Welcome to the Huberman Lab Podcast,
where we discuss science
and science-based tools for everyday life.
I'm Andrew Huberman,
and I'm a professor of neurobiology and ophthalmology
at Stanford School of Medicine.
Today, my guest is Dr. Susanna Soberg.
Dr. Susanna Soberg completed her doctoral thesis work
at the Center of Inflammation and Metabolism
and the Center for Physical Activity Research
at the University of Copenhagen in Denmark.
Her research has focused on how deliberate cold exposure
and deliberate heat exposure
can be used to enhance human metabolism.
She is the first author of a seminal study
which discovered the minimum thresholds
for deliberate heat and deliberate cold exposure
for increasing brown fat thermogenesis,
which is essentially a mode of increasing heat production
and metabolism in the body,
and for establishing actionable protocols
that can be used outside of the laboratory
to improve metabolism and human health.
Dr. Soberg's research was published in the journal
Cell Reports Metabolism in 2021,
adding to a long and important history of research
focusing on the role of cold and the role of heat
in altering various aspects of the body's physiology,
including hormone health, metabolism,
and changes in neurotransmitters
such as dopamine and epinephrine.
In fact, today's discussion with Dr. Soberg
focuses on the role of deliberate heat
and deliberate cold exposure on metabolism,
but it also includes discussion of the effects of cold
and heat on things like neurotransmitter production,
namely dopamine and epinephrine and norepinephrine,
the so-called catecholamines,
which strongly impact mood and metabolism.
In addition, Dr. Soberg answers many common questions
about deliberate cold and deliberate heat exposure,
including, for instance, the difference between cold showers
versus cold immersion up to the neck

versus total body cold immersion,
including whether or not going back and forth
between heat and cold changes fundamentally
the way that heat and cold impact,
the metabolism, hormones, and neurotransmitter production.
And we talk about almost every single nuance and variation
on deliberate cold and deliberate heat exposure protocols
as it relates to the underlying science,
in particular, how cold receptors
at the level of the skin are impacted
versus cold reception and perception
at the level of the brain,
and how all of that impacts systems of the brain and body
relating to mental health, physical health, and performance.
Based on her scientific research
and academic training,
as well as her understanding and use of deliberate heat
and deliberate cold exposure protocols,
Dr. Soberg is considered one of the world's leading experts
on these topics.
In fact, she is the author of a recent book
entitled Winter Swimming,
which is, I have to say, a terrific book
because it breaks down chapter by chapter
the different aspects of deliberate heat and deliberate cold
into its various constituent parts,
including cold acclimation, the cold shock response,
dangers and safeties of cold water,
the impact of cold and the impact of heat
on various aspects of human health,
as well as specifics relating to sauna
versus ice versus cold swimming, showers, et cetera.
It's a very thorough read
and a very easy and accessible read
that if you are interested in deliberate cold
or deliberate heat exposure or both,
will allow you to embrace those protocols
with the greatest degree of confidence
that you're going to obtain the specific endpoints
that you're interested in and to do so safely.
Before we begin, I'd like to emphasize that this podcast
is separate from my teaching and research roles at Stanford.
It is, however, part of my desire and effort

to bring zero cost to consumer information
about science and science-related tools
to the general public.
In keeping with that theme,
I'd like to thank the sponsors of today's podcast.
Our first sponsor is Plunge.
Plunge makes what I believe is the most versatile
at-home self-cooling cold plunge
for deliberate cold exposure.
I've talked numerous times on this podcast
about the many benefits of deliberate cold exposure
and indeed today's episode is focused entirely
on the benefits and the science of deliberate cold exposure.
Plunge uses a powerful cooling filtration
and sanitation unit to give you access
to deliberate cold exposure in clean water
whenever you want.
As we will discuss during today's episode
with Dr. Susanna Soberg, deliberate cold exposure,
especially deliberate cold exposure done
up to the neck in water,
can be used to achieve a number of important endpoints
related to mental health, physical health and performance.
I've been using a plunge for more than two years now.
I can tell you that it makes it very easy
to get your deliberate cold exposure at home.
It doesn't require much cleaning.
In fact, it's very easy to keep clean, which is essential.
You don't want bacteria and other things
growing in your cold plunge.
Basically, everything about the plunge is made easy
so that anyone, including myself,
can get their deliberate cold exposure
on a regular basis at home.
If you're interested in getting a plunge,
you can go to plunge, spell P-L-U-N-G-E dot com slash
Huberman and get $150 off your cold plunge.
Again, that's plunge.com slash Huberman for $150 off.
Today's episode is also brought to us by Maui Nui Venison,
which I can confidently say is the most nutrient dense
and delicious red meat available.
Maui Nui spent nearly a decade
building a USDA certified wild harvesting system

to help balance deer populations on the island of Maui.
The solution they built turns the proliferation
of an invasive species into a wide range
of nutrients dense products from butcher cuts
and organ meats to bone broth and jerky.
Their bone broth has an unmatched 25 grams
of protein per 100 calories.
Several guests on this podcast who are experts in nutrition
have pointed to the value of getting at least one gram
of quality protein per pound of body weight each day.
With Maui Nui, that's very easy to do
while eating delicious meals
and getting it from a sustainable source.
If you would like to try Maui Nui Venison,
go to MauiNuiVenison.com slash Huberman
and get 20% off your first order.
Again, that's MauiNuiVenison.com slash Huberman
to get 20% off.
Today's episode is also brought to us by thesis.
Thesis makes custom new tropics
and new tropics is not a word that I like
because it means smart drugs
and the brain doesn't have neural circuits for being smart,
rather has neural circuits for focus,
neural circuits for task switching,
neural circuits for creativity and on and on.
Thesis understands this and designs custom new tropics
designed to get your brain and body into specific states
in order to do the mental and or physical work
that's important to you,
such as creativity or focus or clarity.
If you'd like to try thesis new tropics,
you simply go to their website,
you fill out a brief quiz
and they will design a custom starter pack
so that you can assess which things work for you
more or less well,
and then they'll iterate with you
over the course of the next few weeks or months
to come up with the ideal new tropic kit for your needs.
To get your own personalized new tropic starter kit,
go online to takethesis.com slash Huberman.
You can take that three minute quiz

and they'll send you four different formulas
to try in your first month.
Again, that's takethesis.com slash Huberman
and use the code Huberman at checkout
to get 10% off your first box.
I'm pleased to announce
that I will be hosting two live events
in September of 2023.
The first live event will take place in Toronto
on September 12th.
The second live event will take place in Chicago
on September 28th.
Both live events will include a lecture
and a question and answer period
and are entitled the Brain Body Contract
during which I will discuss tools and science
related to mental health, physical health and performance.
I should mention that a lot of that content
will have absolutely no overlap
with content covered previously
on the Huberman Lab podcast or elsewhere.
If you're interested in attending
either or both of these events,
please go to hubermanlab.com slash tour
and enter the code Huberman
to get early access to tickets.
Once again, that's hubermanlab.com slash tour
and use the code Huberman to access tickets.
I hope to see you there.
And now for my discussion with Dr. Susanna Soberg.
Dr. Susanna Soberg, welcome.
Thank you.
So great to have you here.
I feel like I should give a little bit
of the backstory of how we got connected,
which was that for many years,
I've been interested in cold thermogenesis.
It was the topic of my senior thesis in college.
And I've, of course, followed the popularity of Wim Hof
and we've had Dr. Craig Heller, my colleague
from Biology Department at Stanford,
who works on cold and its impact on physiology
and sports performance.

So for a long time I'd been interested in this area,
but there's been a real lack of new,
let's say high profile quality scientific information
in terms of how, for instance, cold plunges and sauna,
how that impacts human physiology.
I know there's been some information out there,
but it's been sort of scattered.
And then a little over a year ago,
I see this paper in Cell Reports Medicine
and it was immediately struck the,
first of all, the fact that it was in Cell Reports Medicine.
I've been on the Cell Press editorial board
for a long time now.
So press journals are of course phenomenal journals.
And the title and the content of the paper
was directly in line with the sorts of practices
that people are very curious about
and then are starting to emerge things like sauna,
cold plunges, and there was your name first
on the author list.
And I reach out to you through social media
and we've done a little bit of live content there together.
And I've been tracking what you've been doing in the world
in terms of your book and talking about the results
in your manuscript and talking about the science
and impact of deliberate cold exposure and sauna.
And I have to say that it's been a wonderful
and remarkable thing to see.
And you're bringing so much quality information
about this area that for a long time,
I think was kind of niche and is now becoming
more and more mainstream.
So I'm gonna start off with a thank you for being here
and a thank you for the work that you've done.
And I'm looking forward to talking to you about it today.
So my first question to get things started is,
what is happening when we get into
an uncomfortably cold environment?
So for instance, if I'm really hot on a hot day,
jumping into a cold pool feels really good.
But if I'm already kind of at room temperature,
I'm a little bit chilly,
getting into that same temperature of water

doesn't feel so good, right?
There's a shock there.
So if you could just walk us through what happens
when we get into uncomfortably cold water,
whether or not it's by way of shower or cold plunge
at the level of our physiology.
And if you'd like our psychology,
I think that's a good place for us to start
because I think it will orient people
to their own experience if they do that.
And for those that haven't done it,
might start to peel back some of the layers
as to what the underlying mechanisms of cold are.
Yeah, thank you for that question.
It's really good to just address
what actually happens in our physiology when we get cold.
And you can get cold in many ways.
So you can just head out for the one
that gives you the most potent stressor,
which is submerging into cold water.
And, but you could also go in outside in the cold wind.
That's also gonna activate your sympathetic nervous system.
So get all these neurotransmitters going in your body
and so your catecholomines.
Let's just address that we are taking a cold plunge,
for example.
So if you are very hot, for example,
before you go into the cold water,
it's gonna feel less stressful,
but the temperature difference from your skin to the cold
is definitely gonna give you a shock,
but your core temperature is warmer
and that's gonna feel a little bit better.
So that's why when people go into a sauna, for example,
and go out into the cold water,
they can do it easily, easier
than if they were cold beforehand.
Could I just ask you a few questions?
So you mentioned the sympathetic nervous system,
which for people listening who aren't familiar with that,
is that the branch of our nervous system
that's responsible for creating accelerations
and heart rates, feelings of alertness,

it's accompanied with stress and the stress response,
but it's accompanied with waking up in the morning
for that matter.
It's not always about stress.
And then you mentioned the catecholamines,
which are dopamine epinephrine and norepinephrine.
So maybe a little bit later,
we'll talk about those individual neurotransmitters,
but you raise a really important point,
which is something I get asked about a lot
for people that are curious about
using deliberate cold exposure,
which is how cold should the water be?
And I know it's very hard to give
a straight prescription for that,
because I think it boils down to what you just said,
which is it's really the difference
between your current temperature
and really the temperature of the surface of your skin
and the temperature of the water.
So if you're very warm, getting into cold feels good.
If you're already cold,
getting into more cold feels stressful.
Is there any way that we can start to gauge
what is the best way to approach
a deliberate cold exposure protocol?
I mean, should it feel uncomfortable?
And that leads into the question of,
how do we balance the discomfort
with the amount of time that we spend in?
So for instance, if it's just a little bit uncomfortable,
we'll spending more time in the cold,
get us the same benefit as getting into
very uncomfortably cold water
for a very short period of time.
Yeah, it's really good question.
And I definitely think that this could be
future studies on this as well to really unravel
what kind of protocols are the best way
or also for which outcomes, of course.
So if the temperature is very cold
and you feel that, and you also feel very cold,
then you should stay in the water a little bit longer.

So I think it's just, you should get uncomfortable cold.
So as long as you get uncomfortable cold,
it's cold enough and you get this,
what we call the cold shock.
So the cold shock is activation
of your sympathetic nervous system
and these activation of the catecholomines,
which you just mentioned before.
Does the shock mean that I'm having trouble
controlling my breathing?
Is that a good gauge?
Yeah, you can say so because that's kind of like
how we define it.
So you hyperventilate.
So you have a faster breathing rate.
So that increases also because you activate
your gasping reflex if you are new to this.
But if you are adapted, it kind of subsides
with time, with adaptation.
So what you can do is that you can train this cold exposure
and you can kind of like get adapted to it.
So you don't have this hyperventilating response
every time you go out in the cold water.
So this is like building up your resilience,
building up your adaptation is gonna make this shock
like subside of it.
So it's always harder in the beginning,
but you should do hard things, right?
It's not something that we,
you shouldn't think about cold water
and cold water immersion as something that is comfortable.
It should be hard because that's the point of it, right?
If you enjoy it, then yeah,
then I'm thinking something is wrong, it's not right.
You should not enjoy it.
Well, this is an important point that you're making
because I think that many people shy away
from deliberate cold exposure because it's uncomfortable
in a way that at least from my experience
is very different than the discomfort of exercise.
Because with exercise, for instance,
if running fast and breathing hard is uncomfortable,
you can slow down or walk.

If lifting weights is uncomfortable,
you can remove some weight
or reduce the number of repetitions or stop.
With deliberate cold exposure,
I suppose you can be sort of halfway in,
halfway out of the water
or partially underneath the cold shower,
but it's very hard to titrate and adjust the level.
It's kind of all or none.
And I've seen, I should just, I can tell this by anecdote,
I've done some work with military special operations.
I won't say which country this was outside the U.S.
And these are very tough individuals.
They're used to going without sleep
and doing hard, high consequence, high risk kind of work.
And they were asked to do some cold water exposure training
and I was there that day.
And it was remarkable.
About a third of them just went straight in
and just kind of grinded through it.
They looked stoic anyway to me.
There were a few whimpers, no cries.
About a third talked a lot
and got really, you could tell that they were agitated
and anxious, but they made it through.
And then about a third of them
just simply would not get in past their knees or thighs.
We're just, it seemed like they were
just dreading the whole experience.
Some actually didn't actually go in completely,
which was really surprising to me
and that you couldn't tell based on their physical appearance
or anything else about them.
They're all high performers as to who would have this response.
So it seems like people vary tremendously
in terms of their ability to embrace
the discomfort of the cold.
Is that from your studies, is that your experience as well
or are there these weird mutants
who seem to just love going into the cold
for the first time?
So some people just feel better in the cold
and some people are dread the cold even more.

And you can say the more people are pushing the cold away,
they might feel the cold pain even more.
So they would definitely,
people who are maybe the soldiers you just talked about,
some of them might be already adapted to the cold.
So if they are not scared of the cold,
they go out and they embrace the cold in a better way.
It could also be that some people
have a more sensitive nervous system.
And when you are a bit sensitive to the cold,
you will of course try to get away from it, right?
And you will also have the cold pain more,
feel the cold pain more if you avoid it.
So the more you avoid the cold,
the more painful it will feel when you go into it.
So yeah.
You mentioned being outside in a T-shirt
versus cold immersion up to the neck versus shower.
I think this is something a lot of people wonder about.
What are the differences in terms of impact?
Short-term and perhaps even long-term
between cold showers, cold plunge to the neck.
So that could be in ice water or just very cold water.
Immersion with dunking one's head and then coming up
because obviously people have to come up for air
at some point.
And then simply being outside on a cold day
in shorts and a T-shirt or something of that sort.
So there are different outcomes
because they are very different exposures of the cold
to your cold receptors in your skin.
So the more you can say you cover your body in the cold,
which you would do in cold water
because they're of course covered totally
and the molecules are closer to your skin,
you will have a more potent activation
of all your cold receptors in the skin.
So that one will definitely activate
your other nervous system more and rapid
compared to going out in a T-shirt, in the cold wind,
just go for a walk.
But that is also something that's gonna activate
your sympathetic nervous system,

meaning that you will have an increase in norepinephrine
and you will activate something called the brown fat.
So this is a healthy kind of fat tissue
that we have in our body.
And when you activate that,
that's gonna increase your metabolism.
Before we talk about brown fat,
and I'm so glad you brought it up
because it's so much to talk about there.
What about cold shower?
I mean, obviously cold showers somewhere in between
being outside in the air, cold air
versus being immersed up to the neck.
If we had more studies on cold showers,
we would learn more about how does that activate our metabolism,
how does that increase our nervous transmitters
in the brain, which could also have an impact
on our mental balance.
So I think that would be interesting for the future.
But what we do know is from activating brown fat
and both from rodent studies, but also in humans,
is that as soon as we get cold on our skin,
we will activate our brown fat.
So it is kind of like our first responder in the body
to keep our temperature up.
So our muscles is like the second tissue in our body.
We have two tissues which can increase our thermogenesis.
So the brown fat, which is always like temperature
regulating our body, and then we have the muscles,
which will secondarily start to shiver
and that's gonna increase our temperature in the body.
But as soon as you go into a cold shower,
you will activate your brown fat also immediately.
So it could be good also for increasing metabolism
in theory because we haven't really any studies showing
how much does actually activate the brown fat.
So if someone out there wants to do a study on that,
that would be great.
I've thought about why there are fewer studies
of cold showers than cold immersion.
And I think the answer to my mind is that
from a methodological standpoint, it's just harder to do
because if people are getting into cold water up to the neck,

they're getting into cold water up to the neck.
Whereas if people are getting into a cold shower,
some people are larger or smaller,
some people are gonna stand under the shower
with it hitting their head,
some people the back of the neck,
you could direct people to do it,
but it's a little bit more difficult.
Also, I think for you and I are both research scientists,
there's a little bit of a methodological challenge
that might seem silly to people, but it's a real one,
which is if people are in a cold shower,
also the water is going to be,
I'm kind of pushing their clothing against their skin.
There's a certain vulnerability for most people
coming to a laboratory in the first place,
let alone being absorbed while they shower.
Whereas when you get into cold immersion,
you're getting under the water.
And some people might roll their eyes
and say, okay, really, is that the barrier?
But science exists in these real world contexts.
And this will vary by culture and things of that sort,
but we run human subjects in my lab
and I'll tell you just the process of getting people
to the laboratory and having them park and find the lab.
And it's a whole new environment with people in lab coats
and people moving around and where's the restroom?
I mean, there's a certain amount of stress
just associated with taking part in a study
for most human subjects.
So I totally agree, however,
we need more studies of cold showers.
It's just a harder environment to control in my mind.
So it sounds like any form of cold to the skin
that people register as what you call the cold shock
or uncomfortable, like this is kind of jarring,
activates the brown fat.
Do we know what the pathway is from cold receptors
on the skin to the brown fat?
I mean, how does the brown fat know that we're cold?
Yeah, really good question.
And it seems that I think that, of course,

in the future we will know much more about these pathways.
But what we do know is that the cold receptors
will send a signal to our temperature regulating center
in the brain, so hypothalamus.
And that's gonna be taking in this message.
And we have so many cold receptors in the skin.
So it's gonna be very fast as you can say,
if you immerse the body into cold water,
this is gonna be so rapid.
So it will have a rapid increase in neurotransmitters
in the brain from no adrenaline.
Adrenaline and cortisol, which is not that much,
but it's still there.
So you have this increase in no adrenaline,
which will then immediately activate the brown fat.
Because you can say the activator is the most potent one,
cold and no adrenaline,
that's gonna activate the brown fat.
There's also a direct pathway
from the cold receptors in the skin to the brown fat,
which really shows that because of these different pathways,
it shows that it could be that this tissue
to keep us warm was developed in our involvement as humans
to keep us warm and to save us
whenever the temperature on our skin varies
to just a little bit,
to keep us in that right homeostatic balance.
So we don't get hypothermic,
but also so we don't get hyperthermic,
but because it seems that the brown fat is also activated
when we get warmer on our skin.
So it's also maybe a temperature regulator in our body,
but the pathways is different.
I think it's also a third pathway
from directly from the muscles.
So the brown fat is also activated
even though the muscles are starting to shiver.
So there's an extra pathway that way
to keep our temperature up.
So muscles and brown fat are working together
to keep us warm.
So we don't suffer too much in the cold water.
It's super interesting.

And what I hear you pointing to
is the existence of three parallel pathways.
And this notion of parallel pathways
comes up over and over again in biology, as you and I know.
And I mean, I think it's important for people to know about
because as you said so eloquently,
the when something is very important to our survival
and our evolution,
the brain and body install multiple mechanisms for it,
not just one.
And so it sounds like it's cold skin,
cold on the skin triggers a response in the hypothalamus
which then activates brown fat,
cold receptors in the skin directly to the brown fat
and then shivering in the muscle to the brown fat.
I wanna talk about brown fat in depth
and learn from you more about brown fat.
Before that, however, I wanna ask about shiver.
I've heard that shiver causes the release of succinate
which then activates the brown fat.
Is it known whether or not inducing shiver is important
and when should people shiver?
I mean, I've gotten into cold plunges and shivered
while I was in there.
And then I've also had the experience of getting into
a cold plunger, a cold shower, then getting out
and even standing outside on a warm day
after swimming in a pool and then starting to shiver.
So the shiver comes later.
So how important is shiver
and does it matter when shiver happens?
Yeah, well shivering is good
because that increases your metabolism
and that was gonna burn some calories in your body.
You shouldn't be so afraid of shivering, I think,
because the shivering, as long as you don't get
too hypothermia, so if you don't sit in the cold water
for too long and what you just said by shivering
after you get up, that is because of the after drop.
Something called the after drop is when your core temperature
decreases even after you get out of the cold water.
And it always does that in your body
because as soon as you get into the cold water,

all your blood vessels is gonna constrict
because you need to keep your blood in your core
and keep your vital organs warm.
So as soon as you get up,
that those blood vessels will open again
and the warm blood would flow out and get colder
and then flow back again into the core
and that's gonna decrease the temperature
in your core, of course.
So that's the drop.
So that's the drop, yeah.
I'm so glad you explained that.
I've heard years ago, Wim Hof,
I heard him talk about the drop
and I've heard colleagues of mine talk about the drop
but that's the first time I've ever heard it explained clearly.
Let me make sure I understand this.
So I get into cold water, obviously I'm cold.
Vessels constrict to keep blood near the center of my body,
keep me alive.
I get out,
the warming up of my body allows those vessels
and capillaries to dilate again.
The blood goes out to the surface
but the surface is still cold
and so that blood is cooled
and then my core body temperature drops
and that's what you're referring to as the drop
and that's what induces shiver.
Exactly.
And then am I right in thinking
that then the shiver activates brown fat
which then warms me up again.
Yes.
Got it.
That's why you should end on the cold
so we can get back to that.
Yeah, let's talk about it.
Yes, ending on cold is,
you know, it's what I refer to as
and what has now become known as the sober principle
which is a really important principle
about the importance of ending on cold

and not doing what I do which is to get into a hot shower
or back in the sauna but we'll get back to that
in a few minutes.
So that's wonderful that you can explain that so clearly
because I think that shiver is something
that a lot of people do avoid.
People think, oh, I don't want the,
you know, the chattering of the teeth
and it feels like a loss of bodily control
which really it is, it's an autonomic response.
Yeah, but I don't think that people should avoid it that much.
It's just like seeing shivering as a way of your body
in a, like it's training.
It's training for your, for all your cells,
it's training for your muscles,
it's training of your metabolism
and that's gonna increase your,
what's called the insulin sensitivity.
So if you can like in your mind get used to the thought
of shivering is just like when you go exercising
in the training center and get that feeling of like,
oh, this is tough.
Now it hurts a little bit.
Yeah, it's gonna hurt
because that's what shivering also does
but it's just a different way of training your cells
in your body.
It's gonna create what is healthy stress.
It's called homeosis in the cells
and the more you expose your muscle cells
or your brown fat cells to these kind
of like healthy stresses, exercise, cold and heat exposure,
it's gonna make them better at like activating
and also at keeping you healthy.
So as long as the cells get exposed to this,
it's gonna keep them on its toes.
You can say because it becomes more robust
increasing these heat shock proteins
and cold shock proteins in the cells
to make you more robust for the next time.
And that is also what happens
when you go to the training center
and I keep like drawing that parallel

because people today know more about,
we know more about exercise
and what that is gonna do to your muscle cells.
But the same kind of like training is also what you do
when you go out and into the cold water
and submerge into cold water
because that is just your cold training center.
You can say that.
And also your heat training center going into the sauna
because the cells are getting stronger
with hermetic stress.
So it's the same process, just different practices.
I'm so glad that you brought up the fact
that the discomfort or the embarrassment
or both of shiver is still crucial to actually
to reach for and try and experience
the same way that with exercise,
I think a lot of people don't realize this
but when we did our series with Dr. Andy Galpin
it became clear to me
what should have already been clear to me.
And I think that most people don't realize
which is that if we were to measure heart rate,
blood pressure, stress hormones and inflammation
in a human being during exercise,
it would look as if they were ready to die.
Blood pressure would be high,
inflammation is through the roof
but all of that is setting in motion
in an adaptation or set of adaptations
that allow blood pressure to be lower at rest,
that allow inflammation markers to be lower at rest.
All the things that everybody is seeking with exercise
in addition to of course the aesthetic changes
that people are seeking with exercise.
Sounds like the exact same things
are happening with the cold.
So the redundant message here seems to be
that the more discomfort provided it's done safely,
just like with exercise,
the more shivering the more cold shock
provided it's not to the extreme
and stop somebody's heart, right?

We can talk about thresholds for that a little bit later.
It sounds like all of that is going to set in motion
some long-term changes that will make people feel better
and will improve health.
Could you just touch on a few of the longer-term changes
that are known to occur?
I mean, I'm well aware of the study
showing that I think it was European Journal of Physiology.
It was the European Journal of Physiology
showing long-lasting increases in catecholamines,
dopamine, norepinephrine and epinephrine
for many hours after deliberate cold exposure.
What are some of the other things that happen
at the level of metabolism and brown fat
in, let's say, the hours and day after a deliberate cold exposure?
As soon as you go in, of course, there's an activation,
but it seems like you're asking for the later outcomes
like blood pressure and stuff like that.
Is that what you mean?
Yeah, blood pressure, but also in terms of metabolism.
I know that in your study,
and we'll talk about brown fat in depth here in a moment,
but that there were changes to the brown fat
that equate to changes in, for instance,
people's ability to be comfortable in colder environments.
When they're not doing deliberate cold exposure.
Or in the same way that I can exercise on an exercise bike
or go out for a hard run,
but then if I go hiking with the family on Sunday
and it's a steep climb,
I could do that steep climb more easily
because I'm quote-unquote fit as a consequence of the exercise.
What are some of the fitness adaptations
of deliberate cold exposure?
Yeah, so what happens is that you get adapted a little bit
every time you go.
So you will like exercise, get a little bit stronger.
So every time you go into the cold water
for every time you will be more exposed to it,
you will feel more comfortable in the cold.
So you're gonna build your adaptation,
which happens on a metabolic level,
which is gonna be the brown fat.

So you will have more activation of your brown fat.
The mitochondria in the brown fat cells
are gonna be, you'll have more of those
and they will be more efficient at heating you up
because the body expects you to do this again.
So you are prepared in a way.
The capillaries in your skin will also become better
at like constricting.
So you will have a better shield of your body
to prepare you for the next time.
So you will become better at going into the cold water
in that way.
So the body makes these mechanisms
to changes your body in a way
so you can expose yourself to the next time, right?
And also you will have also your stress response
will also be subsided a bit.
So you will have a less increase
of your catecholamines with time.
With time also you will have because of this activation
of your brown fat or your muscles,
you will have an increase in your metabolism,
which will then make your insulin sensitivity better.
And this is shown in studies, for example,
there was this interesting study I found
just before I started my PhD,
which was from Giverstomer et al from 2016,
where they measured metabolism, not on brown fat,
but they measured insulin sensitivity
in middle-aged men and women
during one winter swimming season.
So they were not very young like they were in my study,
but they were middle-aged.
And I think this is very interesting.
So they, during these four or five months,
they were winter swimming,
they saw that they had a lower blood pressure
after the season and they had a lower heart rate.
And they also saw that they have a better insulin sensitivity.
And I think that is very interesting
because if you can have a better insulin sensitivity,
you can prevent lifestyle diseases.
So, and with lower blood pressure,

which is a very strong outcome also
for telling how much inflammation you have in the body.
And because it didn't measure a brown fat,
I figured that it could be, that was the missing link,
that was one of the explanations
to why we see this less inflammation in the body.
So the longer outcomes or the long-term outcomes
could be that you lower your blood pressure
and have a lower heart rate.
You also have a better insulin sensitivity
and a better glucose balance,
but that was shown, that is shown in my study.
I'd like to take a quick break
and acknowledge one of our sponsors, Athletic Greens.
Athletic Greens, now called AG1,
is a vitamin mineral probiotic drink
that covers all of your foundational nutritional needs.
I've been taking Athletic Greens since 2012,
so I'm delighted that they're sponsoring the podcast.
The reason I started taking Athletic Greens
and the reason I still take Athletic Greens
once or usually twice a day
is that it gets to be the probiotics
that I need for gut health.
Our gut is very important.
It's populated by gut microbiota
that communicate with the brain, the immune system,
and basically all the biological systems of our body
to strongly impact our immediate and long-term health.
And those probiotics and Athletic Greens
are optimal and vital for microbiotic health.
In addition, Athletic Greens contains
a number of adaptogens, vitamins, and minerals
that make sure that all of my foundational
nutritional needs are met and it tastes great.
If you'd like to try Athletic Greens,
you can go to athleticgreens.com slash huberman.
And they'll give you five free travel packs
that make it really easy to mix up Athletic Greens
while you're on the road and the car on the plane, et cetera.
And they'll give you a year supply of vitamin D3K2.
Again, that's athleticgreens.com slash huberman
to get the five free travel packs

and the year supply of vitamin D3K2.
And we'll get back to the insulin sensitivity
and glucose balance.
That's an impressive list of benefits.
Blood pressure, of course, most people are aware
of blood pressure and what it is.
It's what they measure when we go to the doctor.
And it's not very sexy nowadays, you know,
blood pressure, people are like, oh, you know,
blood pressure, it's not, you know,
people want to hear about the inflammatory and the microbiome
and all of that stuff is really interesting.
But I think that blood pressure doesn't get enough attention.
And we have spoken to on this podcast to Dr. Peter Atia,
who is an expert in longevity and health span
and things of that sort.
And I was surprised to learn, again,
I shouldn't have been surprised
that the number one reason people die worldwide
is cerebral vascular disease and cardiovascular disease.
And there are basically three things on the list
of things to address.
One is not smoking or vaping, by the way, not smoking.
There are a few other things
related to blood markers, ApoB and things of that sort.
But then the big one is blood pressure.
And so it's interesting because we don't think
about blood pressure that much anymore
as the kind of people interested in health optimization
but blood pressure is so vital to control.
So it's wonderful to hear that deliberate cold exposure
is one way to control blood pressure.
I'm guessing in concert with other forms of exercise.
Let's talk about brown fat.
And if you're willing, I'd love to drill into brown fat
at a deep level.
Again, my understanding of this is far more elementary
than yours, obviously, you're the expert.
My understanding about brown fat
is that it's located in specific areas of our body,
maybe more widespread than when I learned in school.
I thought it was just at the clavicles
in the back of the neck and upper back,

but who knows, I learned that there's more of it
when we're children, maybe more distributed
throughout our body, and that it's rich in mitochondria.
But what is so special about the brown fat?
Like if we could just go into the biology
of brown fat a little bit, what does it look like?
You've measured it in human subjects.
Where is it distributed really?
Can it expand its distribution?
Can we activate and expand the amount of brown fat as adults?
And for those of you that are cringing already,
thinking we're talking about getting fatter,
it's quite the opposite.
We're talking about not subcutaneous fat,
but fat located around the organs.
But please educate me, tell me where I'm wrong
and expand my knowledge on brown fat.
Yeah, you are not wrong,
but it's true that there are more locations
of the brown fat than we previously thought.
There's this very nice study from 2017 by Leitner et al,
where they had made these Petsitees overlays
of their subjects, where you can see,
where in the body do we have brown fat?
And where can we grow more brown fat, so to say?
So the brown fat is very plastic,
so it means that it can grow and it can decrease.
And this is proven in studies where we have seen
people with a fair cryocytoma
is like a very specific cancer type.
Where from the 70s, where we can see
that if they have this specific kind of cancer type,
they have this tumor on the adrenal gland.
So they have like a huge increase in noreadrenaline.
And because of that,
they have this continuous activation of the brown fat.
And they have grown a lot of brown fat in the whole body,
abdomen or where it's located in these six different places,
but it is just like very much compared to normal people.
And what they then see,
what we learn from this study is that brown fat
can apparently grow if you have an increase
in noreadrenaline in the body.

It's not like you want that
because when that happens, you have a high blood pressure.
You don't want it chronically, right?
You just want it on like a short amount of time
and then it can grow for a bit,
but you don't want it chronically, of course not.
But because it activates also your sympathetic nervous system.
So they have also showed they had high blood pressure.
They had, they lost a lot of weight, of course,
because this is activating your metabolism.
So they found, luckily,
that when they removed this benign tumor,
that the brown fat decreases again to normal size.
And they gain weight again
and they had normal blood pressure.
So the story ends well,
but it's kind of like proof of concept
of the brown fat can actually grow.
So it's plastic in its way of like it can grow
and it can decrease again.
So that's very good.
Good studies to see what the body is capable of.
But we don't, of course, want all that brown fat.
We just want it to be,
we just want to keep it actually and keep it activated
because what we see in studies is also
that after the age of 40,
people, studies have shown that there is an association
with having less brown fat, but increase obesity.
So of course, we don't know yet
whether a brown fat decreases with ACE
and therefore we get obese or we get obese
and therefore we have less brown fat.
But as brown fat is an insulin-sensitive organ
in our body and we get obese,
just like the muscles get less insulin-sensitive,
the brown fat does as well.
And therefore it maybe decreases.
It could be a theory that I think could be
one of the reasons why we don't see
that much brown fat in elderly people.
Some have a lot, especially people working outside.
There are studies showing this.

People who do physical work outside,
farmers and interesting.
Yeah, they expose themselves to it.
So they'll just keep it in their way.
It's, and I suppose we should clarify for people
in case they don't know that insulin sensitivity
is a very good thing.
You want that.
You want yourselves to be sensitive to insulin.
Insulin insensitivity is type two diabetes
and is associated with obesity.
So just a point of clarification there.
Yeah, it's interesting to me.
I usually work out at home,
but I go to a gym once or twice a week if I can,
because it's good if I see the outside world.
And there are a few individuals at the gym
who are, they're not particularly large or muscular,
but they are incredibly lean and their posture is great,
presumably from the musculoskeletal work.
And they, they're in their 70s and 80s.
I mean, it's remarkable, right?
And I know all the telltale signs of hormone augmentation.
I'm very good at spotting that.
There are a few telltale signs.
I've talked about this on other podcasts.
And they're not, that's not why they're fit.
They're clearly of that look.
And you see this outside the gym too, of course,
for people that look like they've done a lot
of physical labor their whole life.
They're just moving a lot.
They have strong hands and features and they're,
and they're not necessarily excessively lean,
but you can tell that they've been using
their musculoskeletal system.
And I like to talk to these people and ask them like,
not what are you doing now for your workout,
but what did you grow up doing?
And I would say, and obviously I haven't run statistics
on this, but more than 75% of them respond
that they grew up on a farm,
or that they did some sort of manual labor

or were a postman or a postwoman
or doing something where they moved a lot
for their early years and throughout middle age.
And most of them are now in retirement,
but some of them are still working
and they all still moving a lot.
So the relationship between shiver and brown fat
makes sense to me.
But is it the case that as we're just moving around,
and I've heard of neat non-exercise induced thermogenesis.
So if we're just moving around
that we are activating brown fat,
or does there need to be this stressor?
Does there need to be shiver and a cold stimulus
or a heat stimulus to activate the brown fat?
In other words, is just staying active enough
or do we need to do some sort of temperature shock type thing
like deliberate cold exposure?
Yeah, I think that is a really good question
because how, also why do we have this tissue?
Then if it has to be extreme,
then you can question what do we need this tissue for?
But it seems that you can activate the brown fat
with just a little bit of exposure to cold.
So cold is the most potent stressor activator of our brown fat
because it's our temperature regulating organ in our body.
So first responder to that.
So the muscles will be a little bit too late
and therefore we have maybe these two kind of tissues.
So actually just exposing yourself or our hand actually
just to cold water.
So studies have shown that if you just put your hand in cold water,
not that you're going to gonna do that all day
or every day or anything,
it's not something you have to do,
but it just shows that you can activate your brown fat
just by getting a temperature change on your skin.
So you can go outside and tissue.
That's why also we were just talking about,
well, people who works outside or move a lot
or get in and out of it,
like changing the temperature of their body all the time.
They will have more brown fat

and activating that is gonna keep your metabolism higher
and your insulin sensitivity study have also shown this.
So the brown fat can be activated
as soon as you just change your temperature in the skin.
So going outside in a T-shirt wearing cooling vest,
also studies have shown this for 10 days.
It's gonna also grow your brown fat.
So you can get more brown fat
if you expose yourself to the cold.
You don't have to start in a cold shower.
You don't have to start in a cold plunge
if you're not really ready for that yet,
but just exposing yourself to the cold wind
has also shown to activate your brown fat.
Or if you don't wanna be like in this awake state,
then you can also just sleep in the cold
and you won't notice it that much maybe,
but studies have shown that if you sleep
in 19 degrees Celsius,
then you will activate your brown fat
and you will grow your brown fat.
So you have more of it.
So this very nice studies from Hansen et al from 2017 showed
that a group of subjects who slept in a room at 24 degrees
and then they made this PET CT scan to see
how much brown fat do they have from the beginning?
So what we call baseline.
Then they measured again after a month of sleeping in 19 degrees
and they saw, I think it's remarkable,
just one month at 19 degrees sleeping there.
They had a duvet on and they were still close on
when they're sleeping.
So they're under a cover, under a duvet?
Yeah, under a duvet.
The subjects were sleeping at 19 degrees for one month,
had increased insulin sensitivity.
The next month they stepped at 24 degrees,
they measured this again
and they had decreased actually a little bit
and then they stepped at 27 degrees.
So quite warm room actually for the fourth month
and they saw even less activation of the brown fat
and also insulin sensitivity.

So it seems that you can expose yourself
and pretty rapidly the brown fat will respond to this
because it's so sensitive to no adrenaline, right?
So if you keep exposing yourself to a little bit of cold,
you also get a little bit adapted to it
but that's because the brown fat
has grown these more mitochondria in the cells.
So these small energy fabrics
that's gonna activate the cells
and that's gonna take up glucose and fat
from the fatty acids from the bloodstream
to keep the thermogenesis up.
And that's gonna clear up some sugar
and it's gonna click in the bloodstream
and some fat as well.
So the brown fat can in that way decrease our unhealthy fat
which is the white fat.
And the white fat is what we don't want too much of
but we still need some of course.
And it's our energy storage.
So it's very important that it's there.
We just don't need a lot of it.
So on our thighs and also around our inner organs
that's where it's located.
So if we can have activation of the brown fat
just by going out in the cold
and just by sleeping in a cold room
or if you have courage for it,
you can go out and expose yourself in a cold plunge.
Cold showers is also gonna do the trick.
So you can do different variations of this
just exposing yourself to various temperatures
is gonna activate the brown fat
because it was involved to keep us in a perfect
homeostatic balance regarding temperature.
So to keep us alive.
Incredible.
I wanna just get a clarification
around this 19 degrees Celsius room that they're sleeping in.
So they're under a comforter duvet
and you mentioned they had clothes on.
The room is 19 degrees Celsius
but the temperature underneath their blanket

might not be 19 degrees Celsius.
So presumably it's the cold on their face
that's activating the increase in brown fat
that was observed.
Is that a reasonable expectation?
I think so, yeah.
Because you have so many co-receptors in your faces.
So actually it's enough.
And I think it corresponds very well
with the studies showing that you can activate the brown fat
just by putting a hand into a bucket of cold water.
And I did this experiment myself in my studies
just to see how well did they respond to cold water.
So it was four degrees Celsius cold water for four minutes.
And then I just measured blood pressure and heart rate
to see do they have like an activation of this.
I actually also measured the brown fat
during this cold exposure for four minutes
with an infrared thermography camera
to see can I see that the brown fat is activated.
And just to go back to the location of the brown fat.
So usually you cannot really see activation
of your brown fat
because it's located centrally
around your central nervous system.
And the biggest depot, as you mentioned before,
is up here under the clavicular bones.
So, and very close to the skin surface.
And because it's so close to the skin surface,
I could measure it with this very expensive camera.
And it's not very feasible for people to go home
and do this at home because it takes a lot of practice,
I can tell.
But we measured the brown fat with this.
And I could see that after a few minutes
that the activation was there
and increase in temperature arose from that activation
just four minutes.
So it's very rapid.
And I'm also measured in my study
how deep was the brown fat under your skin.
So it's very close to the surface,
which also shows that it needs to be there

to heat you up and heat your inner organs.
Well, I'm delighted to hear all of this.
And I'll tell you why.
One is by way of anecdote.
I mentioned a little bit earlier
that as an undergraduate,
I worked in a lab that studied thermogenesis
and we were doing that in animals,
but we had this room that was very cold.
The whole room was cold.
The guy who I worked for at the time,
kind of Harry Carlisle is a very accomplished physiologist.
He came from this lineage.
I don't know if this literature is still discussed much,
but it's a beautiful literature from Rothwell and stock.
They were the ones who discovered
non-exercise induced thermogenesis.
The fact that people bounce,
who bounce their legs a lot and move around a lot
and have a lot of kind of stochastic movement burn
up to 1,800 calories more per day
than people who sit more still.
Fascinating.
Incredible, just incredible.
I don't think that gets as much attention
as it deserves, publishing journals like Nature,
so very fine journals.
But in any event, one of the things that I noticed
when I started working in that laboratory
was that I was cold because the room was cold.
And Dr. Carlisle, Harry said,
well, the key is to wear a t-shirt in here
for about two or three days, and then you will cold adapt.
I thought, well, wouldn't I want to put on a hoodie
and get warm in there?
So I was comfortable.
And he said, no, actually what you want to do
is get yourself uncomfortably cold,
activate your brown fat.
And indeed, when I did that,
I think it was just two days of being
in that cold environment.
Then I could come back on the third day

and be perfectly comfortable
because the brown fat had expanded
or added mitochondria or both.
And I was perfectly comfortable in that environment.
I also got very, very lean in those days and weeks.
Now, I've never been somebody who's very lean,
nor am I somebody who carries a lot of excess adipose tissue.
I'm kind of somewhere in the middle.
I'm sure I could adjust that with feeding if I want to.
But it was striking what a powerful effect it had
on my entire system of thermal regulation.
And one of the things that I also delighted in
when Cell Reports Medicine published your study
is they had an accompanying press release
that went out to those of us that received press releases.
And it described a saying in Scandinavia,
which is essentially, I'm not going to attempt
to speak Danish, even though I have,
much of my family is in Denmark, believe it or not,
from Denmark.
We have a lot of Danes in my family.
I won't embarrass myself by trying to speak Danish
as I did before the microphones were rolling.
But that there's a saying that I think essentially
that translates to in the fall,
when you're approaching winter,
you want to actually wear fewer layers,
not bundle up when you go outside
so that you can prepare yourself for the cold of winter
and be able to heat yourself up using your brown fat.
And that in the spring, as the temperatures are warming,
rather than removing layers,
you want to wear more layers in order to be
a little bit uncomfortably warm
so that in the heat of the summer,
you're better at cooling your body.
Do I have that right?
Maybe, do you know the saying
and would you be willing to share it?
Only the Swedes and Danes will be able to understand.
Maybe the Norwegians too.
If you don't know it, that's okay.
Yeah, so I know the concept of it,

because we say it, you should wear less before winter
and more before summer.
Well, there it is in English,
so it doesn't have to be esoteric, but okay.
Yeah, and you're completely right.
And I think this is just something
that we know in the Scandinavian countries.
I think that we intuitively know this,
but if we just go back a little bit in history,
I think that around the 1950s,
the Russian government went out and said,
well, we should do something about the tuberculosis,
pandemic or epidemic, the worst at this time.
So they wanted to have the people
be more resilient to the cold
and also increase our immune system.
So in Scandinavia and actually also in Russia,
we put our babies outside to sleep in the prom.
And that is like to also to get more resistance to the cold,
but also to increase our immune system.
And we still do that in Denmark.
So we...
Do you really?
Yeah, we do.
Babies are taken out in the cold?
In the snow, in frosty rain, everything.
My two boys have been sleeping out in winter,
at least their first many three, four, five years,
because it's like very good for them.
And they get a better immune system
and get resilient to the cold.
So they will have less colds.
And also they run around in a T-shirt when it's super cold
because they have activated all their brown fat.
I didn't understand at that time, I must say.
But I kind of like intuitively also knew
because we have inherited this way of doing things
with our culture.
So, and I have heard people coming from the U.S.
saying, Danes are crazy.
They put the babies outside in proms and leave them there.
And then they go inside and drink coffee on the cafe.
Well, I don't think Danes are crazy.

I adore the Danes.
They're amazing culture and people.
I'm so fortunate to have family members from Denmark.
But I did notice, so when we were in Copenhagen,
and I know we saw you there not long ago, that was June,
the water in the harbor was cold for,
even though the Pacific is close to here,
which is very cold, felt pretty cold,
but it was summertime-ish.
So people were in summertime mode, right?
T-shirts and shorts and things of that sort.
But it did strike me that people in Copenhagen
are dramatically fitter than they are in the United States.
I mean, first of all, everyone's bicycling everywhere.
Not many people wearing sunglasses,
so trying to extract as much photon energy
from the sun as possible, which I support,
as everyone knows, I'm a big fan of getting sun.
But also, when we did see swimmers,
they were swimming in this cold water,
and like it was nothing,
and the range and age of the swimmers was remarkable.
You saw the kind of fit triathlete-looking types,
but also young kids, like really young kids,
and then people probably in their, again,
their 70s, 80s, maybe even 90s, really remarkable,
vastly different than what you see
if you go to the ocean here in Los Angeles or elsewhere.
So yeah, you Scandinavians are onto something with this.
I'd like to take a quick break
and thank our sponsor, Inside Tracker.
Inside Tracker is a personalized nutrition platform
that analyzes data from your blood and DNA
to help you better understand your body
and help you reach your health goals.
I have long been a believer
in getting regular blood work done
for the simple reason that many of the factors
that impact your immediate and long-term health
can only be assessed with a quality blood test.
The problem with a lot of blood and DNA tests out there,
however, is that they'll give you information
about certain lipid markers or hormone markers,

but no information about what to do with all of that data.
Inside Tracker makes it very easy
to look at your levels of hormones, metabolic factors,
lipids, et cetera, and then to assess
what sorts of behavioral nutritional supplementation
or perhaps other interventions you might want to use
in order to bring those numbers into the ranges
that are optimal for your health.
Inside Tracker's ultimate plan
now includes three new hormone markers
that are critical to measure
during a woman's reproductive and menopausal years.
These are estradiol, progesterone,
and thyroid-stimulating hormone.
If you'd like to try Inside Tracker,
you can go to insidetracker.com slash huberman
to get 20% off any of Inside Tracker's plans.
Again, that's insidetracker.com slash huberman
to get 20% off.
I'd like to talk about your study.
If you could give us a little bit of the backdrop
about what motivated that study
and then walk us through what you did,
who the subjects were, what you had them do,
what you measured, and as much detail
as you would like to share,
because I think it's such an important,
even in fair to say landmark study,
because it also explored not just cold,
but sauna and the co-use of cold and sauna
as a way to probe metabolism and brown fat
and other markers as well.
And as you do this, I'm hoping at some point
that you might tell us some of the observations
that you might have made that interested you
that perhaps were not in the paper,
because that's one of the great benefits
of sitting across from somebody
who did the work in detail.
So if you could tell us about your study
and what you did and what you discovered.
Thank you for that question, Andrew.
I'd love to also explain a little bit what did we do

because when people read this kind of paper,
they just see the numbers.
They don't see what happened before that.
And human studies are very different from my study.
My study, you can do a knockout or something
and then everything is perfectly matched and controlled.
Doing human studies is very far different from that
because people are different even in the groups.
Yeah, but when I started this research in 2016,
I did not really know what the brown fat was.
So I started reading up on all this
and I was very interested in preventive medicine.
Also the studies that I did before brown fat
was also like very much in the preventive side,
like how can we, that was about something else,
but the sweet tooth and how can we lower our sweet tooth
and stuff like that.
But after that, I wanted to do something new.
So I looked into the brown fat,
got hired in this fantastic research group
where it's a cell group.
So they mostly did cell studies
and they didn't have anyone to do a human study yet.
But they really wanted me to do that.
So I read upon a lot of research
about how does the brown fat get activated,
what have been done already.
And I mentioned the paper before with the sleeping in the cold.
I found that particular paper very fascinating.
And that was also where at that time I was like,
okay, so cold exposure as an intervention
of sleeping in the cold could be a good thing
to go out and say, well, people do this.
But on the other hand, first of all, it was already done.
That was one thing.
But the other thing was like, well,
I wanted to see if we can do some kind of activity
so we can have people move also, go and do something,
do something together or whatever.
And the cold made us think about, well,
what about winter swimming?
And it was kind of like a bit of a joke in the beginning
is like winter swimming,

yeah, it's gonna activate the brown fat, right?
But when we read the literature,
we couldn't really find anything about activation
of the brown fat with cold water
besides hand in a bucket of cold water.
That really, there was already there.
So we were just thinking, okay,
so it should be very potent activation of the brown fat
if it's cold water, but very different from cold air.
So it was kind of also a new thing we were going into
and we knew that we were gonna do like a more of a proof
of concept study at the beginning of it
because it was like winter swimmers
must in theory activate the brown fat, right?
But we kind of didn't really know
was this kind of stress too much, too little
or what will happen actually.
But we had this idea about, well,
we always say that cold water and winter swimming
will activate your metabolism,
but do we know if it does that?
No, we don't.
And while this idea was a little bit fun at the beginning,
we kind of accepted it.
It was like, okay, let's just try this out.
But because we didn't have the funding for it,
we was like, okay, let's do a proof of concept study.
Let's go with a small number,
but enough to see a difference between the groups.
So the power calculation of that study is done
on what we know from PET CT scannings of the brown fat.
So that's the main outcome of that, of course.
So, and we wanted to go a little bit small
on the numbers of participants
because we wanted to dig a little bit deeper
into the different mechanisms
and also redo some of the days.
So I really wanted to do that
to see if I can replicate also the findings.
And that's gonna take a lot of funding,
but it's also gonna take a lot of time to do it.
So the proof of concept was just going small,
but looking at different mechanisms,

we also took fat biopsies, for example,
and looked at the white fat to see
if there was any differences between the groups
before and after and stuff like that.
So that's kind of like how it started.
And the first year was like a field study for me.
So I was not a winter swimmer when I started this.
It was just...
Oh, really?
No, I wasn't at all.
And I would say I was a bit afraid of the cold myself.
Bit of a cold sissy, always cold,
having big socks on and sweaters and stuff like that.
So I was like, I am so comfortable.
I'm just like everybody else, very comfortable.
I like being completely temperature neutral.
But I started like playing with this thought,
like, well, if this is so healthy in theory,
I should not pack myself up.
I should start not doing that.
Yeah, but the first year,
observation of winter swimmers on the jetty,
they kind of joked about it.
They say, come on, you need to try this.
You cannot study this unless you have tried it.
And I was like, ha, ha, very funny.
Of course I can do that, but I couldn't.
I read the literature, I understood in theory
what happens when you go into cold water.
But I completely understood it when I first tried it.
The first few times, not so funny, it felt painful.
It was just like running too long after a long break
and your muscles hurt the day after, right?
You completely regret that you took that extra mile.
What about when you say uncomfortable,
you mean uncomfortable when you got in
and when you were in or uncomfortable afterwards?
Because I find that on rare occasions,
well, I should just, full disclosure,
I do deliberate cold exposure every morning
for about a minute to two minutes in a cold plunge.
There are days that I miss, but when I'm at home,
I do that, and when I travel, I do a cold shower.

I do finish with a warm shower.
So, and we'll talk about why that's probably
not the best idea.
But, and I've been doing it for some years now on and off,
but so just full disclosure, I'm a devotee
and I have family members that hate the cold
but have gotten into it and are starting to like it.
But they don't, and I don't necessarily
like the experience in the cold water,
but I love the way I feel when I get out.
And I'm a hundred percent on that statement
about loving it when I get out.
Occasionally, it feels good to be in there,
it feels invigorating, and I think I've learned
to control the gas reflex and the hyperventilation,
and I just have told myself what we know,
which is that the forebrain struggles to engage
for the first 20 or 30 seconds,
but if you can get past that wall,
it's far easier to push through.
But when you say that it was really uncomfortable,
do you mean the experience of getting in
or you also felt lousy afterward?
Yeah, and very important to clear that out.
I only felt very uncomfortable doing it at the moment,
but afterwards, the first time I went with a group,
and actually my husband was as well,
because I really wanted someone I knew coming alone
because it's very normal
if you haven't done this before,
you feel a little bit anxious about it.
This is Jonin's studies as well,
because blood pressure and heart rate goes up
in those who are new to this kind of activity.
So I was a little bit anxious about it.
So it was really uncomfortable just doing it,
but afterwards, as soon as I got up, I felt fantastic.
And we went into the sauna and I did three rounds
because I just loved it.
I loved the feeling afterwards
because you have all these new transmitters
going in your brain and you feel more positive,
I feel invigorated, I had so much energy,

and I could totally see why people would do this
to get energy throughout the day
because I definitely had that.
I didn't have to do three dips to get that.
I think one would be enough,
and I often do that also now today.
I do one dip, sometimes I do two or three dips
in one round, you can say in one day,
but often it's like just one or two times a week.
For me, that is enough to get that energy
and to get that positive feeling.
And I think that that is also why I put up my study
in that way.
I wanted to study the lowest dose, you can say,
the lowest amount that we can get away with,
but still see health benefits.
So what I observed there on the jetty
was that some did it a long time.
They were in the water for a very long time.
And to me, it seemed maybe a little bit extreme.
Could you give me an example of a long time?
Well, so maybe they were really swimming
and they could be 20 minutes or half an hour.
That's a long time.
That's a long time, and there was ice
and people who came up.
I mean, I just didn't really feel that this is something
that I wanted to go out and recommend to people
after my PhD.
You didn't want any of your research subjects dying either
because if you're not adapted,
I mean, people can do that.
Also a 20 minute cold shower or 20 minute cold plunge.
I know people do it, but it's probably not a good idea.
No, probably not.
It's gonna exhaust yourselves and make them age too fast.
So exactly that's, when you pass that hermetic stress,
the healthy stress level,
that's what is happening.
The quite opposite is almost chronic stress
actually in the cells.
Well, what happened then was that I found out
that if I want to have this protocol

get through ethical committee,
I really needed to go very sleek with the not too long
and make sure that they were also very healthy
and to get approval, of course, of this study.
But what I did was to recruit winter swimmers
who already have been swimming for two or three seasons.
And I just observed them.
I said, I'm not gonna do an intervention study yet.
I did that after, but I wanted to do a proof of concept
where they were already adapted to the cold
and then compare them to a matched control group
who were matched on, you can say diet.
So were they vegetarian or not?
And one of them was in each group also.
They weren't all vegetarians.
No, no, no.
Just one in each group, yeah.
I was gonna say with all the amazing fish and meat
in Denmark, I'd have a hard time being a vegetarian.
The breads are amazing, the fruits and vegetables too,
but okay, so there were a couple of vegetarians
in each group.
Yeah, one in each, yeah.
And they were matched on-
I have family members who are vegetarians,
so I'm just poking fun.
Yeah, but they were matched on different things.
So what we usually match the monitor is also BMI.
We chose one gender in this study
and we would always choose both men and women normally,
but we do see that there are different brown fat levels
depending on gender.
So women have more brown fat than men.
Really?
Hmm, interesting.
Yeah, I think it's interesting.
That deserves study.
Yeah, why actually?
I think it's interesting because women are also smaller,
so in size and mass, right?
But they also have a lower peripheral temperature,
especially on hands and ears and...
Is that right?

That's documented that women do run colder than men?
Yeah, and there's also...
Physiologically, I didn't say psychologically.
No, no, no.
We won't go to the psychological cold heat, yeah.
That's different.
That's a different podcast.
Yeah.
Another time.
So women are just colder physically,
so on hands and ears, it's measured on that,
and feet as well.
So compared to men.
And men have bigger hearts than women
and they can pump out more blood peripheral
than in a woman's body.
So that could be an explanation for the colder hands,
for example.
Thermocomfortable state is also different between genders.
So men are more comfortable at 22 degrees Celsius
and women are thermocomfortable at 24 degrees Celsius.
And this is...
So the thermostat wars of home have been now validated.
Yes.
Okay.
Two degrees Celsius.
By the way, prior to starting recording,
I made the executive decision that we were gonna go
with Celsius throughout the podcast
because the majority of the world uses Celsius.
So for those of you that think in Fahrenheit,
the internet is your friend in making those conversions.
So we're sticking with Celsius.
So men tend to be thermocomfortable
at 22 degrees Celsius, women at 24.
Okay, interesting.
Explains a lot about like, oh, so some arguments
in the homes where men are turning down the heater
and women are turning up the heater and they cannot really...
So it's really, I'm on both sides here.
I understand the men, we understand the women,
there is a difference there,
which was also one of the reasons why we had,

we in this proof of concept study chose one gender.
So it is not like only because we wanted to study men,
it was just to see, to eliminate all the confounding factors
which could have an impact on our results.
So that was one of the reasons.
But also because we, yeah,
so women have more brown fat than men,
otherwise we would have to like do four groups
or something like that and not having funding yet.
We were like, okay, we need to do like just one group,
just a control group and then a group
who were already winter swimmers.
So I recruited winter swimmers who have been swimming
for two to three seasons
because I wanted them to be already adapted
but not going too long in the water.
So they told me, I did a lot of screening here,
of course beforehand and interviews
to see, to ask them how much do you do
and how long do you stay in the water?
And I monitored how long did they then stay in the water
and recruited based on that they only did
like two to three times per week.
It seems reasonable for Denmark at least to do that.
And they stayed only in the water for one to two minutes.
So the course subsides very quickly
and you will get this activation of your
rest and digest system,
which is your parasympathetic nervous system.
So the other branch of your autonomous nervous system.
And you get that activation
because you submerge into cold water.
And when you do that,
you have an activation of your diving response
and that's gonna slow down the,
you can say the consumption of oxygen also in your body
and that's gonna slow down your heart rate.
Could I pause you on this?
Cause I've heard this before
that when we get into cold water,
shower or immersion,
we get this sympathetic autonomic response.
So increased blood pressure, increased heart rate,

release of norepinephrine
from the locus ceruleus in the brain,
release of adrenaline, dopamine,
adrenaline from the, from the adrenals,
dopamine presumably within the brain,
but that the parasympathetic response is activated
when we put our face into cold water or go underwater.
And that's a calming relaxation response.
So this brings us back to,
I don't wanna take us off track
from you describing the study,
but this brings us back to the first question,
which is if I go completely underwater for a moment
when I start my cold plunge,
does that change the physiological outcome
as compared to if I just submerge myself up to the neck?
And that, and actually nowadays there's,
it seems to be a little bit of a movement online
of people putting a bowl of ice water on their countertop
and submerging their face into it.
Did you see this?
Sorry, I was seeing more and more posts about this.
So can you just touch on what the dive reflex is
and why it perhaps activates the parasympathetic response,
this calming response?
Well, so the diving reflex is activated
when you submerge into cold water.
Even just to the neck?
Yeah.
Or I thought you had to get your face under.
I'm not arguing different.
You're the expert, I just wanna, yeah.
I haven't really, I haven't read that.
I've just seen that you can activate your diving response
as soon as you go underwater with your body.
So you don't have to do it with your face.
As far as I understand, I could be wrong though, yeah.
So when you activate your diving response,
you will slow down your oxygen consumption in your body.
And that is because the body tries to preserve oxygen,
so you will not get hypothermic too fast.
So it's kind of like a survival system in your body.
So this survival system is very important for us, of course.

So that will be activated.
And because of that, you will have to maybe one minute or so,
that can be precise on that
because maybe also varies a bit in humans.
So one to two minutes,
you will have full activation of the sympathetic nervous system
but also the parasympathetic nervous system.
And that's gonna activate, for example,
something like serotonin in your brain,
which is also good for mental balance
and people feeling in mental balance afterwards,
after they go up.
So that is measured on a questionnaires
and also measured on anecdotes.
Of course, people tell all the time
that they feel good afterwards.
We need studies on this.
So if anyone's sitting out there thinking that's interesting,
then please do some studies on that
to get more out on that.
So you observed these winter swimmers
who have done this for a few seasons.
They're coming around for a new season of winter swimming
and you've decided to recruit them as subjects.
They are getting into cold water,
climbing down a ladder or jumping into the water
up to their neck.
Okay, climbing down a ladder into the,
because this is done outdoors.
What a fun study to do.
My graduate thesis was done under fluorescent lights
with no windows in a building that,
I mean, I had a ton of fun as a PhD student.
I actually lived in the laboratory as a PhD student.
I loved it so much,
but not something required to do a PhD, by the way.
But they're climbing down the ladder,
getting in up to their neck,
staying in for one to two minutes,
and then getting out.
And how many times a week are they doing this?
So they do this two to three times per week.
And for each time they go, each day they go,

they take three rounds of,
so three dips and two sauna sessions.
So they start in the cold and they end in the cold water.
Okay, so it's get in for one to two minutes,
then get out and get into the sauna.
What is the temperature of the sauna?
About 80 degrees Celsius.
Okay, then how long are they in the sauna?
So they stayed there for 10 to 15 minutes.
So depending on if they went two times per week
or three times per week.
Okay, and then they get back into the cold
for a few minutes, two minutes.
Up to two minutes, yeah.
Okay, then back into the sauna, 15 minutes or so.
Then back into the cold for a third round,
back into the sauna, and then they're-
Ending on the cold.
And then back into the cold again,
and then ending on cold.
And we will talk about why it's important to end on cold,
the so-called sober principle.
How cold was the water in this particular,
given the average,
because I realized it's outdoor winter swimming.
So it's gonna vary depending on wind chill
and things as well.
Of course, so it's a very uncontrolled environment
to do this kind of study then.
But I wanted to do something
that was also very close to something people can do for free,
going out in nature and use that
and also have the nature-like,
it's a very healthy impact on us.
It lowers our stress level as well.
So by doing so, I also measured the temperature
every time they went.
So I have this graph,
and it's actually in the winter swimming book.
It shows the temperature in Denmark
going from October to April.
And it starts at 12 degrees.
I think it's around 12 degrees Celsius in the water.

And then it goes down to two degrees
and on average in January and then up again.
So it's within the spectrum of very cold water,
I would say from around 15 degrees Celsius and down.
But it was actually not colder
than two to four degrees on average when it was the coldest.
So it doesn't have to be that cold to be good enough
and enough to activate our metabolism.
And what time of day are the participants doing
this cold sauna alternation?
So I think they did this throughout the day.
So I didn't control whether they wanted to go
in the morning and the afternoon or in the evening.
At that time where I set up this study,
I was not controlling it in that way.
I wanted them to go whenever they had time.
And I also think that is the most important message
to give to people is when do it when you have time.
It's not, if doing it when you get home from work
and it's six o'clock in the evening
and this is the time where you can do it,
then try out if it's gonna impact your sleep or not.
If it doesn't impact your sleep, then fine.
But you have to try for yourself
and find out what works for you.
It's the same for coffee, for example, right?
Some people can drink coffee in the evening
and go to bed and they can sleep.
I can't.
Or exercise.
Or exercise, exactly.
So I can't do that.
And that's because the coffee, exercise, cold water,
immersion, it's gonna activate your sympathetic nervous system.
You have an increase in stress response in your body
and that's gonna make it really hard to fall asleep
for some people at least.
Maybe you are super exhausted anyways
and then you will just crash anyways, but yeah.
But that's the only thing.
So I just told them to do this if they can during the daytime
and that's primarily what they also did.
And then all along you're measuring brown fat

by way of this infrared camera, right?
So what did you observe in terms of changes in brown fat?
How quickly did that occur?
And then I'd like to ask also about sauna a bit more
because earlier you mentioned that you can activate
brown fat with sauna as well, with heat.
Oh, with heat, yeah.
Surface of the skin.
How long did it take before you observed
significant increases in brown fat?
And was it increased density of brown fat or distribution?
Was it showing expansion to different regions
throughout the body?
And maybe you could also touch on some of the changes
in insulin sensitivity and metabolism.
Yeah, a very good question.
And I didn't mention this before,
but besides measuring temperature
as an outcome for brown fat activity,
we also did PET MRI scanning of the brown fat.
So this is like the golden standard for measuring brown fat.
And it's not very feasible for normal people to get
and a PET CT or PET MRI scanning of the brown fat
is super expensive.
So we had both to see if we could have like a continuous measure
of brown fat in humans,
because that was already not out there.
So I wanted to see during both the experimental days,
but also during day and night,
what kind of like circadian rhythm
do we have in our brown fat activity?
So that's why I wanted to have that as well.
So the PET CT scanning or the PET MRI scanning
was to see upon code activation stimulation for some hours.
Do we have activation?
Can we see the brown fat in this subject?
And also during thermonutrality or thermocomfortable state,
how is that activated in each of the group, of course?
So you want to see how comfortable people were
away from the cold water and sauna,
just at different temperature environments.
Is that right?
Yes, I also measured that.

How comfortable are you?
I made this scale like visual analog scale
and asked them,
how comfortable do you feel with this temperature?
And throughout the study days,
during cold exposure and thermocomfortable day,
I had a whole day where I just kept them thermocomfortable,
to see do they activate the brown fat
if they're just completely thermocomfortable,
as good as we could get with that,
because we were asking people on a scale from one to 10
and five being thermocomfortable,
where are you on the scales of one would be very cold
and 10 would be super burning hot.
Yeah, and so that was a way to try to figure out
how do they actually feel also during the studies.
I also measured in electromyography of muscles
to see do they shiver during the cooling day.
Sometimes people shiver before they know
they're really shivering, so I had this.
Interesting, so it's our conscious perception
of shivering might not be the best readout of shiver.
Yeah, well, if you also get adapted to the cold water,
you will have less shivering, there will be less vigorous,
there will be very small,
so you wouldn't probably know that you are shivering
because the shivering is so small
and the mitochondria in the muscle cells will be so dense
that it doesn't need to shiver maybe that much
to get the thermogenesis going,
compared to when you're completely new,
to cold water exposure and you're not adapted,
then the body needs to create these mitochondria,
these energy fabrics to keep you warm
and that's also what the exercise is in the beginning.
But when we measured this,
we did see that the winter swimmers were shivering less
or having less vigorous shivering when they said, I'm cold.
So even though their perception of the cold
was pretty similar in the groups,
we could see that the activation of the muscles
that we measured on were different
and more vigorous in the control group.

Were the subjects incentivized to be in the study?
Were they paid or anything of that sort?
Or did they just happen to like doing cold and sauna?
And so that's why they did the study.
Well, they got paid a little bit for it, but not much
and that's how we do the studies.
Sure, I was just curious.
Yeah, I was just curious.
There might be some folks that wonder.
So what did you discover in terms of changes
in brown fat, insulin resistance,
or insulin sensitivity rather, and metabolism?
So what we saw was we had these kind of different measures
to see what's actually going on
when they are already adapted to the cold water
compared to a control group
who was matched on various parameters.
We did see that the winter swimmers
had an increased insulin sensitivity.
They produced less insulin on all the experimental days.
So besides from just cooling them
and measuring the brown fat on each of these cooling days,
there were two cooling days
and one thermocomfortable day, right?
So I wanted to measure insulin when they were just,
they were fasting, meaning that they hadn't eaten
in eight hours before the study day.
And they were completely laying still,
not moving just in a bed.
And we measured insulin during the experimental day
just to see what level are they on.
And we could see that the winter swimmer
had lower production of insulin.
And they also, when they had glucose strength,
so we give them that to see if they,
to test before we enroll them in studies,
to see if they have diabetes, for example,
and not knowing, for example,
that would ruin maybe the study.
So we test for that and see if they have a normal curve.
So what we did see in that was
the winter swimmers had faster glucose clearance
in the bloodstream.

So after two hours, we could see that they had a lower level
and the curve went down faster than in the control group.
So despite having lower insulin release,
they have better blood glucose clearance,
which is really what we all seek, right?
Excessive insulin is bad.
Insulin being a more or less a chaperone for blood glucose.
We can do all sorts of other things as well, of course,
but, and having high blood glucose, obviously,
terrible for cells, especially brain cells.
I don't think people realize how toxic high blood glucose is.
Having high glucose is sort of,
if you want to kill neurons,
you make, you make their,
put them in an environment where there's too much sugar.
Oh, yeah, very, yeah, very neurotoxic.
I mean, that's, and there are mechanisms like insulin
that buffer that, we keep, you know,
keeping blood glucose in a reasonable range
so that that doesn't happen.
I mean, I think that's why people will go
into insulinemic shock.
Hypoglycemic shock is also possible.
So that range in which neurons are happy
is not a tremendously large range.
Incidentally, the range in which neurons are happy
and surviving is much greater as one gets colder
than when you heat up.
I mean, you can basically destroy brain cells
by getting too hot for too long.
Oh, yeah, yeah.
You can definitely destroy brain cells permanently
by getting too cold for too long,
but you have to get really, really cold
for a really long time.
Yeah, yeah.
Very interesting.
Yeah, we were thinking about doing an episode
on survival of the brain after death kind of things
which actually happens.
You know, you hear about these people
who are declared dead and then come back,
and there's actually now a lot of cryopreservation type

approaches for that.
This is, anyway, we risk going into the esoteric now.
So we'll steer us back to our discussion about your study.
But so if I do the math, these subjects are in the cold.
Let's say they're doing three rounds of cold
for one to two minutes, two or three times a week.
What were the thresholds that you discovered
were important for getting these positive changes
in such as reduced blood sugar
or clearance of blood sugar being more efficient,
reduced insulin, improved brown fat distribution
and density.
How much cold exposure do people need?
How much heat exposure do people need
in order to extract these benefits?
Yeah, so when we then calculated the numbers together,
we could see that this was ended up being 11 minutes
in total per week.
So not in one session, of course,
but they had two to three visits
to the water and the sauna per week.
So when we divide that out,
it corresponds to being in cold water
one to two minutes at a time,
but also in the sauna 10 to 15 minutes at a time.
And I think this is very like,
also similar to what we see in other studies
when we look, for example, to the observational studies
from the Finnish cohort study from Laok and et al.
For example, they published this very amazing paper
in 2015, some results from this long course study
where they show that up to 30 minutes in the sauna
was healthy and you lower your risk of cardiovascular disease.
And that's like the threshold.
And if you go further than that,
then there is not more healthy benefits to gain from that.
So, and before that, it's like 19 minutes,
then you will have this dose-response relationship
up to 19 minutes,
that's really in decreasing your risk
of cardiovascular diseases.
And I think we really-
That's per week, 90 minutes per week.

90 minutes per session now.
Per session.
Yeah, per session.
If we then compare that with my study
which was 10 to 15 minutes per session,
then I think it fits very well
with what we call the hermetic stress or healthy stress
where you expose the cells to this kind of like
potent, very stressful situation
where they increase heat shock proteins in the cells
and that will repair the cells.
But if you then overdo it
and you go beyond the maybe 30 minutes in the sauna,
this observational study from Finland
with more than up to 2000 sauna bathers
where they follow these for 20 years,
they see that 30 minutes per session is like enough.
And if you go above that,
you don't get more health benefits out of it.
So I think there's a window where we can say
the healthy stress corresponds to like 10 minutes.
And I think it's like-
Per session.
Per session.
And it's not much actually.
So you don't need to,
it shows that you don't have to expose yourself
very much to the heat
or very much actually to the cold
to get this healthy benefits from going into cold,
going to heat and have healthy benefits
on your cardiovascular system.
So I think this is very important,
also message to get out
that you don't have to go extreme.
You don't have to swim for a half an hour in the cold water.
You can go in the water for one to two minutes per session
but go up to 11 minutes per week in total.
And for the sauna, my study showed 57 minutes
in total per week.
And if we also then divided out on these two to three days
and two sessions each day correspond to 10 to 15 minutes.
So it's a low stress whole,

but I think it's good to have that
to maybe we can aim for that
if people need to have something to aim for.
And I think it's really good to have that
because then you don't overdo it.
And if you overdo it, you exhaust the cells
and that will increase your risk
of cardiovascular disease also.
So.
Well, I get a lot of questions about this
and I did solicit for questions for this podcast on Twitter.
And one of the questions that I got was
as one becomes more cold adapted,
do the benefits start to wear off
or can people do too much cold exposure?
And of course the answer to that is yes,
you can become hypothermic,
but I'm sensing a different answer now,
which is if I understand correctly,
the threshold is 11 minutes total
per week of deliberate cold exposure
divided into two or three sessions
of maybe one to three minutes
depending on how long somebody stays in.
And then 57 minutes,
I want to be careful not to round up to an hour,
but divided into maybe three 20 minute sessions or so.
So one doesn't have to be perfect
as long as you get beyond that threshold.
But I wonder something which is,
is it the case that if somebody said,
oh, I'm just going to do one 11 minute session per week,
that might actually not be as beneficial as dividing it up
because what you told us earlier
is that the hermetic response
depends on having that cold shock.
You actually don't want to become too cold adapted.
I mean, once the blood pressure response drops down,
so in minute four, five, and six,
you're getting very cold and you're shivering,
but one is not getting the autonomic stimulus that they want.
I guess I could liken this to,
if exercise worked in a way

where it was only the first few minutes of exercise
that really triggered the adaptation,
of course this is not how it works,
but in fact, probably quite the opposite.
But if that were the case,
then it's not simply the total amount of exercise,
but dividing up the sessions into little bouts
where every single time it acts as a stimulus,
that seems to be the key here.
This is very important
because having watched the landscape of this on social media,
but also in books and generally,
I think you're the first person to really touch on this,
that the goal is not to get so cold adapted
that you can sit in for the full 11 minutes in one session,
where the goal isn't to be able to do an hour
of very hot sauna, if you want to,
I suppose people could do it for other reasons,
but if the goal is to improve these health metrics,
then the idea is to keep the stimulus a stimulus.
Short, exactly, yeah.
Great, well, this also,
I think there's practical feasibility as you pointed out
because getting into a cold shower or cold immersion
or natural body water for a couple of minutes
is far less challenging to most people
than finding a full morning to go spend there,
but I've never really heard it articulated
that the longer sessions might not be beneficial
and might actually be detrimental.
That's very important.
Were there any other observations that you made
that did not make it into the paper
or that were kind of in the margin notes,
in terms of psychological benefits or anything of that sort?
There was this recent study on soldiers
that talked about weight loss,
it's sort of a controversial study for a lot of reasons,
but one of the things they remarked in the paper
was that there were a lot of psychological changes,
improved buffering against anxiety.
They even, the men and women in that study reported,
one of the significant effects

was significantly improved sexual satisfaction.
They didn't tell us what that meant for these subjects,
but as we won't go there,
but a number of subjective improvements.
Was there anything that you observed or took note of
in your study that perhaps didn't make the main abstract
but that we should be aware of?
Yeah, there were some.
And today I regret that I didn't measure on sleep,
for example.
I frankly didn't really think about that
when I designed the study.
So we were very much occupied with the metabolism
and kind of had the thought,
maybe this could impact sleep quality.
And I wish I just had the thought
that why don't you just ask them in a questionnaire?
But I asked them every morning,
or everyone who's not many mornings
to just two mornings actually, we measured on,
but the winter swimmers told us before I wrote them
that they had a really good sleep quality.
The control group also had that,
but they told me on the day
where we measured brown fat on a day and a night.
So actually two days and two nights,
they told me that they had a good night's sleep,
but they also woke up.
So it's just telling me
that they also had like a quick wake up
and then they fell asleep again.
And the winter swimmers told that they have a really good sleep.
So it's like, in general,
they also say we sleep very well, I sleep very well.
So it's anecdotally general,
it corresponds to what I heard in my study,
but nothing that I measured on,
which could be fun to do in the future,
but we didn't measure on sleep quality.
That would have been a really good idea to do.
They also told me that they were very comfortable
when they were cold.
They don't mind winter swimmers,

they don't mind going out, for example,
in the cold with a T-shirt.
They were also less scared of showing their skin.
That was also one observation.
Interesting.
So kind of a reduced social anxiety.
Yeah, they were just so comfortable in the lab,
as you just mentioned before,
coats on and everybody was joining around.
It was very busy and all the other scientists
out in the hallway.
And also my supervisor had her office down the hallway
and one of the winter swimmers one day
just got out of bed after having been in the study
for eight hours, it was a long day, right?
He jumped out of the bed
and had his clothes in the bathroom
and he went out completely naked.
He didn't care.
He just went out, it was like, oh.
So that's a side effect perhaps
of getting too comfortable with the cold.
We're not recommending that.
Although in your book you dedicated some,
let me start that again,
although in your book you dedicated some pages
to naked winter swimming
or I should say naked cold water exposure
as opposed to with bathing suit.
Are there any data on this?
I'm sorry, chuckling,
but I think in most places in the United States
skinny dipping is not legal, most public beaches.
There are a few.
In fact, where my laboratory
before moving to Stanford was in San Diego
and at the Salk Institute for Biological Studies,
beautiful building, incredible science is done there.
The beach right below that is called Blacks Beach.
Okay.
And it's a known nude beach.
And so whenever tourists were heading down the stairway there,
I would sort of let them know,

especially if they had kids, I'd let them know.
And it's a nude beach of a particular genre.
So I'd give them a little warning
about what they could expect down below.
In any event, those beaches are quite rare
in the United States, maybe compared to Europe,
I don't know.
But yeah, so is there anything special
about clothes lists versus clothes exposure?
Yeah, I think in that sense we are a bit more free
with this kind of like,
but remember we also had this winter swimming culture
for hundreds of years in Denmark.
And the oldest winter swimming clubs that we have,
especially the one we have in Copenhagen
where I did my next study, which we haven't talked about,
but and it's also not published yet.
But in that winter swimming club,
it's the oldest one we have and it's huge.
And they swim naked at this facility.
Men and women.
Men and women.
And they have sauna where they can go in together.
And they also have the separate saunas.
But it's very much a Danish thing.
And I think it's good if people want that.
And I had it in my book because people want to know
if they have to swim with their bathing suit on
or if they can take it off or what's the difference?
Is there any difference in this?
And if you ask me, there is no difference.
If you have your little skinny bikini on,
it's not gonna do any difference to your cold exposure
or your adaptation.
It's not gonna do any difference.
Your benefits, of course.
But I think that it has something else.
It has something to do with how you also observe yourself,
how you observe your surroundings.
And it's some sense of freedom in skinny dipping.
So I think people in Denmark who does this is,
they do the winter swimming because they feel free
when they do this.

They come home from work.
They go to this club and they skinny dip
and they feel like in touch with nature.
And they have maybe done this their whole life.
So this is an old tradition in Denmark,
in some of the clubs,
but the newer clubs that are coming,
they don't do a skinny dip.
So everyone has bathing suit on.
I never skinny dip because there are people around,
people with phones and taking pictures all the time.
So this-
It's a different nowadays, everything's recorded.
Yeah.
And also this old tradition is also fading away
because of that.
Yeah, I use sauna and cold at home,
but when I travel, there's a banya.
So Russian banya has hot sauna and cold plunge.
There's one in San Francisco called Archimedes banya.
And that one is clothing optional.
So some people are clothed such as myself
and then other people are not.
And it's co-ed most of the time.
I think they have a female separated evenings
or something like that.
And then the other banya is Spa 88,
which is on Wall Street in New York
is an amazing banya as well.
And these are starting to crop up in different cities
or maybe they've been there for a long time
and as deliberate cold exposure in sauna gets more popular,
more people are using them.
The one in New York that that Spa 88 is always clothed.
And it's interesting because people hear naked
or skinny dipping and they might get certain ideas in mind.
It, all these places are very well lit
and they all have a tone of kind of health
that is about the kind of health and wellness.
I guess the point being that there's no requirement
to do one thing or the other.
Although in the studies that you did,
obviously people were clothed.

But I did pay attention to those pages in your book.
I thought it's interesting that you put some
dedicated passages in your book related to this.
And I think it-
My publisher wanted that.
Oh, your publisher wanted that.
Interesting.
Yeah, it was not me.
It was like my publisher really wanted
to have a little discussion about that.
So I was like, okay.
Well, I think it points to a larger theme,
which is I think for a lot of people
who already do these practices, there's no shock there.
For people that do not do deliberate cold exposure
or sauna, I think that there is this idea perhaps
that, oh, these are traditions that are kind of fringe
or that they're kind of-
And I just, I wanna cue that point
because there's so many things that are happening right now
in biomedical research and medicine.
Serious quality peer reviewed studies
published in excellent journals like your paper
on things like deliberate cold exposure, sauna,
the use of particular supplements,
natural herbs and supplements.
I mean, there's an entire branch
of the National Institutes of Health in the United States
dedicated just to the study of supplements
and behavioral interventions for health
like meditation and breath work.
Really incredible.
It's really incredible.
And psychedelics, of course, being something
that for a long time was part of a certain community
and feel and now is being, frankly,
adopted by mainstream medicine, even pharma.
So the times are changing.
And so, yes, I think it's important to know
that it's perfectly acceptable
and encouraged to wear clothing.
So-
Absolutely, absolutely, yeah.

And one other thing that I wanted to mention
going back to your questions around with,
there were any observations in the studies
which we really maybe haven't discussed yet
and maybe it's in the back of the paper
and not mentioned that much was,
one of the winter swimmers didn't have any brown fat
when we measured him.
Zero.
Zero.
And we do see this in previous studies as well
that some humans don't have any brown fat.
Did he carry a lot of white fat adipose tissue?
Was he obese?
No, he wasn't.
No, he was not obese
because that he would not have been in the study then.
Oh, right, yes, you mentioned this earlier.
Forgive me.
No, no, it's fine.
But what I did observe before I knew
that he didn't have any brown fat was that
during the cooling experiment
where I cooled him for two hours
before they go into the PET CT scanner,
he was not able to control his shivering
like the winter swimmers could.
So he got very cold very easily
compared to the others.
So, and without, I didn't know what was different about him
but we could, all of me and the three others
were working on the experiment.
We were like, okay, what's going on?
Because we turned down the temperature
but he started like shivering
and then we had to turn it up again.
And it was just all over the place, the temperature.
It's not, it wasn't that controlled like the others.
It was pretty similar protocol.
I could just do pretty much the same
because they were same size and also same gender.
So it was easier to foresee what was gonna happen
and when will they start shivering?

I quickly learned that.
But with this subject, it was just,
with this volunteer was just very much different.
And then when we scanned him
and didn't find any brown fat,
I didn't even think about it.
So when we scanned him, we didn't see anything.
I told the PET CT people who like,
oh, you put up the wrong scanning.
Blame the technology.
Yeah, the technology was like,
this scanning looked like the thermonutrile day,
the thermocomfortable day
where we also scanned them to see
if they have any brown fat.
So you have made a mistake, I was pretty sure.
And they re-analyzed this scanning
and they just concluded, well, the scanning was fine.
The experiment went well.
It was just that he didn't have any brown fat.
So he was like what we just in the paper called
the brown fat negative.
So he didn't have any.
And in my studies, it would be called a knockout.
So it didn't have any brown fat.
So the observation with him,
and I think that's interesting,
is that he both shivered very early on
and didn't regulate his temperature as well.
He also told me that then he was like a five
on the scale of how comfortable he felt with the code.
Out of.
So it was from one to 10
and five being thermocomfortable
and 10 being very cold and one very hot.
So on this like scale up and down.
And he was like more up and down on this scale
than any of the others.
It was an observation that I did.
But we did see in his blood samples also
that his blood samples looked a bit more
like the control group.
Also his insulin levels

were like the control groups
or a little bit higher than the other winter swimmers.
And he also had his blood glucose clearance
was not as fast as the other winter swimmers.
So he was like an outlier, what we call it.
And in the analysis,
we also had to take him out of the analysis
because he was an outlier.
So the results showing that the brown fat
is more efficiently activated in the winter swimmers
is without him having him in that group.
But it didn't ruin the study.
If I tried to put him in as well
and it didn't ruin the results or anything
but just to keep it more clear,
we put, we took him out of the analysis.
Yeah, so he was a mutant knocking.
Yeah, and I'm sure they're out there.
Very interesting.
So if you shiver early then perhaps
you have less brown fat to begin with,
although it's hard to conclude from one person,
that's sort of the implication there.
Or you haven't adapted to the code.
So you should build that up, yeah.
So in addition to looking at regulation of blood sugar,
brown fat, metabolism and so on,
were there any markers that you examined
in the deliberate cold exposure group
as compared to controls that revealed to you
that deliberate cold exposure
could have additional benefits,
say for immune system function
or for any function for that matter.
Yeah, so for, we looked at inflammation,
of course we measure outcome of blood pressure and so on,
but we also measured IL-6 in the study
just to see also an inflammatory and inflammatory marker.
So IL-6 went up and it also follows with IL-10.
So that is also very known in the literature.
So we measured that and I think it's very important
to think about the cold exposure and the heat exposure
as something that then lowers the inflammation in the body.

And if we can do that,
we will have an open door for preventing lifestyle diseases.
So for type two diabetes,
but actually also for some mental diseases as well.
So as known as depression and anxiety
and also Alzheimer's disease,
which are all associated in research,
also newer research showing that inflammation
increases the risk of depression and anxiety
and Alzheimer's disease with neurological diseases.
So if we can decrease inflammation in the body,
we will decrease our modern lifestyle diseases
but also these increasing mental diseases
that we see in these modern lifestyle times.
So I think it's very interesting
that we can go out in nature
and we can use these natural stressors
and I don't want to have it sound very romantic or anything.
It's just exposure to temperature actually,
just a cold or to heat
that is gonna twerk our body into a natural state again
and reset it where the homeostasis,
the balance is lost a bit.
So the body is gonna repair itself in that way
and I think it's beautiful that we can do that
just by changing the temperature of our body.
And although people are very scared of doing this
because in our times,
we have been away from cold, away from heat,
temperature for decades now
since we isolated our houses better
and we are more sedentary, we also sit more indoor,
we don't move as much.
So this very modern sedentary lifestyle
has made us more temperature comfortable, just neutral.
So no wonder, I mean, that obesity is increasing.
We don't expose ourselves to the natural stresses
that we did earlier on in our involvement
but also up until maybe the 70s, the 60s
where we started having more comfortable lifestyles, right?
And obesity increases in the 80s.
We can see that from statistics.
So I think that if we can take in cold and heat

and you mentioned other things also before
but of course exercise is very important here
and also a bit of fasting actually
because it all increases the hermetic stress in the body.
So it doesn't have to be other than natural stresses
to the body which then could keep us
in that natural balance again.
Could we talk about what I refer to as the Soberg principle
which is to end on cold?
And the reason I called it the Soberg principle
is because in reviewing, oh, by the way,
I wasn't a official reviewer of your paper
but I mean in reading and reviewing your paper
for its after published contents,
I noticed that you had people end on cold
and this has been a long standing debate
in the deliberate cold exposure community.
Should you warm up with a warm shower afterwards
or get back in the sauna?
What should you end on cold or end on heat?
And the Soberg principle says end on cold
as I understand it,
in order to force your body to heat itself back up
and thereby increase metabolism further still.
Is that right?
Yes, so when you end on the cold,
you force your body to heat up by itself
and that will require that you activate,
you keep your brown fat activated
and also your muscles which is a good thing.
It's a good collaboration to keep your thermogenesis up
and that's like an exercise
even when you go home.
So in that way,
you don't have to think about your cold exposure
or dipping in your plunge or open sea or what it is
as just an exercise that you do for one to two minutes
and then it's over.
If you end on the cold,
you have an exercise for your body going on
for hours afterwards
and that's not only on your metabolism
but it's also gonna keep your neurotransmitters

activated as well and increase that
because your body is still cold.
So you need those neurotransmitters
to activate the brown fat as well.
So that's gonna make your brown fats
that's more efficient
and also your muscle cells more efficient
so increasing mitochondria in the cells
which will then generate heat very fast.
So if you have done this for a few times,
so maybe three, four, five times being new to this
but have tried it a few times,
you will notice a switch where you like feel
that you get easily warmer
and you can keep yourself warmer.
And that is also what was shown in my study
is that the winter swimmers were physically warmer
on the skin compared to the control group.
So they-
When they are out of the cold.
When they're out of the cold, just relaxing
and we tested this in on the days
where they were sleeping in the lab.
So we could see that they had a more activation
of the brown fat, a higher temperature.
So probably because they also lose heat,
they have a higher heat loss to the body
compared to the control group
because they have a more vascular skin
because of the contrast of cold and heat.
So they lose heat faster from the body during that day
but is that a bad thing?
No, probably not
because that's gonna keep your brown fat
and your muscles a little bit activated.
So you will have to, it has to work to keep you warm.
And I would hypothesize that it also might lead
to some of the subjectively reported improvements in sleep
because in order to fall asleep,
you need your core body temperature
to drop by about one to three degrees.
So it's not just sufficient to be sleeping
in a cold room and under the blanket,

you also need your body temperature to drop.
And so what you're saying, if I understand correctly
is that by forcing, by ending on cold
and forcing oneself to heat up naturally,
that increases the brown fat stores,
which I sort of see as kind of like the oil in the candle
of the furnace, that is thermogenesis,
and that in turn leads to increased heat loss,
which people might think,
oh, I don't wanna lose heat from the body,
but there are times when we want to lose heat from the body.
Basically, it sounds like what we want
is to be a very efficient heating and cooling system.
That it's not about being cold or being hot,
it's really about keeping the system tuned well,
keeping the oil in the candle, this brown fat functioning.
Yeah.
Could I ask one question about fed or fasted?
Is there any, or rather, are there any known benefits
of doing deliberate cold exposure and or sauna fasted
versus after a meal, say within the last hour
or something of that sort?
I do my deliberate cold exposure first thing in the morning.
So in general, I'm fasted
because I don't eat until a little bit later in the day.
But what's known about that?
And was that looked at in your study?
I know you measured glucose,
but that was as a separate test away from the cold.
Away from the cold, yeah,
but I also tested glucose on the days, on the cold.
So we measured that as well on the cooling days.
Specifically on fasting and fed, I don't know.
I don't think that I have seen studies specifically on this.
Okay.
More science needed.
A number of people asked about the use
of deliberate cold exposure
to offset some of the symptoms of various diseases.
Now here we're not talking about curing disease,
we're talking about offsetting symptoms.
One question I've seen quite often
is whether or not people with Ray Nodes syndrome,

this is a syndrome,
and my high school girlfriend had this syndrome
and I'll never forget,
we went, we were at a school dance together.
And this was when we first started dating
and she had Ray Nodes,
which leads to very poor blood flow to the extremities.
And she was very cold,
so she left to go to the bathroom
and warm up her hands in the warm water.
And I was left standing there at the dance
and people came up to me and asked,
why I was there and who I was there with.
And I kept telling them who I was with
and they didn't believe me
because they couldn't believe that she would be with me.
Made total sense if you knew me at the time.
I was way out of my league with her at the time.
I like to think eventually I caught up,
but in any case,
she was in the bathroom for about an hour.
So at one point I did consider the possibility
that she had just left,
but indeed she hadn't,
she warmed her hands back up,
but people with Ray Nodes suffer from this thing
of very, very cold extremities.
Their fingertips will even turn blue
as if they were starting to get frostbitten.
It's quite dramatic.
And that question gets asked,
whether or not there's any use of cold
to try and increase the elasticity,
the plasticity of the small capillaries and vessels.
By everything you've described up until now,
it seems like that would be a logical thing to do.
And in addition to that,
whether or not people with autoimmune conditions,
people with any other types of conditions
are known to benefit from deliberate cold exposure.
I'm not aware of any studies,
but I get asked about this a lot
and there were a lot of questions about this for you

in the Twitter feed.
Yeah, thank you for those questions
and I get them as well on social media.
And I have to say that I haven't seen any studies directed
on this outcome and measuring Ray Nodes syndrome.
I do know that it's not that rare actually a problem
and I know that many women or more women than men
suffer from this,
but logically it would help them
if they exposed their hands to cold
and also heat to make it more vascular.
But, and I have heard from people saying that it had helped them
but also heard for some others saying it didn't help them.
So studies are needed on this specific topic, I think.
I hurt my hands when I go into the cold
and I don't have this syndrome at all,
but I keep my hands above the water.
You do?
Yeah.
I do that, often I take a little bit of a swim
and then of course I have to have my hands in the water,
but it helps me when I then get back to the daddy
and then take my hands off
because then I can stand there for a little bit
and get my one to two minutes exposure
and then I can go off because then otherwise
that would stop me from being in the water enough time
that I, as long as I would like to.
So people suffer from having this pain in the fingers
and it can be very intense.
So just take the hands up a bit from the water
and that's gonna help you.
Also boots, neoprene boots, it's gonna help on the feet.
Some people have the hurt, feel the pain in the feet
and on the ankles and that's gonna help them also a little bit.
Okay, so there is no problem with keeping hands out
or feet in neoprene booties
if people feel the need to do that.
If pain of the hands or feet is a barrier
for people doing deliberate cold exposure,
then it seems it would be okay to do,
to keep hands out or to keep your feet in the booties.
Yes, because then you do get the exposure,

but of course hands and feet are very potent places
in your body to get a fast activation
of your nervous system, of course.
But if you can just, you can also just dip them
and then take them up.
It's still gonna activate that,
but you have your full body is covered in co-perceptors.
You'll have a full activation anyways, so yeah.
You are providing very reassuring information to people
because I know a number of people
that do not like to put their hands in.
I find that the more of my body I get in,
the more comfortable I am,
I don't know if it's psychologically and or physiologically.
I find that if where there's an interface
between the water and the cold, it's most uncomfortable.
So I prefer to just get everything under.
I keep my head out.
Although these days I've been dunking all the way in
and then coming out and then dunking once more
with my head under before I get out after the plunge.
That raises a different question.
Now we're getting into kind of the practicalities
of deliberate cold exposure, which I think are important.
Sometimes I'll experience, and I hear from a lot of people
that they'll get a kind of back of the head headache
at the interface of the water,
when they're doing cold immersion to the neck.
I assume this has to do with blood flow,
that there's vasoconstriction right up until the neck
and in the region surrounding it,
but that maybe there's still blood flow to the head.
But do we know what the origin of these headaches is?
And again, this doesn't happen for everybody,
but some people do experience them.
Okay, yeah.
I haven't really heard about that one specifically.
So, but I would say that there are different reasons
for maybe keeping your head out of the water.
But it seems like maybe for some,
that could be a reason for like,
just getting like a quick head dunk.
Going all the way in.

That's what I've started doing to eliminate.
I wasn't getting headaches, but I could,
I noticed that interface and I wasn't in the rest
of the experience of it so much.
So I started dunking all the way in.
I noticed in some of the photos that you've put out
and in your book that you'll sometimes wear a cap
while you go in.
And well, it comes from different reasons.
So let's talk about some of the physiological reasons.
So when you submerge in cold water up to the neck,
studies have shown, and this is from Denmark,
studies from Bispepia Hospital,
that when you submerge into cold water up to the neck
at zero degrees, so zero degrees Celsius, very cold,
you will have a decreased blood flow to the brain
by around 30 to 40%.
And makes sense because you activate
the sympathetic nervous system.
And therefore you will have a less blood flow
to the brain, makes you maybe a little bit dizzyer.
Proof again that you need a heart more than a brain
because when the sympathetic nervous system gets activated,
blood flow is maintained to the heart to keep you alive,
but obviously taken away from the brain
to keep you from thinking.
That's why it's hard to think when you're stressed.
Yeah, well, the muscles and your vital organs need to,
you have to be able to run away from that tiger, right?
The rationale makes total sense.
And who am I to disagree with mother nature?
Well, but yeah, so one of the reasons being
that you should keep your head out of the water
is that you could increase that decrease
in blood flow to the brain further if you dunk the head.
So there's just a very nice paper from a research group
in Canada where they have collectively looked
at different papers where they compared heat loss
in the papers where they dunked the head
and compared to heat loss,
submerging up to the neck to see how much extra heat
do we lose from our core when we dunk the head.
So, and I think it's very interesting

that if you submerge up to the neck,
you have a heat loss of 11% from the body core.
And when you then also dunk the head,
you will increase that heat loss rate by 36%.
So that means, I'm not saying that I'm not here to say
what is right and what is wrong.
I just think that people should know the information
so they can for themselves evaluate what is best for them.
But if you increase your heat loss rate by 36% from your core,
that's gonna increase your afterdrop,
which we touched upon a little bit earlier, even further.
So that's meaning that you are closer to hypothermia
than you are if you just submerge up to the neck.
So you should really think about
whether this is like something that you want to do
or if it's just better for you
not to get that cold in your core.
The beanie is also because I have a little bit
of sensitive ears.
So it meaning that if there's wind
and because we swim in the open sea in Denmark,
we have a lot of wind.
Our wind, our conditions are just very rainy, very windy.
And when the temperature is also freezing,
you could get this, what is that called?
So very cold and lightheaded just from wind.
So if you also submerge into cold water
and you then get up,
you will get a brain freeze immediately.
So it is enough to just go up to the neck
where a beanie should just not get dizzy also
because the heat loss is increased, of course,
but also the blood flow to the brain has decreased.
So the beanie will keep you a little bit warmer
so you can stay for one to two minutes.
So it's just a way of like getting around
some of the conditions also.
So people can choose that if they feel that,
but it's quite normal to do in Scandinavia where a beanie.
I love it.
And so for those of you afraid of doing
a two minute cold shower,
what Dr. Silver just described,

let's you see how she and others are capable
of doing things far harder than that.
When the way you describe it with the cold wind
in Scandinavia and is quite striking.
Along the lines of covering the head,
there's this seemingly paradoxical thing
of people going into hot saunas and wearing wool caps.
If you go to a Banya or you go to a sauna
and there are people who are, well, from Eastern Europe
or typically are Finland or Russia or Ukraine
or elsewhere, what you'll see is that many of them
are wearing wool caps in the sauna,
which many people think is to make it hotter.
That's actually not the case.
It actually insulates you from the heat environment.
The sense of urgency to get out of the hot sauna
is a brain driven mechanism.
And so the reason that people wear wool hats in the sauna
is it actually lets you stay in the sauna longer
because it takes a lot of heat to the skin
before you feel that you have to get out.
Whereas so when you insulate the brain,
you don't get that signal.
It's pretty interesting.
I've tried this before just by putting a towel over my head
in the sauna and you can stay in there much more easily
and for much longer.
As we talk about these different stimuli
for the hermetic response, the adaptation distress,
it occurs to me that the big ones
in our evolutionary history have been light, right?
I mean, you were talking about seasonal changes.
We know there, especially as you go up to Nordic countries,
there are seasonal changes in the amount of light
by time of year, dramatic ones in fact,
less so at the equator, of course.
Light, temperature, food, movement.
And it's sort of interesting and at the same time,
perhaps it should have been obvious to us
that there are stimuli that our bodies have evolved
to adapt to in very powerful ways.
And so the idea that temperature, heat and cold
could evoke these tremendous physiological changes

that are beneficial for us,
probably shouldn't surprise us at all.
I mean, this is why, I mean, these are not esoteric mechanisms.
They're actually the foundational mechanisms
by which our bodies and the bodies of other animals adapt.
So I do have a question about the different ways
that people could approach deliberate cold exposure.
So for instance, children.
I've been to Bonyas where there are kids,
six or seven years old with their parents at the Bonyas.
And so they're in hot sauna.
I'm not suggesting people do this
if they're not adapted to it.
And talk to your parents' kids
and talk to your kids' parents, talk to your doctors.
But it is remarkable.
I mean, children doing sauna from a young age
or deliberate cold exposure, are there any date on this?
And is it safe, assuming that obviously they can swim
and they're doing this in a tub or shower?
And then I'd also like to ask you
about are there any additional male-female differences?
I know your study focused on men,
but other studies have focused on both.
And you, of course, are a woman
and can attest to your own experience with this.
So children, men, women, difference is there
in terms of protocols.
Is there anything that people should build
into the structure of their deliberate cold exposure
that's unique to that?
So yeah, so this was an uncold exposure.
So yeah, I think that starting with the question
about children, I think that it's important to think
about as children are smaller than adults.
So we cannot really completely transfer all the information
and the benefits and also protocols for how long
and stuff like that to children.
We cannot do that because they are just smaller in mass.
And one study that actually improves this is a study
where they have compared heat loss in children, boys,
who were 12 years old, compared to adults, men,
and looked at the heat loss of the core temperature

and exposed them to a one or two minutes
cold exposure, so immersion up to the neck.
And what they saw was that the boys in this study
could actually defend the core temperature
in the same way as the adults could,
but they had to use their muscles way faster.
So it means that they couldn't stay for as long
and they use more energy to defend their core temperature
compared to the adults.
But for one minute, it seems that they could actually,
but they will be colder when they then come out
because they are smaller in the mass to their ratio, right?
So it means that if the surface is so large on children
and their mass and muscles being smaller to that ratio,
it means that they can be in the water less time
before they get hypothermic.
So just think about that, they are just smaller.
They can't defend their temperature for a very long time.
But in this study, they saw that for up to,
I think it was a minute or so,
they could one minute, yeah.
I'm glad you mentioned hypothermia
and smaller-bodied people, children.
I used to do some Pacific ocean swims in the morning
without wetsuits and I adapted to it pretty quickly
and these are fairly long swims
and we brought an excellent swimmer with us
that was interning with me for a while,
is 16 years old at the time and very lean.
And he wasn't small for his age,
but he was smaller than us.
And it was all guys on the swim that day.
Sometimes women join us and he got hypothermic
and he's an excellent swimmer
and he didn't report feeling overly cold,
but fortunately we got him to shore and he did him up again.
So he lived, I don't think his mother's gonna ever
let him go swimming with us again.
He's thriving in the world.
He's a university student now and he recalls that swim.
I mean, this is why you always want to ocean swim
with a buddy, with people.
Yeah, he became hypothermic.

His teeth turned yellow, he was got slurring his words,
he wasn't making sense, we got him on the shore
and he was kind of drooling and a little semi-euphoric
and then kind of, hypothermia is no joke.
So I think, yeah, so I'm really glad that this is coming up
because the cold is a powerful stimulus
and kids are at a, and smaller-bodied people
are at a greater risk of hypothermia.
So a good reason to approach it with caution,
maybe start with cold showers,
get then cold immersion and still water.
Natural water and open bodies of water,
of course, are always going to be more dangerous
for other reasons, currents and things of that sort.
Yeah, exactly, I'm drowning.
So an important note there,
what about any additional male-female differences
or similarities that we should be aware of?
And this comes up all the time on social media.
Anytime I post anything about a study,
it's what about women,
because oftentimes there are differences.
Yeah, yeah, and we also just talked about
the difference in temperature in men and women.
So it means that if we did,
if we replicated my study in women,
it could be that they would have enough,
you can say cold exposure with just nine minutes per week.
It could be because they apparently are also just colder
and they have increased metabolism in their brown fat.
It's just they have more brown fat.
It could be, but this is just something
that I frankly don't know,
but women also do cold exposure winter swimming
with the 11 minutes protocol.
I do it myself and feel good about it.
So I would say that women also regarding activation
of the brown fat, it should be the same in theory,
but I don't know if women actually do need
to have another protocol
when it comes to this rapid cold exposure.
I think that it's another question
if we are talking about ice swimming,

when it comes to how far can you be in the cold water
without getting hypothermic,
then there will be differences in men and female,
but if you do this cold exposure
for a very brief amount of time,
which is what I try to talk about,
what we call also micro-stressing the body
to increase the hermetic stress, the healthy stress,
then this is such a short amount of exposure
that it's fairly the same.
I think women can look at this
as a fairly good protocol for them as well.
I always say that if you really dread the cold
and don't like the cold,
then you are a perfect candidate
for using deliberate cold exposure
because the sympathetic,
aka the stress response will be greater
and thereby the adaptation to that shorter
one or two minutes is going to be much greater.
For people that are perfectly comfortable in the cold,
it's harder to get an adaptation response
the same way that if somebody is very strong
and they can lift a very heavy weight
that that very heavy weight is unlikely
to evoke the same degree of adaptive responses
if somebody is not quite as strong.
So another reason to keep these exposures
relatively short and more frequent
than to do longer duration exposures frequently
however, let's say somebody only had two days a week
to do deliberate cold exposure.
Maybe they don't have access to a sauna, maybe they do.
Would you suggest that they get in for one or two minutes,
then get out, then get back in for another couple of minutes,
then get out and call that for four or five minutes
to try and get to that 11 minutes total per week
as opposed to getting in for a full five minutes
and then getting out and coming back a second time that week.
I know this is getting down into the weeds
but these are the sorts of things
that I think people really want to know
because a lot of people either don't live close

to a body of water or don't have a cold plunge
that they can do this with
although cold shower apparently works too.
So most people live close to a shower.
Yeah, so definitely I think the changes in temperature
is what is strengthening your cells in the body.
So if you can do the short amount of exposure
and then get out and get back in, that is gonna,
you can say strengthen your cells
because you are challenging them
to adapt to changing temperatures.
So during one session, you can change this, right?
You can do it if you are able to go to cold water
but also a sauna, then you just do it that automatically
you will have a change in temperature
but you could also do it with
variating the temperature in your cold plunge
if you have a plunge or if you have an open sea
or you have seasons even, we have that in Denmark
so we have four seasons
and the temperature is gonna vary with that.
So we have nature who can just change this for us
and we don't have to think about it.
But if you have a cold plunge, well,
then I would say that changing the temperature
is what is gonna create this hermetic stress
and also keep your cells on its toes, you can say
because the body will still be stressed
to try to adapt to the new temperature
as it's seen as something actually toxic to the body, right?
It's a small piece of toxicity
that you are exposing yourself to.
You don't have to swallow it
but it's enough that you touch it actually.
Yeah, great way to frame it.
That brings me back to this idea of circadian time
in your study you didn't control first.
The specific time of day
and now I'm realizing that may be a great asset
to the whole thing.
So we know for instance that our bodies go through
pretty dramatic shifts in temperature
from the time we wake up.

Our body starts heating up as we wake up
and continues to heat until the afternoon
and then starts to drop in the later afternoon
and then assuming all things are working correctly
that body temperature drops and we sleep.
So I could imagine that doing deliberate cold exposure
at different times just by way of convenience
or by way of intention could be very beneficial
because my body temperature is going to be quite a bit warmer
at one time of day versus another
and in that way keeping the system tuned.
And that's really what I keep hearing coming through
as you explain these data
and all these beautiful studies, yours and others
is that it's not really about getting cold.
It's about going from warm to cold and from cold to warm.
It's not, and I love this idea
because I probably said this a hundred times
on my podcast and a million times in my life
and I'll continue to,
which is that biology is not an event, it's a process.
Like these metabolic and thermoregulatory processes
are indeed like the turning of a knob.
It's a verb, as opposed to a noun.
And so I think if people can internalize that idea
that they're going to have a lot more flexibility,
a lot more fun and get a lot more benefit
as opposed to thinking, okay,
I need to get into X degrees of water
for X amount of time on X number of days
in a very rigid way.
And I get this question all the time, how much and how cold.
And I mean, it's just like, well,
because we also don't have studies showing exactly
if you just keep five degrees in your water
and you do that for a month, then what happens?
Maybe in the future we will know much more about this
and I'm sure it's gonna come and I really hope so.
But I just think by logically changing that temperature
up and down, up and down,
and you also do that in your water,
it doesn't really, it's not that important
what temperature you will have your water then,

then just keep changing it, going up and down.
It could be all up to 12 degrees Celsius.
You're gonna activate your brown fat anyway.
So I mean, 12, 19 degrees cold air
is enough to activate your brown fats.
So maybe we don't have to go as cold
as I think many people think.
And putting ice even all the time, you don't have to.
I don't think it's necessary to expose yourself
to that cold temperature all the time, but vary it a bit.
So keep the system off balance
and it's the way to keep it tuned.
You mentioned a study that is more recent
or an ongoing that's not published.
If you're willing, could you share maybe some of the data
from that findings from that study
with of course the cue to everybody
that these are not yet published data.
So the conclusions could change,
the data could change for that matter.
Yeah, so we haven't analyzed all the data yet.
And I know from the study that we did publish
that we would need to look more of the data.
So I don't really have any results yet that I can share
because we are still in very preliminary analysis of this.
So I wouldn't know yet what to exactly say about it.
But what we looked at was both men and women method.
So that's coming.
Oh, that's fantastic.
That answer is going to please a great number of people
and intrigue everybody.
So, well, I want to really thank you
for coming here today to talk about your work
and the incredible direction that it points to.
Because I think that, you know,
no one study is definitive,
but your study really again stands as a landmark
in the landscape of exploring deliberate cold exposure
and heat, how it can impact
and potentially impact our health.
Because frankly, there just haven't been
that many high resolution detailed modern studies of this.
There have been studies of sauna.

There have been some studies of cold.
There are a lot of groups in physiology
that work on hypothermia and very cold exposure.
But most of the temperatures used in those days
just aren't practical.
So first of all, I just want to thank you
for doing the work that you've done
and for the work that you continue to do.
I'm waiting with bated breath, as they say,
to hear the results of this study
that's ongoing on both men and women.
So we'll have to have you back to inform us about that soon.
And I want to thank you for the incredible
public education efforts that you've been doing
on social media and with respect to your book.
And we, of course, will put links
to all of those things in the show note caption
so people can learn from you
and can continue to learn from you.
We certainly need more scientists
who are both experienced with doing hardcore research,
as it's called, and who also do the practices.
I think that's a wonderful additional asset.
You're not just behind a lab coat
or bundled up in a down feather jacket
as everyone else is getting into the cold.
You do these things and that you are so open and generous
in the way that you share knowledge,
which includes coming here today
to share knowledge with me and our audience.
So thank you ever so much.
You're very welcome.
I am so pleased to be here
and thank you so much for inviting me.
And I could explain my study
and I can share some of my insights from doing that.
So I'm very grateful for being here.
Delighted and we'll have to have you back again.
Thank you for joining me for today's discussion
all about deliberate cold
and deliberate heat exposure science and protocols
with Dr. Susanna Soberg.
If you'd like to learn more about Dr. Soberg's research

or you would like to learn about the research
of her institute, the Soberg Institute,
please see the links in the show note caption.
Also in the show note caption,
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Thank you once again for joining me
for today's discussion with Dr. Susanna Soberg.
And last but certainly not least,
thank you for your interest in science.