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NOTE duration:"00:54:15.6690000"

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NOTE Confidence: 0.713247358798981

00:00:00.870 --> 00:00:03.150 Yale podcast network.

NOTE Confidence: 0.889208674430847

00:00:05.460 --> 00:00:35.950 Hello and welcome to another episode of the Yale Journal of biology and medicine podcast, YJBM is a pub Med index quarterly Journal edited by Yale medical graduate and professional students and peer reviewed by experts in the fields of biology and medicine today. We are presenting an episode that is a little different recently. YJBM worked with the Yale science diplomats a scientific outreach group to host an event centered around our recent Clocks and Cycles issue, which was published in June of this year. This event science at brewery featured a series of short easily understandable talks.

NOTE Confidence: 0.909369707107544

00:00:35.950 --> 00:01:06.300 About a topic of broad interest in this case sleep in the circadian rhythm. We are releasing a modified version of these talks here in this episode of our podcast. Our first speaker is Emma Carley, a second year student in the cell biology Department. Hi I'm Emma and I'm going to start of- our talks today by discussing circadian rhythms and our story begins with French scientist and Explorer Michel Siffre. Now Michel Siffre was just 23 years old when he stumbled

NOTE Confidence: 0.897556900978088

00:01:06.300 --> 00:01:12.550 On an underground glacier in the Swiss Alps. Now this is back in 1962 and

NOTE Confidence: 0.934740304946899

00:01:13.140 --> 00:01:31.940 You know science standards weren't quite where they are today and he decided that he was going to go into this cave that he found and live there in complete darkness completely cut off from Society for 2 months and just to try to see what happened to him.

NOTE Confidence: 0.93852174282074

00:01:32.460 --> 00:02:02.610 And so he went into this cave and after 2 months. He stumbled upon a really interesting discovery. He found that his sleep wake. Cycle was actually still happening while he was in this underground cave, even though he wasn't getting any sort of input of light from the sun and what he discovered was that the human sleep wake. Cycle is 24, 1/2 hours long and it actually occurs without any input from light.

NOTE Confidence: 0.924266755580902

00:02:02.680 --> 00:02:32.750 And this was a really, really exciting discovery at the time because many people, most likely think that our sleep wake. Cycle occurs because the sun comes up and it's time for us to wake up and the sun goes down. It's time for us to go to bed and so this discovery was really revolutionary and what Michel Siffre had stumbled upon was one of our internal circadian rhythms. So we can start to understand what circadian rhythms are by first breaking down the word circadian so circadian.

NOTE Confidence: 0.924201488494873

00:02:32.750 --> 00:03:00.110 Comes from 2 Latin words circa and DM which mean about and day so circadian rhythms are long. Repetitive cycles that last a day. For every cycle and these cycles can be observed at the level of organisms such as our sleep Wake Cycle. But these circadian rhythms can also be observed at the level of the cell, which is the basic unit of life.

NOTE Confidence: 0.943593442440033

00:03:00.750 --> 00:03:12.750 All organisms actually experience circadian rhythms, including plants, who can turn their leaves in a rhythmic pattern in order to catch as much sunlight as they possibly can.

NOTE Confidence: 0.945980489253998

00:03:13.470 --> 00:03:21.370 So today, I'm going to be talking to you about where circadian rhythms come from and then I'll be talking to you about what influences our circadian rhythms.

NOTE Confidence: 0.931934058666229

00:03:22.180 --> 00:03:28.920 So to start of- circadian rhythms are endogenous, Lee generated which means that they are internally generated.

NOTE Confidence: 0.932296276092529

00:03:29.420 --> 00:04:01.990 And for awhile people weren't completely sure if these rhythms were truly generated from within organisms completely independent of any other factors. Michelle see phrase discoveries suggested that these rhythms were internal because he was able to have a sleep wake cycle without any sort of input from the sun. However, there were still scientists who thought that maybe there was something else. Some other external factor that was creating these rhythms, such As for example, the.

NOTE Confidence: 0.959735214710236

00:04:02.140 --> 00:04:04.100 Gravitational pull of the Earth.

NOTE Confidence: 0.918842434883118

00:04:04.770 --> 00:04:35.760 And so in order to figure out whether or not, our circadian rhythms are truly generated from within ourselves, scientists turned to fungi and fungi like all organisms experience, circadian rhythms. One of fun guys circadian patterns is spore formation and so fungi will create a new

spore roughly every 24 hours and so scientists can observe this spore formation overtime in order to measure the fungi circadian rhythm.

NOTE Confidence: 0.944921314716339

00:04:35.870 --> 00:04:47.000 So, in order to make sure that the circadian rhythm of these fungi weren't influenced by any sort of external force present on this earth?

NOTE Confidence: 0.923601746559143

00:04:47.530 --> 00:05:18.680 The scientists took this fungus into space and observed its circadian rhythm and what they found was really exciting. They found that spore formation was actually still able to occur in space in this rhythmic pattern. The spores that were formed weren't quite as perfect, as the Spores formed on Earth showing that you do need some sort of input from the earth in order to have exact perfect spore formation, however, they still occurred in a perfect rhythmic pattern.

NOTE Confidence: 0.926986038684845

00:05:18.730 --> 00:05:27.770 Which truly shows that even in space these rhythms are able to occur and they therefore come from within ourselves?

NOTE Confidence: 0.929986655712128

00:05:28.390 --> 00:05:39.600 So now that we know that circadian rhythms are internally created, how does that happen? How can our bodies tell time to create these rhythmic cycles?

NOTE Confidence: 0.937647521495819

00:05:40.210 --> 00:06:10.840 So our bodies are all made of tissues and organs, which can be further. Broken down into cells and the cells. The basic unit of life and like I mentioned before even our cells have circadian rhythms. So our circadian rhythms actually come from inside of our cells. Cells are made up of 4 major macro molecules or big molecules that includes DNA carbohydrates or sugars.

NOTE Confidence: 0.929865419864655

00:06:10.960 --> 00:06:26.330 Fats also called lipids and the star of our story today are proteins. And so proteins are one of these big macro molecules that perform a lot of really important jobs inside of your body, including keeping time for our circadian rhythms.

NOTE Confidence: 0.910628020763397

00:06:27.030 --> 00:06:58.720 So the way this works is that there are actually cycling proteins. Within your body that act as a Clock 0 in the middle of the night your cells are full of proteins that indicate night time as it the night goes today. These proteins that are around at night start to disappear and they're replaced by proteins that indicate daytime then in the middle of the day. There's

no more of this night time protein on your cells are full of this daytime protein then as you go from day tonight.

NOTE Confidence: 0.917518794536591

00:06:58.720 --> 00:07:14.000 The state high protein starts to disappear and it's replaced by night time protein 0. If the cell wants to know what time it is all it has to do is look at the ratio of this daytime protein to protein that's around at night.

NOTE Confidence: 0.933528304100037

00:07:15.020 --> 00:07:46.210 So scientists can track these rhythmic cycles of protein levels overtime in cells and they can plot or make a graph of these cycles. And So what you end up seeing is this wave like pattern of increasing and decreasing levels of proteins over this circadian time so there are a lot of proteins in our body that can work together in order to make this circadian Clock.

NOTE Confidence: 0.926220953464508

00:07:46.210 --> 00:08:16.260 And if scientists measure the levels of these proteins overtime. They see these cycles that I was talking about or during the day. Some of the levels of these proteins are going and then at night. They go back down, whereas with other proteins. They are levels go up during the night and during the day there back. They go back down and so it's this very complicated network of proteins that all work together that create this circadian Clock inside of every single one of ourselves, so now you may be wondering.

NOTE Confidence: 0.933393180370331

00:08:16.480 --> 00:08:46.630 If every single one of our cells has one of these little clocks. How are they all regulated so that they all act together well there's a master Clock inside of our brain that is located in a region of the brain called the Super chiasmatic nucleus and inside of the Super chiasmatic nucleus. There are a bunch of cells called neurons, which is the type of cell in the brain that sends information so these neurons all have there.

NOTE Confidence: 0.931220650672913

00:08:46.630 --> 00:09:20.880 Own internal clocks and they will create electrical impulses based on these internal circadian rhythms that they can then transmit to the body in order to coordinate all of the clocks inside of the rest of the body. So you can think of it as the Super chiasmatic nucleus is like a Clock tower and so, if any of the cells in the body want to know. Hey, what time in circadian rhythm should I be at all. They have to do is look at what's happening in the Super chiasmatic nucleus by detecting those electrical impulses or?

NOTE Confidence: 0.93858540058136

00:09:20.880 --> 00:09:27.100 A few other types of signals in order to calibrate their clocks to match what's happening in the rest of the body?

NOTE Confidence: 0.919372975826263

00:09:28.280 --> 00:09:58.760 So now that we know that circadian rhythms come from these cycles of proteins. That's regulated by a master Clock in our brain. We can talk about what sorts of things can influence our circadian rhythms. O circadian rhythms are able to adapt to changes in our environment and there are a few different factors that can contribute to this and these factors are called Zeit Gappers or time. Givers they can include things such as food light and temperature but the biggest sitejabber is light.

NOTE Confidence: 0.926359713077545

00:09:59.240 --> 00:10:01.630 Going to be focusing on that for the rest of the talk.

NOTE Confidence: 0.931324064731598

00:10:02.310 --> 00:10:32.520 O light is actually able to change our master Clock within our brain so it's able to mess with the clocks inside of the Super chiasmatic nucleus in order to adjust our circadian rhythms in response to changes in light patterns and the way that this happens is through a different portion of the brain called the pineal gland and the pineal gland is able to make melatonin in the absence of light so melatonin is a hormone that basically tells our body that it's dark.

NOTE Confidence: 0.92625880241394

00:10:32.520 --> 00:11:02.890 Outside and so in order to explain how melatonin is able to adjust our circadian rhythms in response to light. I'll talk to you about jet lag zero. I recently went to a scientific conference in London and so when I flew from New Haven to London. My body Clock thought that it was 3:00 PM, but London is 5 hours ahead of New Haven, so outside it was 8:00 o'clock PM.

NOTE Confidence: 0.924522042274475

00:11:02.960 --> 00:11:34.050 And so there was this disconnect between my internal body Clock and the actual time outside and this is what jet lag is and so a lot of people have been advised. Hey, if you're going to travel you should take some melatonin in order to help you combat jet lag, so that you can sleep and if you look at commercially available bottles and melatonin all over the labels. It says sleep health sleep aid promotes relaxation and sleep so a lot of us think. Hey great melatonin helps to sleep, but that's not exactly what it's doing.

NOTE Confidence: 0.895227670669556

00:11:34.700 --> 00:11:48.730 So, in order to understand what melatonin is was doing to my cells. After I landed in London. Let's think about yeah, so what's happening on the individual cell level?

NOTE Confidence: 0.916006326675415

00:11:49.280 --> 00:12:19.820 So when I landed in London. My cells were full of this daytime protein because in my body thought that it was 3:00 o'clock PM outside. However, outside it was dark. It was night time so my body started to produce melatonin and this melatonin was able to enter my cells where it interacted with the cells in order to change more of the daytime protein into nighttime protein so essentially melatonin shifted the amounts.

NOTE Confidence: 0.947344839572906

00:12:19.820 --> 00:12:27.820 Of protein so that they more closely represented what was happening outside of my body.

NOTE Confidence: 0.846461355686188

00:12:28.580 --> 00:12:29.550 And so.

NOTE Confidence: 0.954995095729828

00:12:30.120 --> 00:12:33.730 Basically, what this means is that when I went to London.

NOTE Confidence: 0.939574003219604

00:12:34.370 --> 00:13:02.500 My brain realized that it was dark and it started to shift these proteins cycles that are happening inside of our bodies in order to match the light dark cycle. That's happening outside O melatonin doesn't actually help you sleep. Instead, what it's doing is adjusting. These internal circadian rhythms, so that the timing of these rhythms match the light dark cycle that's happening outside of your body.

NOTE Confidence: 0.926845908164978

00:13:03.040 --> 00:13:24.070 So the next time that you pick up a bottle of melatonin. You can realize that instead of helping you go to sleep. It's actually adjusting the timing of that master Clock inside of your brain. It's regulating the time on the Super chiasmatic nucleus so that the time on the inside of your body matches? What's happening outside of your body?

NOTE Confidence: 0.930377066135406

00:13:25.150 --> 00:13:44.640 So I hope that from this talk you've learned that circadian rhythms come from cycles of proteins that are generated from within our own bodies and that inputs into our bodies, such as food. An light are able to influence our circadian rhythms by adjusting the timing of this master Clock inside of our brains.

NOTE Confidence: 0.931792974472046

00:13:45.250 --> 00:14:16.190 Our second speaker is Ellen Corcoran, a second year student in the molecular biophysics and Biochemistry Department. My name is Alan and I'm going to be talking about early birds versus night. Owls and the topic of sleep behavior. So I always like to begin this topic by asking the question are you an early bird or are you a night owl. and I hope once I ask

this question. You immediately began to put yourself in a category thinking. I am an early bird or I'm a night owl.

NOTE Confidence: 0.934046983718872

00:14:16.190 --> 00:14:27.490 Or I am somewhere in between. and I really like this exercise because I think it shows that as a society. We really have already sort of an ingrained way to talk about our sleep behavior.

NOTE Confidence: 0.937937557697296

00:14:27.990 --> 00:14:50.200 But just so we're all on the same page. When I am talking about an early bird. I'm talking about someone that likes to wake up early and that feels more energized and productive in the morning time where when I'm talking about a night owl. I'm talking about the opposite someone that likes to stay up late and that feels more energized and productive in the evening time.

NOTE Confidence: 0.915463209152222

00:14:50.920 --> 00:15:07.810 And this ties in nicely to Ms topic of circadian rhythms because if you stop someone on the street and you ask them about their internal Clock an what their circadian rhythm is like that, it likely differs from from someone else's circadian rhythm.

NOTE Confidence: 0.741747260093689

00:15:08.460 --> 00:15:09.140 And.

NOTE Confidence: 0.9252650141716

00:15:09.680 --> 00:15:42.410 This sort of ties into the idea that sleep behavior is kind of a sticky topic because there are so many factors that can impact a person sleep behavior. There are external factors such as your sleep environment? What's your sleep environment like? What's the temperature Watts, the level of noise? What's the light conditions. There are also many other external factors such as your stress levels? What's your job work hours things for that matter.

NOTE Confidence: 0.919605493545532

00:15:42.570 --> 00:15:59.970 There are also internal factors that are more intrinsic to who. We are as people. What's our age once our gender and something that's not often thought about which is what's our genetic variation that is giving us a certain predisposition to a given sleep behavior?

NOTE Confidence: 0.932025909423828

00:16:00.480 --> 00:16:11.310 So the agenda of my talk begins with defining some terminology that we can use to talk about our sleep behavior and defining the word chronotype?

NOTE Confidence: 0.94096302986145

00:16:12.060 --> 00:16:25.210 The second topic of my discussion is the idea that this variation in our sleep behavior can actually be thought of as an evolutionary advantage when we think about.

NOTE Confidence: 0.925098061561584

00:16:25.730 --> 00:16:42.970 The idea of sleep versus the environment and thinking about sleep as our vulnerability. The last topic of my talk is again what I hinted at earlier that we actually have a certain genetic predisposition to a given sleep behavior.

NOTE Confidence: 0.898747324943542

00:16:44.130 --> 00:17:14.220 So as I hinted at my first matter of discussion is defining some terms that we can work with and the term chronotype and we can actually breakdown. The word krone type into Krono and type, where Krono in Latin is time and this definition for chronotype is a person's propensity to sleep at a particular time during a 24 hour period, which we already talked about as being an early bird.

NOTE Confidence: 0.9202721118927

00:17:14.220 --> 00:17:27.780 Being a night owl or being somewhere in between an I want us to all take a step back into really think? Why doesn't make sense that there's such a wide variation in sleep behavior in humans?

NOTE Confidence: 0.920979976654053

00:17:28.460 --> 00:17:48.340 An evolutionary biologists have done just that and to really start to think of hypothesis as to why there is such a range of sleep behavior. In humans and there's a hypothesis called The Sentinel hypothesis where Asentinel is a guard or someone that takes watch.

NOTE Confidence: 0.906741976737976

00:17:48.880 --> 00:18:01.480 And what The Sentinel hypothesis pods is is that group living animals will share the task of vigilance during sleep. While some individuals will sleep well, others where will be awake.

NOTE Confidence: 0.920579552650452

00:18:01.980 --> 00:18:32.510 And this really gets out while sleep. It's necessary for our survival. If we do not sleep. We do not survive. But in the wild sleep is actually quite a vulnerability to us from the external environment an from predators and so the Sentinel hypothesis has actually been really well studied in Meerkats and the idea that some meerkats will take garden lookout for predators while others will take time to eat and sleep and so.

NOTE Confidence: 0.907235205173492

00:18:32.510 --> 00:18:45.650 What evolutionary biologist suggests is that this natural chronotype variation is sort of a way to overcome the vulnerability of sleep and to serve as a Sentinel hypothesis an so.

NOTE Confidence: 0.905874669551849

00:18:46.160 --> 00:19:18.600 Centinel hypothesis was actually tested very recently in a group of humans in a 2017 study in the hostage tribe in Tanzania to again see if chronotype variation can serve as a Sentinel hypothesis and the has a tribe was a particular interest because their lifestyle is not influenced by art officials like eybers such as light or temperature controlled buildings. And so to conduct the study. The sleep wake patterns of participants were measured with active graphs.

NOTE Confidence: 0.914969801902771

00:19:18.600 --> 00:19:50.190 Over a 20 day period where 33 subjects completed the study with up to 22 of the participants wearing active graphs on a given day, and the results were really astounding where the has a tribe was only all simultaneously asleep for a total of 18 minutes in a total over a 20 day period and so this is really the first demonstration of the Sentinel hypothesis in humans and at this chronotype variation in humans can really be thought of as an evolutionary.

NOTE Confidence: 0.905420541763306

00:19:50.190 --> 00:19:51.220 Advantage.

NOTE Confidence: 0.924133539199829

00:19:52.380 --> 00:20:22.850 And now moving on to the 3rd topic of discussion in my talk is the genetic predisposition of Chronotype, an really starting to think about how what's in our jeans can influence how we sleep and so to talk about this? I have to move from a Geno Type and what's in our jeans. All the way down to a phenotype or a physical feature so at this point, I'm talking about how jeans.

NOTE Confidence: 0.928023636341095

00:20:22.850 --> 00:20:44.060 Can impact our sleep behavior and what I have to talk about here is that there are different subtle variations of jeans that result from? What is called a single nucleotide polymorphism or a snip and that these subtle variations in jeans result in different phenotypes or physical features such as a given chronotype.

NOTE Confidence: 0.907003045082092

00:20:44.580 --> 00:21:14.590 And this option gets misconstrued by science media where you see articles publishing where there's no one gene that's dictating your sleep behavior such as you know, having this gene. They make you a night owl or the genetic genetic basis of your chronotype is linked to this gene and when we think back to Anas talk where we have all of these cycling proteins in ourselves that are working in these complex biochemical pathways.

NOTE Confidence: 0.926054060459137

00:21:14.600 --> 00:21:37.460 It really makes no sense that this is going to all be dictated by a single gene so I really want to mark this. This concept that we see so often in science media is incorrect and instead what we have to do as scientists is to do something called a genome wide Association study to identify the genetic factors of a complex trade.

NOTE Confidence: 0.913864493370056

00:21:38.270 --> 00:21:52.340 And what the Geo study does is it looks for associations of these snips. These single nucleotide polymorphism across the human genome to correlate with particular traits for example, your chronotype.

NOTE Confidence: 0.918184876441956

00:21:52.970 --> 00:22:23.480 And so a way to talk about you know how do we look for all these genetic factors that influence a complex trace such as a krone? Type is to think about this topic like making a cocktail and just like you don't have one gene determining your chronotype or your sleep behavior. You don't have one ingredient, making up a cocktail and so my favorite cocktail to talk about is the Bloody Mary.

NOTE Confidence: 0.912908375263214

00:22:23.540 --> 00:22:53.800 And I really don't like the Bloody Mary based on its taste. But what I like about the Bloody Mary is it's the most chemically complex drink because you have hundreds of flavor compounds that are working together in these complex biochemical reactions to give the Bloody Mary. It's unique flavor of salty. Sweet savory sat a little bit sour, but not too bitter. And so just like it's not the vodka. That's making the states of the Bloody Mary. It's

NOTE Confidence: 0.924951910972595

00:22:53.800 --> 00:23:25.370 You know the addition of the tomato juice. Tabasco sauce horseradish. The celery salt and the list goes on and you know just like there's all these ingredients coming together to make the taste of the Bloody Mary. There's all of these jeans that are coming together to give you your certain genetic predisposition to acrona type and just like there can be subtle variations in the jeans that can influence the chronotype. There can be subtle variations in the ingredients.

NOTE Confidence: 0.938610911369324

00:23:25.370 --> 00:23:39.390 That can influence the taste of the Bloody Mary. For example, if you want. Your Bloody Mary to be a little bit more sour. You're going to increase the lemon if you want it to be a little bit spicier. You're going to increase the horseradish and so on, and so forth.

NOTE Confidence: 0.928407788276672

00:23:40.240 --> 00:24:15.250 And so again I wanted to come back to the idea that in the genome wide Association study what we're doing is we're looking at

you know the snips and genetic factors across the human genome that are correlating with the certain chronotype and there was actually a recent study that came out in nature, where they were looking at the genome wide Association analysis of Chronotype in over 600,000 individuals to provide insight circadian rhythms and one of the plot from this paper that I wanted to touch briefly on is called a Manhattan plot where this is really the crux.

NOTE Confidence: 0.92121034860611

00:24:15.250 --> 00:24:48.630 Of all of this genome wide Association analysis is shown in this kind of plot an it's called a Manhattan plot because it looks a lot like a Manhattan skyline. So I want you to visualize it on the X axis. They have all the chromosomes map from all the way from one to 23. You have 23 pairs of chromosomes an on the Y axis? What they plot is the significant so different points on the genome will have a given significance of correlating to a particular Corona type so the one that I pulled was from.

NOTE Confidence: 0.903866827487946

00:24:48.630 --> 00:25:01.730 The different snips correlating to morning. Is and basically points that have a higher correlation to morning. This will look higher on the graph and sort of give that skyline skyscraper appearance.

NOTE Confidence: 0.913311183452606

00:25:02.330 --> 00:25:34.460 And so there was a lot of evidence that the natural variation circadian preference can be ascribed to several different different mechanisms and they found several prominent genetic variations that can lead to Morningness. For example, they found genetic variation near multiple cores. Circadian rhythm jeans. These are the jeans that are encoding. The cycling proteins. That Anna talked about that are cycling in ourselves and acting as clocks, but they also found something that was also really interesting, which was variance in jeans important to the correct formation and functioning.

NOTE Confidence: 0.912711203098297

00:25:34.460 --> 00:25:50.490 Of retinal ganglion cells, and how our bodies can be differentially sensitive to our light environment and this can also impact our sleep behavior. And then finally there are variants in jeans with known role in appetite regulation an insulin and caffeine metabolism.

NOTE Confidence: 0.905724346637726

00:25:50.970 --> 00:26:01.190 And So what I hope you learn from my talk is a what's a chronotype and that you can really use. This work to talk about a person's propensity to sleep during a 24 hour period.

NOTE Confidence: 0.918436229228973

00:26:01.690 --> 00:26:33.560 Next I hope I taught you that there that chronotype variation can really be thought of as an evolutionary advantage for a given species and then finally I hope I have taught you that there is a certain genetic

predisposition to chronotype our third. Speaker is carrying Davidson, a second year student in the genetics Department. Hi everyone, I'm Carrie Ann and today. I want to pose a seemingly simple question, which is why do we sleep and when we think about this? Question it's actually kind of crazy that we have to ask it at all right.

NOTE Confidence: 0.903627395629883

00:26:33.560 --> 00:26:56.390 I mean, we don't have to ask why we eat or while we drink. Yet sleep is just as fundamental need. We can't escape it. In fact, we can live for longer without food, then we can without sleep and Furthermore. Scientists don't have a unified consensus about why we sleep instead. There are 4 main hypothesis about why we sleep.

NOTE Confidence: 0.910282492637634

00:26:56.920 --> 00:27:19.730 1st is that it allows us to conserve. Enerji 2nd is that it allows us to form new long-term memories. While we forget unimportant. Details about our day and 3rd. It is a whole body restorative process that is absolutely vital to our human health finally 4th. It is evolutionarily conserved all animals sleep so we do too.

NOTE Confidence: 0.91638046503067

00:27:20.570 --> 00:27:44.460 And before we get to why we sleep. Let's first briefly define what we mean when we say that an animal is sleeping. We can define sleep as a natural rapidly. Reversible state characterized by reduced responsiveness an activity in loss of consciousness. We can use changes in the activity of our brain to more accurate and more accurately describe what we mean by sleep.

NOTE Confidence: 0.907931983470917

00:27:45.170 --> 00:28:16.200 A brain is composed in part by cells called neurons and these neurons form connections. An communicate with each other through an electrical activity. We can measure. This electric we can measure. This electrical activity using a cap with electrodes on it, and these electrodes will record. What is called an electroencephalogram or more commonly called an EEG this EG is measuring the electrical signals in our brain which appear on the EEG trace.

NOTE Confidence: 0.90610259771347

00:28:16.200 --> 00:28:26.410 As waves by recording EEG measurements at various times. We can see clear differences in the brain waves of people when they're asleep versus when they are awake.

NOTE Confidence: 0.91474461555481

00:28:26.930 --> 00:28:41.100 When we are asleep during the night our brain weighs actually changed such that we can define for different phases of sleep and these phases cycle a couple of times in a full 9 hours of sleep.

NOTE Confidence: 0.910884618759155

00:28:41.960 --> 00:29:13.470 We can broadly define these 4 phases is rapid eye movement or non rapid eye movement sleep and it is during rapid eye movement sleep or REM sleep that as the name suggests, our eyes are moving back and forth rapidly and we are dreaming were in a very deep sleep, and in fact, in most cases were actually paralyzed so that we do not act out our dreams. So sleep must be performing some pretty important functions for us to need to be unconscious for the art of our lifetime.

NOTE Confidence: 0.919380128383636

00:29:13.700 --> 00:29:44.150 Which brings us to the first hypothesis of why we sleep? Which is that we sleep to conserve enerji? When I first heard this hypothesis. I immediately thought of hibernating animals but quickly learn that hibernation is not the same as sleep. Hibernation is a state that animals can go into during the winter in order to conserve. A ton of Energi when food is scarce, an the brain activity of these hibernating animals is actually more similar.

NOTE Confidence: 0.921355664730072

00:29:44.150 --> 00:30:00.090 To the awake brain of these animals at times, while at other times during the hibernation period. The brain activity is actually so low that it can't be accurately measured and what really allows these animals to conserve so much energy.

NOTE Confidence: 0.937979519367218

00:30:00.660 --> 00:30:27.840 Is that their body temperature drops drastically and so their metabolism? Is greatly slowed and fantastic example of an animal? Who drops its body temperature drastically is the Arctic ground squirrel. And while hibernating the Arctic grounds world drops is body temperature from 99 degrees Fahrenheit to 27 degrees Fahrenheit, which is below. The freezing temperature of pure water like that is absolutely crazy.

NOTE Confidence: 0.931717216968536

00:30:28.350 --> 00:30:58.770 However, for us humans and a night of sleep. We're only reducing our body temperature from 98.6 degrees Fahrenheit to 96.4 degrees Fahrenheit and this is a pretty small change in temperature, which allows us to only save about 100 calories, which is as much as a banana or about a spoonful of peanut butter. Now I don't know about you, but a spoonful of peanut butter is not enough for me to avoid starvation so.

NOTE Confidence: 0.928942799568176

00:30:58.770 --> 00:31:08.610 While we do can serve a little energy during sleep. It is probably not the main reason that we, as humans must be unconscious for the art of our lives.

NOTE Confidence: 0.921123266220093

00:31:09.290 --> 00:31:41.260 This brings us to our second hypothesis of why we sleep, which is that we sleep to consolidate our memories. And this is very true. We do form memories. While we sleep. The activity of our brain during sleep allows us to remove some connections between our neurons. While we strengthen others. This process involves crosstalk between 2 areas of the brain. The neocortex and the hippocampus the neocortex is where we store our long-term memories.

NOTE Confidence: 0.914490044116974

00:31:41.280 --> 00:32:04.750 And the hippocampus is where we saw our short term memories during sleep are neurons transport are neurons transfer information from our hippo campus to the neocortex for long term storage and while this process is very important. I'm still left wondering OK but still why do we need to be unconscious and paralyzed during REM sleep to form new memories.

NOTE Confidence: 0.924800157546997

00:32:05.320 --> 00:32:36.720 The 3rd hypothesis for while we sleep also involves an important function that we're able to perform when we're asleep and that is restoration of our entire body sleep is truly vital to nearly every aspect of our human health from our mental health to cardiovascular health immune health creativity and beyond. Lack of sleep is a risk factor for a wide range of diseases and this reason for why we sleep is so important that we will hear a lot more about it from our next speaker.

NOTE Confidence: 0.91740870475769

00:32:37.640 --> 00:33:12.130 So finally we have arrived at our 4th hypothesis which is that we sleep because it is evolutionarily conserved. All animals sleep so we do too. Even jellyfish sleep and this is pretty crazy because jellyfish don't even have a brain. They just have a rudimentary nervous system called a nerve net yet. In 2017 scientists at Caltech published evidence in the Journal of current biology of a sleep like State in the Cassiopeia Jellyfish, the Cassiopeia Jellyfish is a fun little blob that's it's upside down on the ocean floor.

NOTE Confidence: 0.907289564609528

00:33:12.130 --> 00:33:32.420 And pulses so the team of scientists counted the number of times that each jellyfish post over the course of a day over a period of time and then over the night time and what they found is that the jellyfish post much less frequently and less consistency consistently at night.

NOTE Confidence: 0.910094320774078

00:33:32.980 --> 00:33:54.600 In this step with our definition of sleep being a natural state of reduced activity. Next, the team did an experiment where they pick. The jellyfish off the bottom of the tank and moved to the Top these jellyfish really prefer to be on a solid surface. So when they're released from the Top of the tank into the open water they'll post to get back down to the bottom.

NOTE Confidence: 0.906305611133575

00:33:55.290 --> 00:34:09.990 When the scientist did this during the day, the jellyfish would would would respond by Pulsing after being let go into the open water went in about 2 seconds, so they responded pretty quickly and brought themselves back down to the ocean floor.

NOTE Confidence: 0.907097995281219

00:34:10.490 --> 00:34:17.620 But when the scientist did this at night. It took the jellyfish 3 times longer to respond by Pulsing.

NOTE Confidence: 0.89462798833847

00:34:18.400 --> 00:34:47.180 However, when the scientist then repeated this experiment with the same jellyfish at night. They responded as if it were the daytime. They responded much more quickly and so this fit with our definition of sleep that it is rapidly reversible. Once the scientist sort of woke the jellyfish up, they could respond as if it was during the day and that it's a sleep is characterized by reduced responsiveness. It took the sleeping jellyfish a longer amount of time to respond to being let go into the open water.

NOTE Confidence: 0.914410591125488

00:34:48.740 --> 00:35:13.130 So now we know that all animals must sleep. We also must think about the challenges that animals face when they're sleeping and aquatic mammals are a fantastic example of this animals such as Dolphins. Ann Wells must stay in the water, but they also must breathe and watch out for predators in order to solve this problem. Dolphins do something really cool, which is that they sleep with one hemisphere of their brain at a time.

NOTE Confidence: 0.892515540122986

00:35:13.770 --> 00:35:28.710 This is called a symmetrical sleep or uni hemispheric sleep. We can define this unihemispheric sleep by using electrodes similar to what I described for humans to record something like an EEGA brain activity.

NOTE Confidence: 0.905720949172974

00:35:29.380 --> 00:35:55.170 So from these electrode recordings, sometimes we can see that both hemispheres of the dolphin brains show awake activity. While at other times. One hemisphere would show a very different pattern of activity than the other indicating that one hemispheres asleep while one is awake and then after a period of time. These brain activities in the two hemispheres would switch and the other hemisphere of the Dolphins brain would go to sleep.

NOTE Confidence: 0.891284346580505

00:35:55.760 --> 00:36:08.200 When the dolphin is engaging in this unihemispheric sleep. It's often described as seeming groggy. Yet it still able to swim. It still able to go up to the surface to breathe and to watch out for predators.

NOTE Confidence: 0.88545560836792

00:36:09.280 --> 00:36:33.240 Wells also can sleep with one hemisphere of their brain at a time. But other times somewhere else such as sperm whales sleep standing and this is a really cool thing that wells do. I'd encourage you to look up a picture of this these walls will such a sperm whales will swim up to the surface to take a big gulp of air and then they'll slowly sink down to the abyss in a vertical position.

NOTE Confidence: 0.915496349334717

00:36:33.740 --> 00:36:48.500 An they can do this for about 90 minutes an hour to 90 minutes and then when they need to breathe. The wake up the swim back up to the surface take a big gulp of there and then repeat the process and they are able to get a nice deep sleep, with both hemispheres of their brain.

NOTE Confidence: 0.896265149116516

00:36:49.030 --> 00:37:23.700 Mammals on land could also use asymmetrical sleep. It's early as the 14th century actually each also wrote about birds that sleep with open I and a great visual example of this is ducks, which can often be sleeping with one eye seen sleeping with one eye, open, but if you have all your ducks in a row. Then the Ducks in the center of that row will close both of their eyes while the ones on the end of that row will keep one eye open to lookout for predators and this really links back to the central hypothesis when members of a group have different sleep patterns to allow someone to keep guard.

NOTE Confidence: 0.915096163749695

00:37:23.700 --> 00:37:25.920 While others get a good nights sleep.

NOTE Confidence: 0.921928584575653

00:37:26.480 --> 00:37:57.980 Now I really wish that I could sleep with one eye open. I feel like I could get so much more done in a day. But what is really crazy is that humans too? Can have asymmetrical sleep. This is especially evident when we're in an unfamiliar place like a hotel room or a sleep lab. This was reported by a group from Brown University in 2016 in the Journal of current biology here. They describe what they called the first night effect. The first night of participant went into the sleep lab.

NOTE Confidence: 0.911240518093109

00:37:58.060 --> 00:38:25.580 Scientists recorded the activity in their brain by a variety of different measurements and they recorded the activity in the two hemispheres separately they would allow the participant to go to sleep and then they would play some routine noises in the background and at certain times they would play what they called a deviant sound and this is the sound that wouldn't wake. The participant up, but may be considered as something they would want to watch out for it was a deviant sound.

NOTE Confidence: 0.899703025817871

00:38:26.140 --> 00:38:58.910 And what they observed in the brain activity of the participants during the first night of sleep is that one. Hemisphere throughout the night showed less deep sleep activity. The entire night and then when they played the deviant noise. This hemisphere that was less asleep from the get-go also responded with a greater increase in activity to that deviant sound. Then the hemisphere that was in a deeper sleep. But when the team repeated these experiments the second night of participant was in the sleep lab.

NOTE Confidence: 0.916144549846649

00:38:58.910 --> 00:39:29.900 This difference in brain activity and difference in response to a deviant noise with no longer apparent. It didn't exist anymore. An so this, this phenomenon. This first night effect can really explain why we may not feel like we got a good night sleep. The first night in an unfamiliar place such as a hotel room or a new apartment. And while this effect? Is is pretty small. It's still pretty amazing that we have some sort of asymmetrical sleep at times.

NOTE Confidence: 0.912408113479614

00:39:30.850 --> 00:40:01.710 Finally, I want to dispel one misconception about sleep and that is that humans didn't always sleep once per day. In fact before the Industrial Revolution humans actually slept twice per day. This is known as biphasic sleep and it could take 2 forms such as a siesta, which we still see in some cultures today or in what I'd like to think of as an extended midnight snack and in this case people would go to sleep when the sun went down, but then they would wake up around midnight and they would.

NOTE Confidence: 0.913841664791107

00:40:01.710 --> 00:40:10.220 Eat and they would drink and they play music visit their neighbors. They would go back to sleep. After a couple hours of being awake and wake back up when the sun came up.

NOTE Confidence: 0.91449362039566

00:40:10.970 --> 00:40:42.030 But I was really with the increase in shift work that we saw with the Industrial Revolution that allow people to no longer have these extended periods to engage in biphasic sleep and Furthermore. Edison's lightbulb was lighting up the night, keeping us up awake longer. Edison also famously said that sleep is a criminal waste of time inherited by our cave days and I would really challenge us to do away with this thinking of sleep is a waste of time and really see it as a vital beautiful.

NOTE Confidence: 0.920212268829346

00:40:42.030 --> 00:41:07.860 Important process necessarily necessary for human health I mean, it wouldn't be so evolutionary conserved if it wasn't doing something pretty important. Our 4th and final speaker is Elizabeth NAND, a second year student in the microbial pathogenesis Department. Hi I'm Eliza-

beth Nan Dan. I'm going to pick up where Carrie Ann left off. But before I do that. I want to put this idea in your head that Sleeping Beauty had it right.

NOTE Confidence: 0.732024729251862

00:41:09.750 --> 00:41:10.350 0.

NOTE Confidence: 0.924086332321167

00:41:10.950 --> 00:41:17.040 Why do we sleep Carrie and talk to us about the first three hypothesis but I'm going to pick up on restoration.

NOTE Confidence: 0.943615615367889

00:41:17.830 --> 00:41:29.370 And I think the best way to talk about restoration is to talk about what happens when we don't sleep at all. In other words, what would have happened if Sleeping Beauty had stayed awake that whole time.

NOTE Confidence: 0.928766489028931

00:41:31.220 --> 00:41:42.340 Well somebody is actually done this, the world record for staying awake is was set by Randy Gardner in 1964 and he stayed awake for 11 days and 24 minutes.

NOTE Confidence: 0.948554515838623

00:41:42.890 --> 00:41:52.970 Some interesting things about this was that he was 17 and he did this for a high school science fair project because that's what everybody wants to do for a high school science fair project.

NOTE Confidence: 0.936335980892181

00:41:54.310 --> 00:42:16.880 But he did this in California and some researchers in California caught wind of this and immediately rushed to study him and in the paper that they published after the fact they found that Randy Gardner experienced a serious loss of mental capacity. He lost the ability to speak clearly. He was irritable couldn't concentrate had memory lapses literally hallucinated.

NOTE Confidence: 0.901450097560883

00:42:17.400 --> 00:42:19.120 He slurred his speech.

NOTE Confidence: 0.909720778465271

00:42:19.710 --> 00:42:29.490 He had fragmented thinking he was paranoid and he had reduced responsiveness, so Randy Gardner really wasn't doing so well at the end of this ordeal.

NOTE Confidence: 0.925236761569977

00:42:30.210 --> 00:42:40.960 But at the end of it, he slept for over 14 hours and then the following night. He slept for 10 hours and he recovered completely from all of his psychotic symptoms.

NOTE Confidence: 0.926210701465607

00:42:41.480 --> 00:42:42.470 However.

NOTE Confidence: 0.936450898647308

00:42:43.160 --> 00:43:01.800 In an interview with NPR in the mid 2000s, he revealed that he lost the ability to sleep completely. He attributes this to his ordeal when he was 17. This hasn't been studied completely but it's clear that not sleeping for 11 days in 24 minutes is probably not good for you.

NOTE Confidence: 0.929780066013336

00:43:03.100 --> 00:43:07.330 This is supported by experiments done in rats.

NOTE Confidence: 0.903069674968719

00:43:07.840 --> 00:43:35.890 So, in 1989, there was an experiment done on total sleep deprivation in rats and the scientists put these rats on a spinning platform that was over cold water and whenever computer detected that the rats were going into a sleep like state. The platform would start spinning an if the rats did not wake up, they would be pushed into the water. And when I'm tired. I don't want to be dunked in cold water so the rats experienced total sleep deprivation.

NOTE Confidence: 0.899491369724274

00:43:36.980 --> 00:43:58.390 And one of the ways that the scientists measured the health and Wellness of these rats was by assigning an appearance means subject rating and that's basically just the scientists looking at the rats and saying does this rat look healthy does this red not look healthy on a scale of 1 to 5 with one being this. Red is very healthy and 5 being this rat really isn't doing so well.

NOTE Confidence: 0.918528735637665

00:43:59.240 --> 00:44:09.220 And what they found is in the first half of the experiment. The sleep deprived rats and the control rats look very similar, but in the last half of the experiment.

NOTE Confidence: 0.909840941429138

00:44:10.070 --> 00:44:16.620 The sleep deprived rats took a steep decline into unhealthy appearance.

NOTE Confidence: 0.873655319213867

00:44:17.770 --> 00:44:18.910 And what's most?

NOTE Confidence: 0.913110554218292

00:44:19.460 --> 00:44:27.290 Astounding about this experiment is that all of the mice. Excuse me all of the rats in this experiment died within 3 weeks.

NOTE Confidence: 0.953505218029022

00:44:28.500 --> 00:44:32.960 Unfortunately, the cause of death was not completely.

NOTE Confidence: 0.904908061027527

00:44:33.490 --> 00:44:34.390 Determined.

NOTE Confidence: 0.905407309532166

00:44:35.380 --> 00:44:39.050 But every single rat in this experiment died within 3 weeks.

NOTE Confidence: 0.940385580062866

00:44:40.210 --> 00:44:47.320 And that kind of brings me to the thesis statement of this talk is that you need to sleep and you're probably not sleeping enough.

NOTE Confidence: 0.942130744457245

00:44:48.480 --> 00:45:04.380 Sleep deprivation has serious health consequences, including obesity diabetes heart disease reduced immunity or mental health suicide. An shortened life expectancy. All of these will go through at least briefly in this talk and will start with obesity diabetes and heart disease.

NOTE Confidence: 0.944859683513641

00:45:05.530 --> 00:45:13.870 But to understand the connection between sleep deprivation and these diseases. We have to understand why we get hungry in the 1st place.

NOTE Confidence: 0.936391294002533

00:45:14.420 --> 00:45:17.100 And that has to do with hunger hormones.

NOTE Confidence: 0.913668096065521

00:45:17.630 --> 00:45:28.180 So when you are hungry before you eat your stomach releases a hormone called ghrelin ghrelin travels to your brain and tells your brain that you are hungry.

NOTE Confidence: 0.910899579524994

00:45:28.840 --> 00:45:50.280 Hopefully then you eat and after you eat your adipose tissue or your fat tissue releases a different hunger. Hormone called Leptin Leptin Leptin travels to your brain and tells your brain that you are full and in this way. Your stomach and your fat cells using ghrelin and leptin tell your brain when you are hungry and when you were full.

NOTE Confidence: 0.921899914741516

00:45:51.470 --> 00:46:11.940 So that's in a normal healthy sleeping person. But what happens when you're sleep deprived is that this balance is thrown completely out of Wack and your stomach produces more Grill in your fat cells produce less leptin. An what this means is you have a grill and overload and your appetite increases.

NOTE Confidence: 0.939236104488373

00:46:12.540 --> 00:46:19.410 Extremely So what this means is that you are much more likely to eat even though you might not need fuel.

NOTE Confidence: 0.932430982589722

00:46:20.120 --> 00:46:21.190 In addition,

NOTE Confidence: 0.946106433868408

00:46:21.900 --> 00:46:42.890 With this imbalance given the choice between a candy bar and a salad. You are much more likely to choose the candy bar and this is the crux of the connection between sleep deprivation and obesity diabetes and heart disease sleep deprived. People are much more likely to eat more and make less healthy food choices than those who are.

NOTE Confidence: 0.860751867294312

00:46:43.450 --> 00:46:44.640 Sleeping enough.

NOTE Confidence: 0.91067111492157

00:46:46.060 --> 00:46:50.740 Going back to that rat study, we also see the same effect.

NOTE Confidence: 0.919522225856781

00:46:51.780 --> 00:47:04.090 In the same experiment the sleep deprived rats 8, almost twice as much as they were eating before they were put on the spinning platforms compared to the control rats only about 8 about 20% more.

NOTE Confidence: 0.955423057079315

00:47:04.880 --> 00:47:10.860 So we can see that there is a clear connection between increased food consumption and sleep deprivation.

NOTE Confidence: 0.889049410820007

00:47:12.510 --> 00:47:14.290 Moving on to reduced immunity.

NOTE Confidence: 0.941789329051971

00:47:15.400 --> 00:47:31.820 We're going to do a very brief review of the immune system so the immune system has immune cells and immune molecules and together these cells and molecules combat pathogens pathogens are things like viruses, bacteria, fungi and parasites that could make you sick.

NOTE Confidence: 0.912978172302246

00:47:34.150 --> 00:47:37.760 But what's interesting is that sleep and immunity affect each other.

NOTE Confidence: 0.911319613456726

00:47:38.530 --> 00:47:42.740 So let's start with how immunity affects sleep.

NOTE Confidence: 0.935517251491547

00:47:43.260 --> 00:48:05.020 Immune molecules seem to have their own circadian rhythms outside of the circadian rhythm of the Organism so we've talked a lot about circadian rhythms at the whole Organism level. But what's interesting is that recent research has shown that the molecular circadian rhythm. When these immune molecules are being released seems to differ from the circadian rhythm of the whole Organism.

NOTE Confidence: 0.928446114063263

00:48:05.850 --> 00:48:23.420 Furthermore, infections seem to promote sleep and if anybody has ever had. The common cold, they can attest to this when you feel sick. You also feel tired so these are some ways that the immune system and your immune reactions are affecting your sleep.

NOTE Confidence: 0.928130924701691

00:48:24.570 --> 00:48:38.420 But what about the other way? How would it sleep affecting immunity will sleep deprived people have a decreased number of immune cells in your body they literally have less cells that are responsible for fighting off these pathogens.

NOTE Confidence: 0.913711488246918

00:48:39.130 --> 00:48:53.920 In addition, sleep deprivation reduces general immune function so this is a two hit system where if you're not sleeping enough. You have less cells and these cells that you do have are much less efficient at doing their jobs.

NOTE Confidence: 0.935872733592987

00:48:54.580 --> 00:49:00.490 And what this the real conclusion of this is that sleep deprived people are much, much, much more likely to get sick.

NOTE Confidence: 0.901613771915436

00:49:02.240 --> 00:49:05.520 Moving on to poor mental health and suicide.

NOTE Confidence: 0.949025571346283

00:49:06.220 --> 00:49:15.230 Lack of sleep correlate's to mental health issues. In fact, trouble sleeping is one of the diagnostic criteria for depression, anxiety and other mental health disorders.

NOTE Confidence: 0.932231187820435

00:49:15.820 --> 00:49:45.590 So while we know that there is a connection between mental health and sleep what we do not know is what is causing? What is it that mental health is causing sleep problems or is it that lack of sleep is causing mental health problems. This is still up for debate and there's lots of research trying to tease this out, but what we do know is that sleep disturbance

is a risk factor for suicidality suicidality is the act of thinking about planning or death by suicide.

NOTE Confidence: 0.940930306911469

00:49:46.570 --> 00:50:06.140 And what this boils down to is a concept called Hypo Frontality, which is the decrease in frontal lobe function, so the front of your brain is called the prefrontal cortex and it is responsible for executive function executive function is things like problem solving ability and the ability to make tempered rational decisions.

NOTE Confidence: 0.928526282310486

00:50:06.970 --> 00:50:21.510 When we see hypo frontality that function is decreased So what we see is a lack of problem solving ability and increased impulsive behavior when you have lack of problem solving ability an impulsive increased impulsive behavior.

NOTE Confidence: 0.917112112045288

00:50:22.250 --> 00:50:29.630 Coupled with other risk factors, we see a Series A significant increase in risk for suicidality.

NOTE Confidence: 0.936106979846954

00:50:30.690 --> 00:50:51.670 And finally we have shortened life expectancy and to describe this. I'm going to talk about a very, very, very rare genetic disease called fatal familial insomnia, so this disease is caused by a genetic mutation, but it is very rare only about 40 families in the entire world carry this mutation.

NOTE Confidence: 0.921651482582092

00:50:52.910 --> 00:51:05.260 And what this disease does is it causes a progressive inability to sleep. So this starts with the inability of the patient to take a nap and progress is all the way to the patient cannot ever sleep ever.

NOTE Confidence: 0.916508674621582

00:51:06.240 --> 00:51:16.840 And this condition, invariably leads to death within and within an average of 18 months. But what's interesting is that the cause of death is actually organ failure.

NOTE Confidence: 0.931702435016632

00:51:18.040 --> 00:51:28.360 But this disease doesn't actually affect the organs. It only effects the brain. So here we see a very clear example of the lack of sleep and the disease affecting the brain has.

NOTE Confidence: 0.925871610641479

00:51:28.930 --> 00:51:41.840 That leads to organ failure in these patients and that's what causes death. So while we don't fully understand this disease. This disease shows a clear connection between sleep and restoration.

NOTE Confidence: 0.895277261734009

00:51:44.040 --> 00:51:45.870 So we're going to take a pause.

NOTE Confidence: 0.922761380672455

00:51:46.580 --> 00:51:52.200 And this is a lot of Doom and gloom for a podcast, but there is a silver lining here.

NOTE Confidence: 0.935139715671539

00:51:53.640 --> 00:52:21.900 And that is that sleeping 8 hours a night might actually be part of the resolution to these serious epidemics. We've been dealing with the epidemics of obesity heart disease and mental health for decades, and honestly. We don't have fantastic solutions for these right now. We're working on it, but we don't have the answers. But what I think is a beautiful concept is that sleeping 8 hours a night on prioritizing our sleep could put a serious dent in something that we don't really have solutions for right now.

NOTE Confidence: 0.913206517696381

00:52:23.940 --> 00:52:31.050 So with that I'm going to encourage you very strongly to go home and get your shut eye.

NOTE Confidence: 0.929377853870392

00:52:31.830 --> 00:52:42.980 And if everything that I've told you today doesn't convince you that you really, really need to be sleeping, 8 hours a night just know that 60% of you would choose sleep over sex.

NOTE Confidence: 0.90739381313324

00:52:43.610 --> 00:53:04.590 And with that. Thank you for listening to our podcast. Thanks for tuning into this episode of the Yale Journal of biology and medicine podcast. We hope that you enjoy this special episode. If you're located in or near New Haven keep an eye out for future science at brewery events. Wherever you're located keep an eye open for a next podcast episode, which will focus on our newest issue organelles.

NOTE Confidence: 0.839673757553101

00:53:05.140 --> 00:53:38.630 Thank you to the yield broadcast Center for help with recording editing and publishing our podcast. Thank you to the Yale School of medicine for being a home for YJBM in the podcast and to the yield Graduate School of Arts and Sciences for supporting Yale Science diplomats. Thank you to the YJBM editorial board, especially the editors in chief, Devon Washe and Amelia Hallworth, and the outreach coordinator Kavita Israni-Winger For more information on YJBM in our podcast. Please visit medicine.yale.edu slash yjbm. be sure to check out our Journal by searching YaleJournal of biology and medicine at pub Med.

NOTE Confidence: 0.293205827474594

00:53:38.630 --> 00:53:39.130 Com.

NOTE Confidence: 0.88246351480484

00:53:39.790 --> 00:54:12.340 Thank you to the yellow science, diplomats, especially handle Weinberg Wolf, a fifth year. PhD student in psychology Department and the committee and the committee chair of Science at brewery for planning. The live version of this event For more information on yale science diplomats. Please visit their website, sciencediplomats.sights.yale.edu, or check them out on Facebook. We'd love your feedback and questions so please. Feel free to tell us your thoughts by emailing us at YJBM at yale.edu if you enjoyed our podcast. Please rate us on iTunes or shares with your friends.

NOTE Confidence: 0.889097392559052

00:54:12.340 --> 00:54:15.510 See you next month for the next installment of the YJBM podcast.