



一席 | YiXi

星际远航中的生物学

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This episode of speeches presented in collaboration with "Intellectuals"

本集演讲与《知识分子》合作呈现

演讲 (yǎn jiǎng) lecture; to make a speech. 知识分子 (zhī shi fèn zǐ) intellectual; intelligentsia; learned person. 合作 (hé zuò) to cooperate; to collaborate; to work together; cooperation. 呈现 (chéng xiàn) to appear; to emerge; to present (a certain appearance); to demonstrate.

I hope to spend half an hour today

今天我希望能够用半小时的时间

半小时 (bàn xiǎo shí) half hour.

Probably subvert everyone's stereotype of biologists

大概颠覆一下大家对生物学家的刻板印象

颠覆 (diān fù) to topple (i.e. knock over); to capsize; fig. to overturn (a regime, by plotting or subversion); to undermine; to subvert. 生物学家 (shēng wù xué jiā) biologist. 刻板印象 (kè bǎn yìn xiàng) stereotype.

Because I have to brainstorm

因为我今天要开一下脑洞

洞 (dòng) cave; hole; zero (unambiguous spoken form when spelling out numbers).

Talk about a scientific topic that is big enough to be described by brain damage

讲一个脑洞大到可以用脑残来形容的科学话题

脑残 (nǎo cán) moronic; brainless; bonehead; retard. 形容 (xíng róng) to describe; description; appearance; look. 话题 (huà tí) subject (of a talk or conversation); topic.

That is the biology of interstellar voyages

那就是星际远航中的生物学

星际 (xīng jì) interstellar; interplanetary. 远航 (yuǎn háng) to travel a great distance by sea or air; voyage; long-haul flight. 生物学 (shēng wù xué) biology.

The science I will talk about in half an hour today

我今天半个小时中要讲到的科学

半个 (bàn ge) half of sth. 讲到 (jiǎng dào) to talk about sth.

Strictly speaking, no point exists on today's earth

严格意义上讲没有任何一点在今天的地球上存在

意义 (yì yì) sense; meaning; significance; importance. 存在 (cún zài) to exist; to be; existence.

But I hope you can

但我希望讲完之后你们可以

Some of you can believe

你们中间有一部分人可以相信

一部分 (yī bù fen) portion; part of; subset.

In our lifetime we can wait until these things are realized

在我们的有生之年 我们可以**等到**这些东西的**实现**

等到 (děng dào) to wait until; by the time when (sth is ready etc). **实现** (shí xiàn) to achieve; to implement; to realize; to bring about.

First, let's talk about the background of our topic, which is "Interstellar Voyage"

首先要先讲我们话题的**背景** 就是《星际远航》

背景 (bèi jǐng) background; backdrop; context; (fig.) powerful backer.

I think this background may not need to be said too much

我想这个背景可能不用太多说

But I always have a concept like this

但我一直有一个**观念**是这样的就是

观念 (guān niàn) notion; thought; concept; sense; views; ideology; general impressions.

When human beings really start to look up at the stars

当**人类**真正开始**仰望**星空的时候

人类 (rén lèi) humanity; human race; mankind. **仰望** (yǎng wàng) to look up at; to look up to sb hopefully. **星空** (xīng kōng) starry sky; the heavens.

Human childhood is over

人类的**童年时代**就结束了

童年 (tóng nián) childhood. **时代** (shí dài) age; era; epoch; period (in one's life).

When we look up at the starry sky, we immediately realize that

当我们仰望星空的时候 我们就**立刻**意识到一点

立刻 (lì kè) forthwith; immediate; prompt; promptly; straightway; thereupon; at once. **意识** (yì shí) consciousness; awareness; to be aware; to realize.

It's for the whole earth, for every human being on earth

就是对于**整个地球**来说 对于地球上每一个人**类**来说

整个地球 (zhěng gè dì qiú) the whole world. **类** (lèi) kind; type; class; category; similar; like; to resemble.

This universe is too big

这个**宇宙**实在是太大了

宇宙 (yǔ zhòu) universe; cosmos.

There may be hundreds of billions of stars in this universe like our earth

这宇宙中可能有**千亿**个和我们地球一样的**星体**

千亿 (qiān yì) myriads; hundred billion. **星体** (xīng tǐ) celestial body (planet, satellite etc).

There may be trillions of princes and princesses on every star

每一个星体上可能都有**上万**上亿的**王子**和**公主**

上万 (shàng wàn) over ten thousand; fig. untold numbers; innumerable; thousands upon thousands. **王子** (wáng zǐ) prince; son of a king. **公主** (gōng zhǔ) princess.

Can happily ever after

可以happily ever after

So we feel that we are nothing special

所以我们就觉得我们自己**没什么**特别的

没什么 (méi shén me) nothing; it doesn't matter; it's nothing; never mind.

At that moment we bid farewell to our childhood

在那**一时刻**我们**告别**了童年

时刻 (shí kè) time; juncture; moment; period of time; constantly; always. **告别** (gào bié) to leave; to bid farewell to; to say good-bye to.

We are willing to raise our heads

我们就愿意**抬起头**来

起头 (qǐ tóu) to start; at first; beginning.

See what else happened in this starry sky

看看这个**星空**中到底还发生了些什么**别的**事情

空中 (kōng zhōng) in the sky; in the air. **别的** (bié de) else; other.

Of course I want to say
goodbye to childhood for a
long time

So the forerunner of mankind
has taken us far enough

For example, give a few very
simple milestones

Probably decades ago

We have sent the astronauts to
the nearest star to the earth,
which is the moon

380,000 kilometers from the
earth

There have been 12 human
heroes

Stepped on the star

Everyone remembers what
Armstrong said on the surface
of the moon

This is a small step for me but a
big step for humanity

Then another 20 years passed

We have raised the boundary
of human looking up at the
starry sky by two orders of
magnitude

Reached almost tens of
millions of kilometers

Like Mars

We put the Mars Pathfinder in
1996

A spacecraft sent to the surface
of Mars

当然了 我要说人类告别童年已经
很久了

所以人类的先行者已经带我们走
得足够远

比如说举几个非常简单的里程碑
吧

大概在几十年前

我们已经把宇航员送到了离地球
最近的星体 就是月球

离地球38万公里

先后有12个人类的英雄

把自己的脚步踏在了那颗星体上

大家也都记得阿姆斯特朗在月球
表面说过那句话

这是我的一小步 但是是人类的一
大步

然后又过了20年

我们把人类仰望星空的边界提高
了两个数量级

达到了差不多几千万公里

比如说火星

我们在1996年把火星探路者号

一个航天器送到火星表面

要说 (yào shuō) as for; when it comes to.

先行者 (xiān xíng zhě) forerunner. 足够 (zú
gòu) enough; sufficient.

几个 (jǐ ge) a few; several; how many. 里程碑 (lǐ chéng
bēi) milestone.

年前 (nián qián) before the end of the year; before the
new year.

宇航员 (yǔ háng yuán) astronaut. 月球 (yuè qiú) the
moon.

先后 (xiān hòu) early or late; priority; in succession;
one after another. 个人 (gè rén) individual; personal;
oneself. 英雄 (yīng xióng) hero.

脚步 (jiǎo bù) footstep; step. 踏 (tà) to tread; to stamp;
to step on; to press a pedal; to investigate on the
spot. 颗 (kē) classifier for small spheres, pearls, corn
grains, teeth, hearts, satellites etc.

阿姆斯特朗 (ā mǔ sī tè lǎng) surname Armstrong. 表
面 (biǎo miàn) surface; face; outside; appearance.

大步 (dà bù) large strides.

边界 (biān jiè) boundary; border. 数量级 (shù liàng
jí) order of magnitude.

达到 (dá dào) to reach; to achieve; to attain.

火星 (huǒ xīng) Mars (planet).

探路者 (tàn lù zhě) Pathfinder, NASA spacecraft sent to
Mars in 1977.

航天器 (háng tiān qì) spacecraft.

This is the photo of the surface of Mars sent to us by the Mars Pathfinder

这就是火星探路者号为我们送来的火星表面的照片

Of course we have no technical level yet

当然**目前**我们还没有技术水平

目前 (mù qián) at the present time; currently.

Send a real astronaut to Mars

把一个真正的宇航员送到火星去

Then this time has passed almost 20 years

然后这个时间又过了差不多20年

We humans have increased the distance of looking up at the stars by two orders of magnitude

我们人类又把仰望星空的距离又**扩大**了两个数量级

扩大 (kuò dà) to expand; to enlarge; to broaden one's scope.

Reached the scale of almost billions of kilometers

达到了差不多几**十亿**公里的这个**尺度**

十亿 (shí yì) one billion; giga-. **尺度** (chǐ dù) scale; yardstick.

This time it's Pluto

这次是**冥王星**

冥王星 (míng wáng xīng) Pluto (dwarf planet).

Everyone knows this

这个所有人都知道

We do not yet have the ability to send a spacecraft to the surface of Pluto

我们现在还没有**能力**送一个航天器到冥王星的表面

有能力 (yǒu néng lì) able.

But we can send a spacecraft

但是我们可以送一个航天器

From tens of thousands of kilometers in the sky, help us send one back

从几万公里的**高空**帮我们送回一个

高空 (gāo kōng) high altitude.

Photograph of the surface of Pluto

冥王星表面的照片

Everyone may feel very optimistic after seeing these milestones

看到这几个里程碑大家可能有一个非常**乐观**的感觉

乐观 (lè guān) optimistic; hopeful.

Is if we really can every twenty years

就是如果我们真的能够每**二十年**

二十 (èr shí) twenty; 20.

Have widened the eyes of human beings by two orders of magnitude

都把人类的**目光**扩大两个数量级的距离

目光 (mù guāng) sight; vision; view; gaze; look.

Then we will probably be able to explore the entire universe before long

那么没过**多久**我们大概就可以把**整个**宇宙都**探索**遍了

多久 (duō jiǔ) how long?. **整个** (zhěng gè) whole; entire; total. **探索** (tàn suǒ) to explore; to probe.

What I say is optimistic and unrealistic

我这样说的是乐观**不切实际**的

不切实际 (bù qiè shí jì) unrealistic; impractical.

At least from a scientific point of view, why?

We know that even the scale of billions of kilometers

For a human individual already big

But it's too small for the entire universe

Billions of kilometers away science

To be honest, it is largely powerless at present

But human imagination can take us to those places

I am a very experienced science fiction fan

So I will use the artistic conception in science fiction to take you to that place

For example, give a few simple examples

After stepping out of the sun

We can in the scale of a few light years to dozens of light years

Find many stars

These stars are also the protagonists of many science fiction novels

For example, the nearest alpha Centauri star Proxima Centauri

至少从科学**角度**讲 为什么呢

我们知道**即便**是几十亿公里这个尺度

对于一个人**类个体**已经很大

但是对于整个宇宙来说实在是太小太小了

在几十亿公里**之外**呢

科学

说实话目前**而言**很大程度上是**无能为力**的

但是人类的**想象力**可以带我们去那些地方

我是一个特别**资深**的**科幻迷**

所以我就用**科幻小说**中的**意境**来带你们走到那个地方

比如说举几个简单的**例子**

走出太阳之后呢

我们可以在几**光年**到几十光年的尺度里

找到很多**恒星**

这些星体也是很多科幻小说的**主角**

比如离我们最近的**半人马座α星** **比邻星**

角度 (jiǎo dù) angle; point of view.

即便 (jí biàn) even if; even though; right away; immediately.

个体 (gè tǐ) individual.

之外 (zhī wài) outside; excluding.

说实话 (shuō shí huà) to speak the truth; truth to tell; frankly. **而言** (ér yán) with regard to (preceding phrase). **程度** (chéng dù) degree (level or extent); level. **无能为力** (wú néng wéi lì) impotent (idiom); powerless; helpless.

想象力 (xiǎng xiàng lì) imagination.

资深 (zī shēn) veteran (journalist etc); senior; highly experienced. **科幻** (kē huàn) science fiction; abbr. for 科学幻想 (kē xué huàn xiǎng). **迷** (mí) to bewilder; crazy about; fan; enthusiast; lost; confused.

科幻小说 (kē huàn xiǎo shuō) science fiction novel. **意境** (yì jìng) artistic mood or conception; creative concept.

例子 (lì zǐ) case; (for) instance; example.

走出 (zǒu chū) to leave (a room etc); to go out through (a door etc).

光年 (guāng nián) light-year.

恒星 (héng xīng) (fixed) star.

主角 (zhǔ jué) leading role; lead.

半人马座 (bàn rén mǎ zuò) Centaurus (constellation). **比邻** (bǐ lín) neighbor; next-door neighbor; near; next to.

Or the star Procyon which is closer to us

Then if we zoom in a little bit

We can also find similar coordinates in the scale of science fiction

For example, if we take the Milky Way as the coordinates

Then the scale we are talking about is probably tens of thousands to hundreds of thousands of light years

Two of my favorite science fiction writers at this time

Asimov of the United States and Clark of the United Kingdom

Have been depicted in their novels

Scenes of humans or various civilizations communicating and living on the scale of 100,000 light-years

Then we can zoom in on the scale of our eyes

Such as zooming out of the Milky Way

In this scale of the entire galaxy group

Maybe we are talking about a million light years

For example, in another science fiction writer that I particularly like

In the novel “The Hound Spaceship”

或离我们比较近的南河三这个恒星

然后如果我们把目光再**放大**一点

在科幻小说的尺度里我们也可以找到**类似**的**坐标**

比如说如果我们以**银河系**为坐标

那么我们**谈论**的尺度大概就是几**万**到几**十万**光年

这个时候 **我**最喜欢的两位科幻作家

美国的**阿西莫夫**和**英国**的**克拉克**

都**曾经**在他们小说里**描绘**过

人类或者各种**文明**在**十万**光年的尺度上交流和生活的**场景**

然后我们可以把我们目光的尺度再**放大**

比如放大到银河系之外

整个**星系群**的这个尺度里

那大概我们谈论的就是**百万**光年了

比如说在我特别喜欢的另外一个科幻作家的

《**猎犬号宇宙飞船**》这篇小说里

放大 (fàng dà) to enlarge; to magnify.

类似 (lèi sì) similar; analogous. **坐标** (zuò biāo) coordinate (geometry).

银河系 (yín hé xì) Milky Way Galaxy; the galaxy (our galaxy).

谈论 (tán lùn) to discuss; to talk about. **十万** (shí wàn) hundred thousand.

阿西莫夫 (ā xī mò fū) Isaac Asimov (1920-1992), American author and biochemist. **英国** (yīng guó) United Kingdom 联合王国 (lián hé wáng guó); United Kingdom of Great Britain and Northern Ireland; abbr. for England **英格兰** (yīng gé lán). **克拉克** (kè lā kè) Clark or Clarke (name).

曾经 (céng jīng) once; already; former; previously; ever; (past tense marker used before verb or clause). **描绘** (miáo huì) to describe; to portray.

文明 (wén míng) civilized; civilization; culture. **场景** (chǎng jǐng) scene; scenario; setting.

星系 (xīng xì) see **恒星系** (héng xīng xì).

百万 (bǎi wàn) million; millions.

猎犬 (liè quǎn) hound; hunting dog. **宇宙飞船** (yǔ zhòu fēi chuán) spacecraft.

We can see the discussion about the civilization from the Triangulum galaxy

我们可以看到对**三角座**星系那里来的文明的讨论

三角座 (sān jiǎo zuò) Triangulum (constellation).

That's almost a few million light years away

那差不多就是几百万光年**以外**的事情

以外 (yǐ wài) apart from; other than; except for; external; outside of; on the other side of; beyond.

If we continue to deduct this logic

如果我们把这个**逻辑**继续地**推演**

逻辑 (luó jì) logic (loanword). **推演** (tuī yǎn) to deduce; to infer; to derive; an implication.

We can see the artistic conception of a large number of science fiction novels

我们可以看到**大量**的科幻小说的**意境**

大量 (dà liàng) great amount; large quantity; bulk; numerous; generous; magnanimous.

Is set on the most expansive background

是**设置**在一个最**广袤**的背景上的

设置 (shè zhì) to set up; to install. **广袤** (guǎng mào) vast.

That is the whole universe

那就是整个宇宙

The radius of our entire observable universe is almost tens of billions of light years

我们整个**可观**测的宇宙的**半径**差不多有几百亿光年

可观 (kě guān) considerable; impressive; significant. **测** (cè) to survey; to measure; to conjecture. **半径** (bàn jìng) radius.

Of course you can ask

当然你可以会问

If you follow the human kind just now

如果按照刚才人类**那种**

那种 (nà zhǒng) that; that kind of; that sort of; that type of.

Expand your world exponentially

以**指数**式地扩大自己的世界

指数 (zhǐ shù) (numerical, statistical) index; (math.) exponent; index; exponential (function, growth).

Ways to expand the boundaries of your own exploration

扩大自己的探索的边界的方法

46 billion light-years is nothing great

460亿光年也没什么**了不起**的啊

了不起 (liǎo bu qǐ) amazing; terrific; extraordinary.

But I ask everyone to think of another number

但是我请大家想另外一个数字

That is, everyone's life is only 70 to 80 years

那就是**每个人**的生命差不多只有70到80年

每个人 (měi ge rén) everybody; everyone.

We can put aside the difference between the two dimensions of light years and years

我们可以**抛开**光年和年这两个**量纲**的区别

抛 (pāo) to throw; to toss; to fling; to cast; to abandon. **开光** (kāi guāng) eye-opening ceremony for a religious idol (Buddhism); to consecrate; to bless; transparent; translucent; haircut; shaving the head or face (humorous); a method of decoration; first light (astronomy). **量纲** (liàng gāng) dimension (unit).

Just look at the number 46 billion and the two numbers 70 to 80

仅仅看460亿这个数字和70到80两个数字

仅仅 (jǐn jǐn) barely; only; merely; only (this and nothing more).

We will immediately realize that there are almost

我们会马上意识到这中间有差不多

8 to 9 orders of magnitude difference

8到9个数量级的**差别**

差别 (chā bié) difference; distinction; disparity.

I don't know what people think when seeing the difference between these two numbers

我不知道看到这两个数字的差别大家会怎么想

But when I saw this number

但是我看到这个数字的时候

The first thought is a particularly famous sentence in "Zhuangzi"

第一个**想法**就是《庄子》上一句特别有名的话

想法 (xiǎng fǎ) way of thinking; opinion; notion; to think of a way (to do sth). **庄子** (zhuāng zǐ) Zhuangzi (369-286 BC), Daoist author.

Just

就是

I have no boundaries in my life and know no boundaries

我生也有**涯**而知也无**涯**

涯 (yá) border; horizon; shore.

With the boundless as the boundless, almost

以有**涯****随**无**涯** **殆**已

随 (suí) to follow; to comply with; varying according to...; to allow; subsequently. **殆** (dài) dangerous; perilous; to endanger; almost; probably; only.

Is my life span of seven to eighty years

就是我一个**七八十年**的**寿命**

八十 (bā shí) eighty; 80. **寿命** (shòu mìng) life span; life expectancy; lifetime (of a machine).

As a humble human

作为一个**卑微**的人类

作为 (zuò wéi) one's conduct; deed; activity; accomplishment; achievement; to act as; as (in the capacity of); qua; to view as; to look upon (sth as); to take sth to be. **卑微** (bēi wēi) petty and low.

How is it possible

怎么**有可能**有能力

有可能 (yǒu kě néng) possible; probable; possibly; probably; may; might.

Or even have time to explore the universe 46 billion light years away

或者甚至是有时间探索460亿光年以外的宇宙

What about what I want to talk about today

那今天我要讲的事情呢

Is based on this 8-9 order of magnitude difference

就是在这个8到9个数量级差别的基础上

Where is our modern science?

我们**现代**科学到底走到了哪一步

现代 (xiàn dài) modern times; modern age; modern era.

The lifetime of all our audience

我们在**在座**的所有观众的有生之年

在座 (zài zuò) to be present.

We can see where the human civilization is

我们能看到人类的文明走到哪一步

Then first of all

然后首先要讲

We have a way

我们有一个办法

Bring Wuya's Zhi and Youya's life closer

把无涯的知和有涯的**人生**弄得更近一点

人生 (rén shēng) life (one's time on earth).

That is to bring Youya closer

那就是把有涯这件事**变得**更近

事变 (shì biàn) incident; unforeseen event; events (in general).

For example, these are two science fiction novels

比如说这是两个科幻小说中

A mood that is particularly easy to appear in science fiction movies

科幻电影里特别容易出现的意境

科幻电影 (kē huàn diàn yǐng) science fiction movie.

One called near light speed

一个叫近**光速**飞行

光速 (guāng sù) the speed of light. **飞行** (fēi xíng) (of planes etc) to fly; flying; flight; aviation.

This basic principle is to use Einstein's special theory of relativity

这个基本上原理就是利用**爱因斯坦**的**狭义相对论**

基本上 (jī běn shàng) basically; on the whole. **原理** (yuán lǐ) principle; theory. **利用** (lì yòng) to exploit; to make use of; to use; to take advantage of; to utilize. **爱因斯坦** (ài yīn sī tàn) Albert Einstein (1879-1955), German-born theoretical physicist. **狭义相对论** (xiá yì xiāng duì lùn) special relativity.

Accelerate human spacecraft to a level very close to the speed of light

把人类的航天器**加速**到非常**接近**光速的水平

加速 (jiā sù) to speed up; to expedite. **接近** (jiē jìn) to approach; to get close to.

At this time, according to the principle of special relativity

那这个时候呢**依据**狭义相对论的原理

依据 (yī jù) according to; basis; foundation.

The time on the spacecraft will pass much slower than the time on the earth

飞船上的时间会**流逝**得比地球上的时间慢得多得多

飞船 (fēi chuán) airship; spaceship. **流逝** (liú shì) (of time) to pass; to elapse.

In this way, we may be in the limit of human life

这样我们就有可能在一个人类的**寿命****极限**里

极限 (jí xiàn) limit; extreme boundary.

Send a spaceship to the boundary of the entire universe

把一个飞船送到整个宇宙的**边界**里去

This is a

这是一个

I said that

我说了

Is a very commonly used artistic conception in science fiction

是一个科幻小说里非常**常用**的意境

常用 (cháng yòng) in common usage.

Another very commonly used artistic conception is the so-called temporal transition

另外一个非常常用的意境就是**所谓**的**时空跃迁**

所谓 (suǒ wèi) so-called; what is called. **时空** (shí kōng) time and place; world of a particular locale and era; (physics) space-time. **跃迁** (yuè qiān) transition; jump (e.g. quantum leap in spectroscopy).

Many people may have heard of this concept	这个 概念 可能很多人都 听说过	概念 (gài niàn) concept; idea. 听说 (tīng shuō) to hear (sth said); one hears (that); hearsay; listening and speaking.
The principle of this use	这个利用的原理呢	
Physics known to man	也是人类 已知 的 物理学	已知 (yǐ zhī) known (to science). 物理学 (wù lǐ xué) physics.
Is the general theory of relativity proposed by Einstein	就是爱因斯坦 提出 的 广义相对论	提出 (tí chū) to raise (an issue); to propose; to put forward; to suggest; to post (on a website); to withdraw (cash). 广义相对论 (guǎng yì xiāng duì lùn) general relativity; Einstein's theory of gravity.
We can use gravity to distort time and space	我们可以利用 引力 来 扭曲 时空	引力 (yǐn lì) gravitation (force); attraction. 扭曲 (niǔ qū) to twist; to warp; to distort.
Make human beings in three-dimensional space	使得 人类在 三维 时空里	使得 (shǐ de) usable; workable; feasible; doable; to make; to cause. 三维 (sān wéi) three-dimensional; 3D.
Can reach point B from point A to point B at an incalculable speed	可以以一个 难以计量 的速度从A点达到B点	难以 (nán yǐ) hard to (predict, imagine etc). 计量 (jì liàng) measurement; to calculate.
Then when I think of these two scenes	然后当我 想到 这两个场景	想到 (xiǎng dào) to think of; to call to mind; to anticipate.
Or when I repeatedly in science fiction and science fiction movies	或者说当我 反复 地在科幻小说科幻电影里	反复 (fǎn fù) repeatedly; over and over; to upend; unstable; to come and go; (of an illness) to return.
When I saw these two scenes	看到这两个场景的时候	
As a biologist, I feel a little inferior	我作为一个生物学家我会觉得有点 自卑	自卑 (zì bēi) feeling inferior; self-abased.
Because I was already	因为我当时已经	
Almost when I was in college	差不多是在我上大学的时候	
I decided at that time that I must be a biologist	我那个时候已经决定我 一定要 做一个生物学家	一定要 (yī dìng yào) must.
At the same time as a senior science fiction fan, I saw	同时作为一个资深的科幻迷呢我又看到	
Special Relativity and General Relativity	狭义相对论和广义相对论	
Or more general physics	或者说更 广义 的物理学	广义 (guǎng yì) broad sense; general sense.

Played such an important function in the human imagination	在人类的想象力中 发挥 了如此重要的 功能	发挥 (fā huī) to display; to exhibit; to bring out implicit or innate qualities; to express (a thought or moral); to develop (an idea); to elaborate (on a theme). 如此 (rú cǐ) in this way; so. 功能 (gōng néng) function; capability.
So I often ask myself a question	所以我就经常问我自己一个问题就是	
When biology is exploring the boundaries of the universe	那生物学在人类探索宇宙边界的时候	
Can it play any role in the process?	过程中到底能起到任何作用吗	
Then I always think about this question	然后我就总在想这个问题	
Until I later, I figured it out myself	直到我后来 一方面 我自己 想通 了	一方面 (yī fāng miàn) on the one hand. 想通 (xiǎng tōng) to figure out; to realize; to become convinced; to come round (to an idea); to get over it.
On the one hand, I have seen similar moods in more science fiction works	一方面我在更多的科幻 作品 里看到了类似的意境	作品 (zuò pǐn) work (of art); opus.
So I finally strengthened my confidence	所以我后来终于 坚定 了信心	坚定 (jiān dìng) firm; steady; staunch; resolute.
I can proudly be a biologist	我可以骄傲地做一个生物学家了	
What I want to talk about here is	我在这儿想讲的就是	
What is the solution in biology	生物学到底有什么办法	
Bring Youya and Wuya closer	让有涯和无涯更 贴近	贴近 (tiē jìn) to press close to; to snuggle close; intimate.
Here I list four first	这儿我先 列举 四个	列举 (liè jǔ) a list; to list; to enumerate.
In fact, it also appears in science fiction works	其实也出现在科幻作品里的方法	
The first is human hibernation	第一个就是人类 冬眠	冬眠 (dōng mián) hibernation.
If we can freeze people directly	如果我们能够把人直接 速冻 起来	速冻 (sù dòng) to quick-freeze.
Obviously everyone can understand	这样 显然 大家都可以理解	显然 (xiǎn rán) clear; evident; obvious(ly).
We can extend human life to almost unlimited levels	我们可以把人的寿命 延长 到几乎 无限 的水平	延长 (yán cháng) to prolong; to extend; to delay. 无限 (wú xiàn) unlimited; unbounded.
Because people are here	因为人在这个	

let's assume

我们**假设**

假设 (jiǎ shè) to suppose; to presume; to assume; supposing that ...; if; hypothesis; conjecture.

Because people actually don't metabolize during hibernation

因为人在冬眠的过程中其实是不进行**新陈代谢**

新陈代谢 (xīn chén dài xiè) metabolism (biology); the new replaces the old (idiom).

His life span is not counted

他的寿命是不算**在**内的

在内 (zài nèi) (included) in it; among them.

The second way is to live forever

第二个方法就是**长生不老**

长生不老 (cháng shēng bù lǎo) immortality.

If there is a biological method to make astronauts immortal

如果有一个生物学的方法能让宇航员**长生不老**

Or to extend their lifespan very greatly

或者说非常**极大限度**地延长他们的寿命

极大 (jí dà) maximum; enormous. **限度** (xiàn dù) limitation; limit.

Then of course we can imagine

那么当然我们可以**想象**

想象 (xiǎng xiàng) to imagine; to fancy.

The boundaries of the universe explored by human astronauts will become larger

人类宇航员探索的宇宙的边界就会变得**更大**

The third is generational reproduction

第三个是**世代繁衍**

世代 (shì dài) for many generations; generation; era; age. **繁衍** (fán yǎn) to multiply; to reproduce; to increase gradually in number or quantity.

Then I will put aside hibernation and immortality

那么我就**抛开**冬眠和长生不老而言

抛开 (pāo kāi) to throw out; to get rid of.

We turn the spaceship into a small society

我们就把飞船**变成**一个小社会

变成 (biàn chéng) to change into; to turn into; to become.

Let astronauts reproduce for generations on it

让宇航员在**上面**世代繁衍

上面 (shàng miàn) on top of; above-mentioned; also pr. (shàng mian).

Then we may also greatly expand the boundaries of mankind in the universe

那么我们也有可能**极大地扩展**人类在宇宙中的**疆界**

大地 (dà dì) earth; mother earth. **扩展** (kuò zhǎn) to extend; to expand; extension; expansion. **疆界** (jiāng jiè) border; boundary.

The last one may sound the most sci-fi

最后一个可能**听起来**最科幻

听起来 (tīng qǐ lái) to sound like.

On the contrary, it is the closest to my research

反而是和我的研究最**相近**的

而是 (ér shì) rather. **相近** (xiāng jìn) close; similar to.

Is the storage and interpretation of consciousness

就是意识的**存储**和**解读**

解读 (jiě dú) to decipher; to decode; to interpret.

What does that mean

什么意思呢

Just because we think

就是既然我们认为

The difference between humans and animals is mainly in our brain

人和动物的区别主要在我们这颗**大脑**

大脑 (dà nǎo) brain; cerebrum.

It can think, it can generate all kinds of novel ideas

它能**思考** 它能**产生**各种各样新奇的想法

思考 (sī kǎo) to reflect on; to ponder over. **产生** (chǎn shēng) to arise; to come into being; to come about; to give rise to; to bring into being; to bring about; to produce; to engender; to generate; to appear; appearance; emergence; generation; production; yield. **各种各样** (gè zhǒng gè yàng) various kinds; all sorts. **新奇** (xīn qí) novelty; new and odd.

Make all kinds of novel machines

制造出各种各样新奇的**机器**

制造 (zhì zào) to manufacture; to make. **机器** (jī qì) machine.

Then we simply take out the human brain and slice it into thin slices

那我们**干脆**就把人脑拿出来**切成****薄薄**的片

干脆 (gān cuì) straightforward; clear-cut; blunt (e.g. statement); you might as well; simply. **切成** (qiē chéng) to cut up (into pieces); to slice; to carve; to dice; to shred. **薄** (báo) thin; cold in manner; indifferent; weak; light; infertile.

Then I took the picture with the camera and stored it in the spacecraft's computer

然后用**照相机****拍**了照之后存在**宇宙飞船**的**电脑**里

拍 (pāi) to pat; to clap; to slap; to swat; to take (a photo); to shoot (a film); racket (sports); beat (music).

Then wait until this

然后等到这个

Of course, the life span of electronic information must be much longer than that of humans.

当然**电子信息****存活**的**寿命**肯定要**比人****长得**多了

存活 (cún huó) to survive (a serious accident); survival. **长得** (zhǎng de) to look (pretty, the same etc).

After the spacecraft reaches its destination

那等到**飞船**到了**目的地**之后

目的地 (mù dì dì) destination (location).

We then restore a human brain based on this information

我们再根据**这些信息****还原**出**一个****人类****大脑**来

还原 (huán yuán) to restore to the original state; to reconstruct (an event); reduction (chemistry).

Is it possible to expand the scale of human exploration of the universe?

是不是就可以**扩展****人类****探索****宇宙**的**尺度**了呢

四条 (sì tiáo) four of a kind; quads (poker).

Of course these four things I want to say are

当然这**四条**我要说的是

The latter two are impossible at least in current human ethics

后两条至少在目前人类的**伦理**里是**不可能**的

伦理 (lún lǐ) ethics. **不可能** (bù kě néng) impossible; cannot; not able.

We can't lock people on the spaceship like monkeys

我们不可能把人像**猴子**一样关在**飞船**上

猴子 (hóu zi) monkey.

Let them reproduce for generations to explore the universe

让他们世代繁衍就为了**探索****宇宙**

It is impossible for us to take out the head of a living astronaut and cut into pieces

我们也不可能把**一个**活的**宇航员****脑袋**拿出来**切成**片

脑袋 (nǎo dài) head; skull; brains; mental capability.

Just to launch his
consciousness to stars a few
light years away and dozens of
light years away

Today I am going to talk about
the first two

Hibernation and immortality

The first is hibernation

Hibernation is a scene in many
science fiction novels

This is a screenshot of Avatar

Everyone may know

In order to send the astronauts
and workers to Pandora

All people are going to spend
the entire voyage in
hibernation

Then if we turn our eyes from
science fiction back to the
laboratory

What do we know

Here I want to tell a few short
stories

The first story is about bugs

This is a very small bug

Its name is *Caenorhabditis
elegans*

Its scale is only about one
millimeter as big

There are three bugs in this
video

You can clearly see

就为了把他的意识**发射**到几光年
几十光年之外的星体**上去**

那今天我要讲的主要是前两条

冬眠和长生不老

首先是冬眠

冬眠是很多科幻小说的场景

这个是**阿凡达**里的一张**截图**

大家可能都知道

为了把宇航员和**工人**都送到
Pandora

所有的人是要在冬眠中**度过**整个
航程的

然后如果我们把目光从科幻小说
回到**实验室**

我们知道什么呢

这里我要讲几个小故事

第一个故事是关于**虫子**的

这是一个非常**小**的虫子

它的名字叫**秀丽隐杆线虫**

它的尺度大概只有一**毫米**那么大

这个**录像**中有**三条**虫子

大家可以很**明显**地看到

发射 (fā shè) to shoot (a projectile); to fire (a rocket); to launch; to emit (a particle); to discharge; emanation; emission. **上去** (shàng qù) to go up.

阿凡达 (ā fán dá) Avatar (movie). **截图** (jié tú) screenshot (computing).

工人 (gōng rén) worker.

度过 (dù guò) to pass; to spend (time); to survive; to get through. **航程** (háng chéng) flight; passage; sea or air distance.

实验室 (shí yàn shì) laboratory.

虫子 (chóng zi) insect; bug; worm.

小的 (xiǎo de) I (when talking to a superior).

秀丽 (xiù lì) pretty; beautiful. **隐** (yǐn) secret; hidden; concealed; (prefix) crypto-. **杆** (gǎn) stick; pole; lever; classifier for long objects such as guns. **线虫** (xiàn chóng) nematode.

毫米 (háo mǐ) millimeter.

录像 (lù xiàng) to videotape; to videorecord; video recording. **三条** (sān tiáo) three of a kind (poker).

明显 (míng xiǎn) clear; distinct; obvious.

The bug in the middle of this video looks the most active

这个录像中中间这条虫子**看起来最活跃**

看起来 (kàn qǐ lai) seemingly; apparently; looks as if; appear to be; gives the impression that; seems on the face of it to be. **活跃 (huó yuè)** active; lively; excited; to enliven; to brighten up.

Its body surface is also the smoothest

它的身体表面也**最光滑**

光滑 (guāng huá) glossy; sleek; smooth.

And it has the strongest athletic ability

然后它运动能力也**最强**

Then on the left side of everyone's perspective

然后在大家**视角**左边的这条虫子

视角 (shì jiǎo) viewpoint; angle on sth; perspective.

There are some slight movements

有**一些些**微的动作

有一些 (yǒu yī xiē) somewhat; rather; some.

Its surface is also relatively smooth

它的表面也还比较**光滑**

But the bug on the right looks

但是右边的这条虫子**看起来**

Has basically lost its vitality

就已经基本上**丧失了生命力**

丧失 (sàng shī) to lose; to forfeit. **生命力 (shēng mìng lì)** vitality.

It basically has no movement

它基本上没有任何**运动**

Its body wall also began to show signs of shrinkage and folds

它的**体壁**也开始有**萎缩**和**褶皱的痕迹**

体壁 (tǐ bì) integument (biology). **萎缩 (wěi suō)** to wither; to dry up (of a plant); to atrophy (of muscle, social custom etc). **褶皱 (zhě zhòu)** fold; crease; wrinkle; geological fold. **痕迹 (hén jì)** vestige; mark; trace.

In fact, it's the same as everyone thought

其实就和**大家想的一样**

These three bugs are like this

这三条虫子是**这种**

The living room of the very short-lived very tiny Caenorhabditis elegans

非常**短命**非常微小的秀丽隐杆线虫的生活室

短命 (duǎn mìng) to die young; short-lived.

The bug in the middle is a day old bug

中间这条虫子是**一天大**的虫子

天大 (tiān dà) gargantuan; as big as the sky; enormous.

So it's very active, like adolescence

所以它特别活跃 像人的**青春期**一样

青春期 (qīng chūn qī) puberty; adolescence.

The bug on the left is an adult bug

左边这条虫子是**成年期**的虫子

成年 (chéng nián) to grow to adulthood; fully grown; the whole year.

About a week old

大概一个**星期大**

The bug on the right is a 20-day-old bug

右边这条虫子是一个**20天大**的虫子

A bug that is basically on the verge of death	基本上 濒临死亡 的一个虫子	濒临 (bīn lín) on the edge of; (fig.) on the verge of; close to. 死亡 (sǐ wáng) to die; death.
To the end of its life	走到了它生命的 末期	末期 (mò qī) end (of a period); last part; final phase.
You can clearly see	大家可以很明显地看到	
Bugs also have an obvious process of aging and death	虫子也有一个很明显的 衰老 和 死亡 的过程	衰老 (shuāi lǎo) to age; to deteriorate with age; old and weak.
Then there is a particularly interesting phenomenon in this bug	然后在这种虫子中有一个特别 特殊 有趣的 现象	特殊 (tè shū) special; particular; unusual; extraordinary. 现象 (xiàn xiàng) phenomenon; appearance.
Not in humans	在人类是没有的	
This has attracted the attention of many zoologists	这个吸引了很多 动物学家 的注意	动物学 (dòng wù xué) zoological; zoology. 家的 (jiā de) (old) wife.
Hibernation	就叫 冬眠	
Of course “Winter” is quoted	当然了「冬」是加 引号 的	引号 (yǐn hào) quotation mark (punct.).
Because this kind of bug does not enter this state when it is cold	因为这种虫子它不是在冷的时候进入这种 状态	状态 (zhuàng tài) state of affairs; state; mode; situation.
Instead, it enters this state when it is extremely hot	反而是在特别热的时候进入这个 状态	
Because after it detects heat	因为它 检测 到热了之后	检测 (jiǎn cè) to detect; to test; detection; sensing.
It will feel that this is an unsuitable environment for life	它会觉得这是一个 不适宜 生活的 环境	不适 (bù shì) unwell; indisposed; out of sorts.
It will immediately enter a	它就会立刻进入到一种	
I call it “hibernation”	我把它叫「冬眠」的 状态 里去	
Is on the picture	就是在图上	
This bug on the right	这个右边放的这条虫子	
Its body becomes very slender	它身体会变得非常 细长	细长 (xì cháng) slender.
It will stop all eating activities and metabolism	它会 停止 一切的 进食 活动和 新陈 代谢	停止 (tíng zhǐ) to stop; to halt; to cease. 进食 (jìn shí) to take a meal; to eat.
It's like dead	就像死了一样	
But this bug can be used in harsh environments	但是这条虫子可以在 严酷 的 环境 下	严酷 (yán kù) bitter; harsh; grim; ruthless; severe; cut-throat (competition).
Survive for about four or five months	生存 大概四五月	生存 (shēng cún) to exist; to survive.

The normal life history of this bug is only two weeks	而这条虫子正常时候的生活史只有两个星期	
Up to three weeks	最多三个星期	最多 (zuì duō) at most; maximum; greatest (amount); maximal.
So everyone can see such a simple bug	所以大家可以看见 这么简单的一个虫子	
When facing a more dangerous and harsh environment	面对一个比较危险比较恶劣的环境的时候	面对 (miàn duì) to confront; to face. 恶劣 (è liè) vile; nasty; of very poor quality.
Can also take some measures	也可以采取某种措施	采取 (cǎi qǔ) to adopt or carry out (measures, policies, course of action); to take. 某种 (mǒu zhǒng) some kind (of). 措施 (cuò shī) measure; step.
Shut down its own metabolism and aging	关停它自己的新陈代谢和衰老	关停 (guān tíng) (of a power plant, refinery etc) to shut down.
Greatly extend its lifespan	极大地延长它的寿命	
So everyone has a fantasy	所以大家就有一个幻想	幻想 (huàn xiǎng) delusion; fantasy.
If we can really study this bug	如果我们真的能研究清楚这个虫子	
How did you enter this pseudo-hibernation state	到底是怎么进入这种伪冬眠的状态	伪 (wěi) false; fake; forged; bogus; (prefix) pseudo-; Taiwan pr. (wèi).
So is it helpful to our human hibernation?	那么对我们人类的冬眠是不是有什么帮助呢	
A simple summary	一个简单的总结	
I don't want you to understand anything on this picture	我不希望大家理解这个图上的任何东西啊	
This picture is too complicated	这个图太复杂了	
All i want to say is	我想说的就是	
After 20 years	在20年之后	
We do already know a lot about insect hibernation	我们确实已经知道很多关于虫子冬眠的知识	
Here you can see some English nouns	这上面大家可以看见一些英文的名词	名词 (míng cí) noun.
Basically means a protein	基本上就是意味着一个蛋白质	意味着 (yì wèi zhe) to signify; to mean; to imply. 蛋白质 (dàn bái zhì) protein.
The arrow between is basically like	之间的箭头基本上就像	之间 (zhī jiān) between; among; inter-. 箭头 (jiàn tóu) arrowhead; arrow symbol.
You can imagine this is like a	大家可以想象这就好像一个	这就 (zhè jiù) immediately; at once.

The company's reporting line or a production line is the same

公司的**汇报线**或者说一个**生产线**一样

汇报 (huì bào) to report; to give an account of; to collect information and report back. **线 (xiàn)** thread; string; wire; line; (after a number) tier (unofficial ranking of a Chinese city). **生产线 (shēng chǎn xiàn)** assembly line; production line.

One protein controls another

一个蛋白质**控制**另外一个蛋白质

控制 (kòng zhì) control; to exercise control over; to contain.

Control the third protein

又**控制**第三个蛋白质

Eventually make the bug enter or leave hibernation

最终使得虫子进入冬眠或者离开冬眠

最终 (zuì zhōng) final; ultimate.

You may think this is a bit hard to understand

大家可能会觉得这个已经有点**难以理解**了

难以理解 (nán yǐ lǐ jiě) hard to understand; incomprehensible.

In other words, is the research of this thing completely in my technology?

就是说这个东西的研究是不是已经完全在我的技术

就是说 (jiù shì shuō) in other words; that is.

Beyond understanding

理解**范围**之外

范围 (fàn wéi) range; scope; limit; extent.

Actually not

其实也不是的

I can briefly explain this thing

我可以简单地解释一下这个东西

How did we discover these graphs that are like reporting lines and pipelines

我们是怎么发现这些像**汇报线**像**流水线**一样的图的

流水线 (liú shuǐ xiàn) assembly line; (computing) pipeline.

Everyone knows the traits of our creatures

大家都知道我们**生物**的**性状**

生物 (shēng wù) organism; living creature; life form; biological. **性状 (xìng zhuàng)** nature (i.e. properties of sth); character.

Genetic information is stored in our DNA

遗传信息都存在我们的DNA里

遗传信息 (yí chuán xìn xī) genetic information.

This should be the knowledge of high school biology

这个应该是**高中生物学**的知识

高中生 (gāo zhōng shēng) senior high school student.

Then for example, humans have about 20,000 to 30,000 genes in our genome

然后比如说人类大概有两到三万个**基因**在我们的**基因组**里

基因 (jī yīn) gene (loanword). **基因组 (jī yīn zǔ)** genome.

For this simple bug

对于这个简单的虫子来说

There are almost 20,000 to 30,000 genes in their genome

也差不多是有两三万个**基因**在**它们的基因组**里

它们 (tā men) they (for inanimate objects).

We can say with confidence

我们可以很有信心地说

All the proteins that control hibernation

控制冬眠的这件事的所有蛋白质

Is determined by a certain segment of its DNA

都是它的DNA中间的**某一段**所决定的

某 (mǒu) some; a certain; sb or sth indefinite; such-and-such. **所 (suǒ)** actually; place; classifier for houses, small buildings, institutions etc; that which; particle introducing a relative clause or passive.

So what is a simple and rude but very effective method?

所以一个简单**粗暴**但是非常有效的方法是什么呢

粗暴 (cū bào) rough; cruel.

We randomly put tens of thousands of genes in the genome

我们就**随机**地把基因组上几万个基因

随机 (suí jī) according to the situation; pragmatic; random.

Destroy one by one

一个一个给**破坏掉**

破坏 (pò huài) destruction; damage; to wreck; to break; to destroy.

Then put the bug in an environment suitable for hibernation

然后再把这个虫子放到适合冬眠的环境里

If this worm loses its ability to hibernate

如果这个时候这个虫子就**失去了**冬眠的能力

失去 (shī qù) to lose.

Obviously we can immediately know the gene we destroyed

那我们显然就立刻可以知道我们破坏掉的那个基因

The damaged piece of DNA is precisely related to hibernation

破坏掉的那段DNA**恰恰**就和冬眠**相关**

恰恰 (qià qià) exactly; just; precisely. **相关 (xiāng guān)** related; relevant; pertinent; to be interrelated; (statistics) correlation.

We just use this very crude method

我们就利用这种非常**粗暴**的方法就

In theory, it can help us

理论上讲是可以帮助我们

理论 (lǐ lùn) theory; to argue; to take notice of.

All the biological information about the hibernation of insects are found

虫子冬眠的所有生物学信息都找出来的

This is the first thing I want to talk about

这就是我想讲的第一个事情

Of course, after listening to this story, you may

当然了大家听了这个故事之后可能会

There was an immediate reaction that was

立刻有一个**反应**就是说

反应 (fǎn yìng) to react; to respond; reaction; response; reply; chemical reaction.

OK bug hibernation

OK虫子冬眠

I believe you biologists can figure it out

我相信你们生物学家可以把它**搞**清楚

搞 (gǎo) to do; to make; to go in for; to set up; to get hold of; to take care of.

But hibernation of bugs is too simple

但是虫子冬眠这个**事儿**实在太简单了

事儿 (shì r) one's employment; business; matter that needs to be settled; (northern dialect) (of a person) demanding; trying; troublesome; erhua variant of 事 (shì).

And its hibernation is very different from humans

而且它的冬眠和人类有非常大的区别

Including the temperature that triggers hibernation

包括引发冬眠的温度都不一样

包括 (bāo kuò) to comprise; to include; to involve; to incorporate; to consist of. **引发 (yǐn fā)** to lead to; to trigger; to initiate; to cause; to evoke (emotions). **不一样 (bù yī yàng)** different; distinctive; unlike.

How do we know that the bugs you studied hibernate

我们怎么知道你研究的虫子冬眠

Has something to do with human hibernation

和人的冬眠会有关系呢

So here I am going to tell the second story

所以这儿我要讲的是第二个故事

Is that we can look away from very low-level bugs

就是我们可以把目光从特别**低等**的虫子

低等 (dī děng) inferior.

Move it up until it's at least one mammal

往上**挪**一挪 挪到至少是一个**哺乳动物**

挪 (nuó) to shift; to move. **哺乳动物 (bǔ rǔ dòng wù)** mammal.

This animal is called the Arctic Gopher

这个动物叫**北极地鼠**

北极 (běi jí) the North Pole; the Arctic Pole; the north magnetic pole. **鼠 (shǔ)** rat; mouse.

It almost lives near the Arctic Circle

它差不多生活在**北极圈**附近

北极圈 (běi jí quān) Arctic Circle.

Like this place in Alaska, Siberia

像**阿拉斯加西伯利亚**这个地方

阿拉斯加 (ā lā sī jiā) Alaska, US state. **西伯利亚 (xī bó lì yà)** Siberia.

This gopher is a particularly good hibernating animal

这个地鼠是一个特别**善于**冬眠的动物

善于 (shàn yú) to be good at; to be adept at.

It hibernates in a cave several meters deep for almost seven months a year

它一年差不多有七个月的时间是在深达**几米**的**地洞**里冬眠

几米 (jǐ mǐ) Jimmy Liao (1958-), pen name of 廖福彬 (liào fú bīn), Taiwanese illustrator and picture book writer. **地洞 (dì dòng)** tunnel; cave; burrow; dugout.

It's in summer

它在夏天的时候

A rare summer in the Arctic Circle

在**北极圈**里**难得**的夏天

难得 (nán dé) seldom; rare; hard to come by.

It eats like crazy and stores fat

它就会**疯狂**地吃东西 **储存**脂肪

疯狂 (fēng kuáng) crazy; frantic; extreme popularity. **储存 (chǔ cún)** stockpile; to store; to stockpile; storage. **脂肪 (zhī fáng)** fat (in the body, in a plant, or in food).

Then mate wildly to pass offspring

然后疯狂地**交配传递**后代

交配 (jiāo pèi) mating; copulation (esp. of animals). **传递** (chuán dì) to transmit; to pass on to sb else; (math.) transitive. **后代** (hòu dài) descendant; progeny; posterity; later ages; later generations.

Until there is a signal of winter

直到有冬天的**信号**来临之后

信号 (xìn hào) signal. **来临** (lái lín) to approach; to come closer.

It will immediately look like the picture on the right

它马上就会像右边这个图**展示**的一样

展示 (zhǎn shì) to reveal; to display; to show; to exhibit sth.

To hibernate in a cave

到地洞里去冬眠

For a long time, people didn't know how this animal hibernated

长久以来大家其实并不知道这个动物到底是怎么冬眠的

长久 (cháng jiǔ) (for a) long time. **以来** (yǐ lái) since (a previous event).

Because this place where animals hibernate is so special

因为这个动物冬眠的地方实在是太特别了

It has to dig a very deep hole

它要**挖**一个非常深的洞

挖 (wā) to dig; to excavate; to scoop out.

Human scientists can't get in that hole

那个洞人类**科学家**是进不去的

科学家 (kē xué jiā) scientist.

If you really dig a hole to that place

如果你真的挖一个洞到那个地方去

You will destroy its hibernation environment

你就会破坏掉它冬眠的环境

We don't know how it hibernates

我们也就不知道它到底是怎么冬眠的

Until a few years ago

直到几年前

Everyone thought about a method that is actually not very technical

大家想了一个其实技术**含量**也并不是特别高的方法

含量 (hán liàng) content; quantity contained.

Everyone implanted a small chip under the skin of the arctic hamster

大家就在北极地鼠的**皮下**植入一个很小的**芯片**

皮下 (pí xià) under the skin; subcutaneous (injection). **植入** (zhí rù) to implant. **芯片** (xīn piàn) computer chip; microchip.

Can monitor its various physiological indicators

可以**监测**它的各种**生理指标**

监测 (jiān cè) to monitor. **生理** (shēng lǐ) physiology. **指标** (zhǐ biāo) (production) target; quota; index; indicator; sign; signpost; (computing) pointer.

Put it back into its daily life environment

再把它放回到它的**日常生活**环境里看

日常 (rì cháng) daily; everyday.

How does it hibernate

它是究竟是怎么冬眠的

Then we immediately discovered a particularly interesting phenomenon

然后我们马上发现了一个特别有趣的现象

Is shown on this picture

就是这张图上展示的

The curve in this picture shows the body temperature of the arctic hamster

这张图的**曲线**展示的就是北极地鼠的**体温**

曲线 (qū xiàn) curve; curved line; indirect; in a roundabout way. **体温** (tǐ wēn) (body) temperature.

The trajectory of changes in different months of the year

在**一年中**不同的月变化的**轨迹**

年中 (nián zhōng) within the year; in the middle of the year; mid-year. **轨迹** (guǐ jì) locus; orbit; trajectory; track.

You can see the part on the left of this line

大家可以看到在这个线左边这一部分

It's summer in the Arctic Circle

是北极圈内的夏天

From May to September each year

也就是从每年五月到每年九月这段时间

也就是 (yě jiù shì) that is; i.e.. **每年** (měi nián) every year; each year; yearly. **五月** (wǔ yuè) May; fifth month (of the lunar year). **九月** (jiǔ yuè) September; ninth month (of the lunar year).

During this time

这段时间里

The body temperature of the arctic gopher is well maintained at almost 40 degrees

北极地鼠的体温很好地**维持**在差不多40度的**幅度**里

维持 (wéi chí) to keep; to maintain; to preserve. **幅度** (fú dù) width; extent; range; scope.

This is basically a relatively normal body temperature maintained by smaller mammals

这基本上也是比较**小型**的哺乳动物维持的**比较正常**的体温

小型 (xiǎo xíng) small scale; small size.

You can see

大家可以看到

When the signal of winter comes

当冬天的信号来临的时候

Almost at the end of September and beginning of October

差不多就在九月底**十月初**的时候

十月 (shí yuè) October; tenth month (of the lunar year). **初** (chū) at first; (at the) beginning; first; junior; basic.

After the arctic gopher goes into hibernation

北极地鼠进入冬眠之后

Its body temperature will immediately drop from forty degrees to near zero

它的体温会马上从**四十度**降低到**零度**附近

四十 (sì shí) forty; 40. **零度** (líng dù) zero degree.

Only three to five degrees

只有**三五度**的样子

五度 (wǔ dù) five degrees; fifth (basic musical interval, doh to soh).

Then this process will continue until April of the second year

然后这个过程会一直**持续**到第二年的**四月**

持续 (chí xù) to continue; to persist; sustainable; preservation. **四月 (sì yuè)** April; fourth month (of the lunar year).

This is the hibernation process of the entire arctic gopher

这是整个北极地鼠的冬眠过程

From this change in body temperature

从这个体温的变化中

We immediately saw two very meaningful

我们就马上看到两件非常**有意义**

有意义 (yǒu yì yì) to make sense; to have meaning; to have significance; meaningful; significant; worthwhile; important; interesting.

It is very likely that hibernation will also be very meaningful to humans

很有可能会对人类冬眠也非常**有意义**的事情

the first

第一

Arctic hamsters can even lower their body temperature below zero

北极地鼠甚至可以把自己的体温降到零度以下

That's the right part of the curve

那就是在这个曲线的右边这部分的

From January to April

从**一月**到四月这部分

一月 (yī yuè) January; first month (of the lunar year).

The curve is at the horizontal line The horizontal line is at zero degree

那个曲线是在那条**横线** 那条**横线**是零度

横线 (héng xiàn) horizontal line; horizontal coordinate line.

In other words, the body temperature of the arctic gopher has dropped below freezing

换句话说北极地鼠的体温已经降到**冰点**以下

换句话说 (huàn jù huà shuō) in other words. **冰点 (bīng diǎn)** freezing point.

Then we can ask a question right away

那么我们马上就可以问一个问题

Why doesn't the arctic gopher freeze since it has fallen below freezing

既然降到冰点以下为什么北极地鼠没有**结冰**

结冰 (jié bīng) to freeze.

Everyone knows that freezing is a very serious matter for organisms

大家知道结冰对于**生物体**来说是一个**非常严重**的事情

生物体 (shēng wù tǐ) organism.

Because water turns into ice and its volume expands

因为水变成冰 **体积**会**膨胀**

体积 (tǐ jī) volume; bulk. **膨胀 (péng zhàng)** to expand; to inflate; to swell.

Then all our cells will be broken and pierced by the increased volume of ice

那么我们所有的**细胞**都会被**体积增大**的冰给**撑破 刺破**

细胞 (xì bāo) cell (biology). **增大 (zēng dà)** to enlarge; to amplify; to magnify. **撑破 (chēng pò)** to burst. **刺破 (cì pò)** to puncture; to pierce.

So this is a fatal problem for hibernation

所以这对于冬眠来说是一个**致命**的问题

致命 (zhì mìng) fatal; mortal; deadly; to sacrifice one's life.

So why can arctic gophers avoid this?

那么北极地鼠为什么可以**避免**这件事情

避免 (bì miǎn) to avert; to prevent; to avoid; to refrain from.

We now have a little understanding of this matter

我们现在对于这个事情已经有一**点点**了解

一点点 (yī diǎn diǎn) a little bit.

For example, we know why the blood of arctic gophers

比如说我们知道为什么北极地鼠的**血液**

血液 (xuè yè) blood.

It won't freeze even if it drops below zero

降到零度以下还不结冰

Because its blood contains very high levels of sugar and salt

是因为它的血液中含有**非常高浓度**的糖和盐

含有 (hán yǒu) to contain; including. **浓度 (nóng dù)** concentration (percentage of dissolved material in a solution); consistency; thickness; density; viscosity.

This is like everyone may know a phenomenon called "too cold"

这个就像大家可能知道一个现象叫「**过冷**」

that is

就是说

For example, why are the sprinklers still in winter?

比如冬天的时候**洒水车**为什么还

洒水车 (sǎ shuǐ chē) sprinkler truck.

You can continue to sprinkle water below freezing point, and you can continue to remove ice from the ground

在冰点以下还可以继续**洒水**可以继续除地上的冰

洒水 (sǎ shuǐ) to sprinkle.

Because it sprinkled the salt on the ice

是因为它把盐撒在了冰上

At this time, the freezing point of the water will be significantly reduced

那这个时候水的结冰的点就会**明显降低**

Then the blood of the arctic gopher will not freeze

那么这样的话北极地鼠的血液也就不会结冰了

This is the first point that may be a hint for human hibernation

这是第一点可能对人类冬眠很有**提示**的地方

提示 (tí shì) to point out; to remind (sb of sth); to suggest; suggestion; tip; reminder; notice.

Second, you can see that during the whole hibernation process

第二 大家可以看到在整个冬眠的**过程中**

The body temperature of arctic gophers is not always near zero

北极地鼠的体温并不是一直在零度附近的

It's about every half month or so

它大概**每隔**半个月左右

每隔 (měi gé) at intervals of; every (so often).

Its body temperature has a short rise

它的体温就有一个**短暂的回升**

短暂 (duǎn zàn) of short duration; brief; momentary. **回升** (huí shēng) to rise again after a fall; to pick up; rally (stock market etc).

Rises back to almost forty degrees at this time

回升到差不多四十度 这时候

We actually don't fully understand why

我们现在其实还不是完全理解为什么

Arctic gophers do something like this

北极地鼠要做这样的事

But we believe it must have reason to do such a thing

但是我们相信它一定有做这样事的**道理**

道理 (dào lǐ) reason; argument; sense; principle; basis; justification.

For example, we now have many hypotheses to explain this

比如说我们现在有很多**假说**来解释这件事

假说 (jiǎ shuō) hypothesis.

One of them is to say

其中**之一**是说

之一 (zhī yī) one of (sth); one out of a multitude; one (third, quarter, percent etc).

Arctic gophers do this because

北极地鼠这样做是因为

Long-term freezing for any organism

长时间的**冷冻**对任何生物体

冷冻 (lěng dòng) to freeze; to deep-freeze.

Even hibernating experts like Arctic gophers are not good

哪怕是北极地鼠这种冬眠**专家**来说都是不好的

哪怕 (nǎ pà) even; even if; even though; no matter how. **专家** (zhuān jiā) expert; specialist.

Therefore, in order to ensure that its body will not be frozen in the long-term low temperature

因此为了保证它的**肌体**在长时间的**低温**中不会被**冻坏**

肌体 (jī tǐ) the body; organism (usually human); (fig.) fabric (of society etc); cohesive structure (of an entity). **低温** (dī wēn) low temperature. **冻** (dòng) to freeze; to feel very cold; aspic or jelly.

It needs to periodically return to body temperature briefly

它需要**周期性**地**短暂**地回复体温

周期性 (zhōu qī xìng) periodic; periodicity (math); cyclicity.

Mend its body organs

修补它的身体的**器官**

修补 (xiū bǔ) to mend. **器官** (qì guān) organ (part of body tissue); apparatus.

Make some new proteins

制造一些新的蛋白质

Ensure that its metabolism is able to proceed normally

保证它的新陈代谢是能够正常进行的

So this is for the future

所以这一点对于**未来**

未来 (wèi lái) future; tomorrow; approaching; coming; pending.

We want to develop technology for human hibernation	我们想要 开发 人类冬眠的技术来说	开发 (kāi fā) to exploit (a resource); to open up (for development); to develop.
May also be crucial	可能也是 至关重要的	至关重要 (zhì guān zhòng yào) extremely important; vital; crucial; essential.
Because from this point we know	因为从这一点上我们就知道	
If you keep people in low temperature	如果把人一直冻在低温里	
It is very likely that the reversible hibernation of human health cannot be achieved	很有可能是 没法 实现人类的健康的可 逆转 的冬眠的	没法 (méi fǎ) at a loss; unable to do anything about it; to have no choice. 逆转 (nì zhuǎn) to turn back; to reverse.
Of course you may ask again after hearing this story	当然了 听了这个故事你可能又会问了	
You have studied the hibernation of a little mouse so clearly	你把一个 小老鼠 的冬眠研究得那么清楚	小老鼠 (xiǎo lǎo shǔ) @; at symbol.
It might not help humans much	对人类可能也没什么帮助啊	
Because the difference in evolutionary history between mice and humans is still very big	因为 老鼠 和人在 进化史上的 区别还是非常大的	老鼠 (lǎo shǔ) rat; mouse. 进化 (jìn huà) evolution. 史上 (shǐ shàng) in history.
So the third little thing I want to talk about	所以我要讲的第三个 小事情	小事 (xiǎo shì) trifle; trivial matter.
Is a hibernating primate	是一个冬眠的 灵长类	灵长类 (líng zhǎng lèi) primate (monkey, hominid etc).
Everyone knows that it belongs to the same primate as humans	大家知道它和人同 属于 灵长目	属于 (shǔ yú) to be classified as; to belong to; to be part of. 灵长目 (líng zhǎng mù) primate order (including monkeys, hominids etc).
The kinship is much closer than the little mouse	亲缘关系 要比小老鼠要近得多	亲缘关系 (qīn yuán guān xì) phylogenetic relationship.
This kind of cute animal is called fat-tailed Japanese lemur	这种比较 萌 的动物叫 肥尾倭狐猴	萌 (méng) to sprout; to bud; to have a strong affection for (slang); adorable (loanword from Japanese 萌え moe, slang describing affection for a cute character). 尾 (yǐ) horse's tail; pointed posterior section of a locust etc. 倭 (wō) dwarf; Japanese (derog.) (old). 狐猴 (hú hóu) lemur.
Of course it doesn't look similar to humans	看起来当然和人没有任何 相似 之处	相似 (xiāng sì) to resemble; similar; like; resemblance; similarity.

But its kinship	但是它的亲缘关系	
Like I said, it's still very close to people	就像我讲的 还是非常接近人的	
It is the only one known by humans	它是目前人类 唯一 知道的一种	唯一 (wéi yī) only; sole.
Primates that can hibernate under natural conditions	在 天然 条件下能够冬眠的灵长类动物	天然 (tiān rán) natural.
What's more interesting is that this animal does not live in the Arctic Circle or the Antarctic Circle.	比较有趣的是这种动物并不是生活在 北极圈 或者 南极圈 里	南极 (nán jí) south pole. 圈 (quān) circle; ring; loop; classifier for loops, orbits, laps of race etc; to surround; to circle.
It lives near the tropics	它是生活在 靠近热带 的地方	靠近 (kào jìn) near; to approach. 热带 (rè dài) the tropics; tropical.
Living on the island of Madagascar	生活在 马达加斯加 岛上	马达加斯加 (mǎ dá jiā sī jiā dǎo) Madagascar.
So its hibernation sounds a bit suspicious	所以它的冬眠也听起来有点 可疑	可疑 (kě yí) suspicious; dubious.
But in fact this picture hopes to prove that its hibernation is beyond doubt	但 实际上 这张图希望能够证明它的冬眠是 毋庸置疑 的	实际上 (shí jì shàng) in fact; in reality; as a matter of fact; in practice. 毋庸 (wú yōng) no need for. 置疑 (zhì yí) to doubt.
When Madagascar enters winter	就是当 马达加斯加 进入冬天	马达加斯加 (mǎ dá jiā sī jiā) Madagascar.
Of course, the winter temperature in Madagascar is almost 20 to 30 degrees.	当然 马达加斯加 的冬天气温差不多也有20到30度的样子	
After this kind of Japanese lemur, it can enter hibernation	之后这种 倭狐猴 它就可以进入冬眠	
After entering hibernation	在进入冬眠之后	
Its body temperature can change with the local temperature difference between day and night	它的体温就可以随着 当地昼夜 的 温差 变化而变化	当地 (dāng dì) local. 昼夜 (zhòu yè) day and night; period of 24 hours; continuously, without stop. 温差 (wēn chā) difference in temperature.
This is what this red line demonstrates	就是这条 红线 演示的	红线 (hóng xiàn) red line. 演示 (yǎn shì) to demonstrate; to show; presentation; demonstration.
Of course the temperature is the highest at noon	当然这个 中午 的时候 温度最高	个中 (gè zhōng) therein; in this. 最高 (zuì gāo) tallest; highest; supreme (court etc).
Almost thirty-four-five degrees	差不多有 三十四五 度	三十 (sān shí) thirty; 30.

Then the temperature is lowest at night

然后晚上温度最低

It's almost twenty degrees

差不多有二十度左右的样子

This red is the curve of its body temperature

这个红色就是它体温变化的曲线

The curve of the gray ambient temperature changes perfectly.

和灰色的环境温度变化的曲线是完美地吻合的

灰色 (huī sè) gray; ash gray; grizzly; pessimistic; gloomy; dispirited; ambiguous. 环境温度 (huán jìng wēn dù) environmental temperature. 完美 (wán měi) perfect; perfection; perfectly. 吻合 (wěn hé) to be a good fit; to be identical with; to adjust oneself to; to fit in.

In other words, after this animal enters the so-called hibernation

换句话说 这种动物在进入所谓的冬眠之后

It does not consume any energy to maintain body temperature for metabolism

是不消耗任何能量来维持体温进行新陈代谢的

消耗 (xiāo hào) to use up; to consume. 能量 (néng liàng) energy; capabilities.

So this result

所以这个结果

Just tell us one thing

就告诉我们一件事就说

Maybe put humans such as primates at the top of the evolutionary tree into hibernation.

也许把人类这种处于进化树顶端的灵长类的动物进入冬眠期

处于 (chǔ yú) to be in (some state, position, or condition). 顶端 (dǐng duān) summit; peak.

Not a theoretically impossible thing

并不是一个理论上完全不可能的事情

Because at least we have a close relative, the fat-tailed Japanese lemur that can hibernate

因为至少我们有一个近亲肥尾倭狐猴是可以冬眠的

近亲 (jìn qīn) close relative; near relation.

Another particularly interesting discovery is

另外还有一个特别有趣的发现就是

Everyone found that this kind of Japanese lemur has many closely related monkeys

大家发现这种倭狐猴有很多亲缘关系比较近的猴子

Among these kinds of animals

在这几种动物之中

之中 (zhī zhōng) inside; among; in the midst of (doing sth); during.

This fat-tailed Japanese lemur has the longest life span

这种肥尾倭狐猴的寿命是最长的

Can live to thirty

可以活到三十几岁

十几 (shí jǐ) more than ten; a dozen or more.

Other animals can only live as teenagers

Everyone thinks the reason why it can live longer is because

It spends half a year in this so-called hibernation

This also gives us some confidence

Is if we can really put humans into hibernation

That can effectively extend the limited life of human beings

Of course I'm talking about this, you may

If there is a questioning audience, you may ask such a question

That is what you are talking about now from bugs to monkeys

All the stories are in the natural state

It is already an example of hibernation

We study these things more clearly

Can we use that knowledge to put people in hibernation?

Because we can't voyage for the stars

Make some genetically modified humans that can hibernate to be astronauts

So here I want to tell two very small stories

其它动物只能活十几岁

大家觉得它之所以能特别长寿的原因就是因为

它一年有半年时间是在这种所谓的冬眠中度过

这也给了我们一些信心

就是如果我们真的能把人类放入冬眠

那确实是可以有效地延长人类的有限的生命

当然我讲到这 你们可能

如果有质疑精神的观众可能会问这样一个问题

就是你现在从虫子讲到猴子

所有的故事讲的都是天然状态下

它本身就已经会冬眠的例子

我们把这些东西研究得再清楚

难道就能用那些知识把人放到冬眠里吗

因为我们又不可能为了星际远航

制造出一些能够冬眠的转基因人来做宇航员吧

所以在这儿我想讲两个很小的故事

其它 (qí tā) other; the others; else; other than it; in addition to the thing mentioned above. 只能 (zhǐ néng) can only; obliged to do sth; to have no other choice.

之所以 (zhī suǒ yǐ) the reason why. 长寿 (cháng shòu) Changshou suburban district of Chongqing municipality, formerly in Sichuan.

半年 (bàn nián) half a year.

有限 (yǒu xiàn) limited; finite.

质疑 (zhì yí) to call into question; to question (truth or validity). 精神 (jīng shén) spirit; mind; consciousness; thought; mental; psychological; essence; gist.

它本身 (tā běn shēn) itself.

转基因 (zhuǎn jī yīn) genetic modification.

I hope to partially answer this doubt

希望能部分地**解答**这个**疑惑**

解答 (jiě dá) answer; explanation; solution (to a math equation). **疑惑** (yí huò) to doubt; to distrust; unconvincing; to puzzle over; misgivings; suspicions.

The first is a story in a white mouse

第一 是一个**小白鼠**里的故事

小白鼠 (xiǎo bái shǔ) little white mouse (esp. laboratory animal); fig. guinea pig, i.e. human participant in experiment.

We know that a white mouse cannot hibernate

我们知道小白鼠这种动物它是不会冬眠的

It is in its natural history

它在它的**自然史**上

自然史 (zì rán shǐ) natural history (i.e. botany and zoology).

There hasn't been any hibernation since the emergence of this species

出现这个**物种**到今天就没有出现过任何一次冬眠

物种 (wù zhǒng) species.

We can confidently say

我们可以比较自信地说

But in 2005, when scientists were in the laboratory

但是在2005年的时候科学家在实验室里

For the first time induced a state similar to hibernation

第一次诱导出了类似于冬眠的状态

第一次 (dì yī cì) the first time; first; number one. **诱** (yòu) to entice; to tempt. **导出** (dǎo chū) to derive; derived; derivation; to entail; to induce; to export (data).

What do they do

他们怎么做呢

They kept this little white mouse in a small plastic lunch box

他们就把这个小白鼠关在一个很小的**塑料饭盒**里

塑料 (sù liào) plastics. **饭盒** (fàn hé) lunchbox; mess tin.

And then swallow it with a very low concentration of hydrogen sulfide gas

然后给它**吞**非常低浓度的**硫化氢**气体

吞 (tūn) to swallow; to take. **硫化氢** (liú huà qīng) hydrogen sulfide H₂S; sulfureted hydrogen. **气体** (qì tǐ) gas (i.e. gaseous substance).

Someone may know this gas

这个气体大家可能有人知道

It's the smell of rotten eggs after the eggs rot

就是一种鸡蛋**腐烂**之后**散发**出那种**臭鸡蛋**的**气味**

腐烂 (fǔ làn) to rot; to putrefy; (fig.) corrupt. **发出** (fā chū) to issue (an order, decree etc); to send out; to dispatch; to produce (a sound); to let out (a laugh). **臭** (chòu) stench; smelly; to smell (bad); repulsive; loathsome; terrible; bad; severely; ruthlessly; dud (ammunition). **气味** (qì wèi) odor; scent.

This is the gas

就是这种气体

If the concentration is particularly high, it is toxic

如果浓度特别高是**有毒**的

有毒 (yǒu dú) poisonous.

But this group of scientists discovered

但是这组科学家他们就发现

If you swallow a very low concentration of hydrogen sulfide into this mouse

What phenomenon does it see

The first is like the curve shown above

The U-shaped curve shows that

The body temperature of this little mouse will instantly change from 40 degrees under normal conditions

Reduced to only about fifteen degrees

And can last up to six to eight hours

At the same time these little mice consume carbon dioxide

In other words, it's the level of metabolism

It's also reduced to about 20%

Can also last about six to eight hours

At the same time after this six to eight hours is over

We have done a series of work to verify the health of these little mice

Did not notice any obvious health problems

In other words, this experiment proved

Maybe we can think of some external environmental stimuli

如果把非常低浓度的硫化氢吞给这个**小鼠**之后

它看到的是什么现象呢

第一就像这个图上面展示的那个**曲线**

那个**U形**的曲线展示**那样**

这个小老鼠的体温会**瞬间**从正常条件下的四十度

降低到只有**十五度**左右的范围

而且可以持续**长达**六到八个小时

同时这些小老鼠对**二氧化碳**的消耗

换句话说 就是它新陈代谢的水平

也降到了原来只有百分之二十左右

也可以持续大概六到八个小时

同时在这个六到八个小时时间结束之后

我们做了一**系列**的工作来**验证**这些小老鼠的**健康状况**

没有发现出现任何明显的健康问题

换句话说这个实验证明

也许我们可以**想出**一些**外在**的环境的**刺激因素**

小鼠 (xiǎo shǔ) mouse.

形 (xíng) to appear; to look; form; shape. **那样** (nà yàng) that kind; that sort.

瞬间 (shùn jiān) in an instant; in a flash.

十五 (shí wǔ) fifteen; 15.

长达 (cháng dá) to extend as long as; to lengthen out to.

二氧化碳 (èr yǎng huà tàn) carbon dioxide CO₂.

一系列 (yī xì liè) a series of; a string of. **验证** (yàn zhèng) to inspect and verify; experimental verification; to validate (a theory); to authenticate. **健康状况** (jiàn kāng zhuàng kuàng) health status.

想出 (xiǎng chū) to figure out; to work out (a solution etc); to think up; to come up with (an idea etc). **外在** (wài zài) external; extrinsic. **刺激** (cì jī) to provoke; to irritate; to upset; to stimulate; to excite; irritant. **因素** (yīn sù) element; factor.

Make things that can't hibernate at all	使得那些本来 压根 就不能冬眠的东西	压根 (yà gēn) from the start; absolutely; entirely; simply.
Enter hibernation under certain conditions	进入某种条件下的冬眠	
Since little mouse can do this	既然小老鼠能这么做	
Then maybe people can do the same	那么也许人也可以这样做	
The last thing I want to say is	我最后想说的是	
Because of ethical and technical limitations	因为伦理和技术 手段 的 限制	手段 (shǒu duàn) method; means (of doing sth); strategy; trick. 限制 (xiàn zhì) to restrict; to limit; to confine; restriction; limit.
We have no way	我们现在没有任何办法	
Use real people to do all the experiments I just mentioned	把真的人 拿来 做刚才我说的所有 实验	拿来 (ná lái) to bring; to fetch; to get. 实验 (shí yàn) experiment; test; experimental; to experiment.
Study which method can put people into hibernation	研究哪种方法可以让人进入冬眠	
But there is such a story, I want to stay here to tell everyone	但是有这样一个故事 我想留在这儿告诉大家	
This handsome guy on the picture is called Da Yue San Jing	图上 这位帅哥 叫打越三敬	这位 (zhè wèi) this (person). 帅哥 (shuài gē) handsome guy; lady-killer; handsome (form of address). 敬 (jìng) to respect; to venerate; to salute; to offer.
He is a japanese	他是一个 日本人	日本人 (rì běn rén) Japanese person or people.
When he was in 2006	他在06年的时候	
Just a year after the little mouse was hibernated	就在小老鼠冬眠发现之后的一年之后	
A piece of news basically swept the world's major media	出了一个新闻基本上 席卷 了全球的主要 媒体	席卷 (xí juǎn) to engulf; to sweep; to carry away everything. 媒体 (méi tǐ) media, esp. news media.
What did he do	他做了一件 什么事儿 呢	什么事 (shén me shì) what?; which?.
He is a Kobe native, a small clerk in Kobe	他是一个 神户人 一个神户的小 职员	神户 (shén hù) Kōbe, major Japanese port near Ōsaka. 职员 (zhí yuán) office worker; staff member.
He had a fall with his friends	他有一年秋天和他的朋友们	

Go out to the scenic spot near
Kobe called Mount Rokko

到神户附近的**风景名胜**叫**六甲山**
那边去**踏青**

风景 (fēng jǐng) scenery; landscape. **名胜** (míng shèng) a place famous for its scenery or historical relics; scenic spot. **六甲** (liù jiǎ) Liuchia township in Tainan county 台南县 (tái nán xiàn), Taiwan. **那边** (nà bian) over there; yonder. **踏青** (tà qīng) lit. tread the green; go for a walk in the spring (when the grass has turned green); spring hike season around Qingming festival 清明, 4th-6th April.

On the way back from the
outing, he left the team
without permission and then

在踏青回来的**路上**他**擅自****脱队**然
后

路上 (lù shang) on the road; on a journey; road surface. **擅自** (shàn zì) without permission. **队** (duì) squadron; team; group.

Fell off a cliff

从一个**悬崖**上**摔**了下来

悬崖 (xuán yá) precipice; overhanging cliff. **摔** (shuāi) to throw down; to fall; to drop and break.

Broke his spine

摔伤了他的**脊椎**

摔伤 (shuāi shāng) to injure oneself in a fall. **脊椎** (jǐ zhuī) vertebra; backbone.

So he can't call for help himself

所以他没法自己**呼救**

呼救 (hū jiù) to call for help.

I can't go back to where I
started

也没法走回**出发**的地方

Of course the next part is his
narrative

当然**接下来**这部分是他的**自述**

接下来 (jiē xià lái) to accept; to take; next; following. **自述** (zì shù) to recount in one's own words; autobiography; written self-introduction.

We cannot guarantee 100%
authenticity

我们不能保证**百分之百****真实**

百分之百 (bǎi fēn zhī bǎi) a hundred percent; out and out; absolutely. **真实** (zhēn shí) true; real.

He said that after a day of
hunger

他说在**经过**了一天的**饥饿**之后

饥饿 (jī è) hunger; starvation; famine.

He feels warm when the sun is
on him

太阳**晒**在他**身上**他觉得**暖洋洋**的

晒 (shài) (of the sun) to shine on; to bask in (the sunshine); to dry (clothes, grain etc) in the sun; (fig.) to expose and share (one's experiences and thoughts) on the Web (loanword from "share"); (coll.) to give the cold shoulder to. **身上** (shēn shang) on the body; at hand; among. **暖洋洋** (nuǎn yáng yáng) warm; comfortably warm.

So he fell asleep without
knowing it

所以他**不知不觉**之中就**睡**过去了

不知不觉 (bù zhī bù jué) unconsciously; unwittingly. **过去** (guò qu) (verb suffix).

Of course we can't verify this

这件事当然我们无法**考证**

考证 (kǎo zhèng) to do textual research; to make textual criticism.

What can we verify

我们能**考证**的是什么呢

After 22 days, a human rescue
team

就是在**22天**之后**一组**人类的**救援**
队

救援队 (jiù yuán duì) rescue team.

Found him in the same valley

在同样的山谷里发现了他

同样 (tóng yàng) same; equal; equivalent. 山谷 (shān gǔ) valley; ravine.

At that time his temperature had dropped to 22 degrees

那个时候他的体温已经降到22度

There is basically no breathing or heartbeat

基本上没有任何呼吸和心跳

呼吸 (hū xī) to breathe. 心跳 (xīn tiào) heartbeat; pulse.

But after going through hospital care

但是在经过医院的护理之后

护理 (hù lǐ) to nurse; to tend and protect.

He did not have any health problems and was discharged smoothly

他没有出现任何健康问题 顺利出院了

In other words, we have reason to believe that in the past 22 days

换句话说我们有理由相信在过去那22天

理由 (lǐ yóu) reason; grounds; justification.

When trapped in the valley

被困在山谷里的时候

This middle-aged Japanese man named Tagoshi Sankei

这个叫打越三敬的日本中年人

中年 (zhōng nián) middle age.

It is possible to enter a very low metabolic rate similar to hibernation

有可能进入了一种类似于冬眠的新陈代谢率极低

率 (shuài) to lead; to command; rash; hasty; frank; straightforward; generally; usually.

Such a hibernating state with extremely low consumption of nutrients and oxygen

对营养和氧气消耗极低的这么一个类冬眠的状态

营养 (yíng yǎng) nutrition; nourishment. 氧气 (yǎng qì) oxygen.

So at least this

所以至少这个

of course

当然

To be honest

说老实话

实话 (shí huà) truth.

The example of Taekoshi Sankei I can find in the mainstream media

打越三敬的例子是我能从主流媒体上找到的

流媒体 (liú méi tǐ) streaming media.

The only example of human hibernation that I believe

唯一一个我自己比较相信的人类冬眠的例子

Of course this example also gave me a lot of confidence

当然这个例子也给了我很多信心

Makes me believe that maybe one day we can really take the things I just said

使得我相信也许有一天我们真的可以把刚才我说的那些

Whether it's a bug or a mouse or a monkey

不管是虫子也好 小老鼠也好或者是猴子也好

The research results obtained on hibernation are finally used on humans

得到的关于冬眠的研究**成果**最终放在人身上用

成果 (chéng guǒ) result; achievement; gain; profit.

Inspire the kind of possible existence in the human body

激发出人类身体里那种可能存在的

Potential to put people into hibernation

能让人进入冬眠的**潜能**

潜能 (qián néng) potential; hidden capability.

Use hibernation to achieve our leap over time and space

利用冬眠来实现我们对时间和**空间**的**跨越**

空间 (kōng jiān) space; room; (fig.) scope; leeway; (astronomy) outer space; (physics, math.) space. **跨越 (kuà yuè)** to step across; step over.

This is the first story I want to tell

这是我要讲的第一个故事

Eventually I will spend a few minutes telling another little story

最终我会花几分钟时间讲另外一个**小故事**

It might sound a bit more sci-fi

就是可能听起来会更科幻一点

Is immortality

就是长生不老

This is another way to help us cross time and space in a sci-fi sense

这是另外一个科幻意义上可以帮助我们**跨越**时空的方法

If we can make astronauts never age

我们如果能让宇航员**从不**衰老

从不 (cóng bù) never.

Or let astronauts live from 70 to 80 years old

或者让宇航员从活70到80岁

Become two hundred and three hundred years old, two thousand years old and three thousand years old

变得活两百岁三百岁 两千岁三千岁

Then the spaceship piloted by the astronaut

那么这宇航员**驾驶**的宇宙飞船

驾驶 (jià shǐ) to pilot (ship, airplane etc); to drive.

Of course it can lead mankind to a farther frontier of the universe

当然就可以**带领**人类走到更远的宇宙**边疆**去了

带领 (dài lǐng) to guide; to lead. **边疆 (biān jiāng)** border area; borderland; frontier; frontier region.

But first I have to pour some cold water

不过首先我得泼一番**冷水**

番 (fān) foreign (non-Chinese); barbarian; classifier for occurrences (of an event, action or speech utterance); classifier for iterations: times, -fold (as in twofold etc); classifier for situations: kind, sort. **冷水 (lěng shuǐ)** cold water; unboiled water; fig. not yet ready (of plans).

It's this topic

就是这个话题

Immortality is likely to be based on the biological theoretical framework known to man

Impossible like hibernation

Realized so thoroughly why

Because if we only look at the lifespan of creatures in the earth's biosphere

Will find a very big difference

I show you two kinds of creatures

The little bug on the left is called mayfly

You may have heard of this animal

After this animal emerges as an adult

Generally only a few hours to one or two days of life

Because its adults can neither eat

Can't digest things

Its sole purpose for survival is to breed offspring

This animal will die within a few hours

Shown on the right is a plant called North American trembling poplar

What about this plant

A plant can reproduce an entire forest through underground roots

长生不老很有可能在人类已知的生物学理论**框架**上

不可能像冬眠那样

实现得那么**彻底** 为什么呢

因为如果我们仅仅看地球**生物圈**上生物的寿命

会发现有很大的差别

我这张展示给大家的是两种生物

左边这个小虫子叫**蜉蝣**

大家可能听说过这种动物

这种动物**羽化**成为**成虫**之后

一般只有几个小时到一两天的寿命

因为它的成虫既不能吃东西

也不能**消化**东西

它生存的唯一目的就是**繁殖**后代

这种动物基本上几个小时就会**死**掉

右边展示的是一种叫**北美颤杨**的一种植物

这种植物呢

一棵植物可以通过**地下根**繁殖出**整整**一片森林来

框架 (kuàng jià) frame; framework; fig. pattern; outline; organizing plan.

彻底 (chè dǐ) thorough; thoroughly; complete.

生物圈 (shēng wù quān) biosphere; ecosphere.

蜉蝣 (fú yóu) mayfly.

羽化 (yǔ huà) levitation (of Daoist immortal); to become as light as a feather and ascend to heaven; (in Daoism) to become immortal; to die; of winged insects, to emerge from the cocoon in adult form; eclosion. **成虫** (chéng chóng) imago (adult, sexually mature insect, the final stage of its development).

消化 (xiāo huà) to digest; digestion; digestive.

繁殖 (fán zhí) to breed; to reproduce; to propagate.

会死 (huì sǐ) mortal.

北美 (běi měi) North America. **颤** (chàn) to tremble; to shiver; to shake; to vibrate; Taiwan pr. (zhàn).

地下 (dì xià) underground; subterranean; covert. **整整** (zhěng zhěng) whole; full.

Everyone currently speculates that this trembling poplar can live up to 60,000 to 80,000 years

Comparing these two plants, you will find

Just like our comparison at the beginning

Just in the earth's biosphere

The difference between the theoretical life span of different organisms

Can be as large as eight to nine orders of magnitude

The difference of this order of magnitude immediately tells us one thing

Life is probably an intrinsic property of living things

It was formed by a long evolutionary history

We are unlikely to change our living habits by changing the environment

Or just take two pills to increase it by several orders of magnitude

This possibility should be very small

But this does not mean that we are

Or we can't do anything about being immortal

I think there is an example that can be shown to everyone

Our current research in human biology tells us

大家目前**推测**这种颤杨最多可以活六到八**万年**

这两种植物**一对**比大家会发现

就像一开始我们那个**对比**一样

仅仅是在地球生物圈里

不同生物的理论寿命之间的差别

可以大到八到九个数量级

那这个数量级的差别就马上告诉我们一件事就是说

寿命这个东西大概是生物的一个**内在属性**

它是**漫长**进化史**形成**的

我们不太可能通过改变环境 改变生活习惯

或者吃两个**药片**就把它提高几个数量级

这个**可能性**应该是非常小的

但这也不意味着我们对于寿命

或者说对于长生不老我们不能做任何事情

我觉得有一个例子可以展示给大家看

我们现在人类生物学的研究告诉我们

推测 (tuī cè) speculation; to conjecture; to surmise; to speculate. **万年** (wàn nián) Wannian county in Shangrao 上饶, Jiangxi.

一对 (yī duì) couple; pair.

对比 (duì bǐ) to contrast; contrast; ratio.

内在 (nèi zài) inner; internal; intrinsic; innate. **属性** (shǔ xìng) attribute; property.

漫长 (màn cháng) very long; endless. **形成** (xíng chéng) to form; to take shape.

药片 (yào piàn) a (medicine) pill or tablet.

可能性 (kě néng xìng) possibility; probability.

A more conclusive method that can significantly extend life

比较**确凿无疑**的可以**显著**延长寿命的方法

确凿 (què záo) definite; conclusive; undeniable; authentic; also pr. (què zuò). **无疑** (wú yí) no doubt; undoubtedly. **显著** (xiǎn zhù) outstanding; notable; remarkable; statistically significant. **延** (yán) to prolong; to extend; to delay.

Maybe only this one

可能只有这一个

That is to eat less

那就是少吃

This is the simplest yeast

这是一个从最简单的**酵母**

酵母 (jiào mǔ) leaven; yeast.

To more complicated bugs and fruit flies

到比较复杂一点的虫子和**果蝇**

果蝇 (guǒ yíng) fruit fly.

To more complicated mice and monkeys

到更复杂的小老鼠和猴子

There is even a mechanism that extends life span

甚至到人都有可能存在的一个延长寿命的**机理**

机理 (jī lǐ) mechanism.

This picture shows a research result of the University of Wisconsin in 2014

这个图里展示的是2014年**威斯康辛**大学的一个研究成果

威斯康辛 (wēi sī kāng xīn) Wisconsin.

Two monkeys are shut in this picture

在这个图里关了两只猴子

You may clearly see which monkey is healthier

大家可能很明显就看出来哪只猴子比较健康

This is the monkey on the left that is crawling around

就是这个左边的正在爬来爬去的猴子

Whether it is from the gloss of the hair

它不管是从**毛发的光泽度**

毛发 (máo fà) hair. **光泽** (guāng zé) Guangze county in Nanping 南平 (nán píng) Fujian.

From the wrinkles on its face and even from its eyes

从它脸上的褶皱甚至从它**眼神**

眼神 (yǎn shén) expression or emotion showing in one's eyes; meaningful glance; wink; eyesight (dialect).

Everyone may think it is obviously much younger and stronger

大家都可能觉得它明显要年轻**健壮**得多

健壮 (jiàn zhuàng) robust; healthy; sturdy.

And the monkey on the right is obviously old-fashioned

而右边这个猴子明显就是**老态龙钟**

老态龙钟 (lǎo tài lóng zhōng) doddering; senile.

May have entered old age

可能已经进入**老年期**了

老年期 (lǎo nián qī) old age.

Actually the two monkeys are about the same age

其实两个猴子年龄差不多

The monkey on the left is 27 years old, the monkey on the right is 29 years old

左边那个猴子是27岁 右边那个猴子29岁

The difference between the two is

它俩的区别是

The monkey on the left has only eaten to 70% full in life history

左边这个猴子在生活史上一直仅仅吃到七分饱

Just compare with the monkey on the right

就和右边那个猴子比 吃到七分饱

Of course as a biologist I have to emphasize

当然作为一个生物学家我必须得**强调**

强调 (qiáng diào) to emphasize (a statement); to stress.

Regarding whether eating less can really help you live longer

关于少吃是不是真能长命这个事情

The most rigorous set of experiments has not been done in human society

在人类社会里还没有做最严格的那**套**实验

套 (tào) to cover; to encase; cover; sheath; to overlap; to interleave; to model after; to copy; formula; harness; loop of rope; (fig.) to fish for; to obtain slyly; classifier for sets, collections; bend (of a river or mountain range, in place names); tau (Greek letter Ττ).

We now know that the most conclusive animal is the monkey

我们现在知道比较确凿的**最高级**的动物就是猴子

高级 (gāo jí) high level; high grade; advanced; high-ranking.

Of course, when you see this, you may ask

当然大家看到这个可能会问

Even if you know that eating less can help you live longer

你即便知道少吃能长命又怎么样

Are you going to put the astronauts in one

难道你要把宇航员放在一个

Deliberately giving him food and clothing to let him live longer

故意给他缺吃少穿让他活得长一点

To help us explore the universe?

去帮我们探索宇宙吗

This is too inhumane, right?

这也太**不人道**了是吧

不人道 (bù rén dào) inhuman.

But if we know for sure that eating less can live longer

但是如果我们确凿无疑地知道少吃能长命

Then we can have such a hypothesis

那我们就可以有这样一个假设

It's because you can live longer if you eat less

就是少吃之所以能长命

Because it affects the function of certain genes and proteins in our body

是因为它影响了我们身体里**某些**基因**某些**蛋白质的功能

某些 (mǒu xiē) some; certain (things).

Eventually lead to a long life

最终**导致**长命这件事

导致 (dǎo zhì) to lead to; to create; to cause; to bring about.

So if we can better understand

所以如果我们能够更好地理解

What biological basis does eating less make us live longer?

少吃是通过**什么样**的生物学基础使得我们长命的

什么样 (shén me yàng) what kind?; what sort?; what appearance?.

Then we can design other ways to avoid eating less

那我们就可以**设计**其他的方法**绕**开少吃这件事

设计 (shè jì) plan; design; to design; to plan. **绕** (rào) to wind; to coil (thread); to rotate around; to spiral; to move around; to go round (an obstacle); to by-pass; to make a detour; to confuse; to perplex.

It's a long life, right?

直接实现长命了 **对不对**

对不对 (duì bù duì) right or wrong?; Is it right?; OK, yes? (colloquial).

Give two simple examples for everyone

举两个简单的例子给大家

The first example is still related to bugs

第一个例子还是跟虫子**有关**

有关 (yǒu guān) to have sth to do with; to relate to; related to; to concern; concerning.

In this picture we show two kinds of bugs

在这个图里我们展示的是两种虫子

The bug on the left is a normal bug

左边这个虫子是正常的虫子

Interruption, both insects are almost 20 days old

插句话 两种虫子都是差不多二十天

插 (chā) to insert; stick in; pierce; to take part in; to interfere; to interpose.

It's basically the limit of the lifespan of the worm under normal conditions

基本上是虫子正常情况下的寿命的极限了

You can see that the bug on the left basically has no trace of movement

左边这个虫子大家可以看到基本上没有任何**挪动**的痕迹

挪动 (nuó dòng) to move; to shift.

Basically waiting to die

基本上已经在等死的状态

The bug on the right

右边这个虫子它的

At least from this movement track

至少从这个运动轨迹上看

It should be young and happy

应该还是**生龙活虎**的比较年轻比较高兴的状态

生龙活虎 (shēng lóng huó hǔ) lit. lively dragon and animated tiger (idiom); fig. vigorous and lively.

Why is this bug on the right like this

右边这个虫子为什么是这样的

Because it carries a mutant type of gene

因为它身上**携带**了一个基因的**突变型**

携带 (xié dài) to carry (on one's person); to support (old); Taiwan pr. (xī dài). **突变** (tū biàn) sudden change; mutation. **型** (xíng) mold; type; style; model.

This gene is related to the synthesis of insulin

这个基因是和**胰岛素的合成**有关系的

胰岛素 (yí dào sù) insulin. **合成** (hé chéng) to compose; to constitute; compound; synthesis; mixture; synthetic.

And why does this matter have to do with eating less

而这个事情为什么和**少吃**有关系呢

Because we already know that eating less can extend life

因为我们已经知道**少吃**之所以能够**延长寿命**

It is related to the function and activity of the insulin protein in our body

是和我们**体内**的**胰岛素的蛋白质**的功能和**活性**有关系的

体内 (tǐ nèi) within the body; in vivo (vs in vitro); internal to. **活性** (huó xìng) (chemistry) activity; active; activated.

So this example of the longevity gene tells us

所以这个**长寿基因**这个例子就告诉我们

If we can really understand why we live longer

如果我们真的能够理解**少吃**为什么**长寿**

We can consciously change the genomes of animals and even humans

我们就可以**有意识地**改变动物甚至是人类的**基因组**

有意识 (yǒu yì shí) conscious.

So that animals and people can effectively extend their lifespan

使得动物和人可以有效地**延长寿命**

Of course you may say that genetic manipulation on humans is unethical

当然你可能说在**人身上**做**遗传操作**有**悖伦理**

遗传 (yí chuán) heredity; to inherit (a trait); to pass on (to one's offspring). **操作** (cāo zuò) to work; to operate; to manipulate. **悖** (bèi) to go against; to be contrary to; perverse; rebellious.

We don't think about it first.

我们先不**考虑**它 也可以

Then there is another way that might be smarter

那么还有一个可能更**聪明**一点的方法就是

We might be able to design some drugs

我们也许可以设计一些**药物**

药物 (yào wù) medicaments; pharmaceuticals; medication; medicine; drug.

Change the function and activity of these proteins and genes related to longevity

改变这些能够和**长寿**相关的**蛋白质**和**基因**的功能和**活性**

It simulates the state of eating less in the body so that we can live longer

在**体内****模拟**出**少吃**的状态 使得我们能活得**更长**一点

模拟 (mó nǐ) imitation; to simulate; to imitate; analog (device, as opposed to digital).

This is really not a fantasy

这个还已经真的不是**天方夜谭**了

天方夜谭 (tiān fāng yè tán) The Arabian Nights (classic story).

Is what I call the task of finding the elixir of longevity

就是我所说的**寻找**长寿**仙丹**的任务

寻找 (xún zhǎo) to seek; to look for. **仙丹** (xiān dān) elixir; magic potion.

Has basically happened around us

已经基本上在我们**身边**发生了

身边 (shēn biān) at one's side; on hand.

What we are talking about on this picture are two small molecule drugs

我们这个图上**说到**的是两种**小分子**的药物

说到 (shuō dào) to talk about; to mention; (preposition) as for. **分子** (fēn zǐ) members of a class or group; political elements (such as intellectuals or extremists); part.

This on the left

左边这种

If you are familiar with diabetes, chances are you have heard of it

大家如果对**糖尿病**比较熟悉 很有可能听说过它

糖尿病 (táng niào bìng) diabetes; diabetes mellitus.

Its name is metformin

它的名字叫**二甲双胍**

二甲 (èr jiǎ) 2nd rank of candidates who passed the imperial examination (i.e. 4th place and up). **胍** (guā) guanidine.

It is currently the first-line drug of choice for diabetic patients worldwide

是目前全球糖尿病人的一**线**首**选**用药

一线 (yī xiàn) front line. **首选** (shǒu xuǎn) first choice; premium; to come first in the imperial examinations.

Maybe hundreds of millions of people around the world are taking this medicine routinely every day to stay healthy

可能全球每天都有几亿人在**常规**吃这个**药物****保持**健康

常规 (cháng guī) code of conduct; conventions; common practice; routine (medical procedure etc). **保持** (bǎo chí) to keep; to maintain; to hold; to preserve.

This drug is obviously

这个**药物**它显然

Because it treats diabetes

因为它是**治疗**糖尿病的

治疗 (zhì liáo) to treat (an illness); medical treatment; therapy.

Its mechanism of action is related to insulin

它的作用机理是和**胰岛素**相关的

And we already know

而我们已经知道

Insulin is related to the process that leads to longevity by eating less

胰岛素是和少吃导致长寿的这个**过程**相关的

So many people guess

因此就有很多人**猜测**

猜测 (cāi cè) to guess; to conjecture; to surmise.

If you give this medicine for diabetes to healthy people

如果给健康人吃这种**治疗**糖尿病的**药物**

Can it effectively extend life

是不是就可以有效地**延长**寿命

This is no longer science fiction, it has happened in reality

这个已经不是**科幻** 已经在**现实**中发生

现实 (xiàn shí) reality; actuality; real; actual; realistic; pragmatic; materialistic; self-interested.

Because there are already several clinical trials recruiting healthy people	因为目前已经有几个 临床 实验在 招募 健康人	临床 (lín chuáng) clinical. 招募 (zhāo mù) to recruit; to enlist.
Let them take metformin on a regular basis	让他们 定期服用 二甲双胍这种药物	定期 (dìng qī) at set dates; at regular intervals; periodic; limited to a fixed period of time; fixed term. 服用 (fú yòng) to take (medicine).
To see if it can effectively extend their lifespan	看看是不是可以有效地延长他们的 寿命	
The drug on the left looks much more complicated	左边这种药物看起来 结构 要复杂很多	结构 (jié gòu) structure; composition; makeup; architecture.
Its name is rapamycin	它的名字叫 雷帕霉素	雷 (léi) thunder; mine (weapon); (Internet slang) terrifying; terrific. 帕 (pà) to wrap; kerchief; handkerchief; headscarf; pascal (SI unit). 霉素 (méi sù) teichomycin; -mycin.
It sounds much niche than metformin	它就听起来要比二甲双胍 小众 很多	小众 (xiǎo zhòng) minority of the population; non-mainstream (activity, pursuit etc); niche (market etc).
It is an immunosuppressant used on patients undergoing organ transplantation	它是一个用在器官 移植 的 病人 身上的一个 免疫抑制剂	移植 (yí zhí) to transplant. 病人 (bìng rén) sick person; patient; invalid. 免疫 (miǎn yì) immunity (to disease). 抑制剂 (yì zhì jì) suppressant; inhibitor.
Can effectively suppress organ rejection	可以有效地 抑制 器官 排斥 这么一件事情	抑制 (yì zhì) to inhibit; to keep down; to suppress. 排斥 (pái chì) to reject; to exclude; to eliminate; to remove; to repel.
It is such a drug that occurs in fungi	它是在 真菌 里发生的这么一种药物	真菌 (zhēn jūn) fungi; fungus.
People found that this drug can also affect another	这种药物人们发现它也可以影响另外一种	
A protein that can respond to less eating and make animals live longer	能够 响应 少吃 使动物多活一段时间的一个蛋白质	响应 (xiǎng yìng) to respond to; answer.
So by analogy, everyone will guess	所以 以此类推 大家也会猜测	以此类推 (yǐ cǐ lèi tuī) and so on; in a similar fashion.
If we take this medicine	如果我们吃了这种药物之后	
Can you live longer	是不是也可以活得更长一点	
We currently have enough evidence to prove	我们目前已经有足够的 证据 证明	证据 (zhèng jù) evidence; proof; testimony.
It's in some larger animals	它在一些比较大的动物	
For example, if rats take this drug,	比如说 大鼠 身上如果服用这种药物之后	大鼠 (dà shǔ) rat.

It can actually make this animal live about 10% to 20% longer

In fact, it is a very significant improvement for people

And even better is that one of the benefits of this medicine is

We don't need to start eating from the day of birth

We start eating from the day we age

Maybe you can increase your lifespan

At least from the experiment in rats, we can deduce such a result

So this medicine in the foreseeable future

Will also enter human clinical trials

We can see it in healthy people

Can it also effectively help us improve our lifespan

So what I want to tell is basically these two short stories

一个和冬眠相关一个和长生不老相关

然后我希望讲完这两个故事之后能告诉大家的信息就是

是的 宇宙的半径 四百六十亿光年

和人类的寿命之间的鸿沟还是非常非常大

大概有八到九个数量级

确实可以让这种动物多活大概10%到20%

其实对于人来说已经是一个非常显著的提升了

而且更妙的是这种药的一个好处是

我们不需要从出生那天开始吃

我们从衰老的那天开始吃

也许就可以实现寿命的提高

至少从大鼠的实验来看我们可以推导出这么一个结果

所以这个药在可预见的将来

也会进入人的临床试验

我们可以看到它在健康的人身上

是不是也可以有效地帮助我们提高寿命

所以我想讲的基本上就是这么两个小故事

一个和冬眠相关一个和长生不老相关

然后我希望讲完这两个故事之后能告诉大家的信息就是

是的 宇宙的半径 四百六十亿光年

和人类的寿命之间的鸿沟还是非常非常大

大概有八到九个数量级

妙 (miào) clever; wonderful.

那天 (nà tiān) that day; the other day.

来看 (lái kàn) to come and see; to see a topic from a certain point of view.

预见 (yù jiàn) to foresee; to predict; to forecast; to envision; foresight; intuition; vision.

试验 (shì yàn) experiment; test; to experiment; experimental.

是的 (shì de) yes, that's right; variant of 似的 (shì de). 六十 (liù shí) sixty; 60.

鸿沟 (hóng gōu) (fig.) gulf; chasm; wide gap; (originally) the Hong Canal in Henan, which in ancient times formed the border between enemies Chu 楚 and Han 汉.

但是我们至少在我们周围已经发生了一些科学进展和科学发现

能够在一点一滴地但是坚定不移地

帮助我们弥合这两个巨大的数量级的差异的鸿沟

最终有一天可以实现把人类送向星际远航

送向人类社会最后的远方

最后我想用一句话灌点鸡汤来结束我的报告

That is

虽然我们的生活不能没有苟且

但是科学可以带我们到远方

而且我也希望在座的所有人

可以和科学一起到最后的远方

Thank you

字幕志愿者：小草

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那就是

虽然我们的生活不能没有**苟且**

但是科学可以带我们到**远方**

而且我也希望在座的所有人

可以和科学一起到**最后的远方**

谢谢

字幕志愿者：小草

进展 (jìn zhǎn) to make headway; to make progress.

一点一滴 (yī diǎn yī dī) bit by bit; every little bit. **坚定不移** (jiān dìng bù yí) unswerving; unflinching.

弥合 (mí hé) to cause a wound to close up and heal. **巨大** (jù dà) huge; immense; very large; tremendous; gigantic; enormous. **差异** (chā yì) difference; discrepancy.

远方 (yuǎn fāng) far away; a distant location.

一句话 (yī jù huà) in a word; in short. **灌** (guàn) to irrigate; to pour; to install (software); to record (music). **鸡汤** (jī tāng) chicken stock; chicken soup; (fig.) chicken soup for the soul – i.e. feel-good motivational stories (often used disparagingly because the stories don't really effect change in people's lives). **报告** (bào gào) to inform; to report; to make known; report; speech; talk; lecture.

苟且 (gǒu qiě) perfunctory; careless; drifting along; resigned to one's fate; improper (relations); illicit (sex).

字幕 (zì mù) caption; subtitle. **志愿者** (zhì yuàn zhě) volunteer.