In the next few modules, I'm going to talk about communicating directly with general audiences.,In this day and age, it's important for scientists to engage with the lay public.,Even if you're not planning a career in,science writing, you can learn a lot from the techniques that science writers use to engage the way public I'll start with some tips for writing for general audiences.,1st of all, I want to make clear that regardless of audience, your general prose style should not change.,You're going to use the same principles of good writing that we talked about in the 1st half of this course.,Try to be as concise, clear and engaging as possible, but there are a few things you need to do differently when you write for general audiences rather than scientific audiences.,I've identified six skills that I think are the keys to writing for general audiences.,I've laid these out here, and I'm going to go through each one of these in turn in a minute to have some examples to work off of.,I took excerpts from the abstracts of two scientific articles, one from Nature, in one from science, and I wrote lay summaries of these exerpts.,I pick these because I think they're pretty well written for a scientific audience, but I'm going to show you what I do differently when I write for general audiences.,The 1st one reads Here we leverage the wide usage of smartphones with built an accelerometry to measure physical activity at the global scale.,We study a data set consisting of 68 million days of physical activity for 717000 people, giving us a window into activity in 111 countries across the globe.,Globe, we find inequality in how activity is distributed within countries, ,and that this inequality is a better predictor of obesity prevalence in the population than average activity volume.,My lay summary reads. Researchers use data from smartphones to look at the walking habits of 717000 people from 111 countries.,Countries with the widest gaps between the most active and least active people also had the highest obesity rates. Surprisingly, this activity inequality was a stronger predictor of obesity than total amount of activity.,You can hear the difference between those two in a minute.,I'm going to walk you through how I got from the 1st version to the 2nd version.,The 2nd example reads Atmospheric water is a resource equivalent to 10% of all fresh water in lakes on Earth.,However, an efficient process for capturing and delivering water from air, especially at low humidity levels, has not been developed.,We report the design and demonstration of a device, based on a porous metal organic framework the captures water from the atmosphere at the ambient conditions by using low grade heat from natural sunlight and deflux of less than one sun.,This device is capable of harvesting leaders of water, kilogram of moth, daily, at relative humidity levels as low as 20 %, and requires no additional input of energy.,My lay summary is scientists have created a device that can pull water out of air.,Water harvesting devices have been built before, but they were impractical for everyday use, because they only worked on extremely moist air, or required high amounts of energy to run.,The new device contains a poorest crystal called the Metal Organic Framework, that soaks up water vapor like a sponge.,A small solar panel provides the energy needed to condense the water into liquid.,Prototype, containing 2 lb. Of the crystal extracted twelve cups of water from desert air in one day, using only sunlight for power.,Again, you can hear the difference between those two.,When you're writing for general audiences, the 1st thing you need to do is you have to start with the take home message.,You have to tell your readers the most important thing 1st.,If you don't tell them why they should care, then they may not read on.,This is not a hard skill to master, but it's not the way that we're used to writing in science.,In a journal article, we usually start with the background, and then we build up to the takeo message.,When writing for general audiences, you have to flip this, e.g. in the one on the water harvesting device.,The scientists started with some background information about the amount of fresh water available in the air.,But that's not the crooks of the article.,The article is about the device.,So I started my lay summary with scientists have created a device that can pull water out of air.,That's the key accomplishment. And notice that I didn't have to embellish this or give a lot of background information.,Lay readers will get why this is important.,Everyone knows that clean water is a scarce resource, so if you can pull it out of the air, that would be an important breakthrough.,The 2nd skill is that you need to recognize and avoid jargon.,And this is hard for scientists, because we are so immersed in the science we don't even recognize half the jargon we use.,And by,jargon, I don't just mean technical, scientific terms, but just the general way that scientists speak.,A lot of the way we talk in,science sounds unfamiliar to lay audiences.,I teach a short summer course to graduate students in postox at Stanford who want to learn to write for general audiences.,For their final assignment, they have to write a story for the late public.,And even though they are trying to write for the lay public, inevitably their pieces come back riddled with jargon.,So on their 1st drafts, I go through and I highlight all the words and phrases that are jargon to a late person.,And it really takes me pointing out the jargon to them before they even start to recognize it as jargon.,E.g., if you look at the one on physical activity,, it might seem like this abstract is accessible to a general audience because the authors didn't use a lot of fancy words or technical terms.,But in fact, a lot of it is written in scientists speak.,So leverage wide usage. Accelerometry, even the word physical activity, is a more sciencey way of saying exercise global scale is distributed prevalence in the population.,Average activity volume. Lay people don't talk about activity volume.,They might talk about activity duration or the amount of activity, but not activity volume. So all of this sounds like jargon to a lay person.,The 2nd example has even more jargon.,Atmospheric water efficient process for capturing and delivering water.,Design and demonstration Metal organic framework, of course, ambient conditions, low grade heat, a flux of less than one sun, relative humidity levels, no additional input.,All of that is scientists speak.,And I should point out that if you are writing for general American audiences, ,the metric system is also jargon to American audiences, so you have to translate into English units, as I've done here.,Just to give you an example from one of my Stanford students, he was writing an article on pryons, and this was a paragraph from his 1st draft.,And so he had words like, gain of function, protein aberrant process confined to the space of disease.,Natural confirmation changes, docastically, are induced by, of course, all of this is drug into a lay person, but it took me pointing it out to him for him to even recognize it as jargon.,The 3rd thing you have to do is to unpack the science.,When you write for a scientific audience, you can be lazy.,You can assume a basil amount of scientific knowledge, e.g.,you can assume that your reader knows how a gene works, or how receptor lagan binding works, or what A-T test is with general audiences, you cannot assume any prior scientific knowledge.,You have to explain the science from step one.,And this is hard to be able to explain the science step by step to others, you have to deeply understand the science yourself.,In the one on water harvesting, the scientists describe the device in a way that assumes prior scientific knowledge.,When I read their description, I didn't really understand how the device works, ,because I didn't know what's a metal organic framework, and I didn't know where the solar energy was coming into the system.,I actually had to go to youtube and watch videos to educate myself on what's a metal organic framework.,After some research, I came up with this description.,The new device contains a porous crystal called the Metal Organic Framework that soaks up water vapor like a sponge. Small solar panel provides the energy needed to condense the water into liquid.,A few years ago, I was writing a magazine article where the crooks of the story was the trade offs between digital and analog systems.,So for that story, I had to explain to lay readers the difference between digital and analog.,That's a concept I take for granted.,I teach statistics, so to me, the difference is just the difference between continuous variables and discreet variables.,But I knew I couldn't explain it to a lay audience this way.,I had to rack my brain to come up with a good explanation.,I had to think really carefully about what is digital, what is analog?,What are the trade offs? I finally came up with an analogy about how you would add grated lighting to a room.,The analog solution would be to add a dimmer switch.,The equivalent digital solution would be to put, say, ten light bulbs on the wall, each with its own on off switch.,This would allow you to precisely control the lighting in the room.,But there's a cost. The digital solution,takes much more energy, time, space and parts.,It took me a while to come up with that analogy.,One of my Stanford students was writing a piece about the brain, and in her 1st draft, she used the term neural projection.,So I wrote a comment back to her and said, what's a neural projection?,Is that an axon? Is that a bundle of axons?,Is that something other than an axon?,I had never heard the term before, and we actually went back and forth on several drafts, and I kept asking, what's a neural projection?,And then finally, I think it was about the 3rd draft, she wrote back to me and she said, oh, actually, I don't know what a neural projection is.,That's just the term the scientist used.,And I was like, aha, that's the problem.,If you don't know what it is, there's no way you can explain it to others.,So I made her go back to the scientist and figure out what it is.,It was just his fancy way of saying, axon.,In the end, one of the most critical skills, I think, in writing for general audiences is the ability to prioritize details. When you write for a journal article, you have to include all the knitty gritty scientific details.,What strain of mice did you use?,What company did you buy the chemicals from?,What statistical test did you use?,But when you write for general audiences, you have to filter some of these lower level scientific details out.,They're just not meaningful or relevant for a lay audience.,Many people have a misconception that writing for a lay audience involves somehow dumbing down the science, and I completely disagree with this view.,I think what you're doing when you write for a lay audience is that you're filtering out the less important details, and you can do that without sacrificing accuracy.,Good science writers understand and vet the lower level details and then make a conscious decision about which details to prioritize and which to filter out.,I think of scientific knowledge as involving multiple layers of detail.,At the top is the big picture.,Say, if you're doing a drug trial of weight loss, it might be that the drug treatment beat the placebo.,The next layer includes details that are critical to evaluating the quality of the study,, such as how many people were studied and how long they were followed, and how big was the weight loss in both groups.,The next layer includes details that would be meaningful to a lay audience, ,but might be omitted from a very short story on the trial, such as, were participants and investigators blinded and maybe the dosing of the drug?,The next layer might contain some technical details, such as the randomization scheme and what statistical tests were used.,Below that might be some more trivial details, such as what brand of weighing scale was used to weigh the participants.,A scientific audience needs all these details so that they can evaluate the quality of the study and potentially replicate it.,A lay audience simply doesn't need all these details.,Depending on the length of the article, I might stop two layers in if it's a very short article, or I might go down to three layers for a longer article. The rest of the details I'm going to filter out.,In the one about physical activity, the authors gave three different numbers to convey the size of this study, ,but you don't want to bombard a lay reader with too many numbers, so I prioritized the number of countries and the number of people.,I thought the least meaningful number here for a lay audience was the total days of physical activity, so I filtered that out for the water harvesting study.,The authors start with this interesting tidbit about exactly how much water is available in the air on Earth.,Now, that's an interesting detail, and in a longer piece, I might put that detail in later on in the piece, ,but for a short piece, it's not an essential detail, so I'm going to filter it out.,A lay reader doesn't need to know the exact level of humidity at 20 %.,Uh? Mostly readers don't think in humidity levels too often, so if you just say dry or desert air, that's more meaningful to them.,Obviously, a LA reader doesn't need to know the chemical formula of the metal organic framework,, and most readers aren't going to be familiar with units of sun, so you can also filter that out.,The 5th skill is that you need to get to the point faster.,When we write journal articles in science, we tend to take our time getting to the point.,We start with why something was done, and then we say what was done, and then what was found, and then what it all means.,A lay reader is not going to bear with you.,If you take that long to get to the point, you have to cut to the chase, and doing that involves trusting your reader.,Your reader,may not know a lot of science, but you have to assume that their intelligent and can make inferences, ,e.g., if you say what a study found implied in that may be what was done and what it means.,So you don't have to spell out all three of those things for your reader.,Don't hold the reader by the hand and provide them with a running commentary.,Trust your reader to be able to make small leaps in the physical activity.,Example, the authors started with two sentences about the study design. The 1st sentence gives a general description of the study.,The 2nd sentence gives a specific description of the dataset.,A lay reader doesn't want to sit through both of these, so I just went straight for the specific description.,I said, researchers use data from smartphones to look at the walking habits of 717000 people from 111 countries.,Cut to the chase, right to the .1 of my Stanford students was writing a story about this experiment that they did in mice, ,where they rewired the connections between the taste buds and the brain, ,so that sweet taste buds were perceived by the brain as bitter, and bitter taste buds were perceived by the brain as sweet.,She'd already explained all of that, and then she got to explaining the experiment where they verified that the rewiring had actually worked, and in explaining that, ,she goes through why it was done.,She says, in order to examine if this rewiring led to changes in behavior.,Then she says, what was done?,Researchers observed the mice as they tasted these different tastes.,She says, what it all means the mice who were altered seem to have more of a tolerance for bitter taste.,And then finally, she says, what was found?,The altered mice licked the quinine more than the unaltered mice.,In fact, we don't need to go through all of that.,In my edit, I edited this down to just one sentence.,I just said what was found The mice with the altered bitter taste buds licked quinine, a bitter substance, more than unaltered mice.,And notice that implied in that is the why the scientists did it, the what they did, and the what it all means.,You don't need to spell it all out for your reader.,Just get to the point and get there fast.,Finally, to appeal to wide audiences, you have to tell a story.,People don't connect to abstract ideas.,They connect with stories. So in your lab, you may be working on a particular gene or molecule or chemical reaction or device that you find to be fascinating.,You're immersed in that science every day, so it seems inherently exciting to you. I hate to tell you, though, if you go outside of your lab and try to explain that molecule or gene to somebody outside of your lab, ,they're probably not going to find it all that interesting, especially if you explain it as an abstraction, ,if you want to engage people in your science, you have to tell the science as a story, something people can connect to.,And what's a story? A story has description.,It appeals to the five senses.,It has plot, a drama and suspense.,It has characters. Remember, scientists are human beings, after all, their characters.,Now, in those short lay summaries I showed you earlier, there wasn't a lot of room to use storytelling techniques.,You could think of those as short, little stories.,But to be able to illustrate some storytelling techniques, I'm going to show you a larger magazine piece that I wrote a few years back.,In this story, I was actually assigned to write about a specific research study that had just been published in Science magazine, and it was on plant biology.,And to be very honest, I didn't expect it to be all that exciting to me, because I've never been that interested in plant biology.,But this turned out to be one of my favorite stories ever, because the researcher, professor, virginia wal Butt, ,of Stanford, turned out to be this amazing, fascinating woman, and E.G., she invited me to interview her at her outdoor laboratory.,So there's this cornfield in the middle of Stanford campus that I didn't know about, and I met her there at 06:00 a.m.,in the morning, and it was just this beautiful, peaceful outdoor laboratory.,And as we were standing there talking, all of a sudden, uh, the cornstocks became blanketed with birds.,And I looked at dr Walbot and said, what just happened?,So she explained to me that as soon as the temperature hits a certain level, uh, the these little bugs called aphids come out, and those dry out the ladybugs, and those dry out the birds.,But it was just this amazing moment.,And so I used all of that as the opener for my piece, to draw my reader in. And then dr Walbott was a pioneer for women in science, and she had some amazing stories about being an early woman in science.,And so my editor and I decided to actually expand the piece to be about more than just her recent research article, but also about her experiences as an early woman in science.,One of the stories she told is she,did her doctorate at Yale in the late 1960s, and on the 1st day, her department head got up and he was all proud and happy, because half of the incoming class were women.,But he says the reason he was proud and happy is that there is no better combination than a male professor with a phd wife to run his lab.,And that tells you a lot about the state of women in science at that time.,But by couching the science, by putting that research in the context of her laboratory, ,and these stories and her experiences, that made the science more interesting and more accessible for general audiences.,So you have to be a storyteller.

在接下来的几个模块中，我将讨论如何直接与普通受众沟通。在当今时代，科学家与非专业公众互动非常重要。即使你不打算从事科学写作事业，你也可以从科学作家用来吸引非专业公众的技巧中学到很多东西。我将从一些面向普通读者的写作技巧开始。首先，我想明确一点，无论受众是谁，你的总体散文风格都不应改变。你将使用我们在本课程前半部分谈到的同样的优秀写作原则。尽量做到简洁、清晰和引人入胜。但是，当你为普通受众而不是科学受众写作时，你需要做一些不同的事情。我已经确定了六种技能，我认为这些技能是普通读者写作的关键。我已经把它们放在这里，过一会儿我将依次仔细阅读其中的每一个。为了举一些例子，我摘录了两篇科学文章的摘要。一个来自自然，一个来自科学。我写了这些摘录的简短摘要。我之所以选择这些，是因为我认为它们写得很好，适合科学受众。但是我要向你展示当我为普通读者写作时，我做了哪些不同的事情。第一个是这样写的。在这里，我们利用内置加速度计的智能手机的广泛使用来测量全球范围的体育锻炼。我们研究了一个包含71.5万人6800万天体育锻炼的数据集，这为我们提供了一个了解全球111个国家的活动窗口。我们发现各国内部的活动分布不平等，这种不平等可以更好地预测人口中肥胖患病率和平均活动量。我的总结是，研究人员使用智能手机的数据来研究来自111个国家的71.7万人的行走习惯。在最活跃和最不活跃的人群之间差距最大的国家，肥胖率也最高。令人惊讶的是，这种活动不平等性比活动总量更能预测肥胖。你可以听到这两者的区别。过一会我将带你了解我是如何从第一个版本到第二个版本的。第二个例子是，大气中的水资源相当于地球上所有湖泊中所有淡水的10％。但是，尚未开发出一种从空气中捕获和输送水的有效工艺，尤其是在低湿度水平下。我们报告了一种基于多孔金属有机框架的设备的设计和演示，该设备在环境条件下通过使用自然阳光产生的低等级热量，在光通量小于1个太阳的情况下从大气中捕获水。该设备每天能够在相对湿度低至20％的情况下每千克MOF收集2.8升水，并且不需要额外的能量输入。我的简短总结是，科学家们创造了一种可以从空气中抽出水的装置。以前已经建造过集水设备，但它们不适合日常使用，因为它们只能在极其潮湿的空气中工作或需要大量能量才能运行。这种新设备包含一种叫做金属有机框架的多孔晶体，可以像海绵一样吸收水蒸气。小型太阳能电池板提供将水冷凝成液体所需的能量。一个包含两磅晶体的原型在一天之内从沙漠空气中提取了12杯水，仅使用阳光作为电力。再说一遍，你可以听到这两者的区别。当你为普通受众写作时，你需要做的第一件事就是从带回家的信息开始。你必须先告诉读者最重要的事情。如果你不告诉他们为什么他们应该关心，那么他们可能不会继续阅读。这不是一项很难掌握的技能。但这不是我们习惯在科学领域写作的方式。在期刊文章中，我们通常从背景开始，然后再根据带回家的信息进行构建。在为普通受众写作时，你必须扭转局面。例如，在关于集水装置的文章中，科学家们首先提供了一些关于空气中可用淡水量的背景信息，但这不是文章的症结所在。这篇文章是关于该设备的。所以我开始总结一下，科学家们创造了一种可以从空气中抽出水的设备。这是关键成就。请注意，我不必修饰这个，也不必提供很多背景信息。非专业读者会明白为什么这很重要。众所周知，清洁水是一种稀缺的资源。因此，如果你能把它从空中拉出来，那将是一个重要的突破。第二个技能是你需要识别和避免使用行话。这对科学家来说很难，因为我们沉浸在科学中，甚至无法识别我们使用的一半行话。用行话来说，我的意思不仅仅是技术科学术语。但是，就科学家的一般说话方式而言，我们在科学界的许多谈话方式对非专业观众来说听起来并不熟悉。我为斯坦福大学的研究生和博士后教授一门短期暑期课程，他们想学习为普通读者写作。在他们的最后一项任务中，他们必须为非专业公众写一个故事。尽管他们想为非专业公众写作，但不可避免的是，他们的作品回来时充斥着行话。因此，在他们的初稿中，我仔细阅读并突出显示了所有对非专业人士来说是行话的单词和短语。而且我真的需要向他们指出行话，他们才开始认出行话是行话。例如，如果你看一下关于体育锻炼的摘要，普通受众似乎可以理解这个摘要。因为作者没有使用很多花哨的词语或技术术语。但是，实际上，其中很多都是用科学家的话写的。因此，杠杆、广泛使用、加速度计，甚至是工作体育锻炼都是一种更科学的表达锻炼的方式。全球规模是分布的，人口中的患病率，平均活动量。外行人不谈论活动量。他们可能会谈论活动持续时间或活动量，但不会谈论活动量。因此，对于外行人来说，所有这些听起来都像行话。第二个例子有更多的行话。大气中的水、捕获和输送水的高效工艺、设计和演示、金属有机框架，当然还有环境条件。低等级的热量、小于1个太阳的通量、相对湿度水平、没有额外的输入，所有这些都是科学家所说的。我应该指出，如果你为普通美国读者写作...公制对美国观众来说也是行话的，所以你必须像我在这里所做的那样翻译成英文单位。举一个我的斯坦福大学学生的例子，他在写一篇关于朊病毒的文章，这是他初稿中的一段。所以他有诸如功能增益蛋白、异常过程之类的词。仅限于疾病的空间。随机的自然确认变化是由以下因素引起的。当然，所有这些对外行人来说都是行话。但是我花了时间向他指出，他才认出这是行话。你要做的第三件事就是解开科学的面包。当你为科学受众写作时。你可以偷懒。你可以假设有一定基础的科学知识。例如，你可以假设你的读者知道基因是如何工作的，或者受体配体结合是如何工作的，或者什么是T检验。对于普通受众，你不能假设任何先前的科学知识。你必须从第一步开始解释科学，这很难。为了能够逐步向他人解释科学，你必须自己深入了解科学。在关于集水的文章中，科学家们以一种假设先前的科学知识的方式描述了该设备。当我阅读他们的描述时，我并不真正了解该设备的工作原理，因为我不知道什么是金属有机框架，也不知道太阳能是从哪里进入系统的。实际上，我不得不去YouTube上看视频来了解什么是金属有机框架。经过一番研究，我想出了这个描述。新设备包含一种多孔晶体（称为金属有机框架），可以像海绵一样吸收水蒸气；一块小型太阳能电池板提供了将水冷凝成液体所需的能量。几年前，我在杂志上写一篇文章，故事的症结在于数字和模拟系统之间的权衡。因此，对于那个故事，我必须向非专业读者解释数字和模拟之间的区别。我认为这是一个理所当然的概念。我教统计学，所以对我来说，区别只是连续变量和离散变量之间的区别。但我知道我无法用这种方式向非专业观众解释。我不得不绞尽脑汁才能想出一个好的解释。我必须非常仔细地思考，什么是数字化？什么是模拟？有什么权衡取舍？我终于想出了一个比喻，说明如何为房间添加分级照明。模拟解决方案是添加一个调光器开关。等效的数字解决方案是（比如）在墙上放十个灯泡，每个灯泡都有自己的开/关开关。这将使您能够精确控制房间的照明，但这是有代价的。数字化解决方案需要更多的精力、时间、空间和部件。我花了一段时间才想出这个比喻。我的一位斯坦福大学学生正在写一篇关于大脑的文章，在她的初稿中，她使用了神经投影这个词。于是我给她写了一条评论然后说，什么是神经投影？那是轴突吗，那是一束轴突吗？那不是轴突吗？我以前从未听过这个词。实际上，我们在几份草稿上来回走动，我一直在问，什么是神经投影？然后，最后，我想是关于第三稿的，她回信给我，她说，我不知道什么是神经投影。这只是科学家使用的术语。我当时想，啊哈，这就是问题所在。如果你不知道它是什么，你就无法向其他人解释。所以我让她回到科学家那里弄清楚那是什么。归根结底，这只是他说轴突的花哨方式。我认为，在为普通读者写作时，最关键的技能之一是能够确定细节的优先顺序。当你为期刊文章撰稿时，你必须包括所有精确的科学细节。你使用了哪种老鼠？你从哪家公司购买了这些化学品？你使用了什么统计检验？但是，当你为普通读者写作时，你必须过滤掉其中一些较低层次的科学细节，它们对非专业受众来说毫无意义或不相关。许多人有一种误解，认为为非专业读者写作涉及以某种方式简化科学，我完全不同意这种观点。我认为，当你为非专业读者写作时，你正在做的是过滤掉不太重要的细节，你可以在不牺牲准确性的情况下做到这一点。优秀的科学理解并审查较低级别的细节，然后有意识地决定优先考虑哪些细节以及过滤掉哪些细节。我认为科学知识涉及多层细节。最上面是大局。比如说，如果你正在进行减肥药物试验，可能是药物治疗胜过了安慰剂。下一层包括对评估研究质量至关重要的细节，例如研究了多少人。他们被跟踪了多长时间，两组的体重减轻幅度有多大？下一层包括对非专业观众有意义的细节，但可能会从一篇关于审判的非常短的故事中省略。比如，参与者和调查人员是否失明？也许还有药物的剂量。下一层可能包含一些技术细节，例如随机化方案和使用的统计检验。下面可能是一些更微不足道的细节，例如使用哪种品牌的体重秤来称量参与者。科学受众需要所有这些细节，这样他们才能评估研究的质量并有可能对其进行复制。非专业观众根本不需要所有这些细节。根据你文章的长度，如果这是一篇很短的文章，我可能会停下两层，或者我可能会把一篇较长的文章降到三层。其余的细节，我将筛选出来。在关于体育锻炼的文章中，作者给出了三个不同的数字来表达这项研究的规模。但是你不想用太多的数字轰炸非专业读者，所以我优先考虑了国家的数量和人数。我以为对于非专业观众来说，这里最不有意义的数字是体育锻炼的总天数，所以我把它过滤掉了。在集水研究中，作者从这个有趣的花絮开始，讲述了地球上空气中到底有多少水可用。现在，这是一个有趣的细节，在较长的文章中，我可能会在稍后的文章中详细介绍这个细节。但是对于一篇简短的文章来说，这不是一个必不可少的细节，所以我要把它过滤掉。非专业读者不需要知道20％的确切湿度水平。大多数情况下，读者不会经常考虑湿度水平。因此，如果你只说干燥或沙漠空气，那对他们来说更有意义。显然，非专业读者不需要知道金属有机框架的化学式。而且大多数读者不会熟悉太阳的单位，所以你也可以将其过滤掉。第五个尺度，是你需要更快地到达目标。当我们撰写科学期刊文章时，我们往往会花时间直言不讳。我们从为什么做某件事开始，然后说出做了什么，然后说发现了什么，然后说这一切意味着什么。如果你花那么长时间才明白，非专业读者就不会忍受你。你必须切入正题。而要做到这一点，需要信任你的读者。你的读者可能不太了解科学，但你必须假设他们很聪明，可以做出推论。例如，如果你说一项研究的发现，其中的暗示，可能是所做的事情和它的意思。因此，您不必为读者详细说明所有这三件事。不要牵着读者的手，为他们提供连续的评论。相信您的读者能够取得小飞跃。在体育锻炼示例中，作者从两句关于研究设计的句子开始。第一句话概述了这项研究。第二句给出了对数据集的具体描述。非专业读者不想仔细阅读这两个，所以我直接看了具体的描述。我说过，研究人员使用智能手机的数据来研究来自111个国家的71.7万人的行走习惯。切入正题，直截了当。我的一位斯坦福大学学生正在写一篇关于他们在老鼠身上进行的实验的故事，他们重新连接了味蕾和大脑之间的联系。因此，大脑认为甜味蕾是苦味的，而苦味蕾被大脑视为甜味。她已经解释了所有这些，然后她开始解释实验，他们证实了重新布线确实奏效了。在解释这一点时，她详细介绍了为什么这样做。她说，这是为了检查这种重新布线是否导致了行为的改变。然后她说做了什么。研究人员观察了这些老鼠品尝这些不同的口味。她说了这一切的意思。被改变的小鼠似乎对苦味更具耐受性。最后她说出了发现的内容。改变后的老鼠比未改变的小鼠更喜欢奎宁。实际上，我们不需要经历所有这些。在我的编辑中，我把它编辑成只有一句话。我刚才说了发现了什么。苦味蕾改变的小鼠比未改变的小鼠更喜欢奎宁（一种苦味物质）。请注意，这暗示着科学家为什么这样做，他们做了什么，以及这一切意味着什么。你不需要为读者把所有内容都拼出来，只要直言不讳然后快速到达那里即可。最后，为了吸引广大受众，你必须讲一个故事。人们与抽象的想法没有联系。它们与故事息息相关。因此，在你的实验室里，你可能正在研究一个特定的基因或分子，或者化学反应或设备，你会发现它们令人着迷。你每天都沉浸在那门科学中，所以它本质上对你来说似乎令人兴奋。但是我不想告诉你，如果你走出实验室，试图向实验室以外的人解释那个分子或基因，他们可能不会觉得那么有趣，特别是如果你把它解释为抽象的话。如果你想让人们参与你的科学，你必须把科学当作一个故事来讲述，人们可以与之建立联系。那故事是什么？一个故事有描述，它吸引了五种感官，它有情节，有戏剧性和悬念。它有角色。请记住，科学家是人类，毕竟他们是角色。现在，在我之前向你展示的那些简短的简短摘要中，使用讲故事技巧的空间不大。你可以把这些看作是简短的小故事。但是为了能够说明一些讲故事的技巧，我要给你看一篇我几年前写的更大的杂志文章。在这个故事中，我实际上被指派写关于一项刚刚发表在《科学》杂志上的具体研究的文章。这是关于植物生物学的，说实话，我没想到它会让我如此兴奋，因为我对植物生物学从来没有那么感兴趣。但事实证明这是我有史以来最喜欢的故事之一，因为研究人员，斯坦福大学的弗吉尼亚·沃尔伯特教授，竟然是一位了不起的、迷人的女性。例如，她邀请我在她的户外实验室采访她。所以斯坦福大学校园中间有一片我不认识的玉米田。早上6点我在那里遇见了她，同样漂亮、宁静的户外实验室。当我们站在那里说话时，玉米库存突然间被鸟儿覆盖了。然后我看着沃尔伯特博士说，刚才发生了什么？于是她向我解释说，一旦温度达到一定水平，这些叫做蚜虫的小虫子就会出来，它们会把瓢虫抽出来，那些会把鸟儿抽出来。但那只是这个了不起的时刻。所以我用所有这些作为我文章的开场白，来吸引读者。然后，沃尔伯特博士是科学界女性的先驱。她还有一些关于成为科学界早期女性的精彩故事。因此，我和我的编辑决定扩大这篇文章的范围，不仅仅是她最近的研究文章，而且还讲述了她作为科学界早期女性的经历。她讲的故事之一是，她于1960年代末在耶鲁大学攻读博士学位。在第一天，她的部门负责人起身来，他都感到自豪和高兴，因为新来的班级中有一半是女性。但他说，他之所以感到自豪和高兴，是因为没有比男教授和博士妻子来管理实验室更好的组合了。这可以告诉你很多关于当时科学界女性状况的信息。但是，通过表达科学，将这项研究置于她的实验室以及这些故事和经历的背景下，这使科学变得更加有趣，也更容易被普通受众所接受。所以你必须是一个讲故事的人。