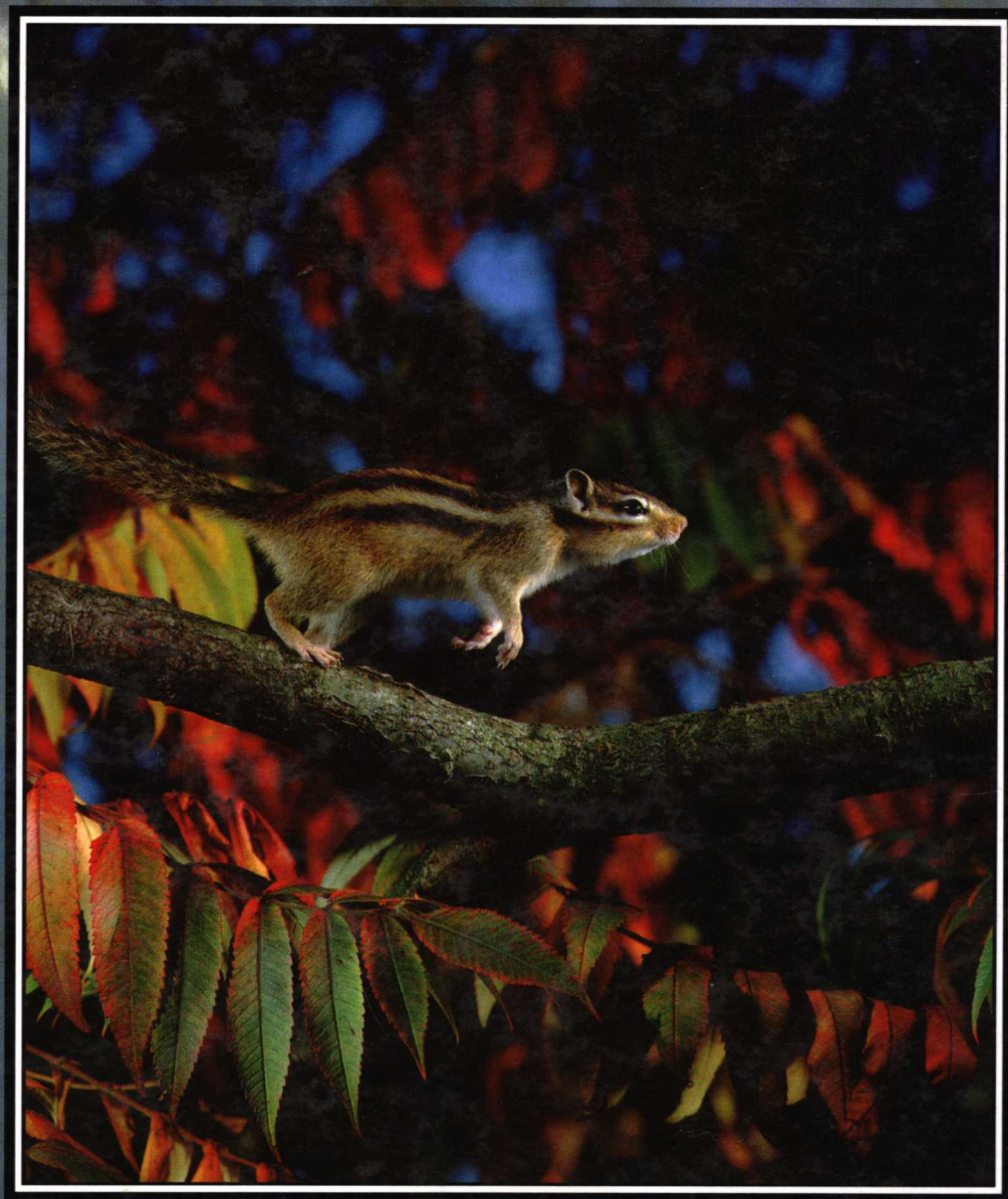


The Nature and Science of **ENERGY**

# 能量的奥秘



Jane Burton and Kim Taylor 著 杨晓洪 译



外语教学与研究出版社

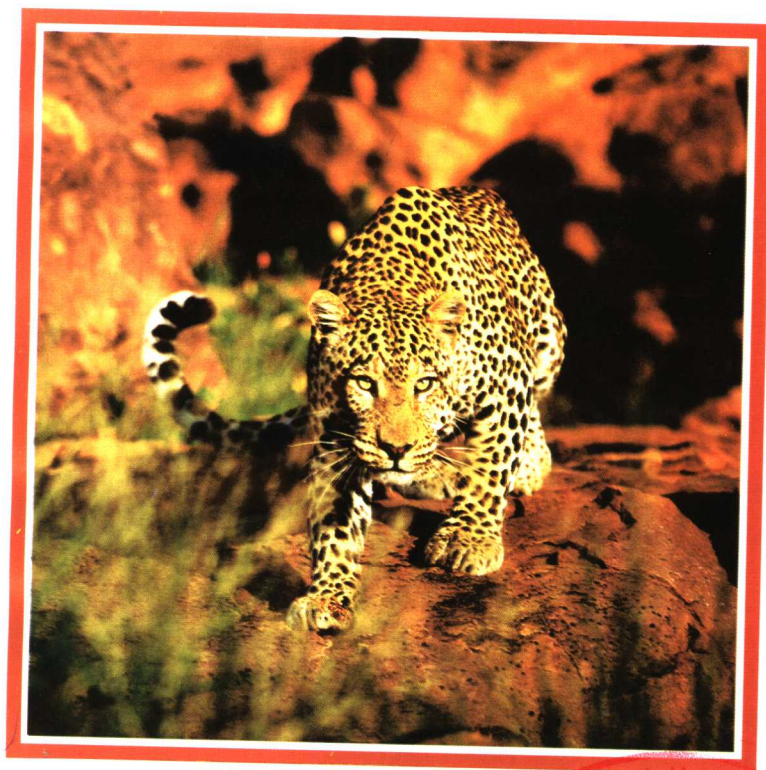
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## 能量的奥秘

Jane Burton and Kim Taylor 著

杨晓洪 译

\* \* \*

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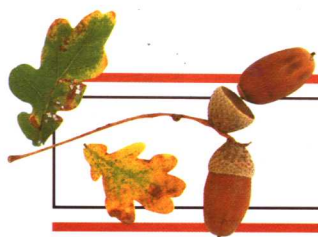
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# Contents 目录

	Natural Energy 4 自然界的能量
	Energy Waves 6 能量波
	Kinetic Energy 8 动能
	Noisy Energy 10 声能
	Energy Does Work 12 能量做功
	Storing Energy 14 储存能量
	Saving Energy 18 节省能量
	Energy from the Sun 20 来自太阳的能量
	Burning Energy 22 燃烧的能量
	Borrowing Energy 24 借取能量
	The Greenhouse Effect 26 温室效应
	Things to Do: Energy is Everywhere 28 动手做: 能量无处不在
	Glossary 30 词汇表
	Plants and Animals 31 动植物索引
	Index 32 索引









# Natural Energy

## 自然界的能量

Energy in nature comes in many different forms. Heat is a form of energy. A lot of heat energy comes from the sun. Heat can also come from a forest fire or, in much smaller quantities, from the warm body of a mouse. Light is another form of energy. It also comes from the sun and from the stars. Some animals and even plants produce small amounts of light energy. **Radio waves** and **ultraviolet rays** are other forms of energy. Then there is electricity, which is yet another sort of energy.

All these different forms of energy can be changed, one into another. Think of lightning. All the electrical energy in it is gone in a flash—changed into brilliant light which you can see, into heat which burns whatever is struck by the lightning, and into sound which you can hear as thunder.

Much of the energy we use at home comes from electricity. Most of the Earth's energy—wind, waves, heat and light—comes from the sun. The sun itself is powered by **nuclear energy**.

自然界有许多种能量的形式。热能就是一种能量形式。热能大多来自于太阳。森林大火也可以产生热能，甚至一只老鼠温暖的身体也可以产生少许的热能。光是能量的另一种形式，它也是来自于太阳和星星的。一些动物甚至植物也可以产生少量的光能。无线电波和紫外线也是能量形式。另外还有电能又是一种能量形式。

所有这些不同形式的能量都可以相互转换。就拿闪电来说，它里面所有的电能都在一道闪光中放掉了——转变为你可以看见的耀眼的光，转变为可以烧毁所有被闪电击中的物体的热能，同时也转变为你可以听见的雷声。

我们在家里使用的很多能量来自于电。地球上的大多数能量——风、波、热和光——来自于太阳。而太阳本身的能量是由核能产生的。



Any animal, even a small snail, uses energy to get moving

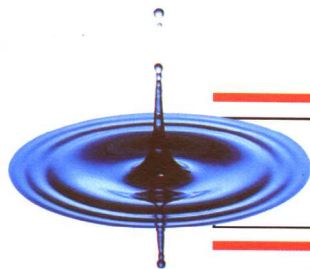
任何动物，甚至一只小小的蜗牛，都使用能量来移动。

When lightning flashes, electrical energy stored in the clouds changes into light, heat and sound energy.

打闪时，储存在云里的电能转变为光能、热能和声能。

The sun is the main supplier of energy to the Earth. Its warmth causes wind and draws water into the air, forming clouds. Its light allows us to see during daytime.

太阳是地球能量的主要提供者。它的热可以产生风、把水蒸发到空气中从而形成云。它的光可以使我们在白天能看清大千世界。



## Energy Waves 能量波

A raindrop hitting water causes ripples that spread out in **concentric rings**.

一滴雨珠击中水面，引起了以同心圆形式向外扩散的环形波纹。

Energy travels through space rather like waves move across the surface of the sea. Heat, light and other sorts of **radiant energy** travel in the form of **electro-magnetic waves**, and the distance between the waves—called **wavelength**—determines the nature of the energy. Radio waves may be metres or even kilometres apart. The waves of radiant heat are less than a millimetre apart while the wavelength of light is measured in millionths of a millimetre.

Electro-magnetic waves travel through space in straight lines at the vast speed of around 300,000 kilometres per second. So, even long waves arrive at a great rate. For instance, kilometre wavelength radio waves from outer space arrive at the Earth at about 300,000 every second. This is called the **frequency** of the radio signal and it is another way of looking at wavelength. If you stood on the shore and counted how

A Mute Swan treads water as he beats his wings, causing waves to spread out, like energy waves from the sun.

一只疣鼻天鹅抖动翅膀踩水使水波向外扩散，就像来自太阳的能量波一样。







many waves crashed down every minute, you would know the frequency of the waves. The frequency of light is of course very much greater than radio. Many billions of light waves are reaching your eyes every second as you read this!

能量在空间传播就像波浪划过海面一样。热、光和其他类型的辐射能量是以电磁波的形式传播的，被称为波长的波与波之间的距离决定能量的特征。无线电波的间距可达几米甚至数公里，热辐射波的波间距不足1毫米，而光波的波长则是用毫微米来测量的。

电磁波是以每秒300,000千米左右的高速在空间直线传播的，所以，即使是长波也可以达到很高的速率。比如，波长为1千米的无线电波可以每秒300,000千米的速度从外层空间传到地表。这就是所谓的无线电信号的频率，它是另一种反映波长的方法。如果你站在海岸边，记下每分钟内海浪拍打的次数，你就可以知道海浪的频率。光的频率比无线电波的频率自然要高得多，当你读这本书时每秒有几十亿束光进入你的眼睛里。

On a North Atlantic shore, ▲  
a massive storm wave,  
carrying a huge amount of  
energy, breaks against the  
rocks.

在北大西洋海岸，一阵大风浪携  
带着巨大的能量撞击在岩石上。





## Kinetic Energy 动能

A Yellow-necked Mouse ▲  
leaps vertically into the air.  
Its kinetic energy will  
become potential energy  
when the mouse reaches the  
top of its jump.

一只黄颈鼠竖直向上跳去。当它  
跳到最高处时，它的动能将转变  
为势能。

Energy always has to go somewhere. It cannot be destroyed but it can be changed from one form into another. When a cat climbs a tree, it uses energy to get to the top. At the top of the tree, the cat's body has **potential energy** because it is high above the ground. When the cat leaps from the tree, its potential energy is converted into **kinetic energy**—the energy of movement. The crash you hear when the cat lands on a tin roof is some of its kinetic energy being converted into sound energy.

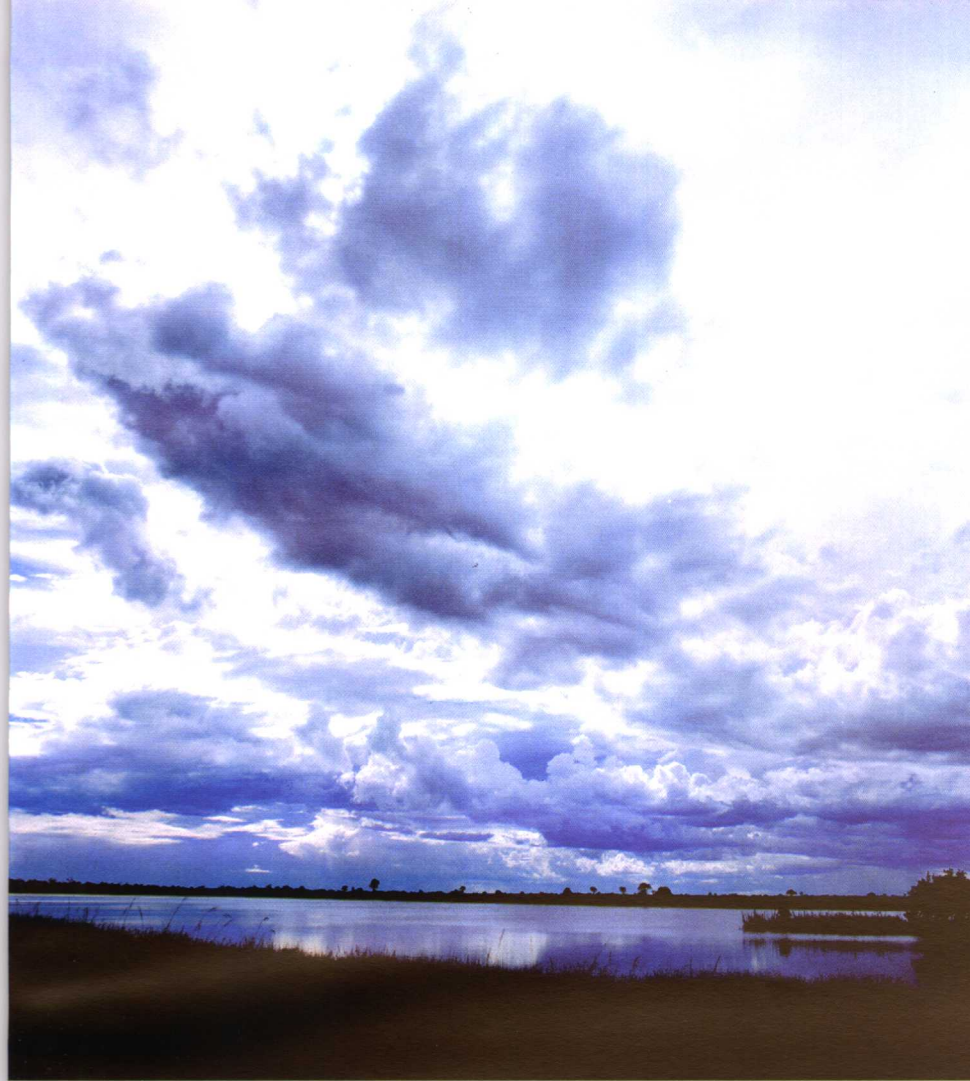
Clouds store huge amounts of potential energy because of all the water they hold high above the ground. This potential energy originally came as heat from the sun which caused water to **evaporate** from the sea and rise into the air forming the clouds. Potential energy in clouds is converted into kinetic energy when rain comes battering down,

As a white cat leaps from ▲  
a garden seat, its body gains  
kinetic energy because it is  
moving.

当一只白猫从花园座椅上跳起  
时，它的身体获得了动能，因为  
它在动。







In the late afternoon, storm clouds are massing beyond this lake in Botswana. The water they contain represents potential energy which will be released when it falls to the ground as rain.

傍晚，博茨瓦纳这个湖的上空乌云密布。云中所包含的水分代表了势能，当雨水下落到地面上时，这些势能被释放。

Water, high in the mountains, has potential energy. It gives up this energy as it comes rushing down rivers and crashing over waterfalls.

高山上的水拥有势能。当它倾泻而下时就释放了能量。

causing rivers to flow. Some energy may be converted into electricity in thunder storms. Rain falling on mountains holds onto some of its potential energy which can then be used to power **hydro-electric** generators.

能量总是在转化着。它不能被消灭，但是它可以从一种能量形式转变为另一种形式。当一只猫爬树时，它使用能量爬到树顶。在树顶上时，猫的身体就拥有了势能，因为它高居地面之上。当猫从树上跳下时，它的势能转变为动能——运动的能量。你会听到猫落到罐头盒上发出的碰撞声，那就是猫的一部分动能转变成了声能。

云彩里储存了大量的势能，因为它所含的水分都高居地面之上。这些势能最初来自于太阳的热能，因为太阳的热能使得大海中的水蒸发到天空中而形成了云。当大雨倾盆而下时，云的势能就转变为动能，使河流动。在暴风雨中，一部分能量可以转变为电能。落在山上的雨水，保持了一部分势能，可以用来转动水电发电机。







## Noisy Energy 声能

This Rook has a very loud ▲  
voice and he uses energy to  
produce his harsh "caw".

这只秃鼻乌鸦嗓门很大，它使用  
能量来发出呱呱的尖叫声。

Sound waves are **reflected**  
like other sorts of energy  
waves. This Natterer's Bat is  
listening to the echoes of its  
own high-pitched squeaks  
and using them to guide itself  
over the surface of the water.  
声波像其他种类的能量波一样被  
反射。这只鼠耳蝙蝠在水面上飞  
行时，通过听它自己发出的高音  
调的尖叫的回音来指引自己。

A male cricket sends a shrill  
song into the Australian night  
by rubbing his wings  
together.

一只雄性蟋蟀通过摩擦翅膀将尖  
声锐气的歌声送入澳大利亚的夜  
空。

Sound travels in waves rather like radiant energy but the waves are not electro-magnetic. Instead, sound waves are **compression** waves. These are waves of slightly compressed air which travel at around 340 metres per second. Sound has to travel through some **medium**—air, water, wood or whatever. It cannot travel through space or through a **vacuum** because there is nothing there to be compressed.

To produce sound, something has to **vibrate**. A plucked guitar string vibrates, making compression waves travel outwards from it through the air. It takes energy to cause the string to vibrate and that energy is converted into sound.

Sound is very important to many animals and they use a lot of energy calling to each other. The calls of whales are thought to travel for more than 100 kilometres beneath the surface of the sea.

声音就像辐射能量一样以波的形式传播，但它不是电磁波，而是压缩波。这些波是经过轻微压缩的空气波，以每秒340米左右的速度来传播。声音得通过空气、水、木头或其他介质来传播。它不能在太空或真空中传播，因为在这些条件下没有任何东西可被压缩。

声音必须通过振动来发出。一根拨动了的吉他琴弦通过振动产生压缩波，经空气向外传出。使弦振动需要能量，而这种能量就被转化为声音。

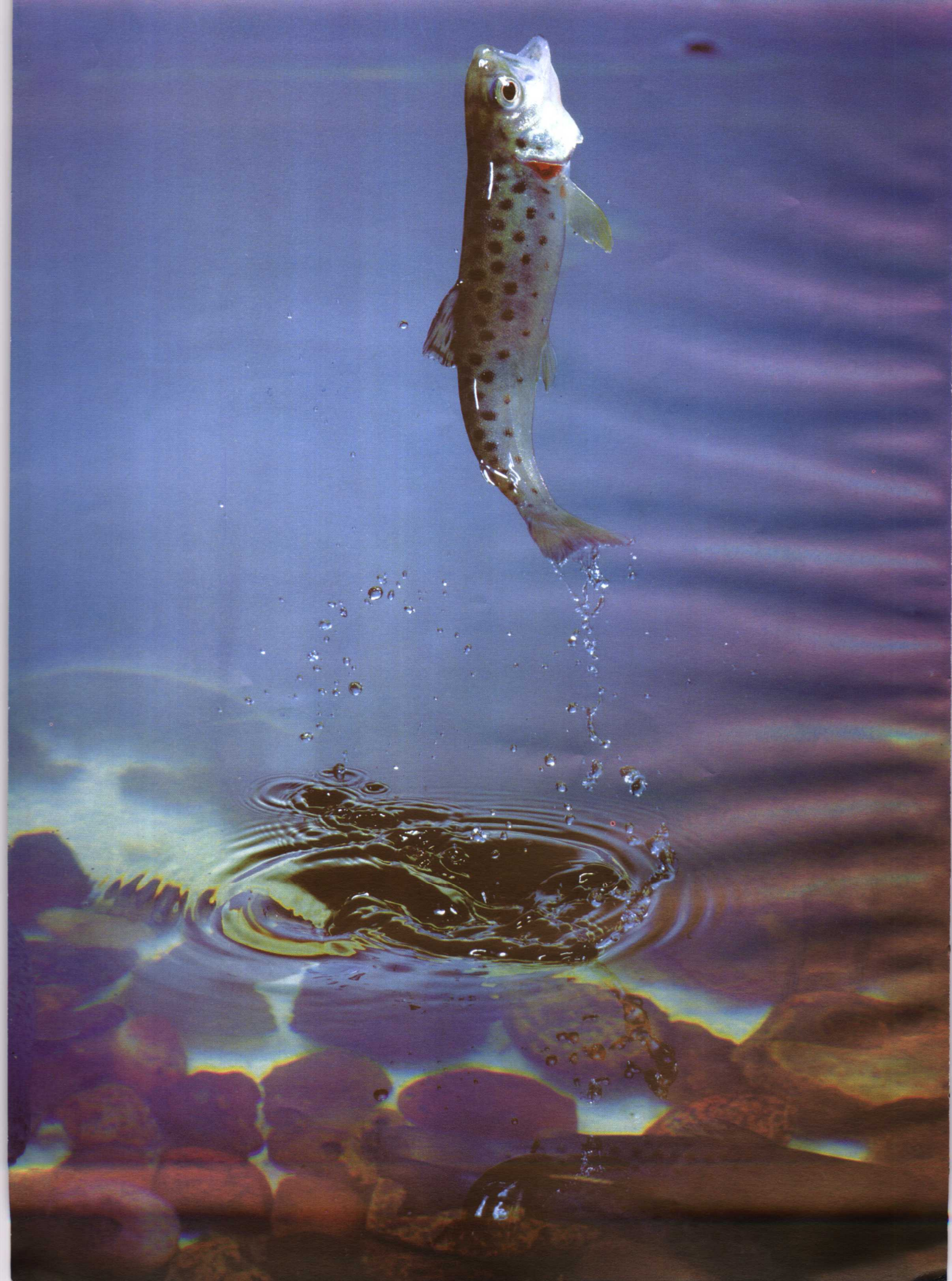
声音对许多动物是非常重要的。这些动物消耗大量能量来彼此呼唤。鲸所发出的呼叫被认为可以在海面下传播100千米以上。



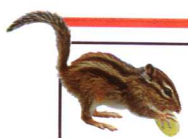












## Energy Does Work

### 能量做功

When a squirrel eats a nut, the energy that is stored in the nut can be used by the squirrel to do some work. For instance, the work the squirrel does may be running along the branch of a tree. The squirrel's strong muscles convert energy from nuts into kinetic energy. But there is another sort of work that the nut's energy can do. This is keeping the squirrel's body warm.

So, if there is work to be done there must be energy to do it. Mammals and birds are warm-blooded and many are very active. They need a constant supply of energy to keep them on the move. Cold-blooded animals, such as fish, use much less energy—especially as they can glide through the water so much more easily than mammals can move on land. Surprisingly, it takes hardly any energy at all to keep a **streamlined** fish moving at a steady speed, and it will go on gliding forward for some time after it has stopped swimming. Energy is then needed to get the fish moving again and to speed it on its way. It is this **acceleration** that requires energy, not movement on its own.

当一只松鼠吃坚果时，坚果中所储存的能量可以被松鼠用来作一部分功。比如，松鼠可以在树枝上来回奔跑。松鼠健壮的肌肉可以将从坚果得来的能量转换为动能。但是坚果的能量还有另一种作用，就是保持松鼠的体温。

因此，要做任何事情都必须使用能量。哺乳动物和鸟类是恒温动物，多数都很活跃。它们在运动中需要不断地补充能量。冷血动物，比如鱼类，使用的能量要少得多——特别是当它们在水中游动时，要比哺乳动物在地面上移动容易得多。令人吃惊的是，一条流线型的鱼在水中匀速滑行时，几乎可以不使用什么能量，而且当它停游之后还可以继续向前滑行一段时间。当鱼再次移动时，就需要能量来提速。就是这个加速度需要能量，而鱼本身运动起来后就不需要什么能量维持了。

This fat Grey Squirrel is opening a nut. The kernel will provide the squirrel with energy so that it can scamper about and keep warm.

这只肥胖的北美灰松鼠正在打开一个坚果。坚果的果核可以给它提供能量，使它可以四处蹦蹦跳跳并保持体温。



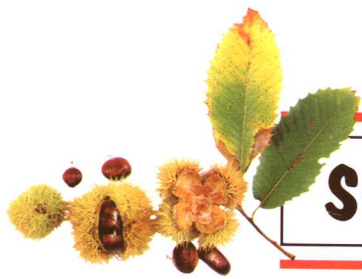
A baby Siberian Chipmunk is eating a sweet grape which will give him energy so that his muscles will work.

一只幼小的西伯利亚金花鼠正在吃一颗甜葡萄，葡萄可以给它提供能量使它的肌肉做功。

Leaping from a shallow stream to catch a passing fly is work for this Brown Trout, and it needs energy to do it. 这条河鳟从一条浅溪中跳起捕捉飞虫，它需要能量来完成这一动作。







## Storing Energy 储存能量

Ripe Sweet Chestnuts are ▲ packed with energy when they burst from their prickly cases in autumn.

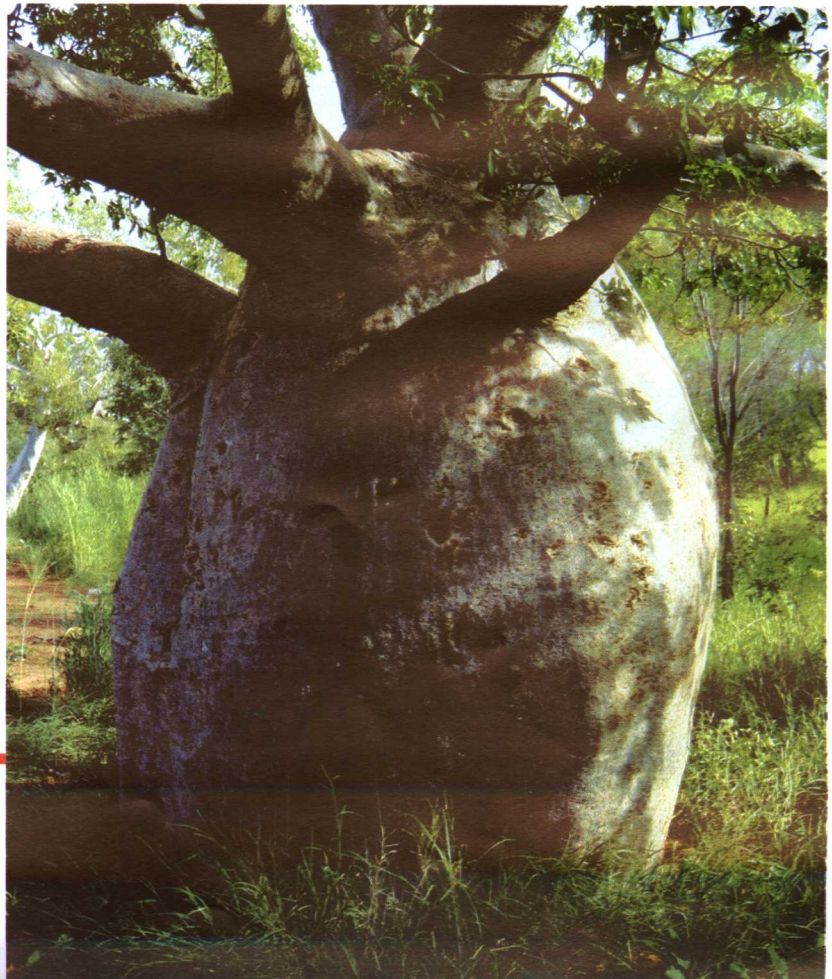
秋天，当成熟的甜栗子从多刺儿的外皮中爆裂出来时饱含能量。

Energy is not always easy to store. Take light energy, for instance. You cannot put light in a bottle and keep it there. Even heat is difficult to store. You can put hot water in a bottle but the heat in it gradually disappears until the water is at the same temperature as its surroundings. The only sort of energy that can be stored for any length of time is **chemical energy**. Chemical energy has been stored underground in coal and oil for millions of years.

Plants have developed many different ways of storing chemical energy. A nut is a concentrated energy store. It contains **carbohydrate** and oil, both of which are rich in energy. It is no wonder that squirrels are keen on nuts! Of course, the energy in the nut is not intended to become fuel for a squirrel, but to help a new nut tree to grow. Other plants, such as potatoes and carrots, store energy in their roots, onions store it in their leaf bases, while sago palms and baobabs store it in their stalks.

The baobab or boob tree ► stores energy in its bulbous trunk.

猴面包树在它的球茎形树干中储存能量。







能量不总是易于储存。就拿光能来说，你不能将光放入一个瓶子里保存起来。就是热能储存起来也非常困难。你可以将热水放入一个瓶子里，但是水中的热量会逐渐散发，直到和它所处的环境温度相同。只有化学能这种能量可以储存任意长的时间。化学能可以储存在地下的煤和石油中长达数百万年之久。

植物中有很多种储存化学能的方式。一颗坚果就集中存储了很多能量。其中包括碳水化合物和脂肪，而这两种物质都含有丰富的能量。难怪松鼠那么喜欢吃坚果。当然，坚果储存能量并不是为了给松鼠提供身体中的燃料，而是为了帮助新生的坚果树成长。还有一些植物，诸如马铃薯和胡萝卜，将能量储存于它们的根部，洋葱将能量储存于叶基，而西谷椰子和猴面包树将能量储存于树干中。

Energy stored in the roots of the Yellow Skunk Cabbage not only grows this magnificent flower in the spring, but also produces enough heat for the flower to melt its way up through the snow. ▲

储存在黄色美洲观音莲根部的能量不仅使它能在春天开出艳丽的花朵，而且还能产生足够的能量使花朵破雪而出。



The Barking Gecko lives in Western Australia where it is warm for most of the year. It stores energy as fat in its tail. 鸣声壁虎生活在一年当中大部分时间气候温暖的西澳大利亚，它把能量以脂肪形式存在尾巴中。



Most animals store chemical energy in their bodies. Fat and oil contain more energy than other **organic** materials and so animals carry their energy stores around with them in the form of fat or oil deposits. Fat can be in a layer just under the skin. This is a good place to keep it, as fat is an effective **insulator**, protecting the animal against cold. **Species** that live in hot climates do not need to be insulated and so tend to keep their fat in lumps. Camels have fatty humps on their backs and some sheep and even geckos have thick, fatty tails.

Before fat can be converted into usable energy, it has to be chemically changed so that it can be carried by the animal's blood to its liver. There the energy is stored temporarily in a form that is ready for immediate use.

Some animals not only store energy inside their bodies but also collect together stores outside their bodies. Mice, squirrels, beavers and several bird species spend a lot of time during the autumn building food stores to tide them over the winter months.

Pikas live among rocky mountains and make hay by cutting green plants and drying them in the sun. They store the hay to eat during the winter months.

鼠兔生活在岩石丛生的群山中，它们折断绿色植物并在太阳下将其晒干制成干草。它们把干草储存起来以便在冬季的几个月里食用。

