非常感谢。 额，我想先说说睾丸。
Thank you very much. Well, I would like to start with testicles.
（笑声）
(Laughter)
那些每晚只睡五个小时的男性 相比每晚睡够至少七个小时的男性， 有着更小的睾丸。
Men who sleep five hours a night have significantly smaller testicles than those who sleep seven hours or more.
（笑声）
(Laughter)
除此之外，习惯性只睡 四到五个小时的男性， 他们的睾酮水平 和比他们年长十岁的人差不多。 所以，从睾酮这一关键的健康指标来看， 缺乏睡眠会让男性老十岁。 我们在女性的生殖健康上也看到了 由缺乏睡眠导致的同等损害。
In addition, men who routinely sleep just four to five hours a night will have a level of testosterone which is that of someone 10 years their senior. So a lack of sleep will age a man by a decade in terms of that critical aspect of wellness. And we see equivalent impairments in female reproductive health caused by a lack of sleep.
这是今天我给你们准备的最好的消息。
This is the best news that I have for you today.
（笑声）
(Laughter)
从现在开始，事情只会变得更糟。 我不仅会告诉你们在你们睡觉时， 会发生的美妙的事情， 还会告诉你们当睡眠不足时， 发生在你们大脑和身体上的 非常糟糕的事情。
From this point, it may only get worse. Not only will I tell you about the wonderfully good things that happen when you get sleep, but the alarmingly bad things that happen when you don't get enough, both for your brain and for your body.
让我从大脑以及 学习和记忆的功能开始讲起， 因为我们在过去十年的研究发现， 在你学习完后，应该睡觉， 以按下新记忆的保存按钮， 这样才不会遗忘。 但是最近，我们发现在学习之前 你也需要睡眠， 来准备好自己的头脑， 就像是一块干海绵， 准备好开始吸收新的知识。 没有睡眠的话，大脑的记忆回路 就像是被堵塞住了， 而你将不能吸收新的记忆。
Let me start with the brain and the functions of learning and memory, because what we've discovered over the past 10 or so years is that you need sleep after learning to essentially hit the save button on those new memories so that you don't forget. But recently, we discovered that you also need sleep before learning to actually prepare your brain, almost like a dry sponge ready to initially soak up new information. And without sleep, the memory circuits of the brain essentially become waterlogged, as it were, and you can't absorb new memories.
让我向你们展示一下数据。 在这个研究中，我们测试了 这么一个假设， 即熬夜到底是不是不错的做法。 我们招募了一组被试， 然后将其分为两组： 睡眠充足组和睡眠不足组。 睡眠充足组的被试可以睡够八个小时， 而睡眠不足组的被试则在实验室中， 在全程监控下，不断地被我们叫醒。 顺便说一句，他们没有小睡或咖啡因的支持， 所以确实很痛苦。 第二天， 我们把这些被试放进MRI扫描仪， 让他们试着学习一整列的新知识， 同时记录下他们的大脑活动情况。 然后，我们测试他们， 来看看他们的学习到底有没有效。 这就是你们所看的纵轴。 当把这两组被试比较时， 你们可以发现没有充足睡眠的大脑 在储存新记忆的能力上 有40%的显著差距。
So let me show you the data. Here in this study, we decided to test

the hypothesis that pulling the all-nighter was a good idea. So we took a group of individuals and we assigned them to one of two experimental groups: a sleep group and a sleep deprivation group. Now the sleep group, they're going to get a full eight hours of slumber, but the deprivation group, we're going to keep them awake in the laboratory, under full supervision. There's no naps or caffeine, by the way, so it's miserable for everyone involved. And then the next day, we're going to place those participants inside an MRI scanner and we're going to have them try and learn a whole list of new facts as we're taking snapshots of brain activity. And then we're going to test them to see how effective that learning has been. And that's what you're looking at here on the vertical axis. And when you put those two groups head to head, what you find is a quite significant, 40-percent deficit in the ability of the brain to make new memories without sleep.

我觉得这一发现令人担忧， 考虑到我们的受教育人群 在睡眠上正在经历的事情。 事实上，说的具体些， 就是学生在考试中得高分 和考砸了之间的差距——40%。 我们进一步研究大脑中 到底哪里出错 产生了这种学习障碍。 在大脑的左侧和右侧， 有着这么一块区域，叫做海马体。 你们可以把海马体想成 大脑的信息收件箱。 海马体很擅长接收新的“记忆文件”， 并保留这些文件。 当你们观察 那些睡了一整晚的被试的海马体时， 我们看到的是许多健康的 与学习相关的大脑活动。 但是在那些睡眠不足的被试身上， 我们基本上找不到任何明显的信号。 这就好像睡眠不足关闭了记忆收件箱， 任何新进的文件——都被退回了。 你不能有效的将新的经历转化为记忆。

I think this should be concerning, considering what we know is happening to sleep in our education populations right now. In fact, to put that in context, it would be the difference in a child acing an exam versus failing it miserably -- 40 percent. And we've gone on to discover what goes wrong within your brain to produce these types of learning disabilities. And there's a structure that sits on the left and the right side of your brain, called the hippocampus. And you can think of the hippocampus almost like the informational inbox of your brain. It's very good at receiving new memory files and then holding on to them. And when you look at this structure in those people who'd had a full night of sleep, we saw lots of healthy learning-related activity. Yet in those people who were sleep-deprived, we actually couldn't find any significant signal whatsoever. So it's almost as though sleep deprivation had shut down your memory inbox, and any new incoming files -- they were just being bounced. You couldn't effectively commit new experiences to memory.

这就是假如我剥夺你的睡眠时， 会发生的糟糕事情， 但容我稍微讲一下对照组。 你们还记得那些睡够了八个小时的被试吗？ 我们可以问一个非常不同的问题： 让你每天睡眠时 恢复和提高你的 记忆力和学习能力的生理质量 是什么样的？ 通过在头部放置电极， 我们所发现的是，在睡眠的最深阶段 会产生巨大而强大的脑电波， 这些脑电波之上会有 我们称之为睡眠纺锤波的 壮观的电活动爆发。 正是这些深度睡眠脑电波的综合作用， 在夜间起到了文件传输机制的作用， 将记忆从一个短期的 易受遗忘的存储库 转移到大脑中一个更永久 的长期存储库， 因此得以保存它们， 使它们不至受损。 重要的是，我们要了解在睡眠中 究竟是什么在发挥这些记忆的作用， 因为这对医学和社会都有实际的影响。

So that's the bad that can happen if I were to take sleep away from you, but let me just come back to that control group for a second. Do you remember those folks that got a full eight hours of sleep?

Well, we can ask a very different question: What is it about the physiological quality of your sleep when you do get it that restores and enhances your memory and learning ability each and every day? And by placing electrodes all over the head, what we've discovered is that there are big, powerful brainwaves that happen during the very deepest stages of sleep that have riding on top of them these spectacular bursts of electrical activity that we call sleep spindles. And it's the combined quality of these deep-sleep brainwaves that acts like a file-transfer mechanism at night, shifting memories from a short-term vulnerable reservoir to a more permanent long-term storage site within the brain, and therefore protecting them, making them safe. And it is important that we understand what during sleep actually transacts these memory benefits, because there are real medical and societal implications.
让我告诉你们 我们已经把这项研究转移到临床的一个领域， 即衰老和痴呆。 因为随着我们变老， 我们的学习和记忆能力 开始衰退和减弱当然 并不是什么秘密。 但我们也发现的是 衰老的一个生理特征是 你的睡眠质量变差了， 尤其在我刚才谈到的 深度睡眠质量中。 仅仅在去年，我们最终发表了证据 表明这两件事，它们 不是简单的同时发生， 它们是显著相互关联的。 这表明深度睡眠的中断 是导致衰老时认知能力和记忆能力衰退 的一个低估因素， 最近我们还发现， 老年痴呆症也是如此。
And let me just tell you about one area that we've moved this work out into, clinically, which is the context of aging and dementia. Because it's of course no secret that, as we get older, our learning and memory abilities begin to fade and decline. But what we've also discovered is that a physiological signature of aging is that your sleep gets worse, especially that deep quality of sleep that I was just discussing. And only last year, we finally published evidence that these two things, they're not simply co-occurring, they are significantly interrelated. And it suggests that the disruption of deep sleep is an underappreciated factor that is contributing to cognitive decline or memory decline in aging, and most recently we've discovered, in Alzheimer's disease as well.
我知道这个消息是如此令人沮丧。 它在邮寄途中，正在走向你。 但也有一线希望。 跟其他我们已知跟衰老 有关的因素不同的是， 比如大脑物理结构的改变， 这是非常难以治疗的。 但睡眠是解释衰老和 阿尔茨海默症谜题中 缺失的一块倒是令人兴奋， 因为我们也许能做点啥对策。
Now, I know this is remarkably depressing news. It's in the mail. It's coming at you. But there's a potential silver lining here. Unlike many of the other factors that we know are associated with aging, for example changes in the physical structure of the brain, that's fiendishly difficult to treat. But that sleep is a missing piece in the explanatory puzzle of aging and Alzheimer's is exciting because we may be able to do something about it.
在我的睡眠中心解决这个问题的方法之一 不是使用安眠药，顺便说一句。 不幸的是，安眠药是钝器， 不能产生自然主义的睡眠。 反之，我们基于这个原理开发了一个方法。 叫做脑直流电刺激方法。 你在大脑中注入少量的电压， 小到你基本上感受不到， 但却具有可衡量的影响。 现在如果你在年轻，健康的 成人睡眠时采用这种刺激， 就好像你在用那些沉睡的脑电波唱歌一样， 你不仅能够放大这些深度睡眠脑电波， 而且这样做，我们可以增强从睡眠中获得 的记忆好处的两倍。 现在的问题是我们能否 将这经济实惠，潜在的便携技术 应用到老年人和老年痴呆群体中。 我们能否恢复深度睡眠的健康质量， 并且通过这样做，我

们 能否挽救他们的学习 和记忆功能？ 这是我目前真实的希望。 可以说，这是我们的登月目标之一。
And one way that we are approaching this at my sleep center is not by using sleeping pills, by the way. Unfortunately, they are blunt instruments that do not produce naturalistic sleep. Instead, we're actually developing a method based on this. It's called direct current brain stimulation. You insert a small amount of voltage into the brain, so small you typically don't feel it, but it has a measurable impact. Now if you apply this stimulation during sleep in young, healthy adults, as if you're sort of singing in time with those deep-sleep brainwaves, not only can you amplify the size of those deep-sleep brainwaves, but in doing so, we can almost double the amount of memory benefit that you get from sleep. The question now is whether we can translate this same affordable, potentially portable piece of technology into older adults and those with dementia. Can we restore back some healthy quality of deep sleep, and in doing so, can we salvage aspects of their learning and memory function? That is my real hope now. That's one of our moon-shot goals, as it were.
所以这是大脑睡眠的一个例子， 但睡眠对你的身体也同样重要。 我们已经讨论过睡眠不足和生殖系统的关系。 或者我可以告诉你睡眠不足 和你的心血管系统， 而这只需要一个小时。 因为有一个全球性的实验每年在70个国家 的16亿人身上进行两次， 这个实验叫做夏令时。 现在，在春天，当我们少一个小时睡眠时， 我们看到接下来的第二天 心脏病发作会增加24%。 在秋季，当我们获得一个小时的睡眠时， 我们看到心脏病发作会减少21%。 是不是让人难以置信？ 你会看到同样的情况发生在车祸，交通事故， 甚至自杀率上。
So that's an example of sleep for your brain, but sleep is just as essential for your body. We've already spoken about sleep loss and your reproductive system. Or I could tell you about sleep loss and your cardiovascular system, and that all it takes is one hour. Because there is a global experiment performed on 1.6 billion people across 70 countries twice a year, and it's called daylight saving time. Now, in the spring, when we lose one hour of sleep, we see a subsequent 24-percent increase in heart attacks that following day. In the autumn, when we gain an hour of sleep, we see a 21-percent reduction in heart attacks. Isn't that incredible? And you see exactly the same profile for car crashes, road traffic accidents, even suicide rates.
但为了更深入些，我想要专注这个： 睡眠不足和你的免疫系统。 这里，我将介绍图片中 这些明亮的蓝色元素。 它们被称为自然杀伤细胞， 你可以把自然杀伤细胞 想象成你免疫系统中的 特勤局特工。 它们非常擅长识别危险和无需的物体 并消灭它们。 事实上，它们正在做的是 摧毁一个癌变的肿瘤团块。 所以你一定时刻希望拥有这群有能力 的刺客， 但悲剧的是，当你睡眠不足时， 你不能拥有它们。
But as a deeper dive, I want to focus on this: sleep loss and your immune system. And here, I'll introduce these delightful blue elements in the image. They are called natural killer cells, and you can think of natural killer cells almost like the secret service agents of your immune system. They are very good at identifying dangerous, unwanted elements and eliminating them. In fact, what they're doing here is destroying a cancerous tumor mass. So what you wish for is a virile set of these immune assassins at all times, and tragically, that's what you don't have if you're not sleeping

enough.
所以在这个实验中， 你不会整晚都被剥夺睡眠， 你一个晚上的睡眠将会被限制在 4个小时， 然后我们来看看你的免疫细胞 会受到多大比例的影响。 这并不是个小数目——不是10%， 不是20%。 自然杀伤细胞的活力下降高达70%。 这是个令人担忧的免疫缺陷状态，你可能能够理解 我们现在发现的 短睡眠时间和你患多种癌症 的风险之间存在重要联系。 目前，这一名单包括肠癌、 前列腺癌和乳腺癌。 事实上，睡眠不足和癌症 之间的联系是如此紧密， 以致世界卫生组织 将任何形式的夜班工作 列为可能的致癌物质， 因为你的睡眠-觉醒节律被打乱了。
So here in this experiment, you're not going to have your sleep deprived for an entire night, you're simply going to have your sleep restricted to four hours for one single night, and then we're going to look to see what's the percent reduction in immune cell activity that you suffer. And it's not small -- it's not 10 percent, it's not 20 percent. There was a 70-percent drop in natural killer cell activity. That's a concerning state of immune deficiency, and you can perhaps understand why we're now finding significant links between short sleep duration and your risk for the development of numerous forms of cancer. Currently, that list includes cancer of the bowel, cancer of the prostate and cancer of the breast. In fact, the link between a lack of sleep and cancer is now so strong that the World Health Organization has classified any form of nighttime shift work as a probable carcinogen, because of a disruption of your sleep-wake rhythms.
你可能听过这句老话， 你死后自当长眠。 我现在是认真的—— 这是极其不明智的建议。 我们从数百万人的流行病学 研究中了解到这一点。 事实很简单： 睡眠越少，生命越短。 睡眠不足预示着全因死亡率。
So you may have heard of that old maxim that you can sleep when you're dead. Well, I'm being quite serious now -- it is mortally unwise advice. We know this from epidemiological studies across millions of individuals. There's a simple truth: the shorter your sleep, the shorter your life. Short sleep predicts all-cause mortality.
如果让你增加患上癌症 或者甚至老年痴呆症的风险 还不足够让人不安的话， 我们还发现，缺乏睡眠甚至会侵蚀 生物生命本身的结构， 你的DNA遗传密码。 所以在这个研究中，他们找来一群健康的成年人， 在一周内限制他们每晚的睡眠时间 在6小时， 然后测量他们的基因活动 与每晚睡足8小时的人 对比的变化。 这个研究有两个重要的发现。 首先，一个数量相当大且 显著的711个基因的活动 因为缺乏睡眠 而被打乱。 第二个结果是一半的这些基因 活动确实增加了。 另一半则减少了。
And if increasing your risk for the development of cancer or even Alzheimer's disease were not sufficiently disquieting, we have since discovered that a lack of sleep will even erode the very fabric of biological life itself, your DNA genetic code. So here in this study, they took a group of healthy adults and they limited them to six hours of sleep a night for one week, and then they measured the change in their gene activity profile relative to when those same individuals were getting a full eight hours of sleep a night. And there were two critical findings. First, a sizable and significant 711 genes were distorted in their activity, caused by a lack of sleep. The second result was that about half of those genes were actually increased in their activity. The other half were decreased.

因睡眠不足而关闭的基因 是跟你免疫系统相关的基因， 所以再一次，你会看到免疫缺陷。 相反，那些因睡眠缺乏而上调 或者活动增加的基因， 是那些促进肿瘤相关的基因， 与体内长期慢性炎症相关的基因， 与压力相关的基因， 还有因此导致心血管疾病 相关的基因。 你的健康没有任何方面 可以在睡眠不足的迹象下 安然无恙。 这很像你家中的水管破了。 睡眠不足会渗透到你身体的 每一个角落， 甚至会篡改你日常健康状况 的DNA核酸字母表。
Now those genes that were switched off by a lack of sleep were genes associated with your immune system, so once again, you can see that immune deficiency. In contrast, those genes that were actually upregulated or increased by way of a lack of sleep, were genes associated with the promotion of tumors, genes associated with long-term chronic inflammation within the body, and genes associated with stress, and, as a consequence, cardiovascular disease. There is simply no aspect of your wellness that can retreat at the sign of sleep deprivation and get away unscathed. It's rather like a broken water pipe in your home. Sleep loss will leak down into every nook and cranny of your physiology, even tampering with the very DNA nucleic alphabet that spells out your daily health narrative.
此刻，你可能在想， “老天，我怎样才能得到更好的睡眠？ 你有没有睡个好觉的提示？” 除了避免酒精和咖啡因 对睡眠的有害影响之外， 如果你晚上睡眠不好， 白天避免打盹，我有两点建议给你。
And at this point, you may be thinking, "Oh my goodness, how do I start to get better sleep? What are you tips for good sleep?" Well, beyond avoiding the damaging and harmful impact of alcohol and caffeine on sleep, and if you're struggling with sleep at night, avoiding naps during the day, I have two pieces of advice for you.
首先是规律。 准时上床，准时醒来， 不管是工作日还是周末。 规律为王， 它会固定你的睡眠 并且提升你睡眠的数量和质量。 第二点是保持凉爽。 你的身体需要把核心温度 降低2到3华氏度来开始睡眠 和保持睡眠， 这也是为什么你会发现 冷的环境要比热的环境 容易入睡。 所以卧室的稳定要控制 在65华氏度左右， 或者大约摄氏18度。 这是大多数人睡眠的最佳选择。
The first is regularity. Go to bed at the same time, wake up at the same time, no matter whether it's the weekday or the weekend. Regularity is king, and it will anchor your sleep and improve the quantity and the quality of that sleep. The second is keep it cool. Your body needs to drop its core temperature by about two to three degrees Fahrenheit to initiate sleep and then to stay asleep, and it's the reason you will always find it easier to fall asleep in a room that's too cold than too hot. So aim for a bedroom temperature of around 65 degrees, or about 18 degrees Celsius. That's going to be optimal for the sleep of most people.
然后最终，退一步说， 这里的关键任务是什么？ 我想也许是这个： 不幸的是，睡眠并不是一个 可选的奢侈的生活方式。 睡眠是一个不容置疑的生理需要。 它是你的生命支持系统，它是自然母亲对永生做的最大努力。 工业化国家睡眠量的大量减少 对我们的健康，我们的幸福，甚至安全 以及孩子的教育有灾难性的影响。 这是一种无声的睡眠缺乏流行病， 它正在快速成为我们在 21世纪面临的其中一个 公众健康的最大挑战。
And then finally, in taking a step back, then, what is the mission-critical statement here? Well, I think it may be this: sleep, unfortunately, is not an optional lifestyle luxury. Sleep is a nonnegotiable biological necessity. It is your life-support system, and it is Mother Nature's best effort yet at immortality. And the

decimation of sleep throughout industrialized nations is having a catastrophic impact on our health, our wellness, even the safety and the education of our children. It's a silent sleep loss epidemic, and it's fast becoming one of the greatest public health challenges that we face in the 21st century.
我认为现在是重申我们睡好整夜 权利的时候了， 放下尴尬 和懒惰的耻辱。 通过这样做，我们可以与生命中 最强大的长生不老药 —瑞士军刀重聚。
I believe it is now time for us to reclaim our right to a full night of sleep, and without embarrassment or that unfortunate stigma of laziness. And in doing so, we can be reunited with the most powerful elixir of life, the Swiss Army knife of health, as it were.
说完这番激昂的演说， 我只想说，晚安，祝你好运， 最重要的是… 我真希望你们睡得好。
And with that soapbox rant over, I will simply say, good night, good luck, and above all ... I do hope you sleep well.
衷心感谢各位。
Thank you very much indeed.
（掌声）
(Applause)
谢谢。
Thank you.
（掌声）
(Applause)
非常感谢。
Thank you so much.
大卫·比洛:别，别，别，呆一会儿。 还好没走开，我感激这点。 那真是很可怕。
David Biello: No, no, no. Stay there for a second. Good job not running away, though. I appreciate that. So that was terrifying.
马特·沃克：不客气。 大卫·比洛：谢谢，谢谢。 马特·沃克：既然我们睡不着，我们应该做什么？ 当我们晚上在床上辗转反侧， 轮班工作或因为其他事情时， 我们应该做什么？
Matt Walker: You're welcome. DB: Yes, thank you, thank you. Since we can't catch up on sleep, what are we supposed to do? What do we do when we're, like, tossing and turning in bed late at night or doing shift work or whatever else?
你说的对，我们睡不着。 睡眠不像银行。 你不能欠点债， 然后希望在后面晚些时候还清。 我还应该指出，这个如此灾难性的， 我们的健康恶化得如此之快的原因， 首先，这是因为人类是唯一 故意无缘无故剥夺自己睡眠 的物种。
MW: So you're right, we can't catch up on sleep. Sleep is not like the bank. You can't accumulate a debt and then hope to pay it off at a later point in time. I should also note the reason that it's so catastrophic and that our health deteriorates so quickly, first, it's because human beings are the only species that deliberately deprive themselves of sleep for no apparent reason.
大卫·比洛：因为我们很聪明。
DB: Because we're smart.
马特·沃克：我提出这一点是因为这意味着大自然母亲， 在整个进化过程中， 从来没有面临过剥夺睡眠的挑战。 所以她从来没有建立安全网， 所以这就是为什么当你睡眠不足时， 大脑和身体内部会奔溃得如此之快。 所以你只需要分清轻重缓急，
MW: And I make that point because it means that Mother Nature, throughout the course of evolution, has never had to face the challenge of this thing called sleep deprivation. So she's never

developed a safety net, and that's why when you undersleep, things just sort of implode so quickly, both within the brain and the body. So you just have to prioritize.
大卫·比洛：但在床上辗转反侧时， 我该做什么?
DB: OK, but tossing and turning in bed, what do I do?
马特·沃克：如果你在床上醒着太久， 你应该下床，去另一个房间 去做些不一样的事情。 原因是你的大脑会很快把你的卧室 和清醒的地方联系起来， 你需要打破这个联系。 所以只在你想睡的时候回到床上， 这样你就会重新学习你曾经拥有的联系， 也就是你的床就是你睡觉的地方。 这就类比像 你永远不要坐在餐桌前等待饥饿。 那么为什么要躺在床上等待入睡呢?
MW: So if you are staying in bed awake for too long, you should get out of bed and go to a different room and do something different. The reason is because your brain will very quickly associate your bedroom with the place of wakefulness, and you need to break that association. So only return to bed when you are sleepy, and that way you will relearn the association that you once had, which is your bed is the place of sleep. So the analogy would be, you'd never sit at the dinner table, waiting to get hungry, so why would you lie in bed, waiting to get sleepy?
大卫·比洛：谢谢你的提醒。 好样的，马特。
DB: Well, thank you for that wake-up call. Great job, Matt.
马特·沃克：不客气，谢谢大家。
MW: You're very welcome. Thank you very much.