"Glial cells control flow through the glymphatic system by shrinking and swelling. The hormone noradrenaline, which increases alertness, is known to cause cells to swell. The researchers thus tested whether the hormone might affect the glymphatic system. Treating mice with drugs that block noradrenaline induced a sleep-like state and increased brain fluid flow and extracellular brain volume. This result suggests a molecular connection between the sleep-wake cycle and the brain's cleaning system."

"Nedergaard and her colleagues also discovered that proper function of these vessels depends on movements of water around the brain, which are carried out by glial cells called **astrocytes**, and therefore named them the glymphatic system. They went on to show that inter-cellular spaces expand by up to 60% in the brains of naturally sleeping and anaesthetised mice, and that this expansion drives the clearance of waste from the brain by facilitating the movements of lymph and water."

Interesting tidbit - this is a quite genius system that - brain didn't get bigger, folded, flush this shit

"This discovery might also help explain why larger animal species typically sleep less than smaller ones, neuroscientist Suzana Herculano-Houzel, of the Federal University of Rio de Janeiro in Brazil, who did not take part in the new study, wrote in a review on this work.

For instance, bats sleep as many as 20 hours a day, while giraffes and elephants sleep as little as three to four hours daily. It could be that larger brains have more interstitial space to accumulate toxins, and so could withstand much longer periods of waking before the need for sleep, Herculano-Houzel said. Follow us @livescience, Facebook & Google+. Original article on LiveScience."

"If a person's sleep cycle depended purely on traditional color vision, we'd expect the blind to universally suffer from disrupted sleep. They do not, however, and this is explained by optical cells that express a photopigment called melanopsin. Unlike the standard rod and cone opsins, melanopsin doesn't help us see. Instead, it reacts most strongly to blue light, and scientists think it's the primary regulator of the biological clock and production of melatonin. In otherwise blind patients with intact melanopsin systems, blue light has a strong effect on their sleep cycles.)"

You can either generate less waste or enhance the efficiency of waste clearance.

★The other thing you can do to improve sleep quality and potentially sleep less, is set your brain up to have less waste to clear. Things that could potentially increase the amount of waste to be cleaned up are: Exercise, Pollutants and or allergens, and probably the biggest: food. We could get into what food is the "cleanest" in terms of leaving the least waste, but the easiest way to be sure you're producing less waste as a biproduct of digesting and metabolizing food is to simply eat less. Before I started eating once a day, I did a fast for about 5 days (check your video for what you actually said). One thing I noticed right away was that I would just wake up

after 5 hours without an alarm clock, and I felt awake and refreshed. I was sure I would have to take a nap or I would get sleepy really early, but that sleepiness never came over me. This was the case everyday I was fasting, but when I returned to my normal eating routine, I went back to sleeping 7 or 8 hours. When I switched over to eating once a day, there was a reduction in the amount of sleep I needed to wake up feeling refreshed. It was somewhere between 6 and 7 hours to wake up without an alarm clock whereas before it could be anywhere from 8 to 9.

As you sleep, your brain cells' mitochondria remove cellular waste

Fasting slows down the accumulation of Amyloid (Or just protects against it?)
Mark Mattson - Something about how fasting is good for the mitochondria and it's the mitochondria in the brain that do the cleanup? Could link to that study that says more muscle means you sleep better. Fasting may increase the number of mitochondria in neurons.
"Mark Mattson argues that in the way exercise is an mild energetic stress that produces an adaptive response in muscles, that is- you get stronger and grow more muscles and muscle mitochondria, fasting is a stress to the brain that results in an adaptive response, growing the mitochondria in the brain."
Intermittent fasting enhances the ability of nerve cells to repair DNA (Oxidative stress enhances the cells ability to heal oxidative damage)

During REM, one of the jobs of the nerve cells is to repair DNA. Intermittent fasting enhances the ability of nerve cells to repair DNA. (Think of it as having a bit of help on one of the steps of the to do list.)

When I ate dinner close to bedtime, I woke up feeling more groggy.

★If your body needs to direct energy and resources into completing the anabolic process of muscle building, then…

You can generate less waste by:
-Eating more quality food
-Eating less
-Fasting
-Protein fasting
-Maybe exercising less
-Be in a less toxic environment by eliminating mold, cat dander, things you're allegic to
-Not being sick

Enhance your glymphatic system by (and Sleep quality in General)
-Doing Yoga (making sure your spine is flexible, good, aligned, whatever)
-Lay on your side!

-Good mattress (Hammock?)
-Sleeping in a sensory deprivation tank?
-Hanging upside down to decompress
“Sleep master sleep mask”
-Can get more REM by waking up on purpose (Tim Ferris 4 Hour)

Sleep onset (Non tool related)
Meditate - emWave2
Read fiction
Play Tetris (visual overwriting)
Short episodic television (I don’t really recommend…)
Chili Pad / Cold Shower / Ice Bath
Rocking - Dewey Sims (fell asleep 40% faster and had more delta)

Things that could raise your need for sleep
Stress
Exercise
Maintenance vs. Repair

Sleep onset (tool and or supplements)
emWave2 meditation
Omega3 and or Krill oil
Coconut Oil and or MCT oil
Honey to replace Glycogen loss & or Consume low glycemic food in small quantities
Valerian Root
Passion flower
Kava
Magnesium 400mg
Potassium 100-200mg
GABA 500mg
5 HTC (+Choline force for lucid dreaming apparently)
L-Theanine
Chamomile tea
California poppy
Incandescent Bulbs
EMF Filter
L-Tryptophan
Gamma HydroxyButyric Acid
Bio Active Milk Peptides
Hot Bath vs. Cold bath?
Write things down GTD style

Do's n Don'ts / General things
-Body creates cortisol surge around 11pm to keep you awake so you need to be asleep by now, otherwise you'll probably be awake until 2am [This sucks because of HGH]
-8 hours before no caffeine
-4 hours before finish eating
-2 hours before start winding down
-2 hours before don't exercise
-Don't watch violence before bedtime (sympathetic nervous system)
-Cut out EMFs
-Wear socks
-Play Max Richter's music
Keep your eating times consistent to preserve circadian rhythm

Other tools / things to buy
Blackout Curtains
Sleep master sleep mask
3M Earsoft FX
Yogi Soothing Caramel Bedtime Tea
Philips GoLITE for the morning
Beddit
Nightwave flashing blue light

Circadian Rhythm maintenance / tweaking / hacking
Fast during your flight

Recommended sequence of events
Get up and get some SUN between 6AM and 8AM
Exercise for at least 10 minutes around 7AM

What happens during sleep

Things to quickly emphasize that sleep is import
HGH Builds muscles
Melatonin fights cancer
Consolidates memory (REM and non-REM difference)

Need to look up
Ultradian multiples (Ultradian Rhythms) - I think this was Tim Ferris

Other interesting tidbits
5th of your circulatory blood goes to the brain

-Concept of the “Forgetting Curve” : You forget 40% of what you learn in the first 20 minutes of learning it (Sleep is good for memory consolidation?)
-Should go to bed 2 hours after formulas, 1 hour after playing the piano
-Familial insomnia dude meditates to get into some wave state and do not so bad
-Very suggestible when lacking sleep
-”Familial advanced sleep phase syndrome”
-Stress is our body’s alarm clock - Like an internal alarm clock through the power of suggestion
-What was that thing about because of this animals brains smaller need less sleep? Bigger animals have smaller brains need less sleep?
-Evidence even in humans that sleep can be a local phenomenon, parts of the brain can sleep more deeply than other parts about the same time (So if somebody did a certain task with their hand, the part of the brain connected to that will sleep more deeply afterwards. If you immobilize an arm for a day, the part of the brain that controls that arm shows lighter sleep)
-”Dream like activity during non-REM sleep”
-Brain does not shut off, only if you’re under the influence of an anaesthetic that suppresses brain activity or if you’re in a coma
-Rat experiment with the color coding
-During REM, things are played out in real time
-REM you connect things unrelated, nonREM it’s just how you remember it
-Part of the eye that watched the show slept more deeply
-REM stop thermoregulating
-Melatonin secretion doesn’t matter if you close your eyes
-Orexin Monkeys sprayed in the nose
-Hadza have flexible sleep wake patterns
-REM sleep may be involved in the neuroprotective effect of SD pre-ischemia
-More muscle : better sleep?
-Could use Caffeine Naps before 2PM
-*”What's turned out to be really exciting 7is that our ability to come up with novel solutions to complex problems 7is hugely enhanced by a night of sleep. In fact, it's been estimated to give us a threefold advantage.”*
-But how do you know if you’re getting enough? If you don’t need an alarm clock & don’t need some massive amount of caffeine to do simple tasks
-Weight gain thing might be vicious cycle of overweight equals bad sleep, bad sleep equals overweight

To illustrate points
-Dementias are closely related with sleep disorders
-Sleep is like studying for a test. Say you have a test on a book. You read the book and get it over with at some point. Then, right before the test, you cram real quick and think “Oh wait what was that guy’s name again?” and you flip to a certain part of the book and check it out. Then you say “Wait why did that person want to kill that woman?” and you flip forward in the book. That’s what’s happening in the brain
-Thomas Edison hated sleep and got Diabetes

-Mental illness is almost always linked with sleep disorders
-Gene for Schizophrenia smeltens sleep
-Shoemaker example where the elfs built the shoe or whatever
-MBA students trying to adapt to change
-Pilots can't communicate
-Military dudes kill each other

Benefits of sleep
Immune function is better

Detriments of sleep deprivation
Less than 7 lead to[Weight gain, diabetes, hypertension, heart disease, stroke, depression, lowered immune, increased pain, increased errors]

Need to rewatch
Sara Mednick (says caffeine doesn't improve performance- doesn't help with memory processing / take a NAP)

Mark's Daily Apple:
Get Your Leptin in Order

Sleep quality and duration are strongly linked to low leptin and leptin resistance. If you recall from my posts on leptin and carb refeeds, I suggested going lower fat and higher carb on leptin refeed days, as carbs have the biggest effect on leptin levels. Avoiding excess omega-6, sugar, and grains should take care of leptin resistance. Just stick to sweet potatoes, squash, and other safe starches for your carb-heavy days, and try to have your carbs an hour or two before bed.

Check Your Thiamine Intake

Thiamine, found in meat, especially pork and animal offal, has a big effect on sleep patterns: a deficiency can lead to poor sleep. Make sure you're eating enough thiamine-rich foods. Yes, this means you may have to start eating more bacon. I'm sorry. Pair your pig flesh and chicken liver with sunflower seeds, which are also high in thiamine.

Eat Your (Beef) Heart Out

Taurine is a non-essential amino acid, but dietary taurine is still very useful. New research suggests that it plays an important role in brain function, specifically with regards to the

inhibitory neurotransmitter GABA, activation of which is linked to sleepiness. It's odd that taurine is included in most energy drinks, since it seems far more likely to sedate than energize. Eat more animal hearts, which are very high in taurine. Whole Foods usually carries frozen boxes of turkey and beef (grass-fed, too) hearts for $1.99/lb, at least in Los Angeles.

Take Magnesium (and/or Zinc)

ZMA is a popular supplement combining zinc and magnesium for workout recovery and sleep improvement. Natural Calm, as popularized by Robb Wolf, is a high quality magnesium supplement that many people use for sleep support. Eating leafy greens like spinach, and nuts like almonds for magnesium, and meat/shellfish for zinc are the best ways to obtain either mineral, of course. If you opt out of nuts and greens and choose supplements, stick to magnesiums and zincs that end in "-ate" (don't take supplements made strictly of oxide, although blends are fine).

Mark's Daily Apple
Stress increases sleep requirements (PDF). These people aren't working 14 hour days. Heck, they may be working 14 hour weeks. They aren't trying to convince their kids to complete their 3.5 hours of homework a night or stewing over a disappointing sex life. In short, the hunter-gatherers haven't erected the manmade stressors that pervade our lives and make sleep such a necessary yet fleeting delicacy. This may explain why we need (but usually don't get) naps and the Hadza, San, and Tsimane do not. Unlike 6.5 hours-a-night-sleeping people from industrialized nations, the people in this study were remarkably free of metabolic syndrome, diabetes, overweight/obesity, and all the other health conditions usually associated with inadequate sleep. They're free to sleep more than 6.5 hours if they want or need it. They just don't do it. 6.5 hours is, clearly, perfectly adequate for them. We want to sleep more than the 6 or 7 hours we're allotted, but we often can't do it.

How do I start this fucking article? "We all know we need to get enough sleep" - but does everyone know this? Is everyone aware of how important sleep is, and if they're not aware, what's the best way to introduce this? Should I present them with a bunch of statistics?

Statistics
"We all know we're supposed to get enough sleep"
"Science doesn't understand sleep"
Shut the hell up I've heard this crap a million times

"I realize that any video I make on Sleep needs to be put into the context of either 'How do I get more of it' or 'How do I get less of it?' "

“Your body has an impressive capacity to adapt to new routines. I found this out with fasting and when I was first adapting to the one meal a day routine. The first couple days I would be terribly hungry, but after a while, I didn’t feel hungry until my usual eating time. Now it’s at the point where it’s not even an issue. At first people would ask “well don’t you get hungry?” and I would say yea but it’s not that bad. Now I really can say no I don’T get hungry.”

I really liked sleeping in a hammock at first, but it’s been a bit hit and miss for me. The first two nights it was actually harder to fall asleep as it was a bit of a new sensation. Then I woke up with some pretty bad knee pain, but I found that was due to me sleeping on it wrong which hyper-extended my knees. So I slept at a bit of a slant and had the best night’s sleep in a long time. I woke up after only 6 hours feeling very rested, went for my morning run and I ran my usual course in the best time in 2 weeks. If I get into the right position then I’ll usually have a pretty good night’s sleep, otherwise I’ll have a bit of tossing and turning before I can fall asleep. I don’t wake up feeling uncomfortable or unrested, but simply will take longer to fall asleep.

However, I do think the yoga sequence I did before that night with the hammock had a big part to play in this. While I don’t doubt the benefits of yoga I’ve never been keen on it. My sister introduced this sequence that’s supposed to be good for your back to me, and after waking up a couple nights with a stiff back, I started to think that could be impeding my body’s ability to get cerebrospinal fluid up to my brain efficiently. After the night when I did the yoga sequence and had the good run, my back felt sort of “wet,” it was an odd sensation but not unpleasant. Tim Ferris suggests to hang upside down with either these moonboots or an inversion table to decompress your spine and other than feeling a lot more comfortable while sleeping, I assume this works in the same way.

It’s also been shown in mice that sleeping on their side isa lot better for quality sleep. Since nothing is pressing on the spine I would think that it would be easier to deliver the CSF to the brain, in the same way you’ll get the best water flow out of the hose if there’s no kinks.

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After reading Arianna Huffington’s book “The Sleep Revolution,” which is all about the importance of getting a good night’s sleep… I found it really hard to fall asleep. Before that I didn’t have a particularly hard time with sleep, but after being barraged with endless statistics and research results illustrating the detriments of inadequate sleep, I became very anxious about how long it was taking me to fall asleep. While laying in bed, I keep thinking about things like:

Inadequate sleep greatly reduces cognitive performance.

- Sleep deprivation *“adds up to more than eleven days of lost productivity per year per worker.”*
- Lack of sleep results in an *“increased risk of heart attack, stroke, diabetes, and obesity.”*

“63 percent of men who suffered a heart attack also had a sleep disorder.”
Disrupted sleep cycles are *“linked to higher rates of breast, ovarian, and prostate cancers.”*

・People who get only “*six hours of sleep per night are 23 percent more likely to be overweight.”*

・80 to 90% of the time, anxiety and depression are related with a sleep problem.

And so on…
Somewhere along the way Samuel L. Jackson’s voice slips in to say “*Go the fuck to sleep.”*

~~So in this video, I want to briefly illustrate why exactly sleep is so important, then explain how sleep works so that you can focus on getting more quality sleep rather than just increasing total time spent laying in bed.~~

Of course there are some cases where you have no choice but to skip out on sleep, I get it. But I’d like to spend video looking over *what* makes so sleep important, how your body accomplishes this sleep process, and provide a couple tips to get more out of your sleep. The aim is to get more quality sleep, not just increasing total time spent in bed.

★When people are trying to get more done and get more out of life in general, they’ll look at their packed schedule trying to make room and sleep is usually the easiest thing to cut down on. The ironic thing is that it can be hard to realize that by cutting back on sleep, we are decreasing productivity, creativity, concentration, patience, communication skills and a lot of what makes a good human, because less sleep results in a less effective brain. ~~This is the case with pretty anything~~. If you’re staying up to study, you’re not learning as efficiently. If you’re cutting back on sleep to spend more time on a creative project, you’re diminishing your chances at having creative insights. Pretty much whatever you’re doing, you’re doing it worse.

(Example of foot race vs. car - jeremy clarkson and that hot hurdler chick)t

~~★One of the most ironic situations in which neglected sleep takes its toll is with fresh entrepreneurs eager to make their mark.~~ In 1999, two professors at Loughborough University wanted to test how sleep affects the brain’s ability to react to changing conditions. They developed a computer game set in the business world and had MBA students act as test subjects. Each student was to promote sales of a fake product until it achieved market dominance and profitability. Halfway through the game, the dynamics of the virtual marketplace suddenly changed. Strategies that used to work now resulted in terrible sales. Only students who could quickly change and adapt could survive.

Students were split into two groups, one with restricted sleep and another where they could sleep as much as they liked. Most of the students who slept well quickly adapted to the new challenge in the virtual marketplace and maintained their sales. On the other hand, the sleep-deprived students were unable to modify their strategy appropriately. They continued to rely on what had worked before, and quickly became bankrupt.

Without sleep, their brains lost the ability to consider alternative solutions to problems. Brain scans have shown that when you're lacking sleep, the neurons firing in the prefrontal cortex begin to slow down. The prefrontal cortex is particularly important for the behaviors that make us... human. This region is associated with planning, personality expression, decision making, attention control, reasoning, and problem solving. When you lack sleep, it's harder for us to complete a thought or see a problem in a new way.

~~That sleep deprivation makes the prefrontal cortex less adept at realizing the meaning of new information coming into the brain presents a problem when one is formulating a business strategy. You're less creative and less innovative~~

4-1-9 Problem - insight

In David Randall's book "Dreamland," he describes an experiment at the University of Lübeck in Germany that wanted to see how sleep

Pg 115 on Dreamland - *"In the first part of the 2000s, a team of researchers at the University of Lubeck in northern Germany decided to put it to a test in a laboratory setting. The question they hoped to solve was whether sleep was the catalyst for a new idea or whether the time the brain spent working through a problem accounted for insights. They assembled a group of volunteers and asked them to solve a number puzzle. Researchers explained to the subjects that, to reach the six-digit answer to the problem in front of them, they should follow two rules that required no math skills beyond basic subtraction. The first step was to look at the relationships between six pairs of numbers in a string of digits. If a subject saw something like two 4's in a row, he or she was told to respond with the repeated number. But if the two numbers were different, then the correct response would be the difference between them.*

What the researchers didn't tell the subjects in the study was that there was actually a much easier way to get to the answer. In each instance, the second three digits in the answer were the mirror images of the first. That meant that if the first part of the answer was 4-9-1, the second part would be 1-9-4. It was a subtle pattern that no subject recognized during the training session, even after completing a block of thirty trial runs.

After everyone knew how to solve the puzzle the long way, the researchers broke them up into groups based on how many hours they would get to sleep. One group was allowed to sleep normally for eight hours. Another was kept up all night. The third group, subjects who were trained to solve the puzzle during a morning session, was asked to come back eight hours later without taking a nap in between. Through this setup, researchers ensured that each group stepped away from the problem for the same number of hours. If the groups more or less improved equally, it would suggest that solutions to problems come after the brain has a long enough time to reflect. But if the improvement rates between the groups were different, it would suggest that something happened during sleep and dreaming that made a difference in their ability to interact with new challenges.

When the results came in, it was clear that sleep was key. Subjects who did not get to sleep before their second shot at the puzzle showed little improvement. Those who slept eight hours, meanwhile, solved the task 17 percent faster. But that wasn't all. The subjects who figured out the hidden, easy solution to the puzzle completed each set approximately 70 percent faster than their peers because they had to solve only the first three digits in the six-digit answer. Only one out of every four subjects in the groups that did not get to sleep caught on to the pattern by the end of the study. But almost everyone who slept eventually discovered the quick solution. Sometime in the night, their minds were able to construct a novel approach to a problem they had faced while awake. Subjects who didn't get to sleep continued to conceive of each puzzle literally, following by-the-book instructions handed to them by the research team. Sleeping, meanwhile, allowed the brains to develop a cognitive flexibility that led them to consider the situation in a new way.

John Pelley says we need sleep to keep important things

★Not is your problem solving creative mind affected, but you're not going to be in the best emotional state either. This study found that if just one partner in a relationship had a poor night's sleep, they were much more likely to have a fight without making up before going to bed. Less empathetic, more negative, more selfish. Amygdala needs to be working in harmony with the rest of the brain and your brain gets hijacked by the amygdala if you don't torp right.
Sociopaths have damage to the amygdala

"It's not only your mental capabilities that suffer, your body does too…"
THROW THE DANIEL PINK THING IN RIGHT AFTER you explain

With better and better artificial intelligence out on the horizon, it is these human capabilities, these more right brained things like creativity, empathy and insightfulness that are important. Without sleep, we'll quickly be losing to the robots.

When you sleep your subconscious takes over into lateral thinking*
Sleep improves lateral thinking
Robert stickgold on the 4-1-9 thing

★In a talk on the role of sleep in learning and creativity, Robert Stickgold discusses an experiment were subjects were supposed to, through a set of relatively complex instructions, figure out which numbers followed in a number sequence. It was a bit tricky, but most everyone got it and could consistently use the instructions to fill out the number sequence. However, there was a trick to make the process much faster. The last three numbers in the sequence were always a mirror image of the numbers before it. In the course of about a 100 trials, 10% of the participants will realize the trick. But for the remaining people, they had them stop and wait 12 hours before being tested again. They were split into three groups, those who finished the inital trials in the morning and got tested 12 hours later at night, those who finished the trials at night then stayed up until morning before getting tested again, and those who got a good night's rest.

The first two showed about the same chance of discovering the trick in the problem. In the 3rd group, remember the only thing different is that they got to seep, they were 2.5 times more likely to have enough insight to find the trick in the problem. Robert Stickgold voice: "*So you can gain these insights when you didn't even know there was an insight to find, just by sleeping on it. It's an amazing phenomenon, it really is. It's like… how does it do it?*"

★One reason why your brain may be setting you up to have these insights is by analyzing the information you picked up throughout the day, pruning out the usless stuff and consolidating worthwhile memories. 19th century psychologist Herman Edinghouse showed that we forget on average 40% of new information within the first 20 minutes of learning it. You can mitigate this by simply consciously reviewing the information in your head or by getting some sleep.

Of the four stages of sleep, slow wave sleep and rapid eye movement have been shown to move electrical impulses between the brain stem, hippocampus, thalamus and cortex. These four areas serve as relay stations for memory formation. During this process, short term memories get moved into long term memories.

Matthew Wilson - By analyzing the brain activity of rats while they were awake and trying to make their way through a maze and then analyzing their brain activity when they were asleep, (Begin showing the brain scan activity at this time stamp)
(Showing the rat asleep replaying this time stamp) non-REM sleep they replay really quickly. 10 times faster - got a rewind button, it can go forward or backward.

Your brain can be flipping the book back and forth making lateral connections - saying oh hey wait wasn't the dude who did this also the guy who ate the pie - that's why pies are illegal now!! (REM plays shit out in proper timing) Even though it doesn't make any sense, it plays out in proper timing that you would expect. "Played out in real time as if the animal is actually experiencing these events. (non-REM is trying to *figure* shit out)
Hippocampus is the one replaying shit - and it is critically involved in recognizing context,

Sleep is composed of four stages, the deepest of which are known as slow wave sleep and rapid eye movement. EEG machines monitoring people during these stages have shown electrical impulses moving between the brain stem, hippocampus, thalamus, and cortex- which serve as relay stations of memory formation. And the different stages of sleep have been shown to help consolidate different types of memories. During the non-REM, slow wave sleep, declarative memory is encoded into a temporary store, in the anterior part of the hippocampus. Through a continuing dialogue between the cortex and hippocampus, it is then repeatedly reactivated, driving its gradual redistribution to long term storage in the cortex. REM sleep on the other hand, with its similarity to waking brain activity is associated with the consolidation of procedural memory. So, based on the studies, going to sleep 3 hours after memorizing your formulas and 1 hour after practicing your scales would be the most ideal.

John Pelley on the importance of sleep - Prune stuff and keep important things

It's theorized that one of the reasons you don't remember much after drinking a bunch of alcohol is that the alcohol interferes with sleep enough so that your brain can't consolidate memories.

Amygdala - The amygdala takes over and makes you more emotional (this is the area that's getting more neuron firing compared to the prefrontal cortex)
"The amygdala has a well-documented role in the processing of emotionally salient information, particularly aversive stimuli"
"We have focused on this network and using functional magnetic resonance image (fMRI) have obtained evidence, reported here, that a lack of sleep inappropriately modulates the human emotional brain response to negative aversive stimuli."

This can manifest itself as more fights with your spouse as illustrated by this article, or as much more *worrying* behavior. In 2009, a band of American soldiers from the 172nd infantry found themselves in court martial for murdering two men against a superior's orders. Their lawyers' defense was that the soldiers were too sleep deprived to make rational decisions.

David Randall's *Dreamland* discusses several other mishaps within the military thanks to sleep deprivation. Randall speaks of how in the early 80's the military found that sleep deprived air force pilots *"changed their vocal patterns, no longer enunciating or speaking loudly enough [to be understood]"* Perhaps that didn't bother them much because …"*In 1996, a time of relative peace, crew fatigue was blamed for thirty-two accidents that destroyed American military aircraft, including three F-14 jetfighters that cost $38 million each.*" Even then, the military hasn't been particularly keen on the concept of sleep. Soldiers are lucky to get even 6 hours of sleep and the goal of a Pentagon division called the Defense Advanced Research Projects Agency was to find "*a way for a soldier to go without sleep for one hundred hours and still perform common tasks."* The military spent millions of dollars testing all kinds of outlandish theories only to conclude in 2007 that the only way to recover from lost sleep was to ...sleep.

Military:
Counts of losing tanks to friendly fire
Loss of the USS Astoria
Air force bombers can't enunciate or speak loudly enough for crewmates to understand them

Pg 131 "*Men and women in the military fly around the world and do everything but sleep. Their lives are set out to the minute. In combat zones, most soldiers have no say in when they wake up, when they eat breakfast, or when they lie down at night. In peacetime, soldiers will be lucky if they get six hours of rest a night, or about three-quarters of what most adult bodies need to maintain an alert brain.*"
…"*In 1996, a time of relative peace, crew fatigue was blamed for thirty-two accidents that destroyed American military aircraft, including three F-14 jetfighters that cost $38 million each."*

*Pg 132 - "**Caffeine** is popular as a stimulant because it readily crosses the barrier between the blood and the brain. Once in the brain, it blocks the absorption of adenosine, a nucleotide that*

slows down nerve connections and makes you feel drowsy. The result is like being able to drive a car backward to roll back the odometer. In research studies, caffeine helped sleep-deprived subjects better discriminate between colors, sort words according to their meaning faster, and see in the dark more clearly."

Pg 135 - "*No drug or procedure has been found to replicate and replace the benefits of sleep. It is unlikely that there ever will be. The Defense Advanced Research Projects Agency - the Pentagon division responsible for the invention of the Internet and the stealth bomber - concluded as much in 2007 after many tries. Its goal was to develop a way for a soldier to go without sleep for one hundred hours and still perform common tasks. The military spent millions of dollars testing theories, such as whether it would be possible to put half of the human brain asleep at a time, essentially allowing a person to sleep like a dolphin. None of the tests worked. The only way to recover from loss sleep was to get more of it later."*

Pg 138 - *"The schematic design of the brain eventually became clear. A bean-shaped structure near the exact center of the brain called the thalamus lets us realize when we are sleepy, while its neighbor, the hypothalamus, monitors feelings of hunger and thirst. Groups of neurons about the size of almonds that are found near the ears, called the amygdala, are partly responsible for the formation of memories, especially those generated by an emotional experience. The nearby pituitary gland and adrenal cortex, meanwhile, send urgent messages in the form of hormones throughout the body when something frightens us.*

What regulates all of the messages from the different parts of the brain is a mass right behind the forehead called the prefrontal cortex. Like a conductor in an orchestra, this part of the brain strives to hit the right balance between responses from the emotional parts of the brain and those from the areas responsible for higher thought. The outcome is a decision. The prefrontal cortex is working every waking second, directing attention in the supermarket, sustaining interest when balancing a checkbook, and suppressing any outward signs of frustration or anger. It notices patterns, and when something novel pops up, it goes to work assessing how new information gels with what the brain already knows. It is responsible for a wide range of decisions, both conscious and unconscious, from the recognition that the person walking toward the car is your brother to whether investing in a condo in Phoenix is a good idea.

Making decision is a very taxing job, with no downtime. Unlike other parts of the brain, the prefrontal cortex gets no benefit from the time that the body spends in a relaxed environment. Even when you are swaying in a hammock sipping a cool beverage on a sunny afternoon, this part of the brain is constantly on alert, making sure you don't topple over or spill your drink. While science still doesn't know exactly how this happens, the time we spend in deep sleep is when the prefrontal cortex recovers and reboots for the next day's work."

Johnathon Wilsor - you can expect your weight loss goals to go to shit (Eat more carbs, ghrelin (hungrier), worsens glucose metabolism)
Jonathan Wisor - Psychomotor vigilance lapse (16 in 10 minutes)

Four nights in a row on 4 hours of sleep - legally too drunk to drive (Chris BArnes - followed up by you're less ethical - Johnny's getting cranky, he's too tired)

There is something called the forgetting curve that prevents us from having a rain-man like memory, 19th century psychologist herman edinghouse showed that we tend to forget 40% of new material within the first 20 minutes. But this process can be miitgated by memory consolidation where the information is moved from the short term memory to the long term memory. Hippocampus is important for long term declarative memory. Major factors for memory consolidation is a good night's sleep - Relay station between brain stem, hippocampus, thalamus and cortex (electrical signals move between them) "Relay stations of Memory formation" REM is good for PROCEDURAL MEMORY - 3 Hours after formula, one hour after scales is best.

Use that other TED talk guy TO SAY HOW IMPORTANT SLEEP IS BECAUSE WE BECOME SHITTY ROBOTS?

Sleep is composed of four stages, the deepest of which are known as slow wave sleep and rapid eye movement. EEG machines monitoring people during these stages have shown electrical impulses moving between the brain stem, hippocampus, thalamus, and cortex- which serve as relay stations of memory formation. And the different stages of sleep have been shown to help consolidate different types of memories. During the non-REM, slow wave sleep, declarative memory is encoded into a temporary store, in the anterior part of the hippocampus. Through a continuing dialogue between the cortex and hippocampus, it is then repeatedly reactivated, driving its gradual redistribution to long term storage in the cortex. REM sleep on the other hand, with its similarity to waking brain activity is associated with the consolidation of procedural memory. So, based on the studies, going to sleep 3 hours after memorizing your formulas and 1 hour after practicing your scales would be the most ideal.

LEARNING:
Pg 122
Stickgold's contention that the brain consolidates information during sleep in order to make new connections was supported by research conducted by one of his former students, a red-headed Englishman named Matthew P. Walker, who is a professor at the University of California, Berkeley. Working off of Stickgold's research, Walker decided to look at how sleep affected what is known in neuroscience as brain plasticity, which is essentially the way the brain remolds and updates itself when it learns ta new skill or stores a new memory. At the time, Walker was fresh from a postdoctroal study at Harvard. He had been part of a team that found that subjects who were test on their ability to type a string of numbers completed the task 20 percent faster when they were given a chance to sleep before approaching it a second time.

In his work at Berkely, Walker asked right-handed subjects to type a five-number sequance using their left hands. It was an unfamiliar task that lowered the chances that a subject could skew the data because of his or her natural ability. By analyzing the time that it took them to hit

the keys, Walker found that almost all of the subjects subconsciously broke the string of digits into smaller, easy-to-manage chunks,much like you might remember your Social Security number by slicing it into a group of three, two and four digits. You can hear this process at work when you say your number aloud and find yourself breaking into a singsong rhythm. Walker then had his subjects come back after a night of normal sleep. Just like in the studies of Wilson and Stickgold, time spent sleeping improved performance. After eight hours of sleep, nearly every person in the study typed the numbers in one smooth motion.

Not all sleep gives the brain the same benefits, however. Timing matters. The smoothing effect Walker identified depends on the quality of sleep a person gets immediately after learning something new. The most important period of learning occurs in the first six hours of the night. In one study researchers trained subjects to perform a motor-skill test. One group was awakened after less than six hours of sleep and trained to perform a second, unrelated task. The other group was allowed to sleep normally. Subjects who did not have their sleep interrupted were able to complete the motor-skill test by an average of 21 percent faster the next day. Those who were awakened, however, improved by an average of only 9 percent. Their brains, it appeared, were interrupted at a crucial time.

If you can bear with me through a personal anecdote for a moment, Sometimes when I'm reading, if there was an interesting part in the book that I don't want to forget, then I will take that passage and type it out verbatim on my computer. This serves as a note taking method and at the same time (I hope) it serves as practice to improve my typing speed. I've even noticed that I type a bit slower and have to spend more time hitting the delete button to make up for mistakes I've made when I have little sleep. So even when I don't have to think at all about what I'm typing, I am making these small mistakes and typing slower in general. My typing speed is even slower when I'm typing my own material and am trying to come up with good examples or figuring out how to stitch together certain pieces of information to make a compelling narrative.

Lack of sleep has been linked to an increase in aggression which will manifest itself in more fights with your spouse, or as a more famous example goes to execute an (iran?) dude despite orders from your superior officer not to.

non-REM repairs DNA
"When we lose sleep, memory, learning, mood and reaction time are affected."

Pg 61 of Dreamland
...But to Troxel, it seemed like the field was overlooking one of the most obvious aspects of daily life between two people in a relationship. "Sleep was largely neglected despite the fact that we know it's a critically important health behavior," she told me. Even though more than 60 percent of couples sleep with their partner, most studies of martial happiness never considered that it could be a factor.

Troxel recruited couples to wear wristwatch sleep monitors while they shared their bed each night and to rate each of their interactions with their partner for ten days. When describing each time they had a conversation with their spouse, subjects were given the choice between four

positive ratings, such as feeling supported, and four negative ones, such as feeling ignored. Each person in the relationhip submitted his or her responses separately, so that a spouse wouldn't feel pressured to modify a rating to appease the other.

The results were clear: the most severe negative ratings came after nights when the woman had slept poorly. Not only that, but the quality of wives' sleep was a more important predictor of happy interactions than a hard day at work or any other form of stress. "Some of that can be because woman drive the emotional climate of a relationship more strongly than men in general," Troxel said. "If they have a poor night of sleep they may be more expressive and tend to be more communicative in relationships. A husband is much more liekyl to pick on his wife's cues that she's had a bad night of sleep than his own."

Men tend to sleep better next to their partners than when they go to bed alone, but that may be beause they get to enjoy the emotional benefits of proximity without having to slisten to their partner snoring. In one of nature's dark jokes, women not only are far less likely to snore than men, but also tend to be lighter sleepers. The result is a nihghtly farce that is one reason why wives also suffer from insomnia more often than their husbands.

Adequate sleep for treatment of obesity
Insufficient sleep undermines attempts to lose adiposity
Shawn Stevenson - Human Growth Hormone - Happens during anabolic deep sleep
SS - Cortisol
SS - Melatonin - Increases brown adipose tissue
SS - Leptin - One night of sleep deprivation leads to decreased leptin
SS - Ghrelin - One night of poor sleep quality leads to 15% increase (200 more calories)
SS - UC Berekely brain imaging, increased amygdala activity
SS - Glucose - 6% decrease in glucose reaching your brain when sleep deprived (14% prefrontal cortex)
SS - Hijacked by Amygdala: Relationships are affected (Here's the article he's talking about - Full paper)
SS - REM Rebound effect

Follow up with the example from Dreamland of how he killed that dude

Pg 144 of Dreamland
In the first few months of 2007, the United States had a precarious hold on Baghdad. One March evening, a band of American soldiers from the 172nd Infantry came under attack while driving through the streets of the capital. They returned fire and eventually chased four men into a warehouse. There, they found a weapons stash that included several machine guns, grenades, and a sniper rifle. The four men were handcuffed, and the convoy turned and headed toward a makeshift jail under American control. A few minutes later, their supriors voice crackled on the radio. There wasn't enough evidence to keep their new prisoners locked up, he told them, and then ordered the men released.

The order was never followed. A few days before, a roadside bomb had killed two of the unit's men. The soldiers resente that fact that they had risked their lives apprehanding four men they believed to be insurgents, only to be told to let them go. Three officers-including the unit's medic- decided to take their prisoners to a canal that snaked its way through an industrial area in a remote part of town. There, they ordered the mean, blindfolded and with their hands tied behind their backs, to line up against the back of their vehicle. The Americans pulled out their nine-millimiter pistols and shot each in the back of the head. They dumped the bodies into the canal and drove away.

At a court-martial in Germany two years later, the Americans who were on patrol that night stood trial for murder. Each had admitted to shooting the captives. They pled not guilty, however. Their lawyers said that they were so sleep deprived they could not make a rational decision. In calling the men's actions a regrettable but common part of war, one of the attorneys said that "good soldiers who freaked out in the field of battle largely as a result of sleep deprivation and a lack of battelfied backup are spending a lot of time in jail." A military psychologist, too, testified that sleep deprivation could have played a role in the shootings. It was not enough. All four soldiers were found guilty and sentenced to twenty-year terms at military prisons in the United states.

In one way, the shootings can be seen as a failure of the prefrontal cortex. As with the sleep-deprived men who seemed to turn into drunks in the army study, the soldiers' emotions and impulses were no longer being held in check by a rational force. What should have been suppressed by a normally functioning brain bubbled to the surface and manifested itself into a terrible action. Unable to accept the fact that the men the soldiers thought were the enemy would be released, the soldiers killed them on the spot. The rational decision-making prowess that separates from animals had collapsed into rage. In a war that depended on winning over the hearts and minds of the locals, a few sleep-deprived soldiers made the Americans appear like warlords who administered justice in the streets.

Military voice example:

In the early 1980's, the military began studying how specific tasks were affected by a lack of sleep. The results were troubling if you wanted to win a war. After a day and a half without sleep, air force bombers changed their vocal patterns, no longer enunciating or speaking loudly enough for their crewmates to always understand them. All of the nonverbal clues indicating that something was important - like raising one's voice to suggest danger - vanished from their speech patterns. In another simulation, researchers separated pairs of soldiers into different rooms with a radio linkup between them. One soldier was given a featureless map with only a route and a destination drawn in, while his partner was given a map with all of the basic landmarks present but nothing in the way of directions. In order to get anywhere, the two would need to work together. The pairs made up of soldiers who had slept well completed the task with little problem. Those deprived of sleep for forty-eight hours were another story. The lack of sleep diminished their ability to communicate, effectively wiping out any sort of spontaneous diaolgue-the running chatter that helps keep everyone focused on the same goal. It was rare for

a pair of sleep-deprived soldiers to piece together a complete map, an essential communications task that soldiers who had slept well accomplished easily. The same breakdown occurred in another study that followed a crew of army soldiers operating on drastically reduced sleep during a siulated battle. Fighting exhaustion, they forgot to do critical tasks such as updating maps with new information and completeing boring but important chores. The problems only worsened as the simulation progressed.

In every situation, the prefrontal cortex- the only part of the brain that has the power to think about how it is thinking- had lost the vital aspect of self-assessment, unable to tell if an action was helping to solve a problem or simply making it worse. Without sleep, the brain's finely tuned mechanics had dissolved from an orchestra led by a conductor into a room full of musicians playing to their own beats. In a report warning that sleep deprivation could lead to mission failure, Shattuck argued that "the ability of sailors to think and reason while in a fatigued state has significant implications for combat effectiveness…. [I]n such a secnario, sailors may give everything they have to give for the mission, but due to human physiology and as a result of fatigue brought on by sleep disruption, their best may not be good enough. The end result of a flotilla of sailors holding key operations, all operating in severe sleep debt, could be disastrous."

Personally, I find that I physically cannot type as fast, I can't come up with good ways to word sentences and I can't remember the material that I read specifically for the article as well if I don't get enough sleep.
-Learning
-Coming up with genius solutions
-Have to give a speech?
-Losing weight, building muscle
-I make dumber choices

If you are learning something or trying to come up with ideas, sleep

Military other mishaps

The bottom line is, if whatever you're doing requires even slightly complex cognitive faculties then a lack of sleep is going to negatively impact that.

Lack of sleep literally lwoers function / glucose usage of the neocortex

So what happens when you're sleeping?

Sleep is a time for growth, repair, memory consolidation, mental junk cleanup.

The glymphatic system has b
Most of the material I've been reading on sleep starts out with "Sleep is one of the biggest mysteries of science…" but it kind of seems like we know a good bit about what sleep is for. Sleep is for memory consolidation, repairing DNA, anabolism, and mental junk cleanup. Everybody likes to say house keeping and yea that's correct. It's kind of like your brain has a frat party every day and the house must have sufficient time devoted to cleaning it up everyday or the house would fall apart. The body's system for waste that accumulates throughout the day is the lymphatic system. "*There are hundreds of lymph nodes in the human body. They are located deep inside the body, such as around the lungs and heart, or closer to the surface, such as under the arm or groin, according to the American Cancer Society*."

The lymphatic system serves an integral role in fluid homeostasis, lipid metabolism and immune control.

"The Lymphatic System drains waste material that our cells create. If the lymph system is stagnant (very common), our cells are then surrounded by their waste material and not able to receive the nutrients and oxygen they need to function. Therefore functioning decreases or is impaired, and this, over a period of time, leads to aging and disease. Think of a sewer system."
- Some Pinterest bullshit

Jeff Iliff - First problem organ has to solve is getting a continuous supply of nutrients. (Intense electrical activity uses up a quarter of the energy supply) Second problem is clearance of waste that every organ has to solve. "*This is the body's lymphatic system, which is evolved to meet this need. It's a second parallel network of vessels that extends throughout the body, it takes up proteins and other waste from the spaces between the cells, it collects them and then dumps them into the blood so they can be disposed of. But if you look really closely at this diagram…"* Enter CSF - Really clever design solution because there's not much space. - Enter Amyloid Beta clearance of Amyloid beta is very rapid in sleep

Adenosine clearance? (What else is cleared during the sleep?)

"A second trigger for sleep is believed to be the build up of the compound adenosine in the brain. Adenosine is a byproduct of your neurons and other cells when they burn up adenosine triphosphate, the main molecule that our bodies use to store energy. Research suggests that when a bunch of adenosine accumulates in your brain, you get sleepy."

"Sleep after all is when you grow muscle tissue, your cells synthesize proteins, your tissues repair themselves and growth hormones are released."

Caffeine works by bonding to the same receptors as adenosine, tricking the body into thinking it's not tired. "But when you do sleep, those adenosine levels drop as it's gradually re-absorbed by your neurons. This is partly what makes you feel rested when you wake up."

“Amyloid beta formation is a bit more complex, but your brain is always creating it as a consequence of being alive. Amyloid plaques have been thoroughly linked to Alzheimer’s disease and it is thought that insufficient clearance of amyloid beta leads to Alzheimer’s.”

So two conceivable ways to get better/more efficient sleep and or sleep less would be to either enhance the capabilities of the glymphatic system so it can get it waste clean up job done quicker or create less waste to begin with.

Fasting improves sleep

Digestion interferes?
Insulin interfere with sleep?

Chapter 13 in the Shawn Stevenson book - Overweight individuals have a higher cortisol spike when they eat

“Scientists at Johns Hopkins University School of Medicine conducted a study on people with reported sleep problems (such as sleep apnea, daytime fatigue, insomnia and restless or interrupted sleep). Half of the volunteers went on a weight-loss diet with supervised exercise training. The other half did just the diet. After 6 months, participants in both *groups had lost an average of 15 pounds and reduced their belly fat by 15 percent. As a result, the researchers found that each group equally boosted their sleep quality by about 20 percent, with a reduction in belly fat being the best indicator of improved sleep. This study also demonstrates that even without the vast benefits of exercise, the power of simply changing your diet has a huge impact on the results that you get.”*

Might get the memory consolidation bit done better with polyphasic.

During REM, one of the jobs of the nerve cells is to repair DNA. Intermittent fasting enhances the ability of nerve cells to repair DNA. (Think of it as having a bit of help on one of the steps of the to do list.)
★SUBSTANTIATE THE EATING BEFORE BEDTIME THING (Does the digestive system receive an influx of blood transfer?)
★Reducing the amount of anabolic requirements (i.e. If you worked out really hard)
★If you’re sick, you need to sleep more

- Then get into how to physically aid your Glymphatic system

-Yoga
-Sleep on your side

*Talk about sleep onset?

If you want to recommend the Honey / Fat or Protein thing then emphasize how it's exempt from the digestion bit.

★You feel really awake at night but that's because of the cortisol thing and that's bad?

★Polyphasic might work by skipping those light phases.

WHEN TO TALK ABOUT CIRCADIAN RHYTHM
-Sunlight between 6 and 8AM
-Exercise at 7AM
-10PM to 2AM is money time
-Melatonin and light blocking / messing up this cycle (blue light green light red light)

Conclusion - You can't just skip it, and if you want to you have to be smart about it
As Daniel Pink says in the right brain book, you're not going to stand out by just putting in more hours. If it was a matter of who can put in the most hours, you're always going to lose to a robot and we're already losing a lot to robots.

Arianna Huffington on jet lag

This internal clock is located in a part of the brain that controls circadian rhythms of all kinds throughout the body-including sleep, temperature, and the digestive system, among others. It does this by processing light from the retina and by the expression of so-called clock genes. A study by researchers from the Beth Israel Deaconess Medical Center in Boston found a helpful tool to beat jet lag: food-or, more accurately, the absence of it. "When food is plentiful," they wrote, "circadian rhythms of anials are powerfully entrained by the light-dark cycle. However, if animals have access to food only during their normal sleep cycle, they will shift most of their circadian rhythms to match the food availability. Studying mice, they discovered a "master clock" in a region of the brain (the dorsomedial nucleus) that can reset the circadian rhythm when faced with a shortage of food. The thinking is that when food is not an issue, lightness and darkness synchronize our sleep cycle. But when food is scarce, another system kicks in to synchronize our sleep cycle with our ability to find food.

So they suggst we can adjust our eating schedules to trigger our circadian rhythms to adapt more quickly. "A period of fasting with no food at all for about 16 hours is enough to engage this new clock," says the study's senior author, Dr. Clifford Saper. For example, for a fourteen-hour flight the researchers suggest that you stop eating two hours before flying and continue your anti-jet-lag fast during the entire flight, aiming for a total of sixteen hours.

★Less focus of blood flow on other processes

★For those of you who are thinking "Man this is bullshit, I don't want to change my sleeping patterns and do all this shit," something's gotta give… *

Mark Mattson talk
Hippocampus
Glutamate is the major excitatory thing (Talks about BDNF after that)
Stem cells form new nerve cells (Enhances spatial pattern seperation)
Running increases stem cells (Slide showing it)
Mice experiment + Spacial Pattern Seperation
Leptin mice
Alzheimer's - starts talking about it (Fasting doesn't prevent accumulation of Amyloid but protects them against it…)
Energy Metabolism - Mechanism by which fasting is good for the brain (Depleting glycogen)
More Mitochondria in your nerve cells if you exercise regularly
Stimulate Autophagy with these challenges - Autophagy is a type of clean up
SIRT3 - Found in Mitochondria, SIRT3 makes mitochondria more resistant to Oxidative stress
Hormesis - Healthiest plants taste the worst. Mild stress is good for you
BDNF can be measured in cerebrospinal fluid

BODY CLOCK WILL DO SHIT BY ITSELF
Hormones going up and down all the time
Adrenal has to make the hormone new every time, so there's a delay - feedforward and feedbackward so it oscillates, Pulses or hormone!
Emotional brain a lot more active when getting pulses instead of constant
Body clock controls the daily rhythm of hormones, but cortisol affects the body clock!
Oscillations are vital for good health
Enter melatonin - opposite of cortisol
BRain to do list - memory consolidation, Information processing, toxin clearance, tissue repair (HGH) relased first half of the night, rebuilding of metabolic pathways that have been burnt up as it were during the waking state are rebuilt at night, and energy replacement
Generation of the sleep wake cycle involves essentially every brain neurotransmitter
Sleep pressure and sleep window need to be in sync
"In addition to clock cells here, essentially every cell innthe body has its own clock. So what's happening is this master clock in the base of the brain is sending a signal out to regulate the rhythmic activity of billions and billions of individual cellular oscillators scattered throughout the organ systems of the body so you have a fantastic circadian network."
Why psychiatric illnesses are associated with sleep disorders - *"We've shown that if you take a gene that's been linked to human schizophrenia and you have a mutated form of that gene in a mouse, the mouse sleep wake patterns start to collapse. So genes that were never associated with the clock and sleep systems initially, when mutated, have a big effect upon the cock systems. So there's that shared pathways. That's not the whole explanation of course…"*
Photosensitive Retinal Ganglion Cells are very sensitive to blue light

Eye gives us our sense of space **and** time

“Further support for the importance of sleep comes from a recent crossover study involving overweight adults. Participants were randomly assigned to sleep either 5.5 hours or 8.5 hours each night for 14 days, in conjunction with moderate caloric restriction (average daily deficit of about 680 kcal) in a laboratory setting. Compared with participants who slept 8.5 hours per night, participants who slept only 5.5 hours lost 55% less body fat and 60% more fat-free mass; they also had less-favourable changes in metabolic hormone levels and substrate and energy use. Despite a loss of about 3 kg of body weight during each treatment, total energy loss was twice as high in the 8.5-hour group (1039 kcal/d) than in the 5.5-hour group (573 kcal/d). Thus, study participants defended their energy balance more vigorously (i.e., they conserved energy-dense fat at the expense of a greater loss of lean body mass) when they did not get enough sleep. In addition, participants in the shorter sleep group perceived greater hunger (accompanied by higher ghrelin levels) than participants in the longer sleep group. Given that higher ghrelin concentrations may facilitate the retention of fat, and increased hunger could compromise adherence to caloric restriction, these mechanisms may help explain why insufficient sleep could compromise the efficacy of common dietary interventions.”

“A more important study, this was done at the university of Chicago…” “They took individuals and put them on a calorie restricted diet.” “They went through that normal modality, put them on a calorie restricted diet. One phase of the study, they have them on this particular diet but they sleep deprive them. Again, 5 ½ hours of sleep, another phase of the study, same diet, 8 ½ hours of sleep. Everything’s tracked. At the end of the study, they found that the individuals when they were getting more sleep they lost 55% more body fat. The sleep deprived group did lose weight, but it was **mainly muscle**. They lost 60% more fat-free mass compared to those who slept well. . In addition, participants in the shorter sleep group perceived greater hunger (accompanied by higher ghrelin levels) than participants in the longer sleep group. Given that higher ghrelin concentrations may facilitate the retention of fat, and increased hunger could compromise adherence to caloric restriction, these mechanisms may help explain why insufficient sleep could compromise the efficacy of common dietary interventions.”

The main reason for this is that hormones get all out of wack, Cortisol goes up making it easier to lose muscle and build up visceral fat, ghrelin (one night of poor sleep leads it up by 15%), decreased leptin (you feel less full), less melatonin which helps with the accumulation of brown adipose tissue. A big factor in this is by not getting enough sleep you’re not letting your body produce proper amounts of human growth hormone.

Hormones are regulated and balanced while you sleep, setting your body up to do everything better. A key hormone of which is Human Growth Factor (HGH), otherwise known as “the youth hormone” HGH can do X, Y, and Z. Not only is it important to get enough sleep, but to get it at the right time. Research has shown that 10PM to 2AM may be the best time whatever - golden time, money time.

19th century psychologist Hermann Ebbinghaus showed that we forget on average 40% of new information within the first 20 minutes of learning it. You can mitigate this forgetting curve by simply consciously reviewing the information in your head, or by getting some sleep.

Of the four stages of sleep, slow wave sleep and rapid eye movement have been shown to move electrical impulses between the brain stem, hippocampus, thalamus and cortex. These four areas serve as relay stations for memory formation. During this process, your brain analyzes new information in short term memory and chooses what deserves to get moved into long term memory. It is thought that the reason we can't remember much after drinking a lot of alcohol is that alcohol interferes with this process.

(Showing the rat asleep replaying this time stamp) non-REM sleep they replay really quickly. 10 times faster - got a rewind button, it can go forward or backward.

Research suggests that if you want to get the most out of whatever information you're putting into your head, going to sleep 3 hours after memorizing your formulas and 1 hour after practicing your scales would be the most ideal.

Your brain can be flipping the book back and forth making lateral connections - saying oh hey wait wasn't the dude who did this also the guy who ate the pie - that's why pies are illegal now!! (REM plays shit out in proper timing) Even though it doesn't make any sense, it plays out in proper timing that you would expect. "Played out in real time as if the animal is actually experiencing these events. (non-REM is trying to figure shit out)
Hippocampus is the one replaying shit - and it is critically involved in recognizing context,

Sleep is composed of four stages, the deepest of which are known as slow wave sleep and rapid eye movement. EEG machines monitoring people during these stages have shown electrical impulses moving between the brain stem, hippocampus, thalamus, and cortex- which serve as relay stations of memory formation. And the different stages of sleep have been shown to help consolidate different types of memories. During the non-REM, slow wave sleep, declarative memory is encoded into a temporary store, in the anterior part of the hippocampus. Through a continuing dialogue between the cortex and hippocampus, it is then repeatedly reactivated, driving its gradual redistribution to long term storage in the cortex. REM sleep on the other hand, with its similarity to waking brain activity is associated with the consolidation of procedural memory.

(Begin showing the brain scan activity at this time stamp)

John Pelley on the importance of sleep - Prune stuff and keep important things
It's theorized that one of the reasons you don't remember much after drinking a bunch of alcohol is that the alcohol interferes with sleep enough so that your brain can't consolidate memories.

★It’s theorized that one of the reasons you have a hard time remembering what happened on nights when you drank a lot is due to the REM rebound effect where alcohol is interfering with this memory consolidation process.