them to happen, and they weren't. [00:58:00] Do you have

any thoughts on that?

Susan: Well, I mean, I've It is one of the things that's, um, kind of frustrating about this assumption that, um, mutations are what drive evolution, um, because that's one problem, and the other problem is that how do you get, when you get an animal to evolve?

Say, like those Russian foxes. All, all of these different systems changing at the same time. And, but one of the aspects of the thyroid hormone hypothesis that is interesting, I think, is that many of the same genes that they're looking at would change during speciation are actually controlled. By how much thyroid hormone that gene, uh, receives it's as a signal.

It's like an on off switch or maybe more like a real stat on a, on a [00:59:00] light switch. It can be turned up or down and so you can actually get, um, a change. In the output of the gene, even without the gene changing. And I think that that's really important because it explains the, um, relationship that we know must exist.

Between an individual and the environment and that relationship exists over the animals lifetime, but we also know that there has to be some connection between the environment and populations. If you get populations of animals changing when climate changes. If that makes sense. Yeah.

Tom\_AI: So I'm way behind you here, but I want to make sure in the lab.

Can they do this thing you're talking about where they can tweak the thyroid and that and prove that that changes the what the gene outputs. They can test that part.

Susan: Absolutely. Absolutely. And so they we know that that happens. We also know that you can change [01:00:00] the thyroid hormone amounts and get changes in the shape and in behavior.

So, experimentally, this is all, you know, it's, it's

It's just that final step of saying, is, is the thyroid metabolism of a brown bear different to that of a polar bear? And no one has actually, you know, taken those samples to show that that's the case.

Tom\_AI: Okay.

The Role of Thyroid Hormone in Species Differentiation

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Tom\_AI: I want to read one more line from your book.

What I'm suggesting is that the species specific flow of thyroid hormone from the mother is largely what causes a chimpanzee fetus to grow into a chimpanzee rather than a human, despite the fact that 99 percent of its genes are identical to ours.

Susan: Well, and and that's that statement is, um, based on the [01:01:00] knowledge that the growth of the fetus.

Is absolutely dependent on the thyroid hormone, um, secreted by the mother. And so she is actually in control, um, of at least the growth in the very early stages. And so the, um, input from the individual that fetus that's growing that is, um, until its own thyroid hormone or thyroid gland develops, then it's not going to have any input.

Um, from its own system, so it is the mother system, the thyroid hormone from the mother interacting with the genes in the embryo. That are causing all the early growth, including, you know, all setting up the, all of the organ systems and the, the body plan of of the embryo. And that, [01:02:00] that, that maternal contribution is critically important.

Tom\_AI: So again, I'm way behind, but maybe, um, thyroid changes could explain part of the reason why some humans grow to four feet versus seven feet.

Susan: Well, um, in, in some cases, and what, um, it's,

it's one of the reasons why, for example, I think you get, um, say if you're getting hybrids. And you're in it's the mule and, um, the horse and the donkey and the hybrid. It depends on which one is the mother of what you get for the offspring and that the offspring are quite different. Depending on which one is the mother and so because she's controlling that the growth hormone primarily, but [01:03:00] also setting up a lot of the, um, the working of the genes during the embryo development.

Okay,

Tom\_AI: so it's hormonal differences that explain most of the differences between those 2 crosses being so different from each other.

Susan: Yes, I would say so. Yeah. Yeah. And that it's, yeah, and it's just, it's the thyroid hormone is, um, involved in so much and so important, much more so than most people understand.

Tom\_AI: I was fascinated by, uh, this, I'll read this part.

## The Process of Animal Domestication

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Tom\_AI: In essence, the animals domesticated themselves By associating with early human settlements.

So there's this story that we, uh, like, caught wolf pups and domesticated them into dogs. But you're thinking maybe that's not the way it happened, right?

Susan: Yeah, and, and really, and I think that most, um, anthropologists actually now agree with me that that is the case, is that, um, because many people have actually tried to, um, take wolf pups and raise them, [01:04:00] and, you know, and what you get is a tame wolf, you don't get a domestic dog, and so you need a process process.

Um, whereby that animal actually changes and so I, I am convinced. The process of dog domestication involved some wolves that like, uh, the Russian foxes were fearless and so they took advantage of this new habitat that people were creating when they settled down for the first time into sort of, um, permanent or semi-permanent settlements.

And that, you know, coming in there would've been food. Probably water nearby, but the food scraps that people were producing from their hunting would have been a really large attractant to the few wolves that would have been brave enough to come in and take advantage of that. And so it was actually, um, almost [01:05:00] the opposite of being pushed out of something.

They were drawn into this new habitat. That humans had created, and that created a new founder population with that same, you know, small interbreeding within themselves. And, um, then the change is happening really quickly. And because of some of these behavioral changes that crop up quite soon, then they're, they're less fearful of people and they're easier to get along with within a human context.

Do you have

Tom\_AI: thoughts about the order of animals getting domesticated? Or maybe dogs were first and horses were way after that? Or what explains

Susan: all that difference? Well, it is, it's one of the things that is, um, a big, um, conundrum amongst some, um, anthropologists about why, you know, certain animals got domesticated and others didn't, but definitely dogs were the first.

And I, I think that's [01:06:00] explained by the fact that when they were domesticated, um, humans were still, uh, primarily hunters. And so the food that they were eating was what the wolves were eating. And

so the wolves were attracted to the scraps, um, left by humans. But after that, it, it seems to be pigs. Pigs after dogs, and then, um, uh, the major, um, livestock animals, goats, sheep, cattle, and, um, last along the line is, um, cats and horses.

So, and it's, you know, the horses things is, um, It's still up in the air, I think, uh, no one has really, um, produced a plausible explanation of how, how you, how you get the horses domesticated in that same kind of sense. And [01:07:00] I, I think it's a bit more complicated. I won't get into it. It's, it's, it's not worth it, but their horses definitely come last in the string of, um, of the sequence of domestication.

### Closing Remarks

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Susan: I think, you know, getting the, the important thing about polar bears and their evolution is that you really can't talk about it without talking about climate change.

And so I really had to get into all of the issues about climate change that, you know, you and I have both been investigating for years now, um, in order to really try and understand what was happening, um, to, uh, the bears during polar bear evolution.

Tom\_AI: Thanks a ton. I really appreciate your time. I hope we can do this again some other time. Thank you. It's

Susan: a pleasure talking to you, Tom. Okay. Have a good day. Talk to you next time. Goodbye. Yep.