WEBVTT

NOTE duration:"00:54:05"

NOTE recognizability:0.936

NOTE language:en-us

NOTE Confidence: 0.950317

00:00:00.000 --> 00:00:02.280 I really appreciate that.

NOTE Confidence: 0.950317

00:00:02.280 --> 00:00:03.744 I really appreciate that

NOTE Confidence: 0.950317

00:00:03.744 --> 00:00:04.476 wonderful introduction.

NOTE Confidence: 0.950317

00:00:04.480 --> 00:00:06.080 Thank you so much.

NOTE Confidence: 0.950317

00:00:06.080 --> 00:00:08.640 I am so pleased to be here.

NOTE Confidence: 0.950317

00:00:08.640 --> 00:00:12.200 I see familiar faces and names like Violet,

NOTE Confidence: 0.950317

00:00:12.200 --> 00:00:14.400 Kimball, Hi, Violet and you,

NOTE Confidence: 0.950317

00:00:14.400 --> 00:00:17.598 Al and Marina and other people.

NOTE Confidence: 0.950317

00:00:17.600 --> 00:00:20.302 I really, it's feels like I am

NOTE Confidence: 0.950317

00:00:20.302 --> 00:00:22.799 coming and joining some friends so.

NOTE Confidence: 0.950317

00:00:22.800 --> 00:00:25.560 I want to, in the spirit of that,

NOTE Confidence: 0.950317

00:00:25.560 --> 00:00:27.960 encourage you to ask me questions

NOTE Confidence: 0.950317

00:00:27.960 --> 00:00:30.060 all along while I give this talk

NOTE Confidence: 0.950317

00:00:30.060 --> 00:00:32.814 because I I will know then that

NOTE Confidence: 0.950317

00:00:32.814 --> 00:00:34.590 you're listening and understanding

NOTE Confidence: 0.950317

00:00:34.590 --> 00:00:36.917 and you're still with me and so

NOTE Confidence: 0.950317

00:00:36.920 --> 00:00:38.397 and then of course at the end,

NOTE Confidence: 0.950317

00:00:38.400 --> 00:00:41.426 I guess we have a whole 15 minutes of time.

NOTE Confidence: 0.950317

00:00:41.426 --> 00:00:42.917 We'll see how much time I take,

NOTE Confidence: 0.950317

00:00:42.920 --> 00:00:44.384 but let's get started.

NOTE Confidence: 0.950317

00:00:44.384 --> 00:00:45.840 All right, so.

NOTE Confidence: 0.7715614

00:00:53.530 --> 00:00:53.930 Okay. Hey,

NOTE Confidence: 0.9251585

00:00:57.090 --> 00:00:58.488 did it, Did it, Did it?

NOTE Confidence: 0.9251585

00:00:58.490 --> 00:00:59.710 Did it show up?

NOTE Confidence: 0.9251585

00:00:59.710 --> 00:01:00.930 What's going on here?

NOTE Confidence: 0.9251585

00:01:00.930 --> 00:01:01.978 Something's happening.

NOTE Confidence: 0.9251585

00:01:01.978 --> 00:01:05.646 The share is not working very well.

NOTE Confidence: 0.9251585

00:01:05.650 --> 00:01:07.580 Or my our point is

NOTE Confidence: 0.9251585

00:01:07.580 --> 00:01:09.124 not working very well.

NOTE Confidence: 0.9251585

00:01:09.130 --> 00:01:09.730 Here we go.

NOTE Confidence: 0.9603805

00:01:20.760 --> 00:01:23.160 better. Yes. OK.

NOTE Confidence: 0.9603805

00:01:23.160 --> 00:01:25.960 So I had a very long title.

NOTE Confidence: 0.9603805

00:01:25.960 --> 00:01:27.280 And so I said forget it.

NOTE Confidence: 0.9603805

00:01:27.280 --> 00:01:29.716 I'm not typing all that anymore.

NOTE Confidence: 0.9603805

00:01:29.720 --> 00:01:32.000 Can you see my screen?

NOTE Confidence: 0.9603805

00:01:32.000 --> 00:01:35.000 Yes. All right. All right.

NOTE Confidence: 0.9603805

00:01:35.000 --> 00:01:37.576 So let me just start by saying

NOTE Confidence: 0.9603805

00:01:37.576 --> 00:01:40.379 that we used to think it was

NOTE Confidence: 0.9603805

00:01:40.379 --> 00:01:42.791 just mammals and birds that had

NOTE Confidence: 0.9603805

00:01:42.800 --> 00:01:45.518 really good two stages of sleep.

NOTE Confidence: 0.9603805

00:01:45.520 --> 00:01:47.578 And that was just because we weren't

NOTE Confidence: 0.9603805

00:01:47.578 --> 00:01:49.429 observing closely enough and we didn't have.

NOTE Confidence: 0.9603805

00:01:49.430 --> 00:01:51.440 Necessarily all the tools or the

NOTE Confidence: 0.9603805

00:01:51.440 --> 00:01:53.714 patients to watch all the different

NOTE Confidence: 0.9603805

00:01:53.714 --> 00:01:56.262 animals sleep through the night.

NOTE Confidence: 0.9603805

00:01:56.262 --> 00:01:59.870 But but now we know that even lizards

NOTE Confidence: 0.9603805

00:01:59.870 --> 00:02:02.230 have not only great sleep but two

NOTE Confidence: 0.9603805

00:02:02.230 --> 00:02:04.688 stages of sleep which includes non REM

NOTE Confidence: 0.9603805

00:02:04.688 --> 00:02:06.908 sleep and rapid eye movement sleep.

NOTE Confidence: 0.9603805

00:02:06.910 --> 00:02:09.682 That is their Dragon's lizard's eyes

NOTE Confidence: 0.9603805

00:02:09.682 --> 00:02:12.988 will rapidly move in a stage of sleep,

NOTE Confidence: 0.9603805

00:02:12.990 --> 00:02:14.530 even Drosophila fruit flies.

NOTE Confidence: 0.9603805

00:02:14.530 --> 00:02:17.572 Seem to have two stages of sleep and

NOTE Confidence: 0.9603805

00:02:17.572 --> 00:02:20.204 the and with the reason why there's a

NOTE Confidence: 0.9603805

00:02:20.277 --> 00:02:22.727 great group in New Zealand working on

NOTE Confidence: 0.9603805

00:02:22.727 --> 00:02:25.376 this is they have the quiet stage of sleep,

NOTE Confidence: 0.9603805

00:02:25.380 --> 00:02:27.580 just like we've always observed,

NOTE Confidence: 0.9603805

00:02:27.580 --> 00:02:28.804 although very few people

NOTE Confidence: 0.9603805

00:02:28.804 --> 00:02:30.334 wanted to call it sleep.

NOTE Confidence: 0.9603805

00:02:30.340 --> 00:02:32.484 But they also have a twitching stage where

NOTE Confidence: 0.9603805

00:02:32.484 --> 00:02:34.655 their limbs twitch and they don't have many.

NOTE Confidence: 0.9603805

00:02:34.660 --> 00:02:36.460 They don't have rapid eye movements so much,

NOTE Confidence: 0.9603805

00:02:36.460 --> 00:02:39.078 but their limbs twitch just like dogs

NOTE Confidence: 0.9603805

00:02:39.078 --> 00:02:41.964 and cats do and our limbs sometimes

NOTE Confidence: 0.9603805

00:02:41.964 --> 00:02:44.484 twitch in some stages of sleep.

NOTE Confidence: 0.9603805

00:02:44.490 --> 00:02:47.286 And then now even the jellyfish.

NOTE Confidence: 0.9603805

00:02:47.290 --> 00:02:50.202 There's a great study out of Caltech

NOTE Confidence: 0.9603805

00:02:50.202 --> 00:02:53.476 a few years ago that shows the

NOTE Confidence: 0.9603805

00:02:53.476 --> 00:02:55.466 jellyfish sleeps and and probably

NOTE Confidence: 0.9603805

00:02:55.466 --> 00:02:56.806 has two stages of sleep.

NOTE Confidence: 0.9603805

00:02:56.810 --> 00:02:59.130 Or at least that's how I interpret it.

NOTE Confidence: 0.9603805

00:02:59.130 --> 00:03:00.684 We don't know about the water bear,

NOTE Confidence: 0.9603805

00:03:00.690 --> 00:03:02.328 but it looked like it was sleeping.

NOTE Confidence: 0.9603805

00:03:02.330 --> 00:03:06.370 So I I put this picture in here.

NOTE Confidence: 0.9603805

00:03:06.370 --> 00:03:08.722 So sleep has to have a really

NOTE Confidence: 0.9603805

00:03:08.722 --> 00:03:09.730 good essential function.

NOTE Confidence: 0.9603805

00:03:09.730 --> 00:03:10.570 Here's jellyfish,

NOTE Confidence: 0.9603805

00:03:10.570 --> 00:03:12.250 which doesn't even have

NOTE Confidence: 0.9603805

00:03:12.250 --> 00:03:13.930 a central nervous system.

NOTE Confidence: 0.9603805

00:03:13.930 --> 00:03:15.450 It's this is the Cassiopeia,

NOTE Confidence: 0.9603805

00:03:15.450 --> 00:03:17.490 which is an upside down jellyfish,

NOTE Confidence: 0.9603805

00:03:17.490 --> 00:03:20.646 pulsing at its waking pulse rate.

NOTE Confidence: 0.9603805

00:03:20.650 --> 00:03:24.050 And then during sleep it pulses much,

NOTE Confidence: 0.9603805

00:03:24.050 --> 00:03:25.220 much more slowly.

NOTE Confidence: 0.9603805

00:03:25.220 --> 00:03:27.950 And you can disturb a jellyfish of

NOTE Confidence: 0.9603805

00:03:28.025 --> 00:03:31.176 sleep by giving it a pulse of a jet

NOTE Confidence: 0.9603805

00:03:31.176 --> 00:03:35.280 of of water to move it and then it

NOTE Confidence: 0.9603805

00:03:35.280 --> 00:03:38.004 will wake up and be annoyed and then

NOTE Confidence: 0.9603805

00:03:38.004 --> 00:03:39.726 quickly get back down to the bottom

NOTE Confidence: 0.9603805

00:03:39.726 --> 00:03:41.760 and and try to go back to sleep again.

NOTE Confidence: 0.9603805

00:03:41.760 --> 00:03:45.453 And if you do this a lot it will actually

NOTE Confidence: 0.9603805

00:03:45.453 --> 00:03:48.693 try and make up for that lost sleep

NOTE Confidence: 0.9603805

00:03:48.693 --> 00:03:52.013 the next day by taking many more naps.

NOTE Confidence: 0.9603805

00:03:52.020 --> 00:03:53.616 We could call it jellyfish napping,

NOTE Confidence: 0.9603805

00:03:53.620 --> 00:03:55.364 but anyway, this is its pulse rate during

NOTE Confidence: 0.9603805

00:03:55.364 --> 00:03:57.099 the day and the pulse rate at night.

NOTE Confidence: 0.9603805

00:03:57.100 --> 00:04:00.402 And this is a Figure 2, I believe,

NOTE Confidence: 0.9603805

00:04:00.402 --> 00:04:02.057 of this Current Biology paper.

NOTE Confidence: 0.9603805

00:04:02.060 --> 00:04:03.908 But it doesn't even mention the

NOTE Confidence: 0.9603805

00:04:03.908 --> 00:04:05.790 fact that in for, you know,

NOTE Confidence: 0.9603805

00:04:05.790 --> 00:04:07.740 good 20 seconds at a time,

NOTE Confidence: 0.9603805

00:04:07.740 --> 00:04:08.740 it's not pulsing at all,

NOTE Confidence: 0.9603805

00:04:08.740 --> 00:04:10.940 which means it's not breathing.

NOTE Confidence: 0.9603805

00:04:10.940 --> 00:04:13.360 And that could be equivalent

NOTE Confidence: 0.9603805

00:04:13.360 --> 00:04:15.780 to our stage REM sleep,

NOTE Confidence: 0.9603805

00:04:15.780 --> 00:04:17.310 which of course they don't have.

NOTE Confidence: 0.9603805

00:04:17.310 --> 00:04:18.099 Bias it move.

NOTE Confidence: 0.9603805

00:04:18.099 --> 00:04:20.633 But we have in our REM sleep a period

NOTE Confidence: 0.9603805

00:04:20.633 --> 00:04:22.824 of time when our muscles are atonic.

NOTE Confidence: 0.93824092

00:04:22.830 --> 00:04:25.662 We are actually not able to

NOTE Confidence: 0.93824092

00:04:25.662 --> 00:04:27.983 move because we are inhibiting

NOTE Confidence: 0.93824092

00:04:27.983 --> 00:04:30.148 the reactivation of our dreams.

NOTE Confidence: 0.93824092

00:04:30.150 --> 00:04:31.490 Or maybe there's another reason

NOTE Confidence: 0.93824092

00:04:31.490 --> 00:04:33.309 for atonia that we don't know yet,

NOTE Confidence: 0.93824092

00:04:33.310 --> 00:04:36.960 but but we don't know if

NOTE Confidence: 0.93824092

00:04:36.960 --> 00:04:38.070 jellyfish are dreaming.

NOTE Confidence: 0.93824092

00:04:38.070 --> 00:04:39.446 It would be cool to see what they

NOTE Confidence: 0.93824092

00:04:39.446 --> 00:04:40.548 are dreaming about if they were,

NOTE Confidence: 0.93824092

00:04:40.550 --> 00:04:42.790 but in any case, it does appear like

NOTE Confidence: 0.93824092

00:04:42.790 --> 00:04:45.189 they have at least two stages of sleep.

NOTE Confidence: 0.93824092

00:04:45.190 --> 00:04:47.410 And here is a new paper.

NOTE Confidence: 0.93824092

00:04:47.410 --> 00:04:50.049 In science just published a few weeks

NOTE Confidence: 0.93824092

00:04:50.049 --> 00:04:52.183 ago showing that elephant seals

NOTE Confidence: 0.93824092

00:04:52.183 --> 00:04:55.410 which are you know marine mammals,

NOTE Confidence: 0.93824092

00:04:55.410 --> 00:04:57.270 they unlike other things like

NOTE Confidence: 0.93824092

00:04:57.270 --> 00:04:59.690 fur seals or dolphins or whales,

NOTE Confidence: 0.93824092

00:04:59.690 --> 00:05:01.570 they don't sleep uni hemispherically.

NOTE Confidence: 0.93824092

00:05:01.570 --> 00:05:04.258 So those animals sleep have adapted

NOTE Confidence: 0.93824092

00:05:04.258 --> 00:05:06.050 by sleeping unit hemispherically.

NOTE Confidence: 0.93824092

00:05:06.050 --> 00:05:08.206 SO1 hemisphere is awake and keeping them

NOTE Confidence: 0.93824092

00:05:08.206 --> 00:05:10.421 at the surface and breathing while the

NOTE Confidence: 0.93824092

00:05:10.421 --> 00:05:12.720 other is sleeping and then they switch.

NOTE Confidence: 0.93824092

00:05:12.720 --> 00:05:15.198 But elephant seals don't do that,

NOTE Confidence: 0.93824092

00:05:15.200 --> 00:05:16.319 nor do we.

NOTE Confidence: 0.93824092

00:05:16.319 --> 00:05:18.930 And how they've adapted is that they

NOTE Confidence: 0.93824092

00:05:19.010 --> 00:05:22.118 dive quickly down past the point where

NOTE Confidence: 0.93824092

00:05:22.118 --> 00:05:25.278 sharks and killer whales would eat them,

NOTE Confidence: 0.93824092

00:05:25.280 --> 00:05:27.230 so they dive pretty darn deep.

NOTE Confidence: 0.93824092

00:05:27.230 --> 00:05:30.668 And then when they get to that past that

NOTE Confidence: 0.93824092

00:05:30.668 --> 00:05:32.790 depth that sharks and seals would get them,

NOTE Confidence: 0.93824092

00:05:32.790 --> 00:05:34.126 then they start sleeping.

NOTE Confidence: 0.93824092

00:05:34.126 --> 00:05:36.789 And they did this by recording their EEG,

NOTE Confidence: 0.93824092

00:05:36.790 --> 00:05:38.046 outfitting them with EEG,

NOTE Confidence: 0.93824092

00:05:38.046 --> 00:05:40.710 putting them back out there and their family.

NOTE Confidence: 0.93824092

00:05:40.710 --> 00:05:42.290 And when they go into

NOTE Confidence: 0.93824092

00:05:42.290 --> 00:05:43.870 the deep slow wave sleep,

NOTE Confidence: 0.93824092

00:05:43.870 --> 00:05:46.270 you can see their big slow waves by,

NOTE Confidence: 0.93824092

00:05:46.270 --> 00:05:48.510 you know, both hemispheres at the same time.

NOTE Confidence: 0.93824092

00:05:48.510 --> 00:05:50.256 And then when they lose muscle

NOTE Confidence: 0.93824092

00:05:50.256 --> 00:05:51.740 tone and go into rim.

NOTE Confidence: 0.93824092

00:05:51.740 --> 00:05:53.078 Usually one side of their body

NOTE Confidence: 0.93824092

00:05:53.078 --> 00:05:54.699 or the other is a little more,

NOTE Confidence: 0.93824092

00:05:54.700 --> 00:05:55.808 you know, Finn down.

NOTE Confidence: 0.93824092

00:05:55.808 --> 00:05:57.193 And so they start circling

NOTE Confidence: 0.93824092

00:05:57.193 --> 00:05:58.458 and they circle down,

NOTE Confidence: 0.93824092

00:05:58.460 --> 00:05:59.200 down, down,

NOTE Confidence: 0.93824092

00:05:59.200 --> 00:06:01.420 and for a good 10 minutes

NOTE Confidence: 0.93824092

00:06:01.420 --> 00:06:02.580 they're circling down.

NOTE Confidence: 0.93824092

00:06:02.580 --> 00:06:05.844 And then when they hit the bottom or

NOTE Confidence: 0.93824092

00:06:05.844 --> 00:06:08.060 just finish their REM sleep cycle,

NOTE Confidence: 0.93824092

00:06:08.060 --> 00:06:09.740 they'll wake up and swim back

NOTE Confidence: 0.93824092

00:06:09.740 --> 00:06:10.860 up to the surface.

NOTE Confidence: 0.93824092

00:06:10.860 --> 00:06:15.315 It's a really cool paper with a really nice.

NOTE Confidence: 0.93824092

00:06:15.320 --> 00:06:18.470 Video So you can just see this

NOTE Confidence: 0.93824092

00:06:18.470 --> 00:06:20.000 happening not in a live seal,

NOTE Confidence: 0.93824092

00:06:20.000 --> 00:06:22.877 but a model of what they've recorded.

NOTE Confidence: 0.93824092

00:06:22.880 --> 00:06:25.528 So here are the just the basic stages

NOTE Confidence: 0.93824092

00:06:25.528 --> 00:06:28.064 of sleep that you could see from

NOTE Confidence: 0.93824092

00:06:28.064 --> 00:06:30.800 something like a Fitbit or Apple Watch.

NOTE Confidence: 0.93824092

00:06:30.800 --> 00:06:32.760 It doesn't come with EE G because

NOTE Confidence: 0.93824092

00:06:32.760 --> 00:06:33.878 you need electrodes, you know,

NOTE Confidence: 0.93824092

00:06:33.878 --> 00:06:35.200 on the skull to be able to see this,

NOTE Confidence: 0.93824092

00:06:35.200 --> 00:06:37.088 but I just overlaid some EE G to

NOTE Confidence: 0.93824092

00:06:37.088 --> 00:06:39.280 look to show you what it looks like.

NOTE Confidence: 0.93824092

00:06:39.280 --> 00:06:40.724 So here we go,

NOTE Confidence: 0.93824092

00:06:40.724 --> 00:06:42.529 from wakefulness to stage two

NOTE Confidence: 0.93824092

00:06:42.529 --> 00:06:44.408 sleep with sleep spindles.

NOTE Confidence: 0.93824092

00:06:44.410 --> 00:06:45.032 To deep,

NOTE Confidence: 0.93824092

00:06:45.032 --> 00:06:47.209 slow wave sleep with big slow waves

NOTE Confidence: 0.93824092

00:06:47.209 --> 00:06:49.866 that sweep through our brain and then

NOTE Confidence: 0.93824092

00:06:49.866 --> 00:06:52.722 back into stage 2 with sleep spindles

NOTE Confidence: 0.93824092

00:06:52.722 --> 00:06:55.618 that come and go once every 10 or

NOTE Confidence: 0.93824092

00:06:55.618 --> 00:06:58.048 20 seconds and they are 10 to 15 Hertz.

NOTE Confidence: 0.93824092

00:06:58.050 --> 00:06:59.730 These are one to three Hertz,

NOTE Confidence: 0.93824092

00:06:59.730 --> 00:07:00.558 something like that.

NOTE Confidence: 0.93824092

00:07:00.558 --> 00:07:03.316 And then in REM sleep with the rapid eye

NOTE Confidence: 0.93824092

00:07:03.316 --> 00:07:05.246 movements where we're actively dreaming,

NOTE Confidence: 0.93824092

00:07:05.250 --> 00:07:07.326 we have in our limbic system,

NOTE Confidence: 0.93824092

00:07:07.330 --> 00:07:08.026 our emotional system,

NOTE Confidence: 0.93824092

00:07:08.026 --> 00:07:09.418 which we're going to talk about

NOTE Confidence: 0.93824092

00:07:09.418 --> 00:07:10.329 a lot more today,

NOTE Confidence: 0.93824092

00:07:10.330 --> 00:07:12.890 and we have a Theta rhythm that that

NOTE Confidence: 0.93824092

00:07:12.890 --> 00:07:16.374 takes over. And it's big. It's juicy.

NOTE Confidence: 0.93824092

00:07:16.374 --> 00:07:18.009 It's even more beautiful than

NOTE Confidence: 0.93824092

00:07:18.009 --> 00:07:19.760 you see during wakefulness,

NOTE Confidence: 0.93824092

00:07:19.760 --> 00:07:22.259 when people on animals are learning and

NOTE Confidence: 0.93824092

00:07:22.259 --> 00:07:24.479 paying attention to their environment,

NOTE Confidence: 0.93824092

00:07:24.480 --> 00:07:27.240 and it's induced by acetylcholine and

NOTE Confidence: 0.93824092

00:07:27.240 --> 00:07:30.349 gabourgic neurons of the basal forebrain.

NOTE Confidence: 0.93824092

00:07:30.350 --> 00:07:30.840 Really important,

NOTE Confidence: 0.93824092

00:07:30.840 --> 00:07:32.310 we know for learning and memory.

NOTE Confidence: 0.93824092

00:07:32.310 --> 00:07:34.347 So what's its function during REM sleep?

NOTE Confidence: 0.93824092

00:07:34.350 --> 00:07:37.110 So yeah, going to concentrate.

NOTE Confidence: 0.93824092

00:07:37.110 --> 00:07:39.108 So what happens with disturbed sleep?

NOTE Confidence: 0.93824092

00:07:39.110 --> 00:07:41.150 Well, you know, it's less lovely.

NOTE Confidence: 0.93824092

00:07:41.150 --> 00:07:42.900 There's a lot more wakefulness

NOTE Confidence: 0.93824092

00:07:42.900 --> 00:07:43.950 that that's interspersed.

NOTE Confidence: 0.93824092

00:07:43.950 --> 00:07:45.670 And that happens either from

NOTE Confidence: 0.93824092

00:07:45.670 --> 00:07:47.733 exogenous stimuli like we did to

NOTE Confidence: 0.93824092

00:07:47.733 --> 00:07:49.686 that poor jellyfish or or they did

NOTE Confidence: 0.93824092

00:07:49.686 --> 00:07:51.668 a Caltech to that poor jellyfish.

NOTE Confidence: 0.93824092

00:07:51.670 --> 00:07:54.058 Or it could come from internal

NOTE Confidence: 0.93824092

00:07:54.058 --> 00:07:55.650 sources like sleep apnea.

NOTE Confidence: 0.93824092

00:07:55.650 --> 00:07:58.128 Can wake people up 500 * a night

NOTE Confidence: 0.93824092

00:07:58.128 --> 00:07:59.801 and they won't even be aware that

NOTE Confidence: 0.93824092

00:07:59.801 --> 00:08:01.646 they woke up because it's so brief.

NOTE Confidence: 0.93824092

00:08:01.650 --> 00:08:03.864 They just have to wake up to breathe and

NOTE Confidence: 0.93824092

00:08:03.864 --> 00:08:06.330 then they go back to sleep and it's but it's,

NOTE Confidence: 0.93824092

00:08:06.330 --> 00:08:07.370 as you can imagine,

NOTE Confidence: 0.93824092

00:08:07.370 --> 00:08:08.842 profoundly disturbing in terms

NOTE Confidence: 0.93824092

00:08:08.842 --> 00:08:10.682 of the functions of sleep,

NOTE Confidence: 0.93824092

00:08:10.690 --> 00:08:12.610 which needs some continuity

NOTE Confidence: 0.93824092

00:08:12.610 --> 00:08:14.172 we found to proceed.

NOTE Confidence: 0.93824092

00:08:14.172 --> 00:08:17.010 So what happens if we don't get enough sleep?

NOTE Confidence: 0.93824092

00:08:17.010 --> 00:08:18.606 Well, I don't know about you,

NOTE Confidence: 0.93824092

00:08:18.610 --> 00:08:20.927 but I feel cranky and short tempered.

NOTE Confidence: 0.93824092

00:08:20.930 --> 00:08:22.870 Inflexible, hard to handle,

NOTE Confidence: 0.93824092

00:08:22.870 --> 00:08:26.006 impulsive and accident prone, in fact.

NOTE Confidence: 0.93824092

00:08:26.006 --> 00:08:29.880 All all causes of mortality increase the

NOTE Confidence: 0.93824092

00:08:29.880 --> 00:08:33.840 further away from 7 hours of sleep you get.

NOTE Confidence: 0.93824092

00:08:33.840 --> 00:08:34.644 The six hours,

NOTE Confidence: 0.93824092

00:08:34.644 --> 00:08:35.716 five hours four hours.

NOTE Confidence: 0.93824092

00:08:35.720 --> 00:08:38.006 If you get sleep 4 hours a night you

NOTE Confidence: 0.93824092

00:08:38.006 --> 00:08:40.129 become more accident prone and the

NOTE Confidence: 0.93824092

00:08:40.129 --> 00:08:41.934 all causes mortality becomes more

NOTE Confidence: 0.93824092

00:08:41.994 --> 00:08:44.004 due to accidents, car accidents,

NOTE Confidence: 0.93824092

00:08:44.004 --> 00:08:46.514 ladder accidents, whatever it is,

NOTE Confidence: 0.93824092

00:08:46.520 --> 00:08:48.560 we also are metabolism changes.

NOTE Confidence: 0.93824092

00:08:48.560 --> 00:08:49.949 We become our.

NOTE Confidence: 0.93824092

00:08:49.949 --> 00:08:51.338 Immune system changes,

NOTE Confidence: 0.93824092

00:08:51.340 --> 00:08:53.055 We get prone to infection and illness.

NOTE Confidence: 0.93824092

00:08:53.060 --> 00:08:54.458 Our memory is not as good.

NOTE Confidence: 0.93824092

00:08:54.460 --> 00:08:55.732 So we're going to talk about

NOTE Confidence: 0.93824092

00:08:55.732 --> 00:08:56.580 that a little more.

NOTE Confidence: 0.93824092

00:08:56.580 --> 00:08:58.536 We have less insight, more pedantic,

NOTE Confidence: 0.93824092

00:08:58.540 --> 00:08:59.948 less able to abstract,

NOTE Confidence: 0.93824092

00:08:59.948 --> 00:09:02.500 and more anxious and depressed and angry.

NOTE Confidence: 0.93824092

00:09:02.500 --> 00:09:05.180 And so adolescents unfortunately

NOTE Confidence: 0.93824092

00:09:05.180 --> 00:09:07.860 have a circadian misalignment,

NOTE Confidence: 0.93824092

00:09:07.860 --> 00:09:09.484 social jet lag really,

NOTE Confidence: 0.93824092

00:09:09.484 --> 00:09:11.108 and their preferred sleep

NOTE Confidence: 0.93824092

00:09:11.108 --> 00:09:13.138 time shifts later at puberty,

NOTE Confidence: 0.93824092

00:09:13.140 --> 00:09:15.100 so that during the week

NOTE Confidence: 0.93824092

00:09:15.100 --> 00:09:17.290 because of school start times.

NOTE Confidence: 0.93824092

00:09:17.290 --> 00:09:20.090 They are getting up too early for

NOTE Confidence: 0.93824092

00:09:20.090 --> 00:09:21.822 their and and depriving themselves

NOTE Confidence: 0.93824092

00:09:21.822 --> 00:09:23.820 asleep based on relative to the

NOTE Confidence: 0.93824092

00:09:23.879 --> 00:09:25.487 time that they went to sleep.

NOTE Confidence: 0.93824092

00:09:25.490 --> 00:09:27.014 They need just as much sleep

NOTE Confidence: 0.93824092

00:09:27.014 --> 00:09:28.650 as a 10 year old does.

NOTE Confidence: 0.93824092

00:09:28.650 --> 00:09:30.160 Their brains are still developing

NOTE Confidence: 0.93824092

00:09:30.160 --> 00:09:31.670 but they're not getting it

NOTE Confidence: 0.93824092

00:09:31.727 --> 00:09:33.287 because of that social jet lag.

NOTE Confidence: 0.93824092

00:09:33.290 --> 00:09:35.054 So they sleep deprived and then

NOTE Confidence: 0.93824092

00:09:35.054 --> 00:09:36.915 they do recovery sleep on weekends

NOTE Confidence: 0.93824092

00:09:36.915 --> 00:09:38.781 and they usually feel much better

NOTE Confidence: 0.93824092

00:09:38.781 --> 00:09:40.550 and happier if you let them sleep

NOTE Confidence: 0.93824092

00:09:40.550 --> 00:09:42.474 in but they're back to social jet

NOTE Confidence: 0.93824092

00:09:42.474 --> 00:09:46.688 lag during the week and and so.

NOTE Confidence: 0.93824092

00:09:46.690 --> 00:09:50.710 These sleep deprived teenagers as as

NOTE Confidence: 0.93824092

00:09:50.710 --> 00:09:54.038 well as anyone else who's sleep deprived,

NOTE Confidence: 0.93824092

00:09:54.038 --> 00:09:57.608 actually have more difficult time

NOTE Confidence: 0.93824092

00:09:57.610 --> 00:10:02.410 with negative emotional circumstances.

NOTE Confidence: 0.93824092

00:10:02.410 --> 00:10:06.928 So those who are sleep well rested

NOTE Confidence: 0.93824092

00:10:06.930 --> 00:10:09.522 actually have better forebrain

NOTE Confidence: 0.93824092

00:10:09.522 --> 00:10:12.114 prefrontal cortex control of

NOTE Confidence: 0.93824092

00:10:12.114 --> 00:10:15.520 amygdala activity and so.

NOTE Confidence: 0.93824092

00:10:15.520 --> 00:10:17.912 And this is a great paper by Michelle

NOTE Confidence: 0.93824092

00:10:17.912 --> 00:10:20.040 Krask and others have shown this.

NOTE Confidence: 0.93824092

00:10:20.040 --> 00:10:22.740 So there's more prefrontal control

NOTE Confidence: 0.93824092

00:10:22.740 --> 00:10:25.840 over amygdala activity during the

NOTE Confidence: 0.93824092

00:10:25.840 --> 00:10:28.800 presentation of emotional stimuli

NOTE Confidence: 0.945581282352941

00:10:28.800 --> 00:10:31.254 when we're well rested and less

NOTE Confidence: 0.945581282352941

00:10:31.254 --> 00:10:33.315 prefrontal control over all of

NOTE Confidence: 0.945581282352941

00:10:33.315 --> 00:10:35.397 that when we're not well rested.

NOTE Confidence: 0.945581282352941

00:10:35.400 --> 00:10:38.228 And so, you know, several papers have

NOTE Confidence: 0.945581282352941

00:10:38.228 --> 00:10:40.687 shown that really a good adaptive

NOTE Confidence: 0.945581282352941

00:10:40.687 --> 00:10:43.033 sleep reduces also our our fear,

NOTE Confidence: 0.945581282352941

00:10:43.040 --> 00:10:44.636 our anger, our aggression.

NOTE Confidence: 0.945581282352941

00:10:44.636 --> 00:10:48.100 And it increases our sense of good judgment,

NOTE Confidence: 0.945581282352941

00:10:48.100 --> 00:10:49.980 our rationality and our self-control.

NOTE Confidence: 0.945581282352941

00:10:49.980 --> 00:10:51.890 There've been really some fun

NOTE Confidence: 0.945581282352941

00:10:51.890 --> 00:10:53.418 psychology experiments with sleep

NOTE Confidence: 0.945581282352941

00:10:53.418 --> 00:10:55.339 deprived people where they give them,

NOTE Confidence: 0.945581282352941

00:10:55.340 --> 00:10:56.560 you know, cake versus salad

NOTE Confidence: 0.945581282352941

00:10:56.560 --> 00:10:58.180 and say what would you prefer.

NOTE Confidence: 0.945581282352941

00:10:58.180 --> 00:10:59.795 And well rested people go

NOTE Confidence: 0.945581282352941

00:10:59.795 --> 00:11:01.820 for the salad a little more,

NOTE Confidence: 0.945581282352941

00:11:01.820 --> 00:11:03.220 but of sleep deprivation they

NOTE Confidence: 0.945581282352941

00:11:03.220 --> 00:11:04.620 go for the cake. So

NOTE Confidence: 0.94427896

00:11:06.660 --> 00:11:09.516 let's see. So we also feel

NOTE Confidence: 0.94427896

00:11:09.516 --> 00:11:11.420 lonelier and less desirable.

NOTE Confidence: 0.94427896

00:11:11.420 --> 00:11:13.710 This is Eddie Ben Simon's.

NOTE Confidence: 0.94427896

00:11:13.710 --> 00:11:16.350 And Ben and Nat Walker's study,

NOTE Confidence: 0.94427896

00:11:16.350 --> 00:11:20.450 which shows that sleep deprived people

NOTE Confidence: 0.94427896

00:11:20.450 --> 00:11:23.150 actually distance themselves from others,

NOTE Confidence: 0.94427896

00:11:23.150 --> 00:11:24.442 physically distance

NOTE Confidence: 0.94427896

00:11:24.442 --> 00:11:27.026 themselves from others more,

NOTE Confidence: 0.94427896

00:11:27.030 --> 00:11:30.240 which was really an interesting study.

NOTE Confidence: 0.94427896

00:11:30.240 --> 00:11:33.530 So we other studies show that you

NOTE Confidence: 0.94427896

00:11:33.530 --> 00:11:36.028 know suicidal urges are mediated

NOTE Confidence: 0.94427896

00:11:36.028 --> 00:11:38.822 through a prior night's sleep quality,

NOTE Confidence: 0.94427896

00:11:38.822 --> 00:11:40.992 our impulsivity and our suicidal

NOTE Confidence: 0.94427896

00:11:40.992 --> 00:11:43.398 urges are all mediated that way.

NOTE Confidence: 0.94427896

00:11:43.400 --> 00:11:48.104 So, so there's kind of a vicious

NOTE Confidence: 0.94427896

00:11:48.104 --> 00:11:50.120 negative cycle feedback of

NOTE Confidence: 0.94427896

00:11:50.120 --> 00:11:52.972 emotional of disturbed sleep,

NOTE Confidence: 0.94427896

00:11:52.972 --> 00:11:54.398 emotional dysregulation,

NOTE Confidence: 0.94427896

00:11:54.400 --> 00:11:57.418 distress that then further disturbs our

NOTE Confidence: 0.94427896

00:11:57.418 --> 00:12:00.729 sleep because we're so distressed and.

NOTE Confidence: 0.94427896

00:12:00.730 --> 00:12:02.650 Yeah, it's a it's a bad,

NOTE Confidence: 0.94427896

00:12:02.650 --> 00:12:04.650 it's a bad situation.

NOTE Confidence: 0.94427896

00:12:04.650 --> 00:12:07.703 So just one more paper by Eddie

NOTE Confidence: 0.94427896

00:12:07.703 --> 00:12:09.809 Van Simon showing that it seems

NOTE Confidence: 0.94427896

00:12:09.809 --> 00:12:12.166 to be that deep slow of sleep,

NOTE Confidence: 0.94427896

00:12:12.170 --> 00:12:13.670 which is interesting.

NOTE Confidence: 0.94427896

00:12:13.670 --> 00:12:16.170 That's most associated with anxiety.

NOTE Confidence: 0.94427896

00:12:16.170 --> 00:12:20.690 So the more the less slow of sleep we get,

NOTE Confidence: 0.94427896

00:12:20.690 --> 00:12:23.250 the more anxious we feel.

NOTE Confidence: 0.94427896

00:12:23.250 --> 00:12:23.537 Yeah.

NOTE Confidence: 0.94427896

00:12:23.537 --> 00:12:23.824 OK,

NOTE Confidence: 0.94427896

00:12:23.824 --> 00:12:26.498 so I'm going to talk a little bit more

NOTE Confidence: 0.94427896

00:12:26.498 --> 00:12:28.986 now about what we're doing in my lab.

NOTE Confidence: 0.94427896

00:12:28.990 --> 00:12:30.866 This is my lab over the pandemic,

NOTE Confidence: 0.94427896

00:12:30.870 --> 00:12:33.294 commuting on zoom every day for

NOTE Confidence: 0.94427896

00:12:33.294 --> 00:12:35.932 a while there because of that

NOTE Confidence: 0.94427896

00:12:35.932 --> 00:12:38.302 sense of isolation that that

NOTE Confidence: 0.94427896

00:12:38.302 --> 00:12:40.589 the pandemic really gave us.

NOTE Confidence: 0.94427896

00:12:40.590 --> 00:12:43.985 So, so the function of that deep,

NOTE Confidence: 0.94427896

00:12:43.990 --> 00:12:46.888 slow way of sleep seems really

NOTE Confidence: 0.94427896

00:12:46.888 --> 00:12:49.423 clearly to clean and restore

NOTE Confidence: 0.94427896

00:12:49.423 --> 00:12:51.948 the energy of our brain.

NOTE Confidence: 0.94427896

00:12:51.950 --> 00:12:54.110 And going there needs to be a lot

NOTE Confidence: 0.94427896

00:12:54.110 --> 00:12:55.935 more studies but the studies that

NOTE Confidence: 0.94427896

00:12:55.935 --> 00:12:57.765 are pointing to the function of

NOTE Confidence: 0.94427896

00:12:57.832 --> 00:12:59.944 slow I sleep point to point to that.

NOTE Confidence: 0.94427896

00:12:59.950 --> 00:13:02.038 And then our new memories really

NOTE Confidence: 0.94427896

00:13:02.038 --> 00:13:03.430 seem to be consolidated,

NOTE Confidence: 0.94427896

00:13:03.430 --> 00:13:05.290 consolidated in the end two

NOTE Confidence: 0.94427896

00:13:05.290 --> 00:13:07.150 stage with the sleep spindles.

NOTE Confidence: 0.94427896

00:13:07.150 --> 00:13:09.026 I also call it transition to REM.

NOTE Confidence: 0.94427896

00:13:09.030 --> 00:13:12.934 So that's why I double labeled this year.

NOTE Confidence: 0.94427896

00:13:12.940 --> 00:13:15.418 And then we'll get into some

NOTE Confidence: 0.94427896

00:13:15.418 --> 00:13:17.635 circuits how our memories become

NOTE Confidence: 0.94427896

00:13:17.635 --> 00:13:20.055 familiar to us through actually

NOTE Confidence: 0.94427896

00:13:20.060 --> 00:13:22.430 distal dendrites in our neurons

NOTE Confidence: 0.94427896

00:13:22.430 --> 00:13:25.376 and then the proximal dendrites can

NOTE Confidence: 0.94427896

00:13:25.376 --> 00:13:27.820 be depotentiated once the memories

NOTE Confidence: 0.94427896

00:13:27.820 --> 00:13:30.474 have been consolidated out and and

NOTE Confidence: 0.94427896

00:13:30.474 --> 00:13:33.043 that refreshes our brain of able to

NOTE Confidence: 0.94427896

00:13:33.043 --> 00:13:35.645 learn new things the next day and

NOTE Confidence: 0.94427896

00:13:35.645 --> 00:13:38.620 and in that way it's our hypothesis,

NOTE Confidence: 0.94427896

00:13:38.620 --> 00:13:41.130 our working hypothesis right now.

NOTE Confidence: 0.94427896

00:13:41.130 --> 00:13:43.945 Our sensory and emotional circuits

NOTE Confidence: 0.94427896

00:13:43.945 --> 00:13:46.197 could actually become detached

NOTE Confidence: 0.94427896

00:13:46.197 --> 00:13:48.796 from the semantic and episodic

NOTE Confidence: 0.94427896

00:13:48.796 --> 00:13:50.768 versions of our memories,

NOTE Confidence: 0.94427896

00:13:50.770 --> 00:13:54.170 so so that they can be refreshed

NOTE Confidence: 0.94427896

00:13:54.170 --> 00:13:55.808 and learn new things the next day,

NOTE Confidence: 0.94427896

00:13:55.810 --> 00:13:58.169 and so that when we're recalling things,

NOTE Confidence: 0.94427896

00:13:58.170 --> 00:14:00.252 we can remember the facts of

NOTE Confidence: 0.94427896

00:14:00.252 --> 00:14:03.384 the emotion and the facts of the

NOTE Confidence: 0.94427896

00:14:03.384 --> 00:14:05.049 sensation without reexperiencing.

NOTE Confidence: 0.94427896

00:14:05.050 --> 00:14:07.250 The emotions and the sensations.

NOTE Confidence: 0.94427896

00:14:07.250 --> 00:14:08.402 As you might imagine,

NOTE Confidence: 0.94427896

00:14:08.402 --> 00:14:10.550 that would be awful if we could

NOTE Confidence: 0.94427896

00:14:10.550 --> 00:14:12.300 remember every pain we ever

NOTE Confidence: 0.94427896

00:14:12.300 --> 00:14:14.454 experienced and when we remember it

NOTE Confidence: 0.94427896

00:14:14.454 --> 00:14:16.524 we are re experiencing that pain.

NOTE Confidence: 0.94427896

00:14:16.530 --> 00:14:19.086 So this is our working hypothesis,

NOTE Confidence: 0.94427896

00:14:19.090 --> 00:14:22.650 the circuit mechanism for that,

NOTE Confidence: 0.94427896

00:14:22.650 --> 00:14:26.987 that adaptive detachment.

NOTE Confidence: 0.94427896

00:14:26.987 --> 00:14:27.901 All right,

NOTE Confidence: 0.94427896

00:14:27.901 --> 00:14:30.643 so so here's our general overview

NOTE Confidence: 0.94427896

00:14:30.643 --> 00:14:33.427 of our functions of slow asleep.

NOTE Confidence: 0.94427896

00:14:33.430 --> 00:14:35.430 We clear the debris through

NOTE Confidence: 0.94427896

00:14:35.430 --> 00:14:36.630 our lymphatic system,

NOTE Confidence: 0.94427896

00:14:36.630 --> 00:14:38.730 probably through the pumping action

NOTE Confidence: 0.94427896

00:14:38.730 --> 00:14:40.830 of those slow waves themselves.

NOTE Confidence: 0.94427896

00:14:40.830 --> 00:14:44.088 Each slow wave is is characterized

NOTE Confidence: 0.94427896

00:14:44.088 --> 00:14:45.174 by silence.

NOTE Confidence: 0.94427896

00:14:45.180 --> 00:14:46.158 Of cortical neurons,

NOTE Confidence: 0.94427896

00:14:46.158 --> 00:14:47.136 and then activity,

NOTE Confidence: 0.929203695

00:14:47.140 --> 00:14:48.715 the simultaneous activity of a

NOTE Confidence: 0.929203695

00:14:48.715 --> 00:14:50.979 bunch of them at the same time,

NOTE Confidence: 0.929203695

00:14:50.980 --> 00:14:54.690 and neurons shrink and swell

NOTE Confidence: 0.929203695

00:14:54.690 --> 00:14:57.335 when they're inactive and active.

NOTE Confidence: 0.929203695

00:14:57.335 --> 00:14:59.645 And the group function or action

NOTE Confidence: 0.929203695

00:14:59.645 --> 00:15:01.883 of that could actually physically

NOTE Confidence: 0.929203695

00:15:01.883 --> 00:15:04.286 pump out the intracellular and

NOTE Confidence: 0.929203695

00:15:04.286 --> 00:15:06.294 extracellular space into the

NOTE Confidence: 0.929203695

00:15:06.294 --> 00:15:08.665 glymphatic system we also know.

NOTE Confidence: 0.929203695

00:15:08.665 --> 00:15:11.850 There's a ton of protein synthesis that

NOTE Confidence: 0.929203695

00:15:11.936 --> 00:15:14.808 happens 5 to 10 times faster during

NOTE Confidence: 0.929203695

00:15:14.808 --> 00:15:18.084 slow wave sleep than than during other

NOTE Confidence: 0.929203695

00:15:18.084 --> 00:15:21.060 States and and and there's a lot of.

NOTE Confidence: 0.91239640173913

00:15:24.100 --> 00:15:26.466 Actually, I'll talk a little bit about

NOTE Confidence: 0.91239640173913

00:15:26.466 --> 00:15:28.865 the the role of the norepinephrine

NOTE Confidence: 0.91239640173913

00:15:28.865 --> 00:15:31.055 which fires the locust surrealist

NOTE Confidence: 0.91239640173913

00:15:31.055 --> 00:15:33.060 fires with every slow wave,

NOTE Confidence: 0.91239640173913

00:15:33.060 --> 00:15:34.652 and when norepinephrine is

NOTE Confidence: 0.91239640173913

00:15:34.652 --> 00:15:36.642 present it can actually prevent

NOTE Confidence: 0.91239640173913

00:15:36.642 --> 00:15:38.569 weakening and protect our memories.

NOTE Confidence: 0.91239640173913

00:15:38.570 --> 00:15:41.130 During that transition to REM

NOTE Confidence: 0.91239640173913

00:15:41.130 --> 00:15:43.930 sleep state with sleep spindles,

NOTE Confidence: 0.91239640173913

00:15:43.930 --> 00:15:45.610 we actually can transfer information.

NOTE Confidence: 0.91239640173913

00:15:45.610 --> 00:15:48.530 There's an and I'll talk about about this.

NOTE Confidence: 0.91239640173913

00:15:48.530 --> 00:15:50.654 There's kind of a unique connectivity

NOTE Confidence: 0.91239640173913

00:15:50.654 --> 00:15:52.768 between the hippocampus and the cortex

NOTE Confidence: 0.91239640173913

00:15:52.768 --> 00:15:54.688 during each of these sleep spindles,

NOTE Confidence: 0.91239640173913

00:15:54.690 --> 00:15:57.084 where the cortex seems to be listening

NOTE Confidence: 0.91239640173913

00:15:57.084 --> 00:15:59.130 to the hippocampus and responding

NOTE Confidence: 0.91239640173913

00:15:59.130 --> 00:16:01.050 to the hippocampal reactivations.

NOTE Confidence: 0.91239640173913

00:16:01.050 --> 00:16:02.770 And then during REM sleep,

NOTE Confidence: 0.91239640173913

00:16:02.770 --> 00:16:05.024 I'll tell you this is one of

NOTE Confidence: 0.91239640173913

00:16:05.024 --> 00:16:05.990 my first studies.

NOTE Confidence: 0.91239640173913

00:16:05.990 --> 00:16:08.222 We really can weaken old connections

NOTE Confidence: 0.91239640173913

00:16:08.222 --> 00:16:10.050 of those proximal dendrites that

NOTE Confidence: 0.91239640173913

00:16:10.050 --> 00:16:11.961 I just mentioned in the last slide

NOTE Confidence: 0.91239640173913

00:16:11.961 --> 00:16:13.970 and and strengthen new ones because

NOTE Confidence: 0.91239640173913

00:16:13.970 --> 00:16:16.064 there's a ton of plasticity that

NOTE Confidence: 0.91239640173913

00:16:16.070 --> 00:16:18.950 can happen during that Theta state.

NOTE Confidence: 0.91239640173913

00:16:18.950 --> 00:16:19.510 All right,

NOTE Confidence: 0.91239640173913

00:16:19.510 --> 00:16:21.750 so so here are the cycles of sleep.

NOTE Confidence: 0.91239640173913

00:16:21.750 --> 00:16:24.198 We go from waking to non REM sleep

NOTE Confidence: 0.91239640173913

00:16:24.198 --> 00:16:26.127 and through the transition to REM

NOTE Confidence: 0.91239640173913

00:16:26.127 --> 00:16:28.520 to REM and we go back and forth

NOTE Confidence: 0.91239640173913

00:16:28.520 --> 00:16:30.788 until the job of sleep is done.

NOTE Confidence: 0.91239640173913

00:16:30.790 --> 00:16:32.505 Different things happening in these

NOTE Confidence: 0.91239640173913

00:16:32.505 --> 00:16:34.440 different stages and we wake up.

NOTE Confidence: 0.91239640173913

00:16:34.440 --> 00:16:36.840 When I was a graduate student,

NOTE Confidence: 0.91239640173913

00:16:36.840 --> 00:16:40.235 I heard a talk by John Listman,

NOTE Confidence: 0.91239640173913

00:16:40.240 --> 00:16:42.158 who came to tell us that he'd

NOTE Confidence: 0.91239640173913

00:16:42.158 --> 00:16:44.000 taken a slice of hippocampus,

NOTE Confidence: 0.91239640173913

00:16:44.000 --> 00:16:46.082 added acetycholine to it to cause

NOTE Confidence: 0.91239640173913

00:16:46.082 --> 00:16:48.518 the Theta rhythm to have to happen,

NOTE Confidence: 0.91239640173913

00:16:48.520 --> 00:16:50.325 and then when he electrically

NOTE Confidence: 0.91239640173913

00:16:50.325 --> 00:16:52.130 stimulated the inputs to the

NOTE Confidence: 0.91239640173913

00:16:52.195 --> 00:16:54.800 hippocampus at the peaks of Theta,

NOTE Confidence: 0.91239640173913

00:16:54.800 --> 00:16:57.187 which is where most cells fire most

NOTE Confidence: 0.91239640173913

00:16:57.187 --> 00:16:59.560 of their spikes during wakefulness.

NOTE Confidence: 0.91239640173913

00:16:59.560 --> 00:17:01.366 He was able to get Long Term

NOTE Confidence: 0.91239640173913

00:17:01.366 --> 00:17:02.665 Potentiation with just four spikes

NOTE Confidence: 0.91239640173913

00:17:02.665 --> 00:17:04.317 at the peaks of 1 Theta Cycle,

NOTE Confidence: 0.91239640173913

00:17:04.320 --> 00:17:06.882 which was really cool and exciting

NOTE Confidence: 0.91239640173913

00:17:06.882 --> 00:17:09.700 because before that LTP could only be.

NOTE Confidence: 0.91239640173913

00:17:09.700 --> 00:17:11.524 Induced with, you know,

NOTE Confidence: 0.91239640173913

00:17:11.524 --> 00:17:14.260 100 Hertz for a solid second,

NOTE Confidence: 0.91239640173913

00:17:14.260 --> 00:17:16.423 which is not something you ever saw

NOTE Confidence: 0.91239640173913

00:17:16.423 --> 00:17:18.220 the hippocampus do spontaneously.

NOTE Confidence: 0.91239640173913

00:17:18.220 --> 00:17:22.017 So as far as the hypothesis that LTP

NOTE Confidence: 0.91239640173913

00:17:22.017 --> 00:17:24.497 was the building block for synaptic

NOTE Confidence: 0.91239640173913

00:17:24.497 --> 00:17:26.857 strengthening and learning and memory,

NOTE Confidence: 0.91239640173913

00:17:26.860 --> 00:17:28.708 there was some skepticism at the

NOTE Confidence: 0.91239640173913

00:17:28.708 --> 00:17:30.659 time because you never really saw

NOTE Confidence: 0.91239640173913

00:17:30.659 --> 00:17:32.969 anything that could induce it in a

NOTE Confidence: 0.91239640173913

00:17:32.969 --> 00:17:34.819 physiological manner until these papers.

NOTE Confidence: 0.91239640173913

00:17:34.820 --> 00:17:36.548 But and then he went on to say when

NOTE Confidence: 0.91239640173913

00:17:36.548 --> 00:17:38.417 he stimulated the troughs of Theta,

NOTE Confidence: 0.91239640173913

00:17:38.420 --> 00:17:39.467 which is when.

NOTE Confidence: 0.91239640173913

00:17:39.467 --> 00:17:41.910 The inside of the cell is most

NOTE Confidence: 0.91239640173913

00:17:41.996 --> 00:17:44.702 negative and least able to respond

NOTE Confidence: 0.91239640173913

00:17:44.702 --> 00:17:47.050 to the external stimuli input.

NOTE Confidence: 0.91239640173913

00:17:47.050 --> 00:17:48.940 Then he actually got a reversal of

NOTE Confidence: 0.91239640173913

00:17:48.940 --> 00:17:50.410 what was previously potentiated,

NOTE Confidence: 0.91239640173913

00:17:50.410 --> 00:17:52.850 which was exciting because in

NOTE Confidence: 0.91239640173913

00:17:52.850 --> 00:17:54.314 computational modeling theory

NOTE Confidence: 0.91239640173913

00:17:54.314 --> 00:17:56.119 depotentiation would be really

NOTE Confidence: 0.91239640173913

00:17:56.119 --> 00:17:58.405 important for not saturating your brain.

NOTE Confidence: 0.91239640173913

00:17:58.410 --> 00:18:00.588 You can see each one of these red dots

NOTE Confidence: 0.91239640173913

00:18:00.588 --> 00:18:02.782 is a is a synapse on this neuron and

NOTE Confidence: 0.91239640173913

00:18:02.782 --> 00:18:05.004 if all of them were potentiated then

NOTE Confidence: 0.91239640173913

00:18:05.004 --> 00:18:07.064 any stray incoming piece of information.

NOTE Confidence: 0.91239640173913

00:18:07.064 --> 00:18:08.934 Or anything coming from the

NOTE Confidence: 0.91239640173913

00:18:08.934 --> 00:18:10.761 outside world would just cause

NOTE Confidence: 0.91239640173913

00:18:10.761 --> 00:18:12.387 all of their cells to fire.

NOTE Confidence: 0.91239640173913

00:18:12.390 --> 00:18:14.070 There's they're all connected

NOTE Confidence: 0.91239640173913

00:18:14.070 --> 00:18:15.967 to one another eventually and

NOTE Confidence: 0.91239640173913

00:18:15.967 --> 00:18:17.269 you would just get white noise.

NOTE Confidence: 0.91239640173913

00:18:17.270 --> 00:18:19.970 So depotentiation might be a way

NOTE Confidence: 0.91239640173913

00:18:19.970 --> 00:18:21.869 to sculpt the memory circuits

NOTE Confidence: 0.91239640173913

00:18:21.869 --> 00:18:24.200 and and he showed how to do

NOTE Confidence: 0.938423783636364

00:18:24.275 --> 00:18:26.730 this. How one could do this with

NOTE Confidence: 0.938423783636364

00:18:26.730 --> 00:18:28.490 a very physiological stimulus just

NOTE Confidence: 0.938423783636364

00:18:28.490 --> 00:18:31.018 at the troughs of Theta and the the

NOTE Confidence: 0.938423783636364

00:18:31.018 --> 00:18:32.442 neurochemical environment of the

NOTE Confidence: 0.938423783636364

00:18:32.442 --> 00:18:34.954 slice is I would argue more like

NOTE Confidence: 0.938423783636364

00:18:34.954 --> 00:18:37.012 REM sleep than any other state.

NOTE Confidence: 0.938423783636364

00:18:37.020 --> 00:18:41.340 Because you have an absence of

NOTE Confidence: 0.938423783636364

00:18:41.340 --> 00:18:43.020 some neurotransmitters that come

NOTE Confidence: 0.938423783636364

00:18:43.020 --> 00:18:44.940 in from from distal parts.

NOTE Confidence: 0.938423783636364

00:18:44.940 --> 00:18:47.102 So like locus, cerilis brings

NOTE Confidence: 0.938423783636364

00:18:47.102 --> 00:18:49.266 norepinephrine to the forebrain.

NOTE Confidence: 0.938423783636364

00:18:49.270 --> 00:18:51.025 In a hippocampus slice you

NOTE Confidence: 0.938423783636364

00:18:51.025 --> 00:18:52.429 don't have that input.

NOTE Confidence: 0.938423783636364

00:18:52.430 --> 00:18:54.038 The dorsal rafae brings serotonin to

NOTE Confidence: 0.938423783636364

00:18:54.038 --> 00:18:56.030 the forebrain and a hippocampus slice,

NOTE Confidence: 0.938423783636364

00:18:56.030 --> 00:18:58.550 you don't have that unless you add it.

NOTE Confidence: 0.938423783636364

00:18:58.550 --> 00:19:00.840 They they did add acetylcholine

NOTE Confidence: 0.938423783636364

00:19:00.840 --> 00:19:03.430 which also comes from outside and

NOTE Confidence: 0.938423783636364

00:19:03.430 --> 00:19:06.038 and to get that Theta and so that

NOTE Confidence: 0.938423783636364

00:19:06.038 --> 00:19:07.929 is neurochemically the most like a

NOTE Confidence: 0.938423783636364

00:19:07.929 --> 00:19:10.076 REM sleep state where you don't have

NOTE Confidence: 0.938423783636364

00:19:10.076 --> 00:19:12.214 those norepinephrine and and serotonin

NOTE Confidence: 0.938423783636364

00:19:12.214 --> 00:19:16.329 inputs but you do have lots of acetylcholine.

NOTE Confidence: 0.938423783636364

00:19:16.330 --> 00:19:18.010 So when I told John Lisman that I

NOTE Confidence: 0.938423783636364

00:19:18.010 --> 00:19:20.454 was a graduate student, I said, hey,

NOTE Confidence: 0.938423783636364

00:19:20.454 --> 00:19:22.202 that sounds like program, sleep,

NOTE Confidence: 0.938423783636364

00:19:22.202 --> 00:19:23.610 neurochemical environment, he said.

NOTE Confidence: 0.938423783636364

00:19:23.610 --> 00:19:25.225 That's really interesting and that

NOTE Confidence: 0.938423783636364

00:19:25.225 --> 00:19:27.316 I didn't have anything more to say

NOTE Confidence: 0.938423783636364

00:19:27.316 --> 00:19:28.980 at the time because I wasn't in a

NOTE Confidence: 0.938423783636364

00:19:29.041 --> 00:19:31.129 learning memory field at the time I was,

NOTE Confidence: 0.938423783636364

00:19:31.130 --> 00:19:32.285 but I did think it was interesting.

NOTE Confidence: 0.938423783636364

00:19:32.290 --> 00:19:33.770 Then for my post doc,

NOTE Confidence: 0.938423783636364

00:19:33.770 --> 00:19:36.330 I was able to go and actually test

NOTE Confidence: 0.938423783636364

00:19:36.330 --> 00:19:38.365 out whether that was important.

NOTE Confidence: 0.938423783636364

00:19:38.365 --> 00:19:40.225 So here's the neurotransmitum,

NOTE Confidence: 0.938423783636364

00:19:40.230 --> 00:19:42.064 a year of the different sleep states.

NOTE Confidence: 0.938423783636364

00:19:42.070 --> 00:19:42.824 So wakefulness.

NOTE Confidence: 0.938423783636364

00:19:42.824 --> 00:19:44.709 You've got lots of acetylcholine,

NOTE Confidence: 0.938423783636364

00:19:44.710 --> 00:19:45.654 norepinephrine, serotonin,

NOTE Confidence: 0.938423783636364

00:19:45.654 --> 00:19:46.126 glutamate,

NOTE Confidence: 0.938423783636364

00:19:46.126 --> 00:19:49.430 all of that during slow wave sleep,

NOTE Confidence: 0.938423783636364

00:19:49.430 --> 00:19:51.590 the deep slow wave sleep state.

NOTE Confidence: 0.938423783636364

00:19:51.590 --> 00:19:52.590 The most

NOTE Confidence: 0.950317

00:19:55.470 --> 00:19:56.838 striking feature is the

NOTE Confidence: 0.950317

00:19:56.838 --> 00:19:57.864 lack of acetylcholine.

NOTE Confidence: 0.950317

00:19:57.870 --> 00:20:00.846 The basal forebrain neurons that provides

NOTE Confidence: 0.950317

00:20:00.846 --> 00:20:03.980 acetylcholine all over the brain are off.

NOTE Confidence: 0.950317

00:20:03.980 --> 00:20:05.045 They're actively inhibited

NOTE Confidence: 0.950317

00:20:05.045 --> 00:20:07.420 during slowing sleep and in unit

NOTE Confidence: 0.950317

00:20:07.420 --> 00:20:09.028 hemispherically sleeping animals.

NOTE Confidence: 0.950317

00:20:09.030 --> 00:20:12.870 It's acetylcholine that switches sides.

NOTE Confidence: 0.950317

00:20:12.870 --> 00:20:14.300 Then during that transition to

NOTE Confidence: 0.950317

00:20:14.300 --> 00:20:16.270 REM and two with sleep spindles,

NOTE Confidence: 0.950317

00:20:16.270 --> 00:20:18.439 you get kind of what is seems to be

NOTE Confidence: 0.950317

00:20:18.439 --> 00:20:20.709 to me the opposite of wakefulness,

NOTE Confidence: 0.950317

00:20:20.710 --> 00:20:23.706 the lack of all of these neurotransmitters.

NOTE Confidence: 0.950317

00:20:23.710 --> 00:20:24.554 No acetylcholine,

NOTE Confidence: 0.950317

00:20:24.554 --> 00:20:26.242 norepinephrine or serotonin or

NOTE Confidence: 0.950317

00:20:26.242 --> 00:20:28.180 levels are really, really low.

NOTE Confidence: 0.950317

00:20:28.180 --> 00:20:30.190 And then during rapid eye movement,

NOTE Confidence: 0.950317

00:20:30.190 --> 00:20:31.230 sleep is almost the opposite

NOTE Confidence: 0.950317

00:20:31.230 --> 00:20:32.270 of slow way of sleep.

NOTE Confidence: 0.950317

00:20:32.270 --> 00:20:35.240 You've got tons of acetylcholine but

NOTE Confidence: 0.950317

00:20:35.240 --> 00:20:38.050 very little norepinephrine or serotonin.

NOTE Confidence: 0.950317

00:20:38.050 --> 00:20:41.068 And all of these neurotransmitters have

NOTE Confidence: 0.950317

00:20:41.068 --> 00:20:43.690 their function for learning memory,

NOTE Confidence: 0.950317

00:20:43.690 --> 00:20:46.270 generating these these patterns that

NOTE Confidence: 0.950317

00:20:46.270 --> 00:20:49.774 we are seeing here and and then I'm

NOTE Confidence: 0.950317

00:20:49.774 --> 00:20:51.930 going to argue for for emotional control.

NOTE Confidence: 0.950317

00:20:51.930 --> 00:20:54.655 So locus surrealists down there

NOTE Confidence: 0.950317

00:20:54.655 --> 00:20:56.290 in the brainstem,

NOTE Confidence: 0.950317

00:20:56.290 --> 00:20:57.875 these neurons don't fire during

NOTE Confidence: 0.950317

00:20:57.875 --> 00:20:59.813 specific sleep states like I just

NOTE Confidence: 0.950317

00:20:59.813 --> 00:21:01.559 showed you during REM sleep and

NOTE Confidence: 0.950317

00:21:01.559 --> 00:21:03.488 that transition to REM which is

NOTE Confidence: 0.950317

00:21:03.488 --> 00:21:04.820 also called intermediate sleep.

NOTE Confidence: 0.950317

00:21:04.820 --> 00:21:05.603 You don't have,

NOTE Confidence: 0.950317

00:21:05.603 --> 00:21:07.169 you don't have much firing of

NOTE Confidence: 0.950317

00:21:07.169 --> 00:21:08.810 the local surrealist bringing

NOTE Confidence: 0.950317

00:21:08.810 --> 00:21:10.574 norepinephrine to the forebrain.

NOTE Confidence: 0.950317

00:21:10.580 --> 00:21:12.890 So here's the firing rate

NOTE Confidence: 0.950317

00:21:12.890 --> 00:21:14.738 across the different states.

NOTE Confidence: 0.950317

00:21:14.740 --> 00:21:17.902 And we don't know really about females

NOTE Confidence: 0.950317

00:21:17.902 --> 00:21:20.788 because the ones ever studied them

NOTE Confidence: 0.950317

00:21:20.788 --> 00:21:23.612 until we have very recently with some

NOTE Confidence: 0.950317

00:21:23.612 --> 00:21:25.402 great preliminary data that we're

NOTE Confidence: 0.950317

00:21:25.402 --> 00:21:28.260 about to amplify with a lot more.

NOTE Confidence: 0.950317

00:21:28.260 --> 00:21:28.820 But anyway,

NOTE Confidence: 0.950317

00:21:28.820 --> 00:21:31.060 this is where it exists in the brainstem,

NOTE Confidence: 0.950317

00:21:31.060 --> 00:21:31.820 I'm sure.

NOTE Confidence: 0.950317

00:21:31.820 --> 00:21:34.480 Doctor Al K has shown you this,

NOTE Confidence: 0.950317

00:21:34.480 --> 00:21:35.473 but you know,

NOTE Confidence: 0.950317

00:21:35.473 --> 00:21:37.790 in the brainstem of a rat it's

NOTE Confidence: 0.950317

00:21:37.871 --> 00:21:40.016 here's the locus realist projecting

NOTE Confidence: 0.950317

00:21:40.016 --> 00:21:43.980 its axons to all over the brain and

NOTE Confidence: 0.950317

00:21:43.980 --> 00:21:46.720 in in a really beautiful fashion.

NOTE Confidence: 0.950317

00:21:46.720 --> 00:21:48.040 And what norepinephrine does.

NOTE Confidence: 0.950317

00:21:48.040 --> 00:21:50.560 One of the things that it does at

NOTE Confidence: 0.950317

00:21:50.560 --> 00:21:53.340 the cell body is when it occupies

NOTE Confidence: 0.950317

00:21:53.340 --> 00:21:54.720 the beta receptors,

NOTE Confidence: 0.950317

00:21:54.720 --> 00:21:57.996 it causes a cascade of events that

NOTE Confidence: 0.950317

00:21:57.996 --> 00:21:59.400 actually prevent depotentiation,

NOTE Confidence: 0.950317

00:21:59.400 --> 00:22:01.278 So that depotentiation.

NOTE Confidence: 0.94780115

00:22:03.290 --> 00:22:04.922 Function if if cells are firing

NOTE Confidence: 0.94780115

00:22:04.922 --> 00:22:06.834 at the Theta troughs can't happen

NOTE Confidence: 0.94780115

00:22:06.834 --> 00:22:08.370 when norepinephrine is present,

NOTE Confidence: 0.94780115

00:22:08.370 --> 00:22:10.274 so the only time it can happen is

NOTE Confidence: 0.94780115

00:22:10.274 --> 00:22:12.181 during that transition to REM and REM

NOTE Confidence: 0.94780115

00:22:12.181 --> 00:22:14.003 sleep state when the slope surrealist

NOTE Confidence: 0.94780115

00:22:14.003 --> 00:22:15.958 isn't firing and not providing

NOTE Confidence: 0.94780115

00:22:15.958 --> 00:22:17.522 norepinephrine to the forebrain.

NOTE Confidence: 0.94780115

00:22:17.530 --> 00:22:20.858 All right, so I wanted to go to

NOTE Confidence: 0.94780115

00:22:20.858 --> 00:22:23.062 the University of Arizona and

NOTE Confidence: 0.94780115

00:22:23.062 --> 00:22:25.769 see what REM sleep Theta is for

NOTE Confidence: 0.94780115

00:22:25.769 --> 00:22:27.767 and firing during and REM sleep.

NOTE Confidence: 0.94780115

00:22:27.770 --> 00:22:30.122 Is it for learning and memory or

NOTE Confidence: 0.94780115

00:22:30.122 --> 00:22:31.690 for depotentiating and erasing?

NOTE Confidence: 0.94780115

00:22:31.690 --> 00:22:32.862 So we have this,

NOTE Confidence: 0.94780115

00:22:32.862 --> 00:22:34.620 you know tetrodes system where we

NOTE Confidence: 0.94780115

00:22:34.681 --> 00:22:36.439 can record from multiple cells at

NOTE Confidence: 0.94780115

00:22:36.439 --> 00:22:38.386 the same time in the hippocampus

NOTE Confidence: 0.94780115

00:22:38.386 --> 00:22:40.528 as animals are learning and running

NOTE Confidence: 0.94780115

00:22:40.528 --> 00:22:42.482 around in their environment and we

NOTE Confidence: 0.94780115

00:22:42.482 --> 00:22:45.147 can see how they fire in relation to

NOTE Confidence: 0.94780115

00:22:45.147 --> 00:22:47.409 that local field potential of Theta.

NOTE Confidence: 0.94780115

00:22:47.410 --> 00:22:49.566 Here's a task where we have rats

NOTE Confidence: 0.94780115

00:22:49.566 --> 00:22:51.960 running around on a on a maze and three

NOTE Confidence: 0.94780115

00:22:51.960 --> 00:22:54.008 of the boxes are baited with food.

NOTE Confidence: 0.94780115

00:22:54.010 --> 00:22:55.774 After a week of that we switch

NOTE Confidence: 0.94780115

00:22:55.774 --> 00:22:56.970 which boxes are baited,

NOTE Confidence: 0.94780115

00:22:56.970 --> 00:22:58.909 so they have to sort of relearn.

NOTE Confidence: 0.94780115

00:22:58.910 --> 00:23:00.486 And depotentiation becomes really

NOTE Confidence: 0.94780115

00:23:00.486 --> 00:23:03.205 important because we want them to stop

NOTE Confidence: 0.94780115

00:23:03.205 --> 00:23:04.933 checking the old boxes where food

NOTE Confidence: 0.94780115

00:23:04.933 --> 00:23:07.748 used to be and start checking the new ones.

NOTE Confidence: 0.94780115

00:23:07.750 --> 00:23:10.060 We can track which cells are firing

NOTE Confidence: 0.94780115

00:23:10.060 --> 00:23:12.437 where and see which cells are

NOTE Confidence: 0.94780115

00:23:12.437 --> 00:23:14.627 associated with encoding old box

NOTE Confidence: 0.94780115

00:23:14.627 --> 00:23:16.788 positions versus new box positions.

NOTE Confidence: 0.94780115

00:23:16.790 --> 00:23:20.375 So we can really see whether the cells

NOTE Confidence: 0.94780115

00:23:20.375 --> 00:23:23.225 are involved in encoding something new.

NOTE Confidence: 0.94780115

00:23:23.230 --> 00:23:26.079 And here is how the cells fire

NOTE Confidence: 0.94780115

00:23:26.079 --> 00:23:27.610 during wakefulness here is.

NOTE Confidence: 0.94780115

00:23:27.610 --> 00:23:30.360 Here's hippocampal cells bursts during

NOTE Confidence: 0.94780115

00:23:30.360 --> 00:23:34.448 when as it goes through a place field.

NOTE Confidence: 0.94780115

00:23:34.450 --> 00:23:36.522 So here's a place where this cell

NOTE Confidence: 0.94780115

00:23:36.522 --> 00:23:38.635 is encoding and you can see the

NOTE Confidence: 0.94780115

00:23:38.635 --> 00:23:40.375 most of the spikes are occurring

NOTE Confidence: 0.94780115

00:23:40.439 --> 00:23:41.769 at the peaks of Theta.

NOTE Confidence: 0.94780115

00:23:41.770 --> 00:23:44.407 As you can see this is the Theta phase

NOTE Confidence: 0.94780115

00:23:44.410 --> 00:23:47.308 as they run around and then they stop to

NOTE Confidence: 0.94780115

00:23:47.308 --> 00:23:50.566 eat and you can see Theta stops altogether.

NOTE Confidence: 0.94780115

00:23:50.570 --> 00:23:51.850 And then during REM sleep,

NOTE Confidence: 0.94780115

00:23:51.850 --> 00:23:53.250 the first data set I looked at,

NOTE Confidence: 0.94780115

00:23:53.250 --> 00:23:55.056 the cells are flying at the opposite

NOTE Confidence: 0.94780115

00:23:55.056 --> 00:23:56.749 phase of Theta at Theta troughs.

NOTE Confidence: 0.94780115

00:23:56.750 --> 00:23:59.613 So Francis Crick had put and Graham

NOTE Confidence: 0.94780115

00:23:59.613 --> 00:24:02.274 Mitchinson had put out a paper to say,

NOTE Confidence: 0.94780115

00:24:02.274 --> 00:24:04.108 hey, maybe REM sleep is for forgetting.

NOTE Confidence: 0.94780115

00:24:04.110 --> 00:24:06.938 And it is sort of belied decades

NOTE Confidence: 0.94780115

00:24:06.938 --> 00:24:08.652 of data where, you know,

NOTE Confidence: 0.94780115

00:24:08.652 --> 00:24:10.158 REM sleep seemed to be really

NOTE Confidence: 0.94780115

00:24:10.158 --> 00:24:11.709 important for memory consolidation.

NOTE Confidence: 0.94780115

00:24:11.710 --> 00:24:15.860 So it was kind of puzzling why are

NOTE Confidence: 0.94780115

00:24:15.860 --> 00:24:17.910 cells firing at Theta troughs?

NOTE Confidence: 0.94780115

00:24:17.910 --> 00:24:20.094 Consistent with what John Lisman had

NOTE Confidence: 0.94780115

00:24:20.094 --> 00:24:22.135 said is important for depotentiation

NOTE Confidence: 0.94780115

00:24:22.135 --> 00:24:24.750 when norepinephrine is not present,

NOTE Confidence: 0.94780115

00:24:24.750 --> 00:24:27.630 or which would be erasing memories.

NOTE Confidence: 0.94780115

00:24:27.630 --> 00:24:29.910 The next data set I looked at though,

NOTE Confidence: 0.94780115

00:24:29.910 --> 00:24:33.630 it was animals learning a new maze,

NOTE Confidence: 0.94780115

00:24:33.630 --> 00:24:35.415 and day after day they're running it

NOTE Confidence: 0.94780115

00:24:35.415 --> 00:24:37.029 Always during the learning session,

NOTE Confidence: 0.94780115

00:24:37.030 --> 00:24:39.431 the cells are firing at Theta peaks

NOTE Confidence: 0.94780115

00:24:39.431 --> 00:24:41.270 consistent with longterm potentiation,

NOTE Confidence: 0.94780115

00:24:41.270 --> 00:24:43.874 but they start firing at Theta

NOTE Confidence: 0.94780115

00:24:43.874 --> 00:24:46.658 troughs only after five or six days.

NOTE Confidence: 0.94780115

00:24:46.660 --> 00:24:50.380 Of running that novel environment,

NOTE Confidence: 0.94780115

00:24:50.380 --> 00:24:51.742 initially novel environment.

NOTE Confidence: 0.94780115

00:24:51.742 --> 00:24:54.920 And this was really cool to me

NOTE Confidence: 0.94780115

00:24:55.000 --> 00:24:57.586 because what this this time course

NOTE Confidence: 0.94780115

00:24:57.586 --> 00:24:59.956 is is consistent with the length

NOTE Confidence: 0.94780115

00:24:59.956 --> 00:25:02.308 of time it takes us to consolidate

NOTE Confidence: 0.94780115

00:25:02.308 --> 00:25:02.980 memories from

NOTE Confidence: 0.946962474

00:25:03.043 --> 00:25:05.058 the hippocampus to the neocortex.

NOTE Confidence: 0.946962474

00:25:05.060 --> 00:25:07.328 After which time you can lesion

NOTE Confidence: 0.946962474

00:25:07.328 --> 00:25:08.840 the hippocampus bilaterally after

NOTE Confidence: 0.946962474

00:25:08.903 --> 00:25:10.856 seven days and still get an animal

NOTE Confidence: 0.946962474

00:25:10.856 --> 00:25:12.629 a month later that remembers.

NOTE Confidence: 0.946962474

00:25:12.630 --> 00:25:15.254 The place you introduced it to on the

NOTE Confidence: 0.946962474

00:25:15.254 --> 00:25:17.310 first day. So that was the end to me.

NOTE Confidence: 0.946962474

00:25:17.310 --> 00:25:17.994 Like, so exciting.

NOTE Confidence: 0.946962474

00:25:17.994 --> 00:25:19.590 I thought maybe room sleep is for

NOTE Confidence: 0.946962474

00:25:19.634 --> 00:25:20.950 remembering or for forgetting,

NOTE Confidence: 0.946962474

00:25:20.950 --> 00:25:23.238 but in fact what seems to be occurring

NOTE Confidence: 0.946962474

00:25:23.238 --> 00:25:25.987 is in the first couple of days before

NOTE Confidence: 0.946962474

00:25:25.987 --> 00:25:28.310 the memories are fully consolidated.

NOTE Confidence: 0.946962474

00:25:28.310 --> 00:25:30.620 The hippocampus is still firing at

NOTE Confidence: 0.946962474

00:25:30.620 --> 00:25:32.678 Theta peaks consistent with Long

NOTE Confidence: 0.946962474

00:25:32.678 --> 00:25:34.883 Term Potentiation and only after.

NOTE Confidence: 0.946962474

00:25:34.883 --> 00:25:37.038 Enough time has passed for

NOTE Confidence: 0.946962474

00:25:37.038 --> 00:25:38.679 that consolidation to happen.

NOTE Confidence: 0.946962474

00:25:38.680 --> 00:25:40.690 Does it start firing at Theta

NOTE Confidence: 0.946962474

00:25:40.690 --> 00:25:42.409 traps consistent with erasing the

NOTE Confidence: 0.946962474

00:25:42.409 --> 00:25:43.999 memory from the hippocampus so

NOTE Confidence: 0.946962474

00:25:43.999 --> 00:25:45.900 the hipocampus can be refreshed?

NOTE Confidence: 0.946962474

00:25:45.900 --> 00:25:48.497 And learn something new the next day.

NOTE Confidence: 0.946962474

00:25:48.500 --> 00:25:51.615 So. So, yeah, so that's the idea.

NOTE Confidence: 0.946962474

00:25:51.620 --> 00:25:53.654 Temporary memory of the hippocampus is

NOTE Confidence: 0.946962474

00:25:53.654 --> 00:25:56.219 cleared in REM sleep to avoid saturation.

NOTE Confidence: 0.946962474

00:25:56.220 --> 00:25:58.140 This is my son when he was 18.

NOTE Confidence: 0.946962474

00:25:58.140 --> 00:26:00.240 Now he's 21.

NOTE Confidence: 0.946962474

00:26:00.240 --> 00:26:02.380 So do not deprive yourself of sleep.

NOTE Confidence: 0.946962474

00:26:02.380 --> 00:26:04.696 There's a really cool paper by

NOTE Confidence: 0.946962474

00:26:04.700 --> 00:26:06.460 from Antoine Adamantides' lab.

NOTE Confidence: 0.946962474

00:26:06.460 --> 00:26:08.220 Richard Boyce did it.

NOTE Confidence: 0.946962474

00:26:08.220 --> 00:26:10.492 And what they did is they reduced the

NOTE Confidence: 0.946962474

00:26:10.492 --> 00:26:12.512 amplitude of Theta by silencing the

NOTE Confidence: 0.946962474

00:26:12.512 --> 00:26:14.594 gabbergic cells in the basal forebrain

NOTE Confidence: 0.946962474

00:26:14.655 --> 00:26:16.419 that projected the hippocampus.

NOTE Confidence: 0.946962474

00:26:16.420 --> 00:26:18.884 And you can see Theta goes from big

NOTE Confidence: 0.946962474

00:26:18.884 --> 00:26:21.179 and lovely to about half amplitude.

NOTE Confidence: 0.946962474

00:26:21.180 --> 00:26:23.340 Here's the five to 10 Hertz

NOTE Confidence: 0.946962474

00:26:23.340 --> 00:26:24.780 frequency range of Theta.

NOTE Confidence: 0.946962474

00:26:24.780 --> 00:26:27.328 And you can see that when they

NOTE Confidence: 0.946962474

00:26:27.328 --> 00:26:28.420 did optogenetic inhibition

NOTE Confidence: 0.946962474

00:26:28.492 --> 00:26:30.220 of these Gabourgic neurons,

NOTE Confidence: 0.946962474

00:26:30.220 --> 00:26:32.590 you got Theta that was half

NOTE Confidence: 0.946962474

00:26:32.590 --> 00:26:33.775 amplitude at best.

NOTE Confidence: 0.946962474

00:26:33.780 --> 00:26:34.860 And when they did this,

NOTE Confidence: 0.946962474

00:26:34.860 --> 00:26:38.180 the animals couldn't learn

NOTE Confidence: 0.946962474

00:26:38.180 --> 00:26:40.080 object place memory task,

NOTE Confidence: 0.946962474

00:26:40.080 --> 00:26:41.980 which is hippocampus dependent.

NOTE Confidence: 0.946962474

00:26:41.980 --> 00:26:44.115 And they also couldn't do

NOTE Confidence: 0.946962474

00:26:44.115 --> 00:26:45.396 contextual fear memory.

NOTE Confidence: 0.946962474

00:26:45.400 --> 00:26:48.040 And that was just inhibiting Theta,

NOTE Confidence: 0.946962474

00:26:48.040 --> 00:26:51.120 and only during REM sleep in these animals,

NOTE Confidence: 0.946962474

00:26:51.120 --> 00:26:52.194 these rats,

NOTE Confidence: 0.946962474

00:26:52.194 --> 00:26:55.953 after introducing them to this new things.

NOTE Confidence: 0.946962474

00:26:55.960 --> 00:26:57.560 So,

NOTE Confidence: 0.946962474

00:26:57.560 --> 00:26:58.700 so yeah,

NOTE Confidence: 0.946962474

00:26:58.700 --> 00:27:02.120 so let's concentrate for a moment,

NOTE Confidence: 0.946962474

00:27:02.120 --> 00:27:04.241 But back from Theta to that transition

NOTE Confidence: 0.946962474

00:27:04.241 --> 00:27:06.399 to REM sleep with sleep spindles.

NOTE Confidence: 0.946962474

00:27:06.400 --> 00:27:10.332 And here are some papers by Ryzowski and

NOTE Confidence: 0.946962474

00:27:10.332 --> 00:27:13.488 Ceapus from Ceapus's lab at Caltech.

NOTE Confidence: 0.946962474

00:27:13.490 --> 00:27:15.324 And what he shows is that the

NOTE Confidence: 0.946962474

00:27:15.330 --> 00:27:17.170 the more the hippocampus fires

NOTE Confidence: 0.946962474

00:27:17.170 --> 00:27:19.460 in a burst mode during sleep,

NOTE Confidence: 0.946962474

00:27:19.460 --> 00:27:22.295 so these are the the more cells

NOTE Confidence: 0.946962474

00:27:22.295 --> 00:27:25.097 that are involved in in giving

NOTE Confidence: 0.946962474

00:27:25.097 --> 00:27:27.407 a burst that they're recording,

NOTE Confidence: 0.946962474

00:27:27.410 --> 00:27:30.890 the more the prefrontal cortex responds.

NOTE Confidence: 0.946962474

00:27:30.890 --> 00:27:32.986 And so this is the amount of response

NOTE Confidence: 0.946962474

00:27:32.986 --> 00:27:35.130 to the prefrontal cortical neurons and

NOTE Confidence: 0.946962474

00:27:35.130 --> 00:27:37.835 the time lag between one response to

NOTE Confidence: 0.946962474

00:27:37.835 --> 00:27:40.732 the next is the spindle frequency, so.

NOTE Confidence: 0.946962474

00:27:40.732 --> 00:27:45.052 The more hippocampus hippocampus fires,

NOTE Confidence: 0.946962474

00:27:45.052 --> 00:27:48.124 the more the prefrontal cortex

NOTE Confidence: 0.946962474

00:27:48.124 --> 00:27:52.360 responds with spindle frequency.

NOTE Confidence: 0.946962474

00:27:52.360 --> 00:27:52.731 Activity.

NOTE Confidence: 0.946962474

00:27:52.731 --> 00:27:55.328 So you can see that the spindles

NOTE Confidence: 0.946962474

00:27:55.328 --> 00:27:57.509 that occur in the prefrontal

NOTE Confidence: 0.946962474

00:27:57.509 --> 00:27:59.784 cortex are linked and responding

NOTE Confidence: 0.946962474

00:27:59.784 --> 00:28:01.400 to hippocampal activity.

NOTE Confidence: 0.946962474

00:28:01.400 --> 00:28:02.652 Here is another paper.

NOTE Confidence: 0.946962474

00:28:02.652 --> 00:28:05.599 Now we're going to get into dendrites again.

NOTE Confidence: 0.946962474

00:28:05.600 --> 00:28:08.520 So here's a pyramidal cells of the neocortex.

NOTE Confidence: 0.946962474

00:28:08.520 --> 00:28:11.800 This is a beautiful paper by Julie Seed

NOTE Confidence: 0.946962474

00:28:11.800 --> 00:28:15.200 and then a review by her and Perash.

NOTE Confidence: 0.946962474

00:28:15.200 --> 00:28:17.321 And what they show is that when

NOTE Confidence: 0.946962474

00:28:17.321 --> 00:28:19.559 animals are in that spindle state,

NOTE Confidence: 0.946962474

00:28:19.560 --> 00:28:21.420 which is an intermediate state

NOTE Confidence: 0.946962474

00:28:21.420 --> 00:28:23.280 of sleep transition to REM

NOTE Confidence: 0.944167144444445

00:28:23.280 --> 00:28:24.387 and two stage.

NOTE Confidence: 0.944167144444445

00:28:24.387 --> 00:28:26.970 And the more you have spindle activity

NOTE Confidence: 0.944167144444445

00:28:27.048 --> 00:28:29.560 which is the 9 to 16 Hertz activity,

NOTE Confidence: 0.944167144444445

00:28:29.560 --> 00:28:32.759 the more you have signs that calcium,

NOTE Confidence: 0.944167144444445

00:28:32.760 --> 00:28:35.010 lots of calcium is entering

NOTE Confidence: 0.944167144444445

00:28:35.010 --> 00:28:36.360 these distal dendrites.

NOTE Confidence: 0.944167144444445

00:28:36.360 --> 00:28:39.264 So we know if calcium entry comes the

NOTE Confidence: 0.944167144444445

00:28:39.264 --> 00:28:42.464 ability to have longterm potentiation, so.

NOTE Confidence: 0.944167144444445

00:28:42.464 --> 00:28:44.184 It seems like that during

NOTE Confidence: 0.944167144444445

00:28:44.184 --> 00:28:46.030 these nonrem states of sleep,

NOTE Confidence: 0.944167144444445

00:28:46.030 --> 00:28:47.782 when you have lots of sleep

NOTE Confidence: 0.944167144444445

00:28:47.782 --> 00:28:49.630 spindles which is in two state,

NOTE Confidence: 0.944167144444445

00:28:49.630 --> 00:28:53.270 you can have longterm potentiation

NOTE Confidence: 0.944167144444445

00:28:53.270 --> 00:28:55.867 with the calcium entry that's going on.

NOTE Confidence: 0.944167144444445

00:28:55.870 --> 00:28:57.594 And it's really specifically

NOTE Confidence: 0.944167144444445

00:28:57.594 --> 00:28:59.749 out here at distal dendrites.

NOTE Confidence: 0.944167144444445

00:28:59.750 --> 00:29:02.000 At the proximal dendrites there's

NOTE Confidence: 0.944167144444445

00:29:02.000 --> 00:29:03.350 practically nothing happening

NOTE Confidence: 0.944167144444445

00:29:03.350 --> 00:29:05.390 in terms of calcium activity

NOTE Confidence: 0.944167144444445

00:29:05.390 --> 00:29:08.666 and and also in the cell body.

NOTE Confidence: 0.944167144444445

00:29:08.670 --> 00:29:09.388 So that's.

NOTE Confidence: 0.944167144444445

00:29:09.388 --> 00:29:12.735 So it might be a time when the hippocampus,

NOTE Confidence: 0.944167144444445

00:29:12.735 --> 00:29:13.685 for example,

NOTE Confidence: 0.944167144444445

00:29:13.685 --> 00:29:16.535 can consolidate memories to the distal

NOTE Confidence: 0.944167144444445

00:29:16.535 --> 00:29:18.618 dendrites of the cortical neurons.

NOTE Confidence: 0.944167144444445

00:29:18.620 --> 00:29:20.265 And it's the distal dendrites

NOTE Confidence: 0.944167144444445

00:29:20.265 --> 00:29:22.521 that house the sort of cortical

NOTE Confidence: 0.944167144444445

00:29:22.521 --> 00:29:25.584 cortical information that and and

NOTE Confidence: 0.944167144444445

00:29:25.584 --> 00:29:28.739 modification of of our perceptions

NOTE Confidence: 0.944167144444445

00:29:28.740 --> 00:29:32.996 and and our actions that it's a place

NOTE Confidence: 0.944167144444445

00:29:32.996 --> 00:29:35.348 where I loosely called schema are

NOTE Confidence: 0.944167144444445

00:29:35.348 --> 00:29:37.910 formed out in the distal dendrites.

NOTE Confidence: 0.944167144444445

00:29:37.910 --> 00:29:38.318 So,

NOTE Confidence: 0.944167144444445

00:29:38.318 --> 00:29:40.358 so another thing that happens

NOTE Confidence: 0.944167144444445

00:29:40.358 --> 00:29:41.990 specifically at distal dendrites,

NOTE Confidence: 0.944167144444445

00:29:41.990 --> 00:29:43.747 both in the cortex and the hippocampus.

NOTE Confidence: 0.944167144444445

00:29:43.750 --> 00:29:45.734 This is both of these slides are true

NOTE Confidence: 0.944167144444445

00:29:45.734 --> 00:29:47.977 in the hippocampus as well as the

NOTE Confidence: 0.944167144444445

00:29:47.977 --> 00:29:49.667 probably true in the hippocampus.

NOTE Confidence: 0.944167144444445

00:29:49.670 --> 00:29:51.504 Here we know it isn't true in

NOTE Confidence: 0.944167144444445

00:29:51.504 --> 00:29:52.624 the hippocampus that there's

NOTE Confidence: 0.944167144444445

00:29:52.624 --> 00:29:54.109 something called these P waves,

NOTE Confidence: 0.944167144444445

00:29:54.110 --> 00:29:56.195 which are big glutamaturgic surges

NOTE Confidence: 0.944167144444445

00:29:56.195 --> 00:29:58.982 that come from the brainstem all the

NOTE Confidence: 0.944167144444445

00:29:58.982 --> 00:30:00.884 way through the thalamus and the

NOTE Confidence: 0.944167144444445

00:30:00.884 --> 00:30:03.253 and the cortex and the hippocampus.

NOTE Confidence: 0.944167144444445

00:30:03.253 --> 00:30:06.476 And these P waves provide tons of

NOTE Confidence: 0.944167144444445

00:30:06.476 --> 00:30:09.036 glutamate also specifically to the

NOTE Confidence: 0.944167144444445

00:30:09.036 --> 00:30:12.058 distal dendrites of these pyramidal cells.

NOTE Confidence: 0.944167144444445

00:30:12.060 --> 00:30:14.391 So the and the P waves happen

NOTE Confidence: 0.944167144444445

00:30:14.391 --> 00:30:17.426 also in the N2 state and then they

NOTE Confidence: 0.944167144444445

00:30:17.426 --> 00:30:19.376 happen in spades in rems,

NOTE Confidence: 0.944167144444445

00:30:19.380 --> 00:30:20.800 like they're bursting all

NOTE Confidence: 0.944167144444445

00:30:20.800 --> 00:30:22.575 the time in REM sleep,

NOTE Confidence: 0.944167144444445

00:30:22.580 --> 00:30:24.414 particularly the active phase of REM sleep.

NOTE Confidence: 0.944167144444445

00:30:24.420 --> 00:30:27.294 And this big glutamaturgic surge combined

NOTE Confidence: 0.944167144444445

00:30:27.294 --> 00:30:30.719 during N2 state with with these big

NOTE Confidence: 0.944167144444445

00:30:30.719 --> 00:30:33.089 calcium inputs could really cause.

NOTE Confidence: 0.944167144444445

00:30:33.090 --> 00:30:35.375 A beautiful longterm potentiation out

NOTE Confidence: 0.944167144444445

00:30:35.375 --> 00:30:38.788 here that I'm going to argue is not

NOTE Confidence: 0.944167144444445

00:30:38.788 --> 00:30:40.843 as readily possible during wakefulness.

NOTE Confidence: 0.944167144444445

00:30:40.843 --> 00:30:42.647 So here's the idea.

NOTE Confidence: 0.944167144444445

00:30:42.650 --> 00:30:45.270 In the hippocampus during our

NOTE Confidence: 0.944167144444445

00:30:45.270 --> 00:30:47.366 waking and coding period,

NOTE Confidence: 0.944167144444445

00:30:47.370 --> 00:30:48.828 the novelty pathway,

NOTE Confidence: 0.944167144444445

00:30:48.828 --> 00:30:51.258 which is the trisynaptic pathway

NOTE Confidence: 0.944167144444445

00:30:51.258 --> 00:30:54.530 that comes from layer two of the

NOTE Confidence: 0.944167144444445

00:30:54.530 --> 00:30:56.915 antarainal cortex to the dentate

NOTE Confidence: 0.944167144444445

00:30:56.915 --> 00:31:00.502 gyrus to CA-3 to CA-1 all impacts the

NOTE Confidence: 0.944167144444445

00:31:00.502 --> 00:31:02.926 proximal dendrites here close to the.

NOTE Confidence: 0.944167144444445

00:31:02.930 --> 00:31:05.618 To the cell body and can cause

NOTE Confidence: 0.944167144444445

00:31:05.618 --> 00:31:07.188 beautiful longterm potentiation there

NOTE Confidence: 0.944167144444445

00:31:07.188 --> 00:31:09.659 in the mill year of wakefulness which

NOTE Confidence: 0.944167144444445

00:31:09.659 --> 00:31:11.297 includes high norepinephrine which

NOTE Confidence: 0.944167144444445

00:31:11.297 --> 00:31:14.328 helps us to learn and helps longterm

NOTE Confidence: 0.944167144444445

00:31:14.328 --> 00:31:17.449 potentiation but prevents depotentiation.

NOTE Confidence: 0.944167144444445

00:31:17.450 --> 00:31:19.725 And the when we're learning

NOTE Confidence: 0.944167144444445

00:31:19.725 --> 00:31:21.090 something brand new,

NOTE Confidence: 0.944167144444445

00:31:21.090 --> 00:31:23.902 the familiarity encoding circuit

NOTE Confidence: 0.944167144444445

00:31:23.902 --> 00:31:27.417 which was identified by Olga

NOTE Confidence: 0.944167144444445

00:31:27.417 --> 00:31:29.794 Vinogradova in Russia and think she

NOTE Confidence: 0.944167144444445

00:31:29.794 --> 00:31:31.948 published her last paper in 2001.

NOTE Confidence: 0.944167144444445

00:31:31.948 --> 00:31:34.456 She called this from from lots

NOTE Confidence: 0.944167144444445

00:31:34.456 --> 00:31:35.710 of her research,

NOTE Confidence: 0.944167144444445

00:31:35.710 --> 00:31:38.290 this is the familiarity coding circuit

NOTE Confidence: 0.944167144444445

00:31:38.290 --> 00:31:40.461 coming from enteranocortex layer three

NOTE Confidence: 0.944167144444445

00:31:40.461 --> 00:31:42.747 directly to the CA-1 distal dendrites.

NOTE Confidence: 0.944167144444445

00:31:42.750 --> 00:31:43.779 That doesn't it.

NOTE Confidence: 0.944167144444445

00:31:43.779 --> 00:31:46.180 It's not that active because LTP is

NOTE Confidence: 0.944167144444445

00:31:46.252 --> 00:31:48.625 much more difficult to get out here.

NOTE Confidence: 0.944167144444445

00:31:48.630 --> 00:31:49.962 That's something that Aaron

NOTE Confidence: 0.944167144444445

00:31:49.962 --> 00:31:51.960 Schumann showed at LTP is very

NOTE Confidence: 0.898233153333333

00:31:52.017 --> 00:31:53.507 difficult to get out here.

NOTE Confidence: 0.898233153333333

00:31:53.510 --> 00:31:54.950 But during that transition

NOTE Confidence: 0.898233153333333

00:31:54.950 --> 00:31:57.110 to REM sleep when we've got

NOTE Confidence: 0.93622826

00:31:59.470 --> 00:32:02.446 that those P waves.

NOTE Confidence: 0.93622826

00:32:02.446 --> 00:32:04.462 And and sleep spindles.

NOTE Confidence: 0.93622826

00:32:04.462 --> 00:32:06.582 You could actually get beautiful

NOTE Confidence: 0.93622826

00:32:06.582 --> 00:32:08.046 longterm potentiation out here

NOTE Confidence: 0.93622826

00:32:08.046 --> 00:32:09.696 And then during REM sleep when

NOTE Confidence: 0.93622826

00:32:09.696 --> 00:32:11.629 you also have no norepinephrine.

NOTE Confidence: 0.93622826

00:32:11.630 --> 00:32:15.790 That potentiated circuit out here

NOTE Confidence: 0.93622826

00:32:15.790 --> 00:32:18.190 which is at a different phase of Theta

NOTE Confidence: 0.93622826

00:32:18.190 --> 00:32:20.103 inputs are coming at the opposite

NOTE Confidence: 0.93622826

00:32:20.103 --> 00:32:22.350 phase of Theta than they are here.

NOTE Confidence: 0.93622826

00:32:22.350 --> 00:32:24.882 Can that now potentiated circuit could

NOTE Confidence: 0.93622826

00:32:24.882 --> 00:32:27.207 actually cause a dendritic spike to

NOTE Confidence: 0.93622826

00:32:27.207 --> 00:32:30.080 cause the cell to fire at the Theta through?

NOTE Confidence: 0.93622826

00:32:30.080 --> 00:32:32.130 If you're measuring the Theta

NOTE Confidence: 0.93622826

00:32:32.130 --> 00:32:33.360 trough intracellular here,

NOTE Confidence: 0.93622826

00:32:33.360 --> 00:32:37.560 and that could cause depotentiation here,

NOTE Confidence: 0.93622826

00:32:37.560 --> 00:32:40.098 because here all of these inputs

NOTE Confidence: 0.93622826

00:32:40.098 --> 00:32:43.254 are not arriving when the cells are

NOTE Confidence: 0.93622826

00:32:43.254 --> 00:32:45.554 firing with their dendritic spike

NOTE Confidence: 0.93622826

00:32:45.560 --> 00:32:47.918 causing the whole cell to fire.

NOTE Confidence: 0.93622826

00:32:47.920 --> 00:32:50.256 These inputs are not arriving and so that

NOTE Confidence: 0.93622826

00:32:50.256 --> 00:32:52.559 would cause heterosynaptic depotentiation,

NOTE Confidence: 0.93622826

00:32:52.560 --> 00:32:55.816 particularly in the absence of neuropaneph.

NOTE Confidence: 0.93622826

00:32:55.816 --> 00:32:57.156 Sorry, let me get it.

NOTE Confidence: 0.9402536

00:32:59.660 --> 00:33:01.340 There's my dog. Hello dog.

NOTE Confidence: 0.7632581

00:33:07.020 --> 00:33:10.960 OK, so all right,

NOTE Confidence: 0.7632581

00:33:10.960 --> 00:33:13.710 so spontaneously spindles increase after

NOTE Confidence: 0.7632581

00:33:13.710 --> 00:33:15.958 learning hippocampus dependent learning.

NOTE Confidence: 0.7632581

00:33:15.958 --> 00:33:20.486 So in humans, during a declarative

NOTE Confidence: 0.7632581

00:33:20.486 --> 00:33:23.216 task which involves the hippocampus,

NOTE Confidence: 0.7632581

00:33:23.220 --> 00:33:26.046 spindles increase. In animals,

NOTE Confidence: 0.7632581

00:33:26.046 --> 00:33:27.594 during a digging task where they

NOTE Confidence: 0.7632581

00:33:27.594 --> 00:33:29.480 have to dig in a particular place

NOTE Confidence: 0.7632581

00:33:29.480 --> 00:33:31.112 and associate that dig with an

NOTE Confidence: 0.7632581

00:33:31.112 --> 00:33:32.684 odor that's in a particular place,

NOTE Confidence: 0.7632581

00:33:32.690 --> 00:33:34.535 or a nose poke task where they have to

NOTE Confidence: 0.7632581

00:33:34.535 --> 00:33:36.365 poke their nose in a particular place,

NOTE Confidence: 0.7632581

00:33:36.370 --> 00:33:39.570 sleep spindles really increase.

NOTE Confidence: 0.7632581

00:33:39.570 --> 00:33:41.796 And then there's just been study after

NOTE Confidence: 0.7632581

00:33:41.796 --> 00:33:44.132 study showing the importance of sleep

NOTE Confidence: 0.7632581

00:33:44.132 --> 00:33:45.888 spindles for memory consolidation.

NOTE Confidence: 0.7632581

00:33:45.890 --> 00:33:48.530 So my student Michelle Frazier,

NOTE Confidence: 0.7632581

00:33:48.530 --> 00:33:50.846 who's almost finished with her dissertation,

NOTE Confidence: 0.7632581

00:33:50.850 --> 00:33:52.488 I'm going to be sad to see her go.

NOTE Confidence: 0.7632581

00:33:52.490 --> 00:33:53.756 She's absolutely brilliant,

NOTE Confidence: 0.7632581

00:33:53.756 --> 00:33:55.444 is able to test.

NOTE Confidence: 0.7632581

00:33:55.450 --> 00:33:58.006 Are kind of working hypothesis that

NOTE Confidence: 0.7632581

00:33:58.010 --> 00:34:01.190 that input to the distal dendrites

NOTE Confidence: 0.7632581

00:34:01.190 --> 00:34:03.810 versus the proximal dendrites is is

NOTE Confidence: 0.7632581

00:34:03.810 --> 00:34:06.606 really important for the sense of

NOTE Confidence: 0.7632581

00:34:06.606 --> 00:34:09.210 familiarity and she's looking at is the

NOTE Confidence: 0.7632581

00:34:09.210 --> 00:34:11.802 interneurons that specifically inhibit

NOTE Confidence: 0.7632581

00:34:11.802 --> 00:34:15.042 activity at the distal dendrites,

NOTE Confidence: 0.7632581

00:34:15.050 --> 00:34:17.382 they're called OLM interneurons.

NOTE Confidence: 0.7632581

00:34:17.382 --> 00:34:18.548 So again,

NOTE Confidence: 0.7632581

00:34:18.550 --> 00:34:21.262 the idea is that during wakefulness

NOTE Confidence: 0.7632581

00:34:21.262 --> 00:34:23.670 you're able to strengthen quickly

NOTE Confidence: 0.7632581

00:34:23.670 --> 00:34:25.710 through a long term potentiation the

NOTE Confidence: 0.7632581

00:34:25.710 --> 00:34:28.110 proximal dendrites of the hippocampus,

NOTE Confidence: 0.7632581

00:34:28.110 --> 00:34:31.870 which encodes novel information and then and.

NOTE Confidence: 0.7632581

00:34:31.870 --> 00:34:33.550 But nothing much is happening here.

NOTE Confidence: 0.7632581

00:34:33.550 --> 00:34:38.206 And then during the late consolidation phase,

NOTE Confidence: 0.7632581

00:34:38.206 --> 00:34:40.090 after potentiation has happened

NOTE Confidence: 0.7632581

00:34:40.090 --> 00:34:42.190 here at the distal dendrites,

NOTE Confidence: 0.7632581

00:34:42.190 --> 00:34:44.560 you can get dendritic spikes

NOTE Confidence: 0.7632581

00:34:44.560 --> 00:34:46.268 occurring at to force.

NOTE Confidence: 0.7632581

00:34:46.268 --> 00:34:48.921 The cell to fire at what is

NOTE Confidence: 0.7632581

00:34:48.921 --> 00:34:50.569 locally fatal troughs.

NOTE Confidence: 0.7632581

00:34:50.570 --> 00:34:54.128 Sorry to cause deep potentiation there.

NOTE Confidence: 0.7632581

00:34:54.130 --> 00:34:55.610 Sleep spindles are the thing,

NOTE Confidence: 0.7632581

00:34:55.610 --> 00:34:59.650 and PGO waves to strengthen these dendrites.

NOTE Confidence: 0.7632581

00:34:59.650 --> 00:35:00.410 OK,

NOTE Confidence: 0.931448125

00:35:03.370 --> 00:35:06.156 So what does all this have to do with

NOTE Confidence: 0.931448125

00:35:06.156 --> 00:35:08.086 REM sleep, dreaming, and emotions?

NOTE Confidence: 0.931448125

00:35:08.090 --> 00:35:10.489 Let's get back to that. All right, so.

NOTE Confidence: 0.945285231

00:35:12.570 --> 00:35:13.992 What's happening during REM sleep is

NOTE Confidence: 0.945285231

00:35:13.992 --> 00:35:15.985 you have these P waves and they come

NOTE Confidence: 0.945285231

00:35:15.985 --> 00:35:17.485 from what's called the sub cyrillus,

NOTE Confidence: 0.945285231

00:35:17.490 --> 00:35:19.849 an area just beneath the local cyrillus.

NOTE Confidence: 0.945285231

00:35:19.850 --> 00:35:21.873 We know that the local cyrillus and

NOTE Confidence: 0.945285231

00:35:21.873 --> 00:35:23.569 dorsal rafae nucleus are not firing,

NOTE Confidence: 0.945285231

00:35:23.570 --> 00:35:26.150 so you not providing those two

NOTE Confidence: 0.945285231

00:35:26.150 --> 00:35:28.368 neurotransmitters and if I've skipped

NOTE Confidence: 0.945285231

00:35:28.368 --> 00:35:30.888 something you please feel free to

NOTE Confidence: 0.945285231

00:35:30.890 --> 00:35:32.899 interrupt me if you're like, wait a minute,

NOTE Confidence: 0.945285231

00:35:32.899 --> 00:35:34.930 what does this have to do with this?

NOTE Confidence: 0.945285231

00:35:34.930 --> 00:35:38.066 Please just feel free to interrupt me that.

NOTE Confidence: 0.945285231

00:35:38.070 --> 00:35:41.868 So areas of the brain that are really active

NOTE Confidence: 0.945285231

00:35:41.868 --> 00:35:44.948 during REM sleep are the limbic areas,

NOTE Confidence: 0.945285231

00:35:44.950 --> 00:35:47.710 including the anterior cingulate cortex,

NOTE Confidence: 0.945285231

00:35:47.710 --> 00:35:49.750 the secondary visual areas probably

NOTE Confidence: 0.945285231

00:35:49.750 --> 00:35:51.790 responsible for the visual content

NOTE Confidence: 0.945285231

00:35:51.853 --> 00:35:52.669 of our dreams.

NOTE Confidence: 0.945285231

00:35:52.670 --> 00:35:54.728 But there are whole swaths of our

NOTE Confidence: 0.945285231

00:35:54.728 --> 00:35:56.525 brain that are actually not very

NOTE Confidence: 0.945285231

00:35:56.525 --> 00:35:59.533 active at all if you look at pet pet

NOTE Confidence: 0.945285231

00:35:59.533 --> 00:36:03.448 images like our prefrontal cortex.

NOTE Confidence: 0.945285231

00:36:03.450 --> 00:36:06.375 Where judgments and decision making

NOTE Confidence: 0.945285231

00:36:06.375 --> 00:36:09.761 happen probably the reason why in

NOTE Confidence: 0.945285231

00:36:09.761 --> 00:36:12.578 our dreams we have do things that we

NOTE Confidence: 0.945285231

00:36:12.578 --> 00:36:14.238 wouldn't necessarily do when we're

NOTE Confidence: 0.945285231

00:36:14.238 --> 00:36:16.685 awake and things happen that are not

NOTE Confidence: 0.945285231

00:36:16.685 --> 00:36:18.791 necessarily logic logical and we don't

NOTE Confidence: 0.945285231

00:36:18.791 --> 00:36:20.807 really question them because you know,

NOTE Confidence: 0.945285231

00:36:20.810 --> 00:36:23.020 our prefrontal cortex is really

NOTE Confidence: 0.945285231

00:36:23.020 --> 00:36:25.230 fairly inactive and these are

NOTE Confidence: 0.945285231

00:36:25.312 --> 00:36:27.845 various studies that show that so.

NOTE Confidence: 0.945285231

00:36:27.845 --> 00:36:30.330 So what we think this is important

NOTE Confidence: 0.945285231

00:36:30.330 --> 00:36:33.298 for is again that heterosynaptic

NOTE Confidence: 0.945285231

00:36:33.298 --> 00:36:34.750 depotentiation idea.

NOTE Confidence: 0.945285231

00:36:34.750 --> 00:36:37.066 So when norepinephrine is not present,

NOTE Confidence: 0.945285231

00:36:37.070 --> 00:36:38.310 you can get depotentiation.

NOTE Confidence: 0.945285231

00:36:38.310 --> 00:36:40.499 When some areas of the brain are

NOTE Confidence: 0.945285231

00:36:40.499 --> 00:36:42.125 super active and other areas of

NOTE Confidence: 0.945285231

00:36:42.125 --> 00:36:43.829 the brain are super inactive,

NOTE Confidence: 0.945285231

00:36:43.830 --> 00:36:46.524 you can actually get a weakening

NOTE Confidence: 0.945285231

00:36:46.524 --> 00:36:48.870 of synapses between those areas.

NOTE Confidence: 0.945285231

00:36:48.870 --> 00:36:52.404 So our frontal cortex is really

NOTE Confidence: 0.945285231

00:36:52.404 --> 00:36:55.430 relatively inactive during REM sleep,

NOTE Confidence: 0.945285231

00:36:55.430 --> 00:36:57.578 and this is a PET scan.

NOTE Confidence: 0.945285231

00:36:57.580 --> 00:37:02.020 And also inactive relative to slow a sleep.

NOTE Confidence: 0.945285231

00:37:02.020 --> 00:37:05.557 But REM sleep is has a time when our

NOTE Confidence: 0.945285231

00:37:05.557 --> 00:37:08.109 limbics areas are very very active

NOTE Confidence: 0.945285231

00:37:08.109 --> 00:37:09.954 and probably responsible for the

NOTE Confidence: 0.945285231

00:37:09.954 --> 00:37:11.900 emotional content of our dreams.

NOTE Confidence: 0.945285231

00:37:11.900 --> 00:37:14.861 And it is our idea that without

NOTE Confidence: 0.945285231

00:37:14.861 --> 00:37:17.309 norepinephrine there to cause potentiation

NOTE Confidence: 0.945285231

00:37:17.309 --> 00:37:20.054 and to block deep potentiation,

NOTE Confidence: 0.945285231

00:37:20.060 --> 00:37:24.260 we could actually get a separation

NOTE Confidence: 0.945285231

00:37:24.260 --> 00:37:27.260 between this activated emotional circuit.

NOTE Confidence: 0.945285231

00:37:27.260 --> 00:37:29.108 And the prefrontal cortex.

NOTE Confidence: 0.945285231

00:37:29.108 --> 00:37:31.418 So during wakefulness it's all,

NOTE Confidence: 0.945285231

00:37:31.420 --> 00:37:32.146 you know,

NOTE Confidence: 0.945285231

00:37:32.146 --> 00:37:33.961 being knit together and the

NOTE Confidence: 0.945285231

00:37:33.961 --> 00:37:36.076 emotionality and the facts are all

NOTE Confidence: 0.945285231

00:37:36.076 --> 00:37:38.309 coming in together into our brain and

NOTE Confidence: 0.945285231

00:37:38.380 --> 00:37:40.700 causing lovely longterm potentiation.

NOTE Confidence: 0.945285231

00:37:40.700 --> 00:37:42.590 Because the locus Cerulis is providing

NOTE Confidence: 0.945285231

00:37:42.590 --> 00:37:44.180 neuropidephrine all over the place,

NOTE Confidence: 0.945285231

00:37:44.180 --> 00:37:46.420 letting everything be knit together.

NOTE Confidence: 0.945285231

00:37:46.420 --> 00:37:49.339 But normally during that transition to REM,

NOTE Confidence: 0.945285231

00:37:49.340 --> 00:37:52.480 the the information can be

NOTE Confidence: 0.945285231

00:37:52.480 --> 00:37:54.992 transferred toward distal dendrites.

NOTE Confidence: 0.945285231

00:37:55.000 --> 00:37:57.590 And then during REM sleep we can

NOTE Confidence: 0.945285231

00:37:57.590 --> 00:38:00.200 actually erase them from our that

NOTE Confidence: 0.945285231

00:38:00.200 --> 00:38:02.440 information from our proximal dendrites

NOTE Confidence: 0.945285231

00:38:02.510 --> 00:38:05.336 and reduce then the immediacy,

NOTE Confidence: 0.945285231

00:38:05.336 --> 00:38:10.600 the novelty of all of those emotional,

NOTE Confidence: 0.945285231

00:38:10.600 --> 00:38:12.930 emotional memories as at once

NOTE Confidence: 0.945285231

00:38:12.930 --> 00:38:15.172 memories have been consolidated okay.

NOTE Confidence: 0.945285231

00:38:15.172 --> 00:38:18.148 So they also the the cyclicity of sleep

NOTE Confidence: 0.945285231

00:38:18.148 --> 00:38:21.008 is probably really important here.

NOTE Confidence: 0.945285231

00:38:21.010 --> 00:38:22.657 So during nonrems,

NOTE Confidence: 0.945285231

00:38:22.657 --> 00:38:26.500 we need one stage to happen after

NOTE Confidence: 0.945285231

00:38:26.608 --> 00:38:29.285 the next or or you know,

NOTE Confidence: 0.945285231

00:38:29.285 --> 00:38:32.315 we might end up depotentiating before

NOTE Confidence: 0.945285231

00:38:32.315 --> 00:38:35.529 we've potentiated and consolidated.

NOTE Confidence: 0.945285231

00:38:35.530 --> 00:38:37.490 So really the timing of sleep is,

NOTE Confidence: 0.945285231

00:38:37.490 --> 00:38:39.715 is important and that's probably

NOTE Confidence: 0.945285231

00:38:39.715 --> 00:38:42.250 why disturbed sleep is so bad

NOTE Confidence: 0.945285231

00:38:42.250 --> 00:38:43.566 because when we go back to sleep,

NOTE Confidence: 0.942489911111111

00:38:43.570 --> 00:38:44.810 we don't necessarily go

NOTE Confidence: 0.942489911111111

00:38:44.810 --> 00:38:46.360 back into the same state.

NOTE Confidence: 0.942489911111111

00:38:46.360 --> 00:38:48.143 We could start back up, but you know,

NOTE Confidence: 0.942489911111111

00:38:48.143 --> 00:38:49.690 wakefulness and then end to and then

NOTE Confidence: 0.942489911111111

00:38:49.739 --> 00:38:51.195 try and get into deep slow sleep.

NOTE Confidence: 0.942489911111111

00:38:51.200 --> 00:38:53.050 We might miss our slowly

NOTE Confidence: 0.942489911111111

00:38:53.050 --> 00:38:54.160 sleep stayed altogether.

NOTE Confidence: 0.942489911111111

00:38:54.160 --> 00:38:56.896 We might go, you know,

NOTE Confidence: 0.942489911111111

00:38:56.896 --> 00:38:59.080 just our REM sleep might be disturbed.

NOTE Confidence: 0.942489911111111

00:38:59.080 --> 00:39:02.836 And actually with insomnia it's been

NOTE Confidence: 0.942489911111111

00:39:02.836 --> 00:39:05.224 shown that that the locus surrealis

NOTE Confidence: 0.942489911111111

00:39:05.224 --> 00:39:07.856 is overly active awakening us and

NOTE Confidence: 0.942489911111111

00:39:07.856 --> 00:39:10.502 probably also preventing some of that

NOTE Confidence: 0.942489911111111

00:39:10.578 --> 00:39:13.398 depotentiation function from happening.

NOTE Confidence: 0.942489911111111

00:39:13.400 --> 00:39:16.200 So here is our idea.

NOTE Confidence: 0.942489911111111

00:39:16.200 --> 00:39:18.744 This is true of some mice that that

NOTE Confidence: 0.942489911111111

00:39:18.744 --> 00:39:20.647 the neurodinergic locus realis is off

NOTE Confidence: 0.942489911111111

00:39:20.647 --> 00:39:22.874 during all the states of sleep except

NOTE Confidence: 0.942489911111111

00:39:22.874 --> 00:39:25.034 for and then on during wakefulness.

NOTE Confidence: 0.942489911111111

00:39:25.040 --> 00:39:28.082 But at least we know the rats and cats

NOTE Confidence: 0.942489911111111

00:39:28.082 --> 00:39:31.555 and and other monkeys and probably humans,

NOTE Confidence: 0.942489911111111

00:39:31.560 --> 00:39:33.680 that this is the pattern of locus realis

NOTE Confidence: 0.942489911111111

00:39:33.680 --> 00:39:35.398 activity across the sleep waking states.

NOTE Confidence: 0.942489911111111

00:39:35.400 --> 00:39:37.444 And so there's been a lot of

NOTE Confidence: 0.942489911111111

00:39:37.444 --> 00:39:39.056 sort of anecdotal, not anecdotal,

NOTE Confidence: 0.942489911111111

00:39:39.056 --> 00:39:40.896 but secondary evidence in people

NOTE Confidence: 0.942489911111111

00:39:40.896 --> 00:39:42.440 with post traumatic stress.

NOTE Confidence: 0.942489911111111

00:39:42.440 --> 00:39:43.930 Disorder that the locus cerulis

NOTE Confidence: 0.942489911111111

00:39:43.930 --> 00:39:45.420 actually doesn't shut off during

NOTE Confidence: 0.942489911111111

00:39:45.473 --> 00:39:46.638 REM sleep like it should.

NOTE Confidence: 0.942489911111111

00:39:46.640 --> 00:39:48.320 Sorry, these things are a little

NOTE Confidence: 0.942489911111111

00:39:48.320 --> 00:39:49.520 shifted and it might be doing.

NOTE Confidence: 0.942489911111111

00:39:49.520 --> 00:39:51.296 Depression is also,

NOTE Confidence: 0.942489911111111

00:39:51.296 --> 00:39:52.480 you know,

NOTE Confidence: 0.942489911111111

00:39:52.480 --> 00:39:54.650 a difference in terms of the way

NOTE Confidence: 0.942489911111111

00:39:54.650 --> 00:39:56.399 things happen during during sleep.

NOTE Confidence: 0.942489911111111

00:39:56.400 --> 00:39:59.280 So if the locus cerulis isn't shutting off,

NOTE Confidence: 0.942489911111111

00:39:59.280 --> 00:40:00.948 what would that do?

NOTE Confidence: 0.942489911111111

00:40:00.948 --> 00:40:04.387 One of the things it could do is

NOTE Confidence: 0.942489911111111

00:40:04.387 --> 00:40:07.814 instead of erasing the OR weakening the

NOTE Confidence: 0.942489911111111

00:40:07.814 --> 00:40:10.704 proximal synapses associated with novelty.

NOTE Confidence: 0.942489911111111

00:40:10.710 --> 00:40:13.100 It just continues to reinforce

NOTE Confidence: 0.942489911111111

00:40:13.100 --> 00:40:15.490 and and strengthen those proximal

NOTE Confidence: 0.942489911111111

00:40:15.565 --> 00:40:18.029 synapses associated with novelty,

NOTE Confidence: 0.942489911111111

00:40:18.030 --> 00:40:20.550 thereby disabling people from putting

NOTE Confidence: 0.942489911111111

00:40:20.550 --> 00:40:24.085 the past in the past and making

NOTE Confidence: 0.942489911111111

00:40:24.085 --> 00:40:26.310 these emotional memories always feel

NOTE Confidence: 0.942489911111111

00:40:26.310 --> 00:40:28.206 like they're happening right now.

NOTE Confidence: 0.942489911111111

00:40:28.206 --> 00:40:29.966 Or just happened, you know,

NOTE Confidence: 0.942489911111111

00:40:29.966 --> 00:40:31.310 that same day.

NOTE Confidence: 0.942489911111111

00:40:31.310 --> 00:40:32.954 So there's a really great series

NOTE Confidence: 0.942489911111111

00:40:32.954 --> 00:40:34.550 of papers by Rick Wassing,

NOTE Confidence: 0.942489911111111

00:40:34.550 --> 00:40:36.680 who's got now got an independent

NOTE Confidence: 0.942489911111111

00:40:36.680 --> 00:40:37.745 position in Australia.

NOTE Confidence: 0.942489911111111

00:40:37.750 --> 00:40:39.736 I'm working with OS van Summeren

NOTE Confidence: 0.942489911111111

00:40:39.736 --> 00:40:41.837 in in the Netherlands and what

NOTE Confidence: 0.942489911111111

00:40:41.837 --> 00:40:43.265 they're showing in humans,

NOTE Confidence: 0.942489911111111

00:40:43.270 --> 00:40:46.350 what they've showed in humans is that

NOTE Confidence: 0.942489911111111

00:40:46.350 --> 00:40:48.690 that people with insomnia disorder

NOTE Confidence: 0.942489911111111

00:40:48.690 --> 00:40:51.515 have very disturbed sleep and what

NOTE Confidence: 0.942489911111111

00:40:51.515 --> 00:40:54.378 seems to be disturbed most are those

NOTE Confidence: 0.942489911111111

00:40:54.378 --> 00:40:56.812 sleep spindles of the end to stage

NOTE Confidence: 0.942489911111111

00:40:56.812 --> 00:41:00.440 of sleep and REM sleep itself.

NOTE Confidence: 0.942489911111111

00:41:00.440 --> 00:41:02.798 So they have reduced sleep spindles.

NOTE Confidence: 0.942489911111111

00:41:02.800 --> 00:41:05.012 They have many more arousals from REM

NOTE Confidence: 0.942489911111111

00:41:05.012 --> 00:41:07.477 sleep and that transition to REM sleep.

NOTE Confidence: 0.942489911111111

00:41:07.480 --> 00:41:09.360 They have heightened sympathetic Dr.

NOTE Confidence: 0.942489911111111

00:41:09.360 --> 00:41:13.320 heightened fight or flights sympathetic Dr.

NOTE Confidence: 0.942489911111111

00:41:13.320 --> 00:41:14.415 and the loathe.

NOTE Confidence: 0.942489911111111

00:41:14.415 --> 00:41:16.605 The Syrillis never seems to really

NOTE Confidence: 0.942489911111111

00:41:16.605 --> 00:41:19.152 rest and be silent during and to and

NOTE Confidence: 0.942489911111111

00:41:19.152 --> 00:41:21.470 REM sleep and it is associated with

NOTE Confidence: 0.942489911111111

00:41:21.470 --> 00:41:23.180 depression and other anxiety related

NOTE Confidence: 0.942489911111111

00:41:23.241 --> 00:41:25.227 disorders and what they showed with.

NOTE Confidence: 0.942489911111111

00:41:25.230 --> 00:41:28.396 Brain scans of people is that novel

NOTE Confidence: 0.942489911111111

00:41:28.396 --> 00:41:30.660 experience in normal sleepers

NOTE Confidence: 0.942489911111111

00:41:30.660 --> 00:41:32.030 are encoded

NOTE Confidence: 0.94780115

00:41:37.190 --> 00:41:40.790 initially, but then they are reduced

NOTE Confidence: 0.94780115

00:41:40.790 --> 00:41:43.425 and after after sleep you can see

NOTE Confidence: 0.94780115

00:41:43.425 --> 00:41:45.259 the activity in these brain areas

NOTE Confidence: 0.94780115

00:41:45.259 --> 00:41:46.949 that are involved in encoding.

NOTE Confidence: 0.94780115

00:41:46.950 --> 00:41:49.562 These emotional memories are

NOTE Confidence: 0.94780115

00:41:49.562 --> 00:41:52.811 less activated when they recall.

NOTE Confidence: 0.94780115

00:41:52.811 --> 00:41:55.399 But in insomnia disorder,

NOTE Confidence: 0.94780115

00:41:55.400 --> 00:41:57.992 the recall of this emotional experiences

NOTE Confidence: 0.94780115

00:41:57.992 --> 00:42:00.646 is if anything much stronger in

NOTE Confidence: 0.94780115

00:42:00.646 --> 00:42:02.756 all of these emotional areas.

NOTE Confidence: 0.94780115

00:42:02.760 --> 00:42:04.810 So here's the relived experiences

NOTE Confidence: 0.94780115

00:42:04.810 --> 00:42:06.040 in normal sleepers.

NOTE Confidence: 0.94780115

00:42:06.040 --> 00:42:08.488 You can see the you know these areas are

NOTE Confidence: 0.94780115

00:42:08.488 --> 00:42:11.077 not they are able to recall them fine,

NOTE Confidence: 0.94780115

00:42:11.080 --> 00:42:14.326 but the emotionality of it the.

NOTE Confidence: 0.94780115

00:42:14.330 --> 00:42:16.050 You know, galvanic skin responses,

NOTE Confidence: 0.94780115

00:42:16.050 --> 00:42:17.406 the heart rate, all of that,

NOTE Confidence: 0.94780115

00:42:17.410 --> 00:42:19.288 doesn't get invoked again when they're

NOTE Confidence: 0.94780115

00:42:19.288 --> 00:42:20.930 recalling an old emotional memory.

NOTE Confidence: 0.94780115

00:42:20.930 --> 00:42:23.744 But people with insomnia do have a

NOTE Confidence: 0.94780115

00:42:23.744 --> 00:42:26.170 reactivation of these emotional areas.

NOTE Confidence: 0.94780115

00:42:26.170 --> 00:42:27.109 Plus, you know,

NOTE Confidence: 0.94780115

00:42:27.109 --> 00:42:29.406 all of the external signs and

NOTE Confidence: 0.94780115

00:42:29.406 --> 00:42:31.666 that the emotionality of the

NOTE Confidence: 0.94780115

00:42:31.666 --> 00:42:34.352 memory is still being involved.

NOTE Confidence: 0.94780115

00:42:34.352 --> 00:42:37.640 So here's just dorsal.

NOTE Confidence: 0.94780115

00:42:37.640 --> 00:42:39.580 Anterior singular cortex in

NOTE Confidence: 0.94780115

00:42:39.580 --> 00:42:42.005 insomnia disorder is is activated

NOTE Confidence: 0.94780115

00:42:42.005 --> 00:42:44.355 almost as though it had happened

NOTE Confidence: 0.94780115

00:42:44.355 --> 00:42:46.738 that same day instead of in the

NOTE Confidence: 0.94780115

00:42:46.738 --> 00:42:49.240 past through a sleep period.

NOTE Confidence: 0.94780115

00:42:49.240 --> 00:42:51.568 So these people with insomnia

NOTE Confidence: 0.94780115

00:42:51.568 --> 00:42:54.720 are kind of haunted by the past,

NOTE Confidence: 0.94780115

00:42:54.720 --> 00:42:57.200 overdriven by the present,

NOTE Confidence: 0.94780115

00:42:57.200 --> 00:43:00.309 so and and probably have

NOTE Confidence: 0.94780115

00:43:00.309 --> 00:43:02.178 this dysfunctional sleep.

NOTE Confidence: 0.94780115

00:43:02.180 --> 00:43:05.260 We do know that they have dysfunctional

NOTE Confidence: 0.94780115

00:43:05.260 --> 00:43:08.360 sleep activity that could lead to

NOTE Confidence: 0.94780115

00:43:08.360 --> 00:43:11.604 a very dire and drastic actions.

NOTE Confidence: 0.94780115

00:43:11.604 --> 00:43:14.852 So here's the case of Post Traumatic

NOTE Confidence: 0.94780115

00:43:14.852 --> 00:43:18.232 Stress Disorder that that Al K

NOTE Confidence: 0.94780115

00:43:18.232 --> 00:43:21.297 had mentioned in his introduction.

NOTE Confidence: 0.94780115

00:43:21.300 --> 00:43:23.964 Here is someone in the theater of war

NOTE Confidence: 0.94780115

00:43:23.964 --> 00:43:26.196 learning that a helicopter could bring

NOTE Confidence: 0.94780115

00:43:26.196 --> 00:43:29.220 bombs and bullets and you should avoid them,

NOTE Confidence: 0.94780115

00:43:29.220 --> 00:43:31.200 but when you come home.

NOTE Confidence: 0.94780115

00:43:31.200 --> 00:43:33.220 The helicopter is probably associated

NOTE Confidence: 0.94780115

00:43:33.220 --> 00:43:35.502 with safety and people without PTSD,

NOTE Confidence: 0.94780115

00:43:35.502 --> 00:43:37.680 which is the majority of people, thankfully,

NOTE Confidence: 0.94780115

00:43:37.680 --> 00:43:40.680 who encounter A traumatic experience.

NOTE Confidence: 0.94780115

00:43:40.680 --> 00:43:42.204 They don't have PTSD.

NOTE Confidence: 0.94780115

00:43:42.204 --> 00:43:44.926 They can reassociate the sound and sight

NOTE Confidence: 0.94780115

00:43:44.926 --> 00:43:47.720 of a helicopter with safety of home,

NOTE Confidence: 0.94780115

00:43:47.720 --> 00:43:49.440 that context of home,

NOTE Confidence: 0.94780115

00:43:49.440 --> 00:43:51.636 but with PTSD it's more difficult.

NOTE Confidence: 0.94780115

00:43:51.640 --> 00:43:56.118 They they their war experience is,

NOTE Confidence: 0.94780115

00:43:56.118 --> 00:43:57.908 or whatever the traumatic experience

NOTE Confidence: 0.94780115

00:43:57.908 --> 00:44:00.598 is a lot more immediate to them.

NOTE Confidence: 0.94780115

00:44:00.600 --> 00:44:01.220 And so,

NOTE Confidence: 0.94780115

00:44:01.220 --> 00:44:01.530 yes,

NOTE Confidence: 0.94780115

00:44:01.530 --> 00:44:03.390 they could learn that the helicopters

NOTE Confidence: 0.94780115

00:44:03.390 --> 00:44:05.198 can also be news helicopters.

NOTE Confidence: 0.94780115

00:44:05.200 --> 00:44:07.765 But whether what's immediately triggered

NOTE Confidence: 0.94780115

00:44:07.765 --> 00:44:11.205 when they see a helicopter or hear

NOTE Confidence: 0.94780115

00:44:11.205 --> 00:44:13.316 one approaching is more strongly

NOTE Confidence: 0.94780115

00:44:13.316 --> 00:44:15.606 associated with that old fearful

NOTE Confidence: 0.94780115

00:44:15.606 --> 00:44:18.558 memory and not with the new memory.

NOTE Confidence: 0.94780115

00:44:18.560 --> 00:44:21.437 This is a picture of my uncle,

NOTE Confidence: 0.94780115

00:44:21.440 --> 00:44:23.120 my mother's brother, of my uncle,

NOTE Confidence: 0.94780115

00:44:23.120 --> 00:44:24.868 daddy, my favorite uncle.

NOTE Confidence: 0.94780115

00:44:24.868 --> 00:44:28.110 He's a sweet guy who played the flute

NOTE Confidence: 0.94780115

00:44:28.110 --> 00:44:30.712 and taught us how to ride bicycles.

NOTE Confidence: 0.94780115

00:44:30.712 --> 00:44:33.694 But he was drafted to go to

NOTE Confidence: 0.94780115

00:44:33.694 --> 00:44:36.306 Vietnam in the 70s and when he

NOTE Confidence: 0.94780115

00:44:36.306 --> 00:44:38.820 came home a couple years later,

NOTE Confidence: 0.94780115

00:44:38.820 --> 00:44:41.571 his wife had joined the the movement

NOTE Confidence: 0.94780115

00:44:41.571 --> 00:44:43.777 antiwar movement and he wasn't as

NOTE Confidence: 0.94780115

00:44:43.777 --> 00:44:46.469 welcomed at home and she left him and

NOTE Confidence: 0.94780115

00:44:46.469 --> 00:44:50.288 took their daughter with them and.

NOTE Confidence: 0.94780115

00:44:50.290 --> 00:44:51.008 And he,

NOTE Confidence: 0.94780115

00:44:51.008 --> 00:44:51.726 you know,

NOTE Confidence: 0.94780115

00:44:51.726 --> 00:44:54.688 drove off a freeway at 70 miles an

NOTE Confidence: 0.94780115

00:44:54.688 --> 00:44:56.490 hour after closing his bank account.

NOTE Confidence: 0.94780115

00:44:56.490 --> 00:44:59.666 So the effects of this are are very

NOTE Confidence: 0.94780115

00:44:59.666 --> 00:45:02.435 drastic and direly left his whole

NOTE Confidence: 0.94780115

00:45:02.435 --> 00:45:05.570 family behind and is missed to this day.

NOTE Confidence: 0.94780115

00:45:05.570 --> 00:45:07.402 So what we're thinking is that we have

NOTE Confidence: 0.94780115

00:45:07.402 --> 00:45:09.090 too much norepinephrine in sleep.

NOTE Confidence: 0.94427896

00:45:09.090 --> 00:45:12.090 We can't ever depotentiate so.

NOTE Confidence: 0.94427896

00:45:12.090 --> 00:45:15.386 So we also know with too much norepinephrine

NOTE Confidence: 0.94427896

00:45:15.386 --> 00:45:18.706 you have lower REM sleep Theta activity.

NOTE Confidence: 0.94427896

00:45:18.710 --> 00:45:21.020 Insomnia and disturbed sleep happen

NOTE Confidence: 0.94427896

00:45:21.020 --> 00:45:22.868 with too much norepinephrine,

NOTE Confidence: 0.94427896

00:45:22.870 --> 00:45:24.902 too much Lococils activity.

NOTE Confidence: 0.94427896

00:45:24.902 --> 00:45:27.324 And people with PTSD have nightmares,

NOTE Confidence: 0.94427896

00:45:27.324 --> 00:45:29.112 and we know they have a

NOTE Confidence: 0.94427896

00:45:29.112 --> 00:45:30.430 heightened sympathetic drive.

NOTE Confidence: 0.94427896

00:45:30.430 --> 00:45:32.050 So the idea is that they're

NOTE Confidence: 0.94427896

00:45:32.050 --> 00:45:33.749 kind of stuck in the past.

NOTE Confidence: 0.94427896

00:45:33.750 --> 00:45:36.186 That novelty and coding circuit can never,

NOTE Confidence: 0.94427896

00:45:36.190 --> 00:45:38.710 can never be depotentiated.

NOTE Confidence: 0.94427896

00:45:38.710 --> 00:45:41.062 So your hippocampus becomes

NOTE Confidence: 0.94427896

00:45:41.062 --> 00:45:43.618 saturated with that traumatic

NOTE Confidence: 0.94427896

00:45:43.618 --> 00:45:46.770 memory you can't contextualize.

NOTE Confidence: 0.94427896

00:45:46.770 --> 00:45:49.930 The fear or the shame or the guilt.

NOTE Confidence: 0.94427896

00:45:49.930 --> 00:45:51.595 You can't detach from the

NOTE Confidence: 0.94427896

00:45:51.595 --> 00:45:52.927 emotionality of these memories,

NOTE Confidence: 0.94427896

00:45:52.930 --> 00:45:56.970 and the main memories stay salient and novel.

NOTE Confidence: 0.94427896

00:45:56.970 --> 00:45:58.368 So this is just the idea.

NOTE Confidence: 0.94427896

00:45:58.370 --> 00:45:59.204 Novel information,

NOTE Confidence: 0.94427896

00:45:59.204 --> 00:46:01.289 normally with good healthy sleep,

NOTE Confidence: 0.94427896

00:46:01.290 --> 00:46:02.090 you know,

NOTE Confidence: 0.94427896

00:46:02.090 --> 00:46:04.090 with lovely sleep spindles can

NOTE Confidence: 0.94427896

00:46:04.090 --> 00:46:06.195 be incorporated into our schema

NOTE Confidence: 0.94427896

00:46:06.195 --> 00:46:07.859 or distal dendritic schema.

NOTE Confidence: 0.94427896

00:46:07.860 --> 00:46:09.136 Through those sleep spindles

NOTE Confidence: 0.94427896

00:46:09.136 --> 00:46:11.050 and then during REM sleep with

NOTE Confidence: 0.94427896

00:46:11.113 --> 00:46:12.737 the absence of norepinephrine.

NOTE Confidence: 0.94427896

00:46:12.740 --> 00:46:14.140 And I didn't really mention

NOTE Confidence: 0.94427896

00:46:14.140 --> 00:46:14.980 much about serotonin,

NOTE Confidence: 0.94427896

00:46:14.980 --> 00:46:19.300 but as part of the circuit you can get a

NOTE Confidence: 0.94427896

00:46:19.300 --> 00:46:22.620 rearasure of synapses that no longer service,

NOTE Confidence: 0.94427896

00:46:22.620 --> 00:46:24.500 like the novelty encoding circuit.

NOTE Confidence: 0.94427896

00:46:24.500 --> 00:46:26.900 But if you have maladaptive sleep,

NOTE Confidence: 0.94427896

00:46:26.900 --> 00:46:28.580 too much norepinephrine or

NOTE Confidence: 0.94427896

00:46:28.580 --> 00:46:30.260 not good sleep spindles,

NOTE Confidence: 0.94427896

00:46:30.260 --> 00:46:32.588 you can't really incorporate that new

NOTE Confidence: 0.94427896

00:46:32.588 --> 00:46:34.670 information like the context of home.

NOTE Confidence: 0.94427896

00:46:34.670 --> 00:46:35.176 And then,

NOTE Confidence: 0.94427896

00:46:35.176 --> 00:46:36.947 if REM sleep is too much norepinephrine,

NOTE Confidence: 0.94427896

00:46:36.950 --> 00:46:38.150 you can't ever depotentiate.

NOTE Confidence: 0.94427896

00:46:38.150 --> 00:46:41.630 In fact, you just keep repotentiating

NOTE Confidence: 0.94427896

00:46:41.630 --> 00:46:45.830 those familiar or those novel circuits,

NOTE Confidence: 0.94427896

00:46:45.830 --> 00:46:47.990 and you can't ever get away

NOTE Confidence: 0.94427896

00:46:47.990 --> 00:46:51.308 from from that those memories.

NOTE Confidence: 0.94427896

00:46:51.310 --> 00:46:52.358 All right, so recipe,

NOTE Confidence: 0.94427896

00:46:52.358 --> 00:46:53.668 what would be the recipe

NOTE Confidence: 0.94427896

00:46:53.668 --> 00:46:54.990 for changing your mind?

NOTE Confidence: 0.94427896

00:46:54.990 --> 00:46:57.750 Well, you got to have good slowly sleep

NOTE Confidence: 0.94427896

00:46:57.750 --> 00:47:00.953 where you can wash and replenish the energy,

NOTE Confidence: 0.94427896

00:47:00.953 --> 00:47:03.968 the milieu of your brain.

NOTE Confidence: 0.94427896

00:47:03.970 --> 00:47:06.007 You need and two state with lovely,

NOTE Confidence: 0.94427896

00:47:06.010 --> 00:47:08.166 rich sleep spindles where you can reduce

NOTE Confidence: 0.94427896

00:47:08.166 --> 00:47:10.809 the amount of norepinephrine and serotonin,

NOTE Confidence: 0.94427896

00:47:10.810 --> 00:47:13.288 allowing those sleep spindles to appear.

NOTE Confidence: 0.94427896

00:47:13.290 --> 00:47:14.682 You can reactivate those

NOTE Confidence: 0.94427896

00:47:14.682 --> 00:47:15.726 memories with hippocampus,

NOTE Confidence: 0.94427896

00:47:15.730 --> 00:47:16.874 sharp ways,

NOTE Confidence: 0.94427896

00:47:16.874 --> 00:47:17.446 ripples,

NOTE Confidence: 0.94427896

00:47:17.446 --> 00:47:20.878 and that couples with long sleep

NOTE Confidence: 0.94427896

00:47:20.878 --> 00:47:23.490 spindles and helps consolidate

NOTE Confidence: 0.94427896

00:47:23.490 --> 00:47:25.927 those memories into your brain.

NOTE Confidence: 0.94427896

00:47:25.927 --> 00:47:28.850 And then during REM sleep you really need.

NOTE Confidence: 0.94427896

00:47:28.850 --> 00:47:31.490 High acetylcholine for good plasticity,

NOTE Confidence: 0.94427896

00:47:31.490 --> 00:47:34.328 high glutamate from those PGO waves,

NOTE Confidence: 0.94427896

00:47:34.330 --> 00:47:36.610 no norepinephrine to allow depotentiation,

NOTE Confidence: 0.94427896

00:47:36.610 --> 00:47:40.402 no serotonin to allow the familiar

NOTE Confidence: 0.94427896

00:47:40.402 --> 00:47:42.930 reconsolidation and novel depotentiation.

NOTE Confidence: 0.94427896

00:47:42.930 --> 00:47:44.688 Again, we didn't talk about serotonin.

NOTE Confidence: 0.94427896

00:47:44.690 --> 00:47:46.888 I'll just briefly say what serotonin does,

NOTE Confidence: 0.94427896

00:47:46.890 --> 00:47:49.530 and one of the things it does is it it

NOTE Confidence: 0.94427896

00:47:49.530 --> 00:47:53.358 shunts activity from those distal dendrites.

NOTE Confidence: 0.94427896

00:47:53.360 --> 00:47:55.236 So it doesn't reach the Axon hill.

NOTE Confidence: 0.94427896

00:47:55.240 --> 00:47:56.878 It can cause the cell to fire.

NOTE Confidence: 0.94427896

00:47:56.880 --> 00:47:58.060 So when it's present,

NOTE Confidence: 0.94427896

00:47:58.060 --> 00:47:59.240 which is during wakefulness,

NOTE Confidence: 0.94427896

00:47:59.240 --> 00:48:03.635 the familiar is The sensory inputs

NOTE Confidence: 0.94427896

00:48:03.635 --> 00:48:06.880 are more guided by what's novel.

NOTE Confidence: 0.94427896

00:48:06.880 --> 00:48:07.760 What's new about this?

NOTE Confidence: 0.94427896

00:48:07.760 --> 00:48:09.080 What can I learn from it

NOTE Confidence: 0.94427896

00:48:09.128 --> 00:48:10.440 rather than what's familiar?

NOTE Confidence: 0.94427896

00:48:10.440 --> 00:48:11.888 But during REM sleep,

NOTE Confidence: 0.94427896

00:48:11.888 --> 00:48:13.698 when you don't have norepinephrine

NOTE Confidence: 0.94427896

00:48:13.698 --> 00:48:14.720 with serotonin,

NOTE Confidence: 0.94427896

00:48:14.720 --> 00:48:17.583 the familiar can take over and cause

NOTE Confidence: 0.94427896

00:48:17.583 --> 00:48:19.590 the depotentiation of the novel.

NOTE Confidence: 0.94427896

00:48:19.590 --> 00:48:20.228 All right.

NOTE Confidence: 0.94427896

00:48:20.228 --> 00:48:22.142 So really need this whole cycle

NOTE Confidence: 0.94427896

00:48:22.142 --> 00:48:23.951 and the structure of sleep

NOTE Confidence: 0.94427896

00:48:23.951 --> 00:48:25.786 to really change your mind.

NOTE Confidence: 0.94427896

00:48:25.790 --> 00:48:27.950 And we've talked about how this

NOTE Confidence: 0.94427896

00:48:27.950 --> 00:48:30.470 happens on a micro circuit basis.

NOTE Confidence: 0.94427896

00:48:30.470 --> 00:48:31.266 All right.

NOTE Confidence: 0.94427896

00:48:31.266 --> 00:48:34.450 So what about in the last two minutes

NOTE Confidence: 0.914017975714286

00:48:34.536 --> 00:48:39.320 of this talk here? What about? PTSD.

NOTE Confidence: 0.914017975714286

00:48:39.320 --> 00:48:42.715 So we've started testing this in rats.

NOTE Confidence: 0.914017975714286

00:48:42.720 --> 00:48:44.816 We give them the worst day of their

NOTE Confidence: 0.914017975714286

00:48:44.816 --> 00:48:46.958 lives where they're bound for two hours,

NOTE Confidence: 0.914017975714286

00:48:46.960 --> 00:48:47.950 they're swimming together,

NOTE Confidence: 0.914017975714286

00:48:47.950 --> 00:48:49.600 and without a way out,

NOTE Confidence: 0.914017975714286

00:48:49.600 --> 00:48:52.280 they are put into a jar with ether,

NOTE Confidence: 0.914017975714286

00:48:52.280 --> 00:48:55.502 which is a direct activator of the HBA axis.

NOTE Confidence: 0.914017975714286

00:48:55.510 --> 00:48:57.190 And then they're isolated for a week.

NOTE Confidence: 0.914017975714286

00:48:57.190 --> 00:49:00.018 And that is also interestingly important for

NOTE Confidence: 0.914017975714286

00:49:00.018 --> 00:49:02.366 setting up the PTSD phenotype in animals.

NOTE Confidence: 0.914017975714286

00:49:02.366 --> 00:49:04.070 If you give them the ability

NOTE Confidence: 0.914017975714286

00:49:04.122 --> 00:49:05.310 to comfort one another,

NOTE Confidence: 0.914017975714286

00:49:05.310 --> 00:49:07.425 or if you even interact with them a lot,

NOTE Confidence: 0.914017975714286

00:49:07.430 --> 00:49:09.870 they're much less likely to get PTSD.

NOTE Confidence: 0.914017975714286

00:49:09.870 --> 00:49:12.270 And they get PTSD phenotypes,

NOTE Confidence: 0.914017975714286

00:49:12.270 --> 00:49:16.110 which include the inability to extinguish

NOTE Confidence: 0.914017975714286

00:49:16.110 --> 00:49:20.198 fear as about as often as a as a

NOTE Confidence: 0.914017975714286

00:49:20.198 --> 00:49:22.990 human does in a normal circumstance

NOTE Confidence: 0.914017975714286

00:49:22.990 --> 00:49:25.230 where they're socially connected.

NOTE Confidence: 0.914017975714286

00:49:25.230 --> 00:49:27.225 But if you socially I isolate them,

NOTE Confidence: 0.914017975714286

00:49:27.230 --> 00:49:29.148 they're much more likely to get it.

NOTE Confidence: 0.914017975714286

00:49:29.150 --> 00:49:32.376 And what happens with an animal with PTSD

NOTE Confidence: 0.914017975714286

00:49:32.376 --> 00:49:34.534 is during REM sleep or PTSD phenotype.

NOTE Confidence: 0.914017975714286

00:49:34.534 --> 00:49:35.470 During REM sleep,

NOTE Confidence: 0.914017975714286

00:49:35.470 --> 00:49:37.678 the look of syrillis is really

NOTE Confidence: 0.914017975714286

00:49:37.678 --> 00:49:38.782 continuing to fire,

NOTE Confidence: 0.914017975714286

00:49:38.790 --> 00:49:41.070 unlike the silence it happens

NOTE Confidence: 0.914017975714286

00:49:41.070 --> 00:49:43.350 during during normal REM sleep.

NOTE Confidence: 0.914017975714286

00:49:43.350 --> 00:49:45.828 So and sleep spindles are also changed.

NOTE Confidence: 0.914017975714286

00:49:45.830 --> 00:49:49.028 So in animals that are resilient,

NOTE Confidence: 0.914017975714286

00:49:49.030 --> 00:49:51.508 this is the day versus night,

NOTE Confidence: 0.914017975714286

00:49:51.510 --> 00:49:54.569 this is sleep phase versus waking phase.

NOTE Confidence: 0.914017975714286

00:49:54.570 --> 00:49:57.114 Amount of sleep spindles and you can see

NOTE Confidence: 0.914017975714286

00:49:57.114 --> 00:49:59.849 that that really doesn't change very much.

NOTE Confidence: 0.914017975714286

00:49:59.850 --> 00:50:01.895 Actually this is single prolonged

NOTE Confidence: 0.914017975714286

00:50:01.895 --> 00:50:04.290 stress that I just showed you.

NOTE Confidence: 0.914017975714286

00:50:04.290 --> 00:50:06.400 Initially they go up and

NOTE Confidence: 0.914017975714286

00:50:06.400 --> 00:50:08.088 then they normalize again.

NOTE Confidence: 0.914017975714286

00:50:08.090 --> 00:50:11.410 But in animals that are susceptible to PTSD,

NOTE Confidence: 0.914017975714286

00:50:11.410 --> 00:50:14.330 the sleep spindles don't rise

NOTE Confidence: 0.914017975714286

00:50:14.330 --> 00:50:16.750 after the single prolonged stress.

NOTE Confidence: 0.914017975714286

00:50:16.750 --> 00:50:19.305 And over the course of that week,

NOTE Confidence: 0.914017975714286

00:50:19.310 --> 00:50:20.998 during the consolidation of

NOTE Confidence: 0.914017975714286

00:50:20.998 --> 00:50:22.264 that traumatic memory,

NOTE Confidence: 0.914017975714286

00:50:22.270 --> 00:50:24.307 the number of sleeve spindles goes down,

NOTE Confidence: 0.914017975714286

00:50:24.310 --> 00:50:26.830 goes down instead of staying normal.

NOTE Confidence: 0.914017975714286

00:50:26.830 --> 00:50:28.588 What happens with the estrus cycle?

NOTE Confidence: 0.914017975714286

00:50:28.590 --> 00:50:29.041 Well,

NOTE Confidence: 0.914017975714286

00:50:29.041 --> 00:50:31.747 animals during the high estrus phase,

NOTE Confidence: 0.914017975714286

00:50:31.750 --> 00:50:36.358 which in humans here is about the week before

NOTE Confidence: 0.914017975714286

00:50:36.358 --> 00:50:39.110 our periods during the high estrus phase,

NOTE Confidence: 0.914017975714286

00:50:39.110 --> 00:50:41.870 this, there's a,

NOTE Confidence: 0.914017975714286

00:50:41.870 --> 00:50:43.430 let's see if I'm trying to say whatever,

NOTE Confidence: 0.914017975714286

00:50:43.430 --> 00:50:45.818 I'm starting here.

NOTE Confidence: 0.914017975714286

00:50:45.818 --> 00:50:49.512 We actually have as little activity

NOTE Confidence: 0.914017975714286

00:50:49.512 --> 00:50:52.254 in the locus cyrillus during REM

NOTE Confidence: 0.914017975714286

00:50:52.254 --> 00:50:56.510 sleep as this is rats as as males do.

NOTE Confidence: 0.914017975714286

00:50:56.510 --> 00:50:59.050 But at high at low hormonal

NOTE Confidence: 0.914017975714286

00:50:59.050 --> 00:51:01.050 phases the locus cyrillus remains

NOTE Confidence: 0.914017975714286

00:51:01.050 --> 00:51:02.969 active and what like this?

NOTE Confidence: 0.914017975714286

00:51:02.970 --> 00:51:04.490 Do this might actually

NOTE Confidence: 0.954629885714286

00:51:07.250 --> 00:51:11.807 give make females during low hormonal phases,

NOTE Confidence: 0.954629885714286

00:51:11.810 --> 00:51:15.875 no? Estrogen phases more susceptible to PTSD

NOTE Confidence: 0.954629885714286

00:51:15.875 --> 00:51:18.905 because melocosuris doesn't stop firing even

NOTE Confidence: 0.954629885714286

00:51:18.905 --> 00:51:23.650 on normal even without trauma exposures.

NOTE Confidence: 0.954629885714286

00:51:23.650 --> 00:51:26.158 All right, So we also interestingly

NOTE Confidence: 0.954629885714286

00:51:26.158 --> 00:51:28.410 in these high estrogen phases,

NOTE Confidence: 0.954629885714286

00:51:28.410 --> 00:51:29.610 we sleep a lot less,

NOTE Confidence: 0.954629885714286

00:51:29.610 --> 00:51:32.490 a lot less REM sleep and slow wave sleep.

NOTE Confidence: 0.954629885714286

00:51:32.490 --> 00:51:36.738 But when we do sleep, we have more rich

NOTE Confidence: 0.954629885714286

00:51:36.738 --> 00:51:40.250 sleep spindles and this high hormonal phase.

NOTE Confidence: 0.954629885714286

00:51:40.250 --> 00:51:42.506 So that this is the number of

NOTE Confidence: 0.954629885714286

00:51:42.506 --> 00:51:44.046 spindles per minute in females.

NOTE Confidence: 0.954629885714286

00:51:44.050 --> 00:51:45.202 In the Proestres phase,

NOTE Confidence: 0.954629885714286

00:51:45.202 --> 00:51:46.642 you'll see they're just much,

NOTE Confidence: 0.954629885714286

00:51:46.650 --> 00:51:49.010 much, much higher. And

NOTE Confidence: 0.942083309090909

00:51:51.050 --> 00:51:53.178 so it might be that that even

NOTE Confidence: 0.942083309090909

00:51:53.178 --> 00:51:54.450 though we're sleeping less,

NOTE Confidence: 0.942083309090909

00:51:54.450 --> 00:51:56.146 we're sleeping more efficiently.

NOTE Confidence: 0.942083309090909

00:51:56.146 --> 00:51:58.690 And so can is it estrogen?

NOTE Confidence: 0.942083309090909

00:51:58.690 --> 00:52:00.634 Well, there's been a study showing

NOTE Confidence: 0.942083309090909

00:52:00.634 --> 00:52:03.104 that if you give women the morning

NOTE Confidence: 0.942083309090909

00:52:03.104 --> 00:52:06.308 after pill in an emergency room.

NOTE Confidence: 0.942083309090909

00:52:06.310 --> 00:52:07.549 That contains estrogen.

NOTE Confidence: 0.942083309090909

00:52:07.549 --> 00:52:10.440 They're much less likely to get PTSD

NOTE Confidence: 0.942083309090909

00:52:10.514 --> 00:52:12.190 than than women given a morning

NOTE Confidence: 0.942083309090909

00:52:12.190 --> 00:52:13.310 after pill without estrogen.

NOTE Confidence: 0.942083309090909

00:52:13.310 --> 00:52:14.742 So there's probably something

NOTE Confidence: 0.942083309090909

00:52:14.742 --> 00:52:16.890 to do with with estrogen and

NOTE Confidence: 0.942083309090909

00:52:16.952 --> 00:52:18.728 the locus surrealis in the way

NOTE Confidence: 0.942083309090909

00:52:18.728 --> 00:52:20.778 it fires that has not yet been.

NOTE Confidence: 0.942083309090909

00:52:20.780 --> 00:52:21.756 Thoroughly investigated and it

NOTE Confidence: 0.942083309090909

00:52:21.756 --> 00:52:22.976 would be interesting to see.

NOTE Confidence: 0.942083309090909

00:52:22.980 --> 00:52:26.156 So I think I'm going to stop here

NOTE Confidence: 0.942083309090909

00:52:26.156 --> 00:52:28.488 because there's lots more to talk

NOTE Confidence: 0.942083309090909

00:52:28.488 --> 00:52:30.152 about and and I don't really

NOTE Confidence: 0.942083309090909

00:52:30.152 --> 00:52:32.060 necessarily have the time for it right now.

NOTE Confidence: 0.942083309090909

00:52:32.060 --> 00:52:34.859 So I just want to say sleep is important.

NOTE Confidence: 0.942083309090909

00:52:34.860 --> 00:52:37.194 It's important for memory and for

NOTE Confidence: 0.942083309090909

00:52:37.194 --> 00:52:39.556 erasure or weakening of at least

NOTE Confidence: 0.942083309090909

00:52:39.556 --> 00:52:41.396 certain aspects of memory like

NOTE Confidence: 0.942083309090909

00:52:41.396 --> 00:52:42.780 the novelty of it.

NOTE Confidence: 0.942083309090909

00:52:42.780 --> 00:52:44.364 Our work brain is working really

NOTE Confidence: 0.942083309090909

00:52:44.364 --> 00:52:46.515 hard and this is the threat that's

NOTE Confidence: 0.942083309090909

00:52:46.515 --> 00:52:48.235 been funding this research since.

NOTE Confidence: 0.942083309090909

00:52:48.240 --> 00:52:49.212 The year 2000,

NOTE Confidence: 0.942083309090909

00:52:49.212 --> 00:52:51.156 and this is a current picture

NOTE Confidence: 0.942083309090909

00:52:51.156 --> 00:52:52.520 of my laboratory,

NOTE Confidence: 0.942083309090909

00:52:52.520 --> 00:52:54.008 and I want to thank all of my

NOTE Confidence: 0.942083309090909

00:52:54.008 --> 00:52:55.513 students for all of the work that

NOTE Confidence: 0.942083309090909

00:52:55.513 --> 00:52:56.868 they've been doing to gather all

NOTE Confidence: 0.942083309090909

00:52:56.868 --> 00:52:58.194 these data that I've shown you,

NOTE Confidence: 0.942083309090909

00:52:58.200 --> 00:53:00.696 and then I could leave you with a while.

NOTE Confidence: 0.942083309090909

00:53:00.696 --> 00:53:01.560 We do a Q&A.

NOTE Confidence: 0.942083309090909

00:53:01.560 --> 00:53:04.500 I'll leave you with the video of

NOTE Confidence: 0.942083309090909

00:53:04.500 --> 00:53:08.130 these elephant seals during wakefulness,

NOTE Confidence: 0.942083309090909

00:53:08.130 --> 00:53:11.400 diving down past the place where

NOTE Confidence: 0.937378342857143

00:53:13.840 --> 00:53:15.716 you know the sharks can get them,

NOTE Confidence: 0.937378342857143

00:53:15.720 --> 00:53:19.396 and then starting to glide. And sleep.

NOTE Confidence: 0.937378342857143

00:53:19.396 --> 00:53:22.383 And you can see this is the sleep

NOTE Confidence: 0.937378342857143

00:53:22.383 --> 00:53:24.621 frequency going slow to slow wave

NOTE Confidence: 0.937378342857143

00:53:24.621 --> 00:53:27.010 sleep as they continue to dive.

NOTE Confidence: 0.937378342857143

00:53:27.010 --> 00:53:29.050 I don't know why they're continuing to dive.

NOTE Confidence: 0.937378342857143

00:53:29.050 --> 00:53:31.939 I you know I guess they must not have

NOTE Confidence: 0.937378342857143

00:53:31.939 --> 00:53:34.610 enough body fat to keep them floating.

NOTE Confidence: 0.937378342857143

00:53:34.610 --> 00:53:36.290 But yeah here they are

NOTE Confidence: 0.932715003333333

00:53:38.450 --> 00:53:40.064 and fairly soon this one is

NOTE Confidence: 0.932715003333333

00:53:40.064 --> 00:53:42.289 going to go into it gets upside

NOTE Confidence: 0.932715003333333

00:53:42.289 --> 00:53:44.089 down now it's definitely asleep.

NOTE Confidence: 0.932715003333333

00:53:44.090 --> 00:53:46.715 Wouldn't it be freaky to be in

NOTE Confidence: 0.932715003333333

00:53:46.715 --> 00:53:48.184 a submarine and. Looking out.

NOTE Confidence: 0.932715003333333

00:53:48.184 --> 00:53:49.560 I don't know if some brains have windows.

NOTE Confidence: 0.932715003333333

00:53:49.560 --> 00:53:51.520 I guess they do.

NOTE Confidence: 0.932715003333333

00:53:51.520 --> 00:53:54.355 Looking out and seeing this seal

NOTE Confidence: 0.932715003333333

00:53:54.355 --> 00:53:56.725 diving and diving in a spiral

NOTE Confidence: 0.932715003333333

00:53:56.725 --> 00:53:59.638 fashion as it goes into REM sleep.

NOTE Confidence: 0.932715003333333

00:53:59.640 --> 00:54:00.208 All right.

NOTE Confidence: 0.932715003333333

00:54:00.208 --> 00:54:02.480 So thank you very much for your attention.

NOTE Confidence: 0.932715003333333

00:54:02.480 --> 00:54:05.000 Do you have any questions?