

We could kick-start life on another planet. Should we?

人类是否应该向外星播种生命?

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Imagine two universes. In one of these universes, life flourishes on nearly every planet you can encounter. Floating in the atmosphere, swimming in the seas, lounging on the beaches. Life in every body form and size you can imagine.

想象一下有两个宇宙存在。在其中一个宇宙中，每一个星球上，生命都繁荣不息。有的飘荡于空中，有的遨游于大海，有的在海滩上闲荡。各种形态各种大小，任何你想象得到的生命。

Now imagine the other universe where life is nowhere to be found. Stars collide, galaxies explode, meteorites crash, asteroids everywhere. A ton of action, but no life. Let me ask you this. Which one of these universes is more interesting to you? Which one has more value?

现在想象一下没有生命存在的另一个宇宙。恒星碰撞，星系爆炸，陨石坠落，到处都是小行星。宇宙中充满各种活动，但是没有生命的踪迹。请让我来问问你：这两个宇宙，你对哪一个更感兴趣？哪一个更有价值？

So today I want to take you to a journey to explore and understand the origin of life, the future and where it is headed and an ethical dilemma that may arise from understanding this. First things first, Earth was formed 4.5 billion years ago. Life happened fairly quickly, within the first few hundred million years. So that's very fast. Think about that next time you feel like you're aging too fast.

今天，我将带大家探索和理解生命的起源、生命的未来、生命将走向何方，以及由此可能带来的伦理困境。首先要说的是，地球诞生于45亿年前。生命出现得十分迅速，早在最初的几亿年，这是非常快的。下次你担心自己加速衰老的时候想想这个吧。

You're not. You're fine. And here is how life works. Life is a form of chemistry. A form of chemistry that explores solutions in response to the problems in its own immediate chemical environment. Life is a form of chemistry that retains a memory of these solutions over billions of years. And life's first solution was quite the trick: copy itself. This is astounding. We would not be standing here today if other tricks didn't follow, like how to use water as a source of electrons or how to use the nitrogen in the atmosphere or how to chew on sunlight. This is remarkable. I am chemistry that explores. I am chemistry that defies degradation, and I am chemistry that remembers. I am a tiny part of an unbroken four-billion-year-old heritage, a four-billion-year-old linkage. Life makes our planet an incredibly exotic place compared to the rest of the known universe. This is the only place that it is known to exist. In fact, you can study physics or chemistry or geology anywhere else in the universe. But this is the only place where you can study biology. Well, I happen to be a biologist on the only planet where you can be a biologist in the entire universe.

你没有加速衰老。一切正常。生命是这样的：生命是一种化学物质。生命会探索自己所处的直接化学环境中存在的问题的解决对策。生命这种化学物质，几十亿年来对这些解决对策保持着记忆。生命的第一个对策很是奇妙：自我复制。这种方式非常惊人。假如接下来的步骤没有发生，我们今天就不会站在这里。比如如何把水作为电子的来源，如何利用大气中的氮，如何利用太阳光。这都是非同寻常的。我就是会探索的化学物质。我就是反抗退化的化学物质，我就是保有记忆的化学物质。我是四十亿年连续的历史遗产的一小部分，四十亿年不间断的历史。生命的存在，让地球与已知宇宙的其他地方相比，显得如此奇妙。这是已知有生命存在的唯一的一个地方。事实上，你可以在宇宙其他任何地方研究物理、化学或地理。但是只有在地球上才能研究生物学。我恰好在宇宙中唯一的一个可以研究生物学的星球上当生物学家。

And that makes my job very, very special, right? Because our planet offers an incredible opportunity to explore its own origins and understand how chemistry converted itself into an agent capable of responding to its environment and stimulating itself in response to this. In the past 10 years, there has been remarkable innovations in our understanding of origin of life. I lead a research laboratory, and we are using statistics and mathematical models and evolutionary systems and infer the sequences of ancient DNA that existed billions of years ago. We then synthesize these ancient DNA molecules and engineer them inside organisms. For the first time, we are able to activate molecules that existed billions of years ago to understand and capture what happened back then. We also stimulate and simulate ancient environments in the lab to understand the ingredients by creating them from water, air and rocks. This means accessing and obtaining chemistry that is novel. This means the ability to drive chemical reactions so that they can create chemistry that organizes itself. This means having chemistry in hand that may act lifelike. This is really remarkable.

这就是说，我的职业非常、非常特别，对吧？那是因为地球为我们提供了绝无仅有的机会来探索地球的起源，理解化学物质如何转变成能够对环境做出反应的物质，并刺激自己做出反应。过去10年中，人们对生命起源的理解有了重大创新。我领导研究团队，我们利用统计学和数学模型、进化系统来推算几十亿年前存在的古DNA序列。之后，我们合成了这些古DNA分子，并将其植入生命体中。这是我们第一次成功激活了几十亿年前存在的分子，理解、捕捉当时发生的事情。我们还在实验室中刺激、模拟远古环境，利用水、空气、岩石还原这些环境，理解当时的环境成分。这意味着获取新的化学物质。这意味着刺激化学反应发生，形成能够自我组织的化学物质。这意味着，我们拥有了具有生命特征的化学物质。这真的很了不起。

So we might wonder: What do we do when we have this knowledge in our hands? This may mean that we would be able to connect the dots between nonliving and living and understand how chemistry is translating and transforming and transitioning into a lifelike behavior. This may mean that we would be able to obtain the recipe of life, if you will, and having this recipe would enable us to connect the dots between these two states of living and nonliving. This may enable us to look at the particular environments and know how far along is that particular environment from its own unique chemical revolution. We might be able to study different planets and moons and assess them, and assess their chemistry, and know how far along they are from giving birth to life. And we may be able to guide our telescopes in the vast sky in more guided ways in our pursuit of finding life in the universe.

所以我们或许会想：掌握了这些知识，那下一步呢？这或许意味着我们能够连接生命界与非生命界，理解化学物质如何转变、转化、过渡为生命的形态。这也许意味着我们能掌握生命的配方，如能这么说的话，拥有了生命的配方，我们就能连接生命与非生命两种状态。我们也许就能观察特定环境，知晓这个环境距离其独特的化学演化还有多远。也许我们能研究不同行星和卫星，对它们进行评估，评估其化学物质，知晓它们距离孕育生命还有多远。也许我们能用望远镜更精准地望向广阔的太空，在宇宙中寻找生命。

We might also ask ourselves: What can we do with this knowledge? What if you weren't only assessing? What if we were also interacting and engaging with these planets and moons? What if we were able to seed life across the billions of planets in the galaxy? This would not be seeding them with Earth life. This wouldn't be engineering an Earth organism and preadapting them, and preconditioning them in a way that they exist and survive in this other planetary body. No. This this wouldn't be terraforming, altering the environment of this other planet, so that whatever we ship there makes it. No. This would be about empowering and not colonizing these environments. This would be about letting them explore their own unique chemistry to express their own unique reactions by providing them the missing ingredients. This wouldn't be about sending them some life so that we are genetically related or something that is familiar to us. This would be enabling them to do what perhaps they were supposed to do or meant to do all along, but they were lacking and missing ingredients. And not lacking in the sense that they themselves were lacking something important, in the sense that they weren't lacking, right? But what if we were able to send the spice? The secret sauce. Give it a little nudge. For it to react with whatever is already present in this planetary body so that life is sparked, in conjunction and agreement with the own history and journey and origin of this own planetary body, without our meddling, without our direction, without anything that we do to direct this in any way. This would be kickstarting a process that may unfold itself over thousands or millions of years into the future.

我们可能还会问自己：用这些知识能做什么？要是不只是评估呢？如果还要与这些行星、卫星互动呢？如果我们能在银河中几十亿个星球上中播种生命，会怎么样？并不是播种来自地球生命。不是改造地球已有的生命，对其进行预处理，使其适应其他星球的生活方式。不是的。我们要做的并不是地球化，改变其他星球原本的环境，然后我们运送的任何东西都能生存。不是的。我们是要赋予这些星球孕育生命的能力，而不是去殖民。为这些星球提供缺失的成分，让它们自己探索独特的化学物质，发生独特的化学反应。并不是输送生命，让这些生命与我们有亲缘关系，或是为我们所熟知。这些星球上会发生本来就该发生的事情，只是之前缺少了一些成分。并不是它们本身缺少了什么重要的东西，它们自己本身并不缺乏什么，对吧？那如果我们能添一把调料呢？给它们神秘配方。稍微推一下。使其与星球上本身存在的物质发生反应，就这样，生命迸发，与星球本身的历史、旅程和起源结合，没有我们的干预和指挥，我们也没有用任何方式引导这一切。这将有可能会启动一个在未来数千年甚至数百万年里展开的旅程。

But should we do it? This is an extraordinary proposition. And it brings up an extraordinary dilemma about what it means to be alive. Does life, as a chemical system capable of formulating, and in some cases answering, questions about its own existence, have a responsibility or should have a prohibition against sponsoring more life across the universe? Do we do this just because we could? And what is the ethical difference and is there any ethical difference between spreading a particular Earth life versus spreading a potential of life across the galaxy? And where does this difference lie?

但我们应该这么做吗？这个提议多么非同寻常。这个提议引发了新的困境：活着意味着什么？生命作为化学系统，能够对自身的存在发出疑问，甚至在一定条件下能够解答这些问题，那么生命体是否有责任，抑或是否该制止在宇宙中播种生命的行为？我们能因为自己做得到，就去这样做吗？在向外星播种某种地球生命，与赋予外星孕育生命的可能之间，是否存在伦理上的差异？这种差异是什么？

So I really tried to bring you answers today, and I don't have any. But I see the facts shaping in front of me. A universe full with life is interesting because having a solution in hand has value, right? But perhaps the spontaneity and unpredictability of discovering novel chemistries and novel life forms is also interesting and has its own unique merits. But do we get to set course and let natural evolution discover its own local environments wherever it might be in the cosmos? An empty universe in this regard, I think, can be viewed as an wide open palette for solutions waiting to be discovered. But should we do it just because we can?

我很想试着给出答案，我却没有答案。但我看到事实在我面前展开。充满生命的宇宙很有趣，因为掌握解决对策是有价值的，对吧？但是也许发现新化学物质、新生命形式的自发性与不确定性也很有趣，具有独特的价值。但是我们是否应该设定方向，让自然演化无论在宇宙中的何处都能探索自己所处的环境呢？在这一点上，我认为可以视宇宙为一块巨大的空白调色板，等待未知答案的出现。能因为我们做得到，就去这样做吗？

It is very important to keep in mind that Earth is our only home, and it's a good planet. And you know the saying: "Good planets are hard to find."

地球是人类唯一的家园，这一点我们需要牢记在心。地球是个美好的星球。大家都听说过一句话：“好的星球很难找到”。（SteveForbert演唱的歌曲）

I know that, I've been looking for one. I'll let you know when I find a good one.

我知道，我一直在寻找。等我找到了会告诉大家。

Exploring the origins may allow us to truly understand life around us, and perhaps an exercise like this may encourage us to truly appreciate and understand how life emerged in the first place. I really think that in order for us to understand the biology and life around us, we really need to understand how life happened to this planet in the first place. I really, really believe in this. I will dedicate my life to do this.

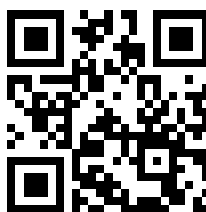
探索生命的起源让我们真正理解我们周围的生命，也许这样的实验将会促进人类真正珍惜和理解生命最初是如何诞生的。我相信，要理解我们身边的生物学和生命，就要理解地球上的第一个生命是如何诞生的。我真的相信这一点。我会用我的一生去做这件事。

And before I leave to do that, back to my lab that I missed very much, let me ask you again: A universe that is empty and one with a lot of life. Which one of this is more interesting to you?

在我结束演讲，回到我十分想念的实验室之前，让我再来问一次：一个空荡荡宇宙和一个充满生命的宇宙，你对哪个更感兴趣？

Thank you. Thank you very much.

谢谢。非常感谢。



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