**TED演讲者：Dan Gibson | 丹・吉布森**

**演讲标题：How to build synthetic DNA and send it across the internet | 如何制造合成DNA，并通过互联网传送**

**内容概要：Biologist Dan Gibson edits and programs DNA, just like coders program a computer. But his "code" creates life, giving scientists the power to convert digital information into biological material like proteins and vaccines. Now he's on to a new project: "biological transportation," which holds the promise of beaming new medicines across the globe over the internet. Learn more about how this technology could change the way we respond to disease outbreaks and enable us to download personalized prescriptions in our homes.**

**生物学家丹・吉布森的工作是编辑和编程DNA，就跟计算机程序员一样。但他的代码能够制造生命，赋予了科学家将数字信息转变为生物材料，如蛋白质和病毒的能力。现在他正在从事一个新的项目：“生物传送”，具有将药物通过互联网远程发送的能力。通过这个演讲，了解更多关于这项技术如何改变我们对疾病暴发的反应方式，以及使我们能够在家中下载个性化处方的可能。**



| | |
|---|---|
| Alright, let me tell you about building **synthetic** cells and printing life. | 我来给大家讲讲制造合成细胞 和打印生命。[00:13] |
| But first, let me tell you a quick story. | 首先,给你们讲个简短的故事。[00:18] |
| On March 31, 2013, my team and I received an email from an international health organization, **alerting** us that two men died in China shortly after **contracting** the H7N9 bird flu. | 2013年3月31号, 我和团队收到了一封来自 国际卫生组织的电邮, 提醒我们说,有两个中国人 在感染H7N9禽流感不久后死亡了。[00:20] |
| There were fears of a global **pandemic** as the virus started rapidly moving across China. | 随着病毒开始迅速在中国传播, 人们担心病毒会在全球扩散。[00:33] |
| Although methods existed to produce a flu **vaccine** and stop the disease from spreading, **at best**, it would not be available for at least six months. | 尽管有生产流感疫苗 和阻止病毒传播的方法, 但至少也要需要花上 6个月的时间。[00:39] |
| This is because a slow, **antiquated** flu vaccine **manufacturing** process developed over 70 years ago was the only option. | 因为只能选择一种60年前发明的, 过时且缓慢的流感疫苗生产方法。[00:49] |
| The virus would need to be isolated from **infected** patients, **packaged** up and then sent to a facility where scientists would **inject** the virus into chicken eggs, and **incubate** those chicken eggs for several weeks | 病毒需要从受感染的患者中分离出来, 打包然后运送到严密的设施中, 在那儿,科学家将病毒注入鸡蛋, 孵化上几个星期,[00:58] |

**synthetic:** adj.综合的;合成的,人造的/n.合成物 **alerting:** n.报警;警示讯号/v.报警;发信号(alert的ing形式) **contracting:** adj.缔约的;承包的;收缩的 **pandemic:** adj.(疾病等)全国流行的;普遍的/n.流行性疾病 **vaccine:** n.疫苗;牛痘苗/adj.疫苗的;牛痘的 **at best:** 最多 **antiquated:** adj.过时的;陈旧的;年老的/v.使古旧;废弃(antiquate的过去分词) **manufacturing:** adj.制造的;制造业的/n.制造业;工业/v.制造;生产(manufacture的ing形式) **infected:** adj.被感染的/v.传染(infect的过去分词) **packaged:** adj.包装过的/v.包装;把...装袋(package的过去式和过去分词) **inject:** vt.注入;注射 **incubate:** vt.孵化;培养;温育;逐渐发展/vi.孵化;酝酿/n.孵育物

| | |
|---|---|
| in order to prepare the virus for the start of a multistep, multimonth flu vaccine manufacturing process. | 从而为接下来需要 多个步骤,耗时数月的 疫苗生产过程做好准备。[01:11] |
| My team and I received this email because we had just invented a biological printer, which would **allow for** the flu vaccine instructions to be instantly downloaded from the internet and printed. | 我和团队之所以收到这个邮件 是因为我们刚刚发明出 一台生物打印机, 这台打印机可以即时从互联网上 下载流感疫苗指令并打印出来。[01:19] |
| **Drastically** speeding up the way in which flu **vaccines** are made, and **potentially** saving thousands of lives. | 这极大加快了疫苗的生产过程, 具有拯救成千上万人生命的潜力。[01:31] |
| The biological printer **leverages** our ability to read and write DNA and starts to **bring into focus** what we like to call biological **teleportation**. | 生物打印机利用了 我们读写DNA的能力, 并让我们开始把目光聚焦在 我们称之为生物传送的技术上面。[01:38] |
| I am a **biologist** and an engineer who builds stuff out of DNA. | 我是个用DNA来造东西的 生物学家和工程师。[01:49] |
| Believe it or not, one of my favorite things to do is to take DNA apart and put it back together so that I can understand better how it works. | 不管你们信不信,我的爱好之一是 把DNA打散,再组合起来, 以便更好地理解它的工作原理。[01:54] |

**allow for:** 考虑到,虑及 **Drastically:** adv.彻底地；激烈地 **vaccines:** n.[药][计]疫苗 **potentially:** adv.可能地,潜在地 **leverages:** n.手段,影响力;杠杆作用;杠杆效率 **bring into focus:** 使变得清楚;对好焦距 **teleportation:** n.心灵传动;远距传动 **biologist:** n.生物学家

| | |
|---|---|
| I can edit and program DNA to do things, just like **coders programing** a computer. | 我可以编辑和编程DNA去做事情, 就如同码农编程计算机一样。[02:02] |
| But my apps are different. | 但我们的应用程序不一样。[02:07] |
| They create life. | 它们创造生命。[02:09] |

| | |
|---|---|
| **Self-replicating** living cells and things like vaccines and **therapeutics** that work in ways that were previously impossible. | 如自我复制的活细胞, 以及疫苗和疗法之类的东西, 这在过去是根本不可能的。[02:10] |
| Here's National Medal of Science **recipient** Craig **Venter** and Nobel **laureate** Ham Smith. | 这是国家科学奖章获得者 克雷格 · 文特尔（Craig Venter） 和诺贝尔奖得主 哈姆 · 史密斯（Ham Smith）。[02:18] |
| These two guys shared a similar vision. | 这两位有着相似的远见,[02:24] |
| That vision was, because all of the functions and **characteristics** of all biological **entities**, including **viruses** and living cells, are written into the code of DNA, if one can read and write that code of DNA, then they can be **reconstructed** in a distant location. | 即,所有生物体的功能和特征, 包括病毒和活细胞, 都被写入了DNA的代码中, 如果可以读写DNA的代码, 那么他们就可以 在千里之遥进行重建。[02:27] |
| **coders:** n.编码器;编码员 **programing:** n.程式设计,程序编排;节目制作/v.编写程序;设计程式(program的ing形式) **Self-replicating:** adj.自我复制的/自我复制 **therapeutics:** n.疗法,治疗学 **recipient:** n.容器,接受者;容纳者/adj.容易接受的,感受性强的 **Venter:** n.腹部;腹面;母 **laureate:** adj.戴桂冠的;荣誉的/n.桂冠诗人;得奖者/vt.使戴桂冠 **characteristics:** n.特性,特征;特色(characteristic的复数);特质 **entities:** n.实体;存在(entity的复数形式);字符实体 **viruses:** n.[病毒]病毒;病霉(virus的复数) **reconstructed:** adj.重建的;改造的/v.重建;改造(reconstruct的过去式) | |
| This is what we mean by biological teleportation. | 这就是我们所说的生物传送。[02:45] |
| To prove out this vision, Craig and Ham set a goal of creating, for the first time, a synthetic cell, starting from DNA code in the computer. | 为了证明这一观点, 克雷格和哈姆树立了一个目标, 在历史上首次, 从计算机的DNA代码开始, 去制造合成细胞。[02:50] |
| I mean, come on, as a scientist looking for a job, doing **cutting-edge** research, it doesn't get any better than this. | 我意思是,得了, 一个想养家糊口的科学家, 做做尖端研究,这就够好了。[02:58] |
| (Laughter) OK, a **genome** is a complete set of DNA within an organism. | （笑声） 基因组是一个 生物体完整的DNA集合。[03:06] |
| Following the Human Genome Project in 2003, which was an international effort to identify the complete genetic **blueprint** of a human being, a **genomics** revolution happened. | 继2003年国际社会共同协作, 以识别人类完整 基因蓝图为目标的 人类基因组计划后, 基因组学的革命发生了。[03:12] |
| Scientists started **mastering** the techniques for reading DNA. | 科学家们开始掌握读取DNA的技术。[03:23] |
| In order to determine the order of the As, Cs, Ts and Gs within an organism. | 这项技术的目的,是确定有机体中 所有的A,C,T和G碱基的 排列顺序。[03:27] |
| But my job was far different. | 但我做的事情大不相同。[03:32] |
| I needed to master the techniques for writing DNA. | 我需要掌握书写DNA的技巧。[03:34] |
| Like an author of a book, this started out as writing short sentences, or **sequences** of DNA code, but this soon turned into writing **paragraphs** and then **full-on novels** of DNA code, to make important biological instructions for **proteins** and living cells. | 就像图书的作者, 一开始写个短句, 或DNA序列, 但很快就变成书写段落, 然后是完整的DNA代码小说, 去为蛋白质和活细胞 做出重要的生物指示。[03:37] |
| **cutting-edge:** n.(刀片的)刃口;尖端;前沿/adj.先进的,尖端的 **genome:** n.基因组;染色体组 **blueprint:** vt.计划;制成蓝图/n.蓝图,设计图;计划 **genomics:** n.基因组学;基因体学 **mastering:** n.控制;母带后期处理 **sequences:** n.[数][计]序列,顺序;继起的事(sequence的复数形式) **paragraphs:** n.段落(paragraph的复数形式) **full-on:** adj.最典型的;最强烈的 **novels:** n.小说(novel的复数) **proteins:** n.[生化]蛋白质(protein复数) | |
| Living cells are nature's most efficient machines at making new products, **accounting** for the production of 25 percent of the total **pharmaceutical** market, which is billions of dollars. | 活细胞是自然界制造新产品的 最高效机器, 占药品生产总市场的25%, 价值几十亿美金。[03:52] |
| We knew that writing DNA would drive this bioeconomy even more, once cells could be programmed just like computers. | 我们知道,一旦细胞 可以像电脑一样编程, 书写DNA会推动 生物经济进一步发展。[04:03] |
| We also knew that writing DNA would enable biological teleportation ... | 我们也清楚,书写DNA 可以增强生物传送...[04:11] |
| the printing of defined, biological material, starting from DNA code. | 从DNA代码开始, 打印已定义的生物材料。[04:17] |
| As a step toward bringing these promises to **fruition**, our team **set out** to create, for the first time, a synthetic **bacterial** cell, starting from DNA code in the computer. | 为了实现这些愿景, 我的团队第一次 从电脑上的DNA代码中 创造了一种合成细菌细胞。[04:22] |
| Synthetic DNA is a **commodity**. | 合成DNA是一种商品。[04:33] |
| You can order very short pieces of DNA from a number of companies, and they will **start from** these four bottles of chemicals that make up DNA, | 你可以从一些公司 订购到非常短的DNA片段, 他们采用的方法是 从构成DNA的G, A, T 和C[04:35] |
| **accounting:** n.会计,会计学;账单/v.解释(account的ing形式);叙述 **pharmaceutical:** adj.制药(学)的/n.药物 **fruition:** n.完成,成就;结果实 **set out:** 出发;开始;陈述;陈列 **bacterial:** adj.[微]细菌的 **commodity:** n.商品，货物；日用品 **start from:** | |

从...开始

| | |
|---|---|
| G, A, T and C, and they will build those very short pieces of DNA for you. | 这四瓶化学物质开始, 为你合成非常短的DNA片段。[04:43] |
| Over the past 15 years or so, my teams have been developing the technology for **stitching** together those short pieces of DNA into complete bacterial **genomes**. | 在过去15年左右, 我的团队开发了 一种把DNA短片段拼接在一起, 形成完整细菌基因组的技术。[04:48] |
| The largest genome that we constructed contained over one million letters. | 我们创造的最大基因组 包含100多万字母。[04:58] |
| Which is more than twice the size of your average novel, and we had to put every single one of those letters in the correct order, without a single **typo**. | 是普通小说平均长度的两倍多, 我们必须把每一个字母 都按正确顺序排列, 不能有丝毫差错。[05:03] |
| We were able to accomplish this by developing a procedure that I tried to call the "**one-step isothermal** in **vitro recombination** method." | 我们开发了一个流程 来完成这个任务, 我称之为“一步体外等温重组法”。[05:11] |
| (Laughter) But, surprisingly, the science community didn't like this technically accurate name and decided to call it **Gibson Assembly**. | （笑声） 但是,意外的是,科学界并不喜欢 这个技术上准确的名字, 并决定把它命名为“吉布森组装法”。[05:20] |

**stitching:** n.缝合;针脚;绑结;压合/v.缝;固定(stitch的ing形式) **genomes:** n.[遗]基因组(genome复数) **typo:** n.排印错误;排字工;印刷工 **one-step:** vi.跳单步舞/n.单步舞曲;一步舞 **isothermal:** adj.等温的;等温线的/n.等温线 **vitro:** n.在试管内 **recombination:** n.复合,再结合;[遗]重组 **Gibson:** n.吉布森鸡尾酒 **Assembly:** n.装配；集会，集合

| | |
|---|---|
| Gibson Assembly is now the gold standard tool, used in **laboratories** around the world for building short and long pieces of DNA. | 吉布森组装法现在是黄金标准工具, 被全球各地的实验室应用于 制造或短或长的DNA片段。[05:31] |
| (Applause) Once we **chemically synthesized** the complete bacterial genome, our next challenge was to find a way to convert it into a **free-living**, self-replicating cell. | （鼓掌） 一旦我们用化学方法 合成了完整的细菌基因组, 我们的下个挑战,就是找到 把它转变成能独立生存、 自我复制的细胞的方法。[05:40] |
| Our approach was to think of the genome as the operating system of the cell, with the cell containing the hardware necessary to boot up the genome. | 我们的解决方法是把基因组 看作细胞的操作系统, 而细胞内则含有 启动基因组所需的硬件。[05:55] |
| Through a lot of trial and error, we developed a procedure where we could **reprogram** cells and even convert one bacterial species into another, by replacing the genome of one cell with that of another. | 在经历无数的尝试和失败后, 我们开发了一种 可以重新编程细胞的程序, 通过将某个细胞的基因组 替换成另一个细胞的基因组, 它甚至可以将某种细菌转化为另一种细菌。[06:04] |
| This genome **transplantation** technology then **paved** the way for the booting-up of genomes **written by** scientists and not by Mother Nature. | 这种基因移植技术为科学家, 而非自然母亲编写基因组 铺平了道路。[06:17] |

**laboratories:** n.实验室(laboratory的复数) **chemically:** adv.用化学;以化学方法 **synthesized:** adj.合成的;综合的/v.合成(synthesize的过去分词);综合 **free-living:** adj.独立生存的;生活无拘束的 **reprogram:** vt.改编程序;程序重调 **transplantation:** n.移植;迁移;移民 **paved:** 铺砌面 **written by:** 由...所写



| | |
|---|---|
| In 2010, all of the technologies that we had been developing for reading and writing DNA all came together when we announced the creation of the first synthetic cell, which of course, we called Synthia. | 2010年,当所有这些 我们开发来读写DNA的技术都已就绪, 我们就联合宣告了 第一个合成细胞的诞生。 理所当然,我们将其 命名为“辛西娅”。[06:26] |
| (Laughter) Ever since the first bacterial genome was **sequenced**, back in 1995, thousands more whole bacterial genomes have been sequenced and stored in computer databases. | （笑声） 自从1995年第一个 细菌基因组被测序以来, 已经有成千上万的完整 细菌基因组被测序和储存在 电脑数据库中。[06:39] |
| Our synthetic cell work was the proof of concept that we could reverse this process: pull a complete bacterial genome sequence out of the computer and convert that information into a free-living, self-replicating cell, with all of the expected characteristics of the species that we constructed. | 合成细胞的诞生证明了 我们可以逆转这个过程的概念: 从计算机中取出一个 完整的细菌基因组序列, 并将这些信息转换成一种 带有其所构建物种所有预期特征的 能独立生存,自我复制的细胞。[06:51] |
| Now I can understand why there may be concerns about the safety of this level of genetic **manipulation**. | 现在我可以理解 为什么那么多人会有 对这种基因操纵水平的 安全性的担忧。[07:10] |
| While the technology has the potential for great **societal** benefit, it also has the potential for doing harm. | 尽管这项技术有可能 带来巨大的社会效益, 它也有可能造成伤害。[07:16] |
| With this in mind, even before carrying out the very first experiment, our team started to work with the public and the government to find solutions together to **responsibly** develop and regulate this new technology. | 考虑到这一点, 早在进行第一次实验之前, 我们的团队就开始 与公众和政府合作, 寻找解决方案, 负责任地开发和管理这项新技术。[07:24] |

**sequenced:** [数][计]序列 **manipulation:** n.操纵;操作;处理;篡改 **societal:** adj.社会的 **responsibly:** adv.负责地,可信赖地

| | |
|---|---|
| One of the outcomes from those discussions was to screen | 这些讨论的成果之一, 是对每个客户 和客户的 |

| | |
|---|---|
| every customer and every customer's DNA **synthesis** orders, to make sure that **pathogens** or **toxins** are not being made by bad guys, or accidentally by scientists. | DNA合成订单进行筛选, 确保病原体或毒素 不会被坏人利用, 或被科学家意外制造出来。[07:38] |
| All suspicious orders are reported to the FBI and other relevant **law-enforcement agencies**. | 所有可疑的订单都会报告给FBI 和其他相关执法机构。[07:52] |
| Synthetic cell technologies will power the next industrial revolution and transform industries and economies in ways that address global **sustainability** challenges. | 合成细胞技术将为 下一次工业革命提供动力, 以应对全球可持续性挑战的方式, 去改变行业和经济。[08:00] |
| The possibilities are endless. | 其应用潜力是无穷无尽的。[08:11] |
| I mean, you can think of clothes constructed form **renewable** biobased sources, cars running on **biofuel** from **engineered microbes**, **plastics** made from **biodegradable polymers** and **customized therapies**, printed at a patient's **bedside**. | 你可以想象 可再生生物材料做成的衣服, 工程微生物生产的生物燃料汽车, 生物可降解聚合物制成的塑料, 以及在病人床边 就可以打印的定制疗法。[08:14] |
| **synthesis:** n.综合,[化学]合成;综合体 **pathogens:** n.[基医]病原体;病原菌;[基医]致病菌 **toxins:** n.[毒物]毒素,毒质;毒素类(toxin的复数) **law-enforcement:** 执法 **agencies:** n.代理;代理处(agency的复数) **sustainability:** n.持续性;永续性;能维持性 **renewable:** adj.可再生的;可更新的;可继续的/n.再生性能源 **biofuel:** n.生物燃料 **engineered:** adj.设计的,工程/v.设计;指导(engineer的过去分词) **microbes:** n.细菌,[微]微生物;微生物类(microbe的复数形式) **plastics:** n.塑料;整形外科;外科修补术 **biodegradable:** adj.生物所能分解的,能进行生物降解的 **polymers:** n.[高分子]聚合物;[高分子]高分子(polymer的复数) **customized:** n.自定义;客制化;自定义级别/v.定制;按特别订货生产(customize的过去式和过去分词)/adj.定制的;用户化的 **therapies:** n.治疗方法(therapy复数形式) **bedside:** n.床边,床旁/adj.床旁的,枕边的 | |
| The massive efforts to create synthetic cells have made us world leaders at writing DNA. | 创造合成细胞的大量努力 使我们成为书写DNA的全球领导者。[08:31] |
| Throughout the process, we found ways to write DNA faster, more **accurately** and more **reliably**. | 在这一过程中,我们 发现了书写DNA更快, 更精确和更可靠的方式。[08:36] |
| Because of the **robustness** of these technologies, we found that we could readily automate the processes and move the laboratory workflows out of the scientist's hands and onto a machine. | 因为这些技术的稳健性, 我们发现可以很容易地 将过程自动化, 将实验室的工作流程 从科学家的手中转移到机器上面。[08:43] |
| In 2013, we built the first DNA printer. | 2013年,我们创造了 第一台DNA打印机。[08:54] |
| We call it the BioXp. | 我们把它命名为BioXP。[08:58] |
| And it has been absolutely essential in writing DNA across a number of applications my team and researchers around the world are working on. | 它的DNA书写功能在我的团队和 全球研究者的 各种应用场景中, 有着绝对重要的地位。[09:00] |
| It was shortly after we built the BioXp that we received that email about the H7N9 bird flu scare in China. | 在BioXp诞生之后不久, 我们就收到了中国H7N9禽流感恐慌的电子邮件。[09:09] |
| A team of Chinese scientists had already isolated the virus, sequenced its DNA and **uploaded** the DNA sequence to the internet. | 当时,中国的科学家团队 已经分离出了病毒, 测序了DNA结构,并将 序列上传到了互联网。[09:17] |
| At the request of the US government, we downloaded the DNA sequence and in less than 12 hours, we printed it on the BioXp. | 在美国政府的要求下, 我们下载了DNA序列, 不到12个小时内, 就在BioXp上打印了出来。[09:25] |
| **accurately:** adv.精确地,准确地 **reliably:** adv.可靠地;确实地 **robustness:** n.[自]鲁棒性;[计]稳健性;健壮性 **uploaded:** vt.上传 | |
| Our **collaborators** at Novartis then quickly started turning that synthetic DNA into a flu vaccine. | 我们在诺华的合作者 迅速将合成DNA转化为流感疫苗。[09:33] |
| Meanwhile, the CDC, using technology dating back to the 1940s, was still waiting for the virus to arrive from China so that they could begin their egg-based approach. | 与此同时,使用的技术可追溯到 20世纪40年代的疾病防控中心, 还在等待来自中国的病毒样本, 这样他们才可以开始 以鸡蛋为基础的方法。[09:39] |
| For the first time, we had a flu vaccine developed ahead of time for a new and potentially dangerous strain, and the US government ordered a **stockpile**. | 首次,我们提前开发了 针对这种具备新的 潜在危险的毒株的流感疫苗, 而美国政府从我们 这里订购了一批药物。[09:50] |
| (Applause) This was when I began to appreciate, more than ever, the power of biological teleportation. | （鼓掌） 于是,我开始 比任何时候都更为欣赏 生物远距离传送力量。[09:58] |
| (Laughter) Naturally, with this in mind, we started to build a biological **teleporter**. | （笑声） 自然的,心里有了这个底, 我们就着手制造生物传送器。[10:09] |
| We call it the DBC. | 我们称之为DBC。[10:16] |
| That's short for digital-to-biological **converter**. | 这是数字生物转换器的缩写。[10:18] |
| Unlike the BioXp, which starts from pre-manufactured short pieces of DNA, the DBC starts from **digitized** DNA code and **converts** that DNA code into biological entities, such as DNA, RNA, proteins or even viruses. | 与预制短链DNA 开始的BioXp不同的是, DBC从数字化DNA代码开始, 将DNA代码转化为生物实体, 比如DNA,RNA,蛋白质,甚至病毒。[10:22] |
| **collaborators:** n.[劳经]合作者;投敌者(collaborator的复数) **stockpile:** n.库存;积蓄/vt.贮存;储蓄/vi.积累;储备物资 **teleporter:** n.传送点;瞬移器;传送器 **converter:** n.[电]变流器,整流器;转化器 **digitized:** adj.数字化的/v.使数字化(digitize的 | |

过去分词) **converts:** vt.使转变;转换...;使...改变信仰/vi.转变,变换;皈依;改变信仰/n.皈依者;改变宗教信仰者

| | |
|---|---|
| You can think of the BioXp as a DVD player, requiring a physical DVD to be inserted, whereas the DBC is **Netflix**. | 你可以把BioXp想象成DVD播放器, 需要插入DVD光盘, 而DBC则相当于Netflix （在线播放平台）。[10:37] |
| To build the DBC, my team of scientists worked with software and **instrumentation** engineers to collapse multiple laboratory workflows, all in a single box. | 为了制造DBC, 我团队的科学家跟软件 和仪器仪表工程师合作, 将多项实验室的工作流程 整合到一个盒子里面。[10:47] |
| This included software algorithms to predict what DNA to build, chemistry to link the G, A, T and C building blocks of DNA into short pieces, | 其中包括用软件算法来 预测要构建的DNA, 用化学方法将碱基结构单元 构成的DNA片段连接成短链,[10:58] |
| Gibson Assembly to stitch together those short pieces into much longer ones, and biology to convert the DNA into other biological entities, such as proteins. | 用吉布森组装法将这些短链 拼接成更长的片段, 以及用生物学方法 将DNA转化为像蛋白质 那样的其他生物实体。[11:06] |
| This is the prototype. | 这是产品的原型。[11:16] |
| Although it wasn't pretty, it was effective. | 虽然它不完美,但却非常有效。[11:18] |
| It made therapeutic drugs and vaccines. | 它能够制造治疗药物和疫苗。[11:20] |
| And laboratory workflows that once took weeks or months could now be carried out in just one to two days. | 以前在实验室工作流程中 需要耗时数周或数月的工作, 如今在1-2天内就能完成。[11:23] |
| And that's all without any human **intervention** and simply **activated** by the receipt of an email which could be sent from anywhere in the world. | 而且它无需任何人工干预, 电子邮件即可激活, 这个电子邮件可以来自 全球任何地方。[11:30] |

**Netflix:** n.网飞公司(出租DVD;在线观看电影的网站。) **instrumentation:** n.使用仪器;乐器法;仪表化 **intervention:** n.介入;调停;妨碍 **activated:** adj.活性化的;活泼的/v.使激活;使活动起来;有生气(activate的过去分词)

| | |
|---|---|
| We like to compare the DBC to fax machines. | 我们喜欢把DBC比喻成传真机。[11:38] |
| But whereas fax machines received images and documents, the DBC **receives** biological materials. | 传真机接收图像和文件, 而DBC接收生物材料。[11:42] |
| Now, consider how fax machines have evolved. | 想想传真机是如何演化的。[11:49] |
| The prototype of the 1840s is **unrecognizable**, compared with the fax machines of today. | 1840年代的原型 与今天的传真机相比, 简直无法辨认。[11:53] |
| In the 1980s, most people still didn't know what a fax machine was, and if they did, it was difficult for them to grasp the concept of instantly **reproducing** an image **on the other side** of the world. | 上世纪80年代,很多人 仍然不知道传真机是什么, 即便知道了, 他们也很难理解 在世界另一端即刻复制图像的概念。[11:59] |
| But nowadays, everything that a fax machine does is **integrated** on our smart phones, and of course, we take this rapid exchange of digital information for granted. | 而今天,传真机做的所有事情 都被植入到了我们的智能手机中, 当然,我们早已把数字信息的 快速交换视为理所当然。[12:11] |
| Here's what our DBC looks like today. | 这是今天我们的DBC的样子。[12:20] |
| We imagine the DBC **evolving** in similar ways as fax machines have. | 我们想象DBC以类似于 传真机的方式发展。[12:23] |
| We're working to reduce the size of the instrument, and we're working to make the **underlying** technology more reliable, cheaper, faster and more accurate. | 我们正在努力减少仪器尺寸, 努力让基础技术 更可靠,更廉价,更快,更准确。[12:28] |

**receives:** n.受光面/v.接受,接收(receive的第三人称单数) **unrecognizable:** adj.未被承认的;无法认出的 **reproducing:** v.复制;繁殖(reproduce的ing形式);重述 **on the other side:** 另一面;在另一边 **integrated:** adj.综合的;完整的;互相协调的/v.整合;使...成整体(integrate的过去分词) **evolving:** adj.进化的;展开的/v.进化;展开(evolve的ing形式) **underlying:** adj.潜在的;根本的；在下面的；优先的/v.放在...的下面；为...的基础；优先于(underlie的ing形式)

| | |
|---|---|
| Accuracy is extremely important when **synthesizing** DNA, because a single change to a DNA letter could mean the difference between a medicine working or not or synthetic cell being alive or dead. | 在合成DNA时,准确性是极其重要的, 因为一个DNA字母的改变 就可能影响一种药物是否有效, 这个合成细胞是存活还是死亡。[12:37] |
| The DBC will be useful for the distributed manufacturing of medicine starting from DNA. | DBC对于从DNA开始的 药物的分布式制造是很有用的。[12:50] |
| Every hospital in the world could use a DBC for printing **personalized** medicines for a patient at their bedside. | 世界上每所医院都可以使用DBC 在病人床边打印个性化药物。[12:56] |
| I can even imagine a day when it's routine for people to have a DBC to connect to their home computer or smart phone as a means to download their **prescriptions**, such as **insulin** or **antibody** therapies. | 我甚至想象着, 有一天可以实现人手一台DBC, 连上家中的电脑或智能手机, 就可以去下载他们的处方, 例如胰岛素或抗体疗法。[13:03] |
| The DBC will also be valuable when placed in **strategic** areas around the world, for rapid response to disease **outbreaks**. | 在世界各地的战区, DBC也将会派上用场, 它可以快速应对疾病的爆发。[13:15] |
| For example, the CDC in **Atlanta**, Georgia could send flu vaccine instructions to a DBC on the other side of the world, where the flu vaccine is **manufactured** right on the front | 例如,乔治亚州亚特兰大的 疾病防控中心, 可以将流感疫苗的指令 发送到世界另一端的DBC, 这样流感疫苗就可以在前线生产。[13:22] |

lines.

**synthesizing:** v.合成;不同元素间的整合(synthesize的ing形式) **personalized:** adj.个性化的;个人化的/v.个性化(personalize的过去式);个人化 **prescriptions:** n.医药处方,[医]药方(prescription复数形式) **insulin:** n.[生化][药]胰岛素 **antibody:** n.[免疫]抗体 **strategic:** adj.战略上的，战略的 **outbreaks:** n.(战争的)爆发;(疾病的)发作/vi.爆发 **Atlanta:** n.亚特兰大(美国城市) **manufactured:** adj.制造的,已制成的/v.制造,加工(manufacture的过去式)

| | |
|---|---|
| That flu vaccine could even be specifically **tailored** to the flu strain that's **circulating** in that local area. | 这种流感疫苗甚至可以专门针对 在当地流行的流感病毒。[13:34] |
| Sending vaccines around in a digital file, **rather than stockpiling** those same vaccines and shipping them out, promises to save thousands of lives. | 将疫苗通过数字文件发送, 而不再将其打包运出, 可以拯救成千上万的生命。[13:43] |
| Of course, the applications go as far as the imagination goes. | 当然,梦想有多大, 舞台就有多大。[13:53] |
| It's not hard to imagine placing a DBC on another planet. | 不难想象,在另一个星球上 放置这么一台DBC。[13:57] |
| Scientists on Earth could then send the digital instructions to that DBC to make new medicines or to make synthetic **organisms** that produce oxygen, food, fuel or building materials, as a means for making the planet more **habitable** for humans. | 地球上的科学家就可以 将数字指令发送到DBC, 去制造新药物,或合成生物, 以产生氧气,食物, 燃料或建筑材料, 这不失为一种把外星球 变成适合人类居住的方法。[14:03] |
| (Applause) With digital information traveling at the speed of light, it would only take minutes to send those digital instructions from Earth to Mars, but it would take months to physically deliver those same samples on a spacecraft. | （鼓掌） 数字信息以光速前进, 数字指令从地球传到火星 只需要几分钟。 但如果通过太空船去 运送这些实体样本 则需要耗时数月。[14:19] |

**tailored:** adj.定做的;裁缝做的;剪裁讲究的/v.裁制;调整使适应(tailor的过去式和过去分词) **circulating:** adj.循环的;流通的/v.循环(circulate的ing形式);流通 **rather than:** 而不是;宁可...也不愿 **stockpiling:** n.囤积;贮存/v.储备(stockpile的现在分词) **organisms:** n.[生物]生物体(organism的复数);[生物]有机体 **habitable:** adj.可居住的;适于居住的

| | |
|---|---|
| But **for now**, I would be satisfied **beaming** new medicines across the globe, fully **automated** and on demand, saving lives from emerging **infectious** diseases and printing personalized cancer medicines for those who don't have time to wait. | 但就目前而言,能在全球范围内, 完全自动化和根据需求 打印出新药物, 挽救感染了新发传染病的生命, 为那些没有时间等待的人打印个性化的 癌症药物,就已经让我感到很满足了。[14:37] |
| Thank you. | 谢谢。[14:52] |
| (Applause) | （鼓掌）[14:54] |

**for now:** 目前,暂时 **beaming:** adj.喜气洋洋的;愉快的;光亮的;耀眼的/v.照耀(beam的ing形式) **automated:** adj.自动化的；机械化的/v.自动化（automate的过去分词）；自动操作 **infectious:** adj.传染的；传染性的；易传染的