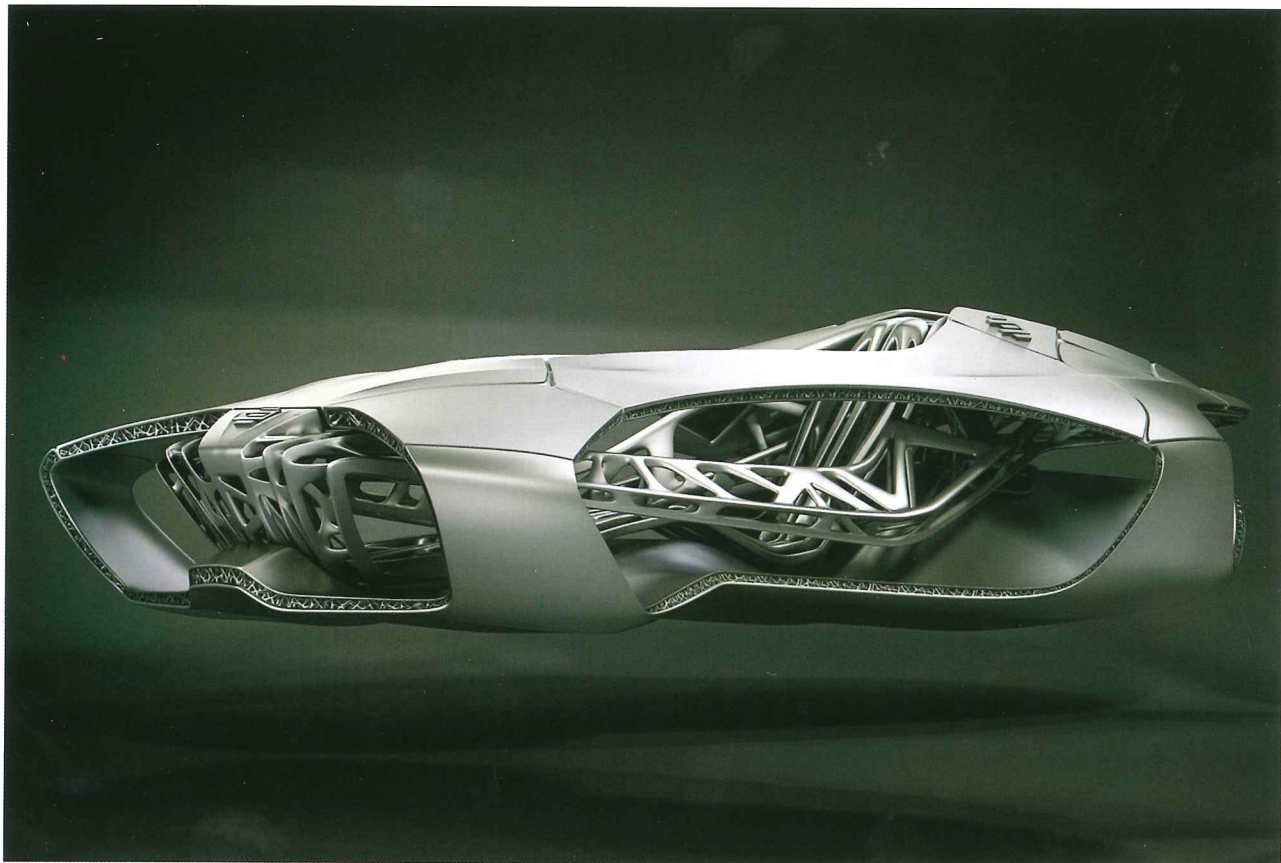


仿生技术 研发智能汽车 探索人工智能

Bionic Tech, Smart Vehicle, Artificial Intelligence

文/池小宁 Text/Chi Xiaoning



人脑中有一个小区域负责“回避危险”，保留着某种重要的原始功能。不仅人类，爬虫类、昆虫、鱼、鸟等生物的大脑中都有这个区域。地球上的生命大约起源于40亿年前。其间，人类不断进化并传承了许多生物的功能。

人类探索生物的神秘性，探索这种“回避危险”的功能，这是目前仿生技术人员正在做的事情，日产通过观察蜜蜂和鱼群的活动成功开发出自动驾驶汽车，东京大学再现昆虫的大脑应用于机器人，为将来再现人脑迈出的第一步。

通过仿生技术避免事故

2013年9月，日产在美国加利福尼亚州公开了两辆自动驾驶汽车。在演示行驶中，当路上突然出现人时，汽车会自动打方向盘，通过灵敏的动作平安地避开。

There is a small area in the human brain that is responsible for the avoidance of danger and that retains some important original function. This small area also exists in reptiles, insects, fish, birds, and so on. Life on earth originated about 4 billion years ago. Meanwhile, human in the evolution possesses many biological functions.

Human explores the mysteries of biology, including the function of the "risk avoidance". At present, The bionic technical personnel has done some work. Nissan observes the activities of the bees and fish and develops a self-driving car. In University of Tokyo, the insect brain is applied to the robot, which is a first step to reproduce the human brain in the future.

Through the bionic technology to avoid accidents

In September 2013, Nissan in the United States, California, unveiled two self-driving cars. In the demo drive, when a person suddenly appears in the road, the car will automatically hit the steering wheel and safely avoid him.

Self-driving cars history dates back to 2008 when "BR23C" robot

自动驾驶汽车的历史要追溯到2008年公开的机器人车“BR23C”，该车是日产与东京大学尖端科学技术研究中心的共同研究成果，它利用的仿生技术是“蜜蜂飞行模式”。蜜蜂成天飞来飞去为何不会碰撞呢？这是因为蜜蜂具备一种“躲避风险”的能力，可以用左右的复眼检测周围的情况，针对闯进“自己领域”的天敌和障碍物，通过瞬间组合各种动作来躲避障碍物和天敌，蜜蜂实现瞬间转换方向。

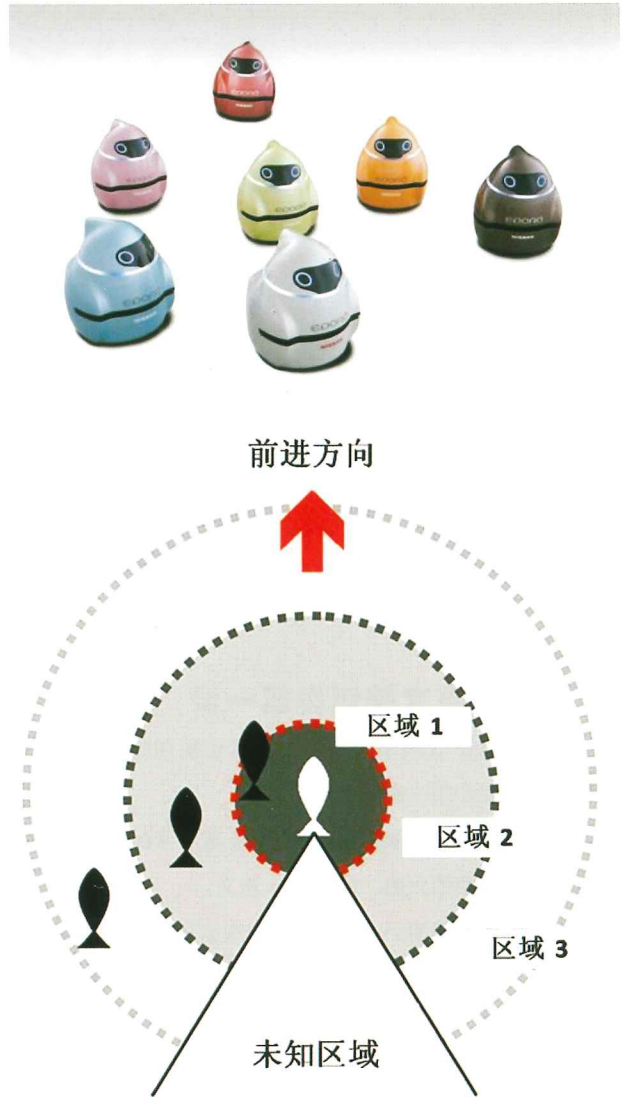
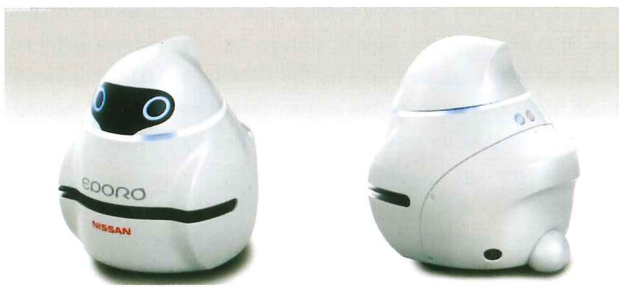
BR23C自动驾驶车技术人员则把这种躲避动作数字化，在障碍物从不同方向接近时，形成规则化的汽车躲避行为。他们研发的“激光测距仪”的传感器具有掌握周围情况的复眼功能。通过检测投射激光的反射光，根据时间差测量到障碍物的距离，按规则化的数据及时切换车轮的角度，自动驾驶车就可以加速、减速或旋转，避免碰撞，实现“瞬间躲避”。

之后，日产又参考了“鱼群巡游模式”。鱼群在巡游中，即使鱼与鱼之间的距离非常近也不会碰撞，可以畅通无阻地游动。如果汽车也能实现同样的巡游行动，就可以构筑不易拥堵的高效率交通系统。

鱼群在巡游中，鱼与鱼之间保持适当距离，从而避免碰撞的是“侧线”。侧线名符其实是位于鱼体侧面鱼鳞下方的感觉器官，用来感知水中水压和水流的变化；根据水流的乱流检测出障碍物和碰撞危险，从而实现与旁边的鱼保持适当的距离，并且一直巡游下去。

日产2009年公开的机器人车“EPORO”，同样采用BR23C“激光测距仪”，也发挥了侧线的作用。“激光测距仪”随时测量与附近车辆的距离，加以适当地控制；通过用无线通信功能使多辆汽车联动，在车流中可畅通无阻地自动行驶。

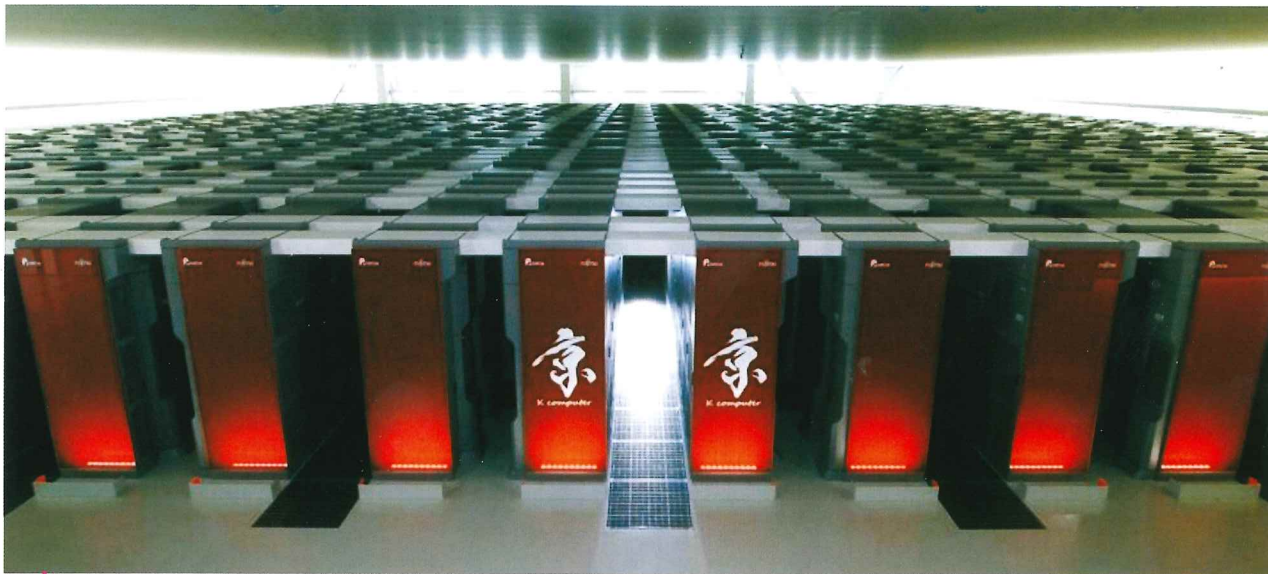
日产集成这些仿生技术成果，创新自动驾驶汽车。将在2020年之前开发出多种自动驾驶汽车。



car was revealed. This car is a result of cooperation between Nissan and University of Tokyo in the research. It uses the bionic technology being a bees flying model. The bees fly around all day, why do not they produce a collision? This is because the bees have a kind of "avoiding risk" ability. They can use the left and right compound eyes for detection. They thus can avoid the natural enemy or obstacle in their own field by the instant change of direction.

BR23C self-driving car technical personnel can digitalize the evasive action. When the obstacle approaches from different directions, the car can shun it. They develop the laser rangefinder sensor has the function as a compound eye. It detects the reflected light, measure the distance to the obstacle, so that the car can avoid the obstacle by changing the direction, accelerating, decelerating or rotating.

Later, Nissan also adopts the fish cruise mode. The fishes do not collide with each other even if their distance is very close. If a car can realize such cruise, then a jam-free efficient transport system



电脑再现大脑迈出第一步

仿生技术不仅限于汽车领域，其功能还蕴藏着使机器人和人工智能实现飞跃发展的可能性。

东京大学教授神崎亮平用世界最高水平的超级计算机“京”再现昆虫的大脑，具有重大意义。

昆虫的大脑只有几mm大，再现这么小的东西意义非常重大。昆虫大脑的基本机制与人类相同，由称为神经元的神经细胞构成，其形状和作用与人类相同。人类大脑的细胞数量为1000亿，而昆虫只有区区10万，但其能力却是“非同寻常的”潜藏着巨大的功能。

昆虫的反应能力比人类强。它通过复眼和触觉等器官感知到外部刺激后做出反应的时间为0.01秒，是人类的十分之一。人轻易捕捉不到昆虫，就是因为在昆虫看来人类的动作像“慢动作”似的，存在“时间差”。



can be built.

The fishes in their parade keep a proper distance between them. The lateral line refers to the sense organ in the side of the fish, and is used to detect the change in the water pressure and flow. According to the turbulence of water flow, the risk of the obstacle and collision can be detected, so as to realize no mutual collision between fishes.

Nissan in 2009 revealed its "EPORO" robot car, that also adopts BR23C "laser rangefinder" play the role of the lateral line. The "laser rangefinder" can measure the distance to the surrounding car and make a proper control. By wireless communication function, it can coordinate a number of cars letting the traffic congestion-free. Nissan uses the bionic technology to create self-driving cars. It will develop a variety of self-driving cars by 2020.

The computer will reproduce the brain

Bionic technology is not only confined to the field of automobile, but also is leading to the possibility for the robot and of artificial intelligence to realize leap development.

A professor at the University of Tokyo exhibited a super computer that could reach the intelligence level of the insect, so being of great significance.

Insect's brain is small but is very significant. Their brain has the same basic mechanism as the human brain, and is composed of nerve cells. The brain number in human is 100 billion but insect only 100000. However, the insect brain has an unusual huge function.

The reaction of the insects is stronger than human. Their compound eye and tactile organ sensor and so forth detect the external stimulus. Their response time for the stimulus is 0.01 seconds, so much faster than human. The human cannot easily catch insects, the reason is that, for insects, the human has a slow action, namely there is a time lag.

The insect has a keen sense of smell. In Boolean's Record of Insects, the French famous biologist author Boolean describes a scene: a male moth can look for a female moth by the scent of the

昆虫的嗅觉也十分灵敏。在《法布尔昆虫记》中，法国著名生物学家让-亨利·法布尔描述的一段场景：雄蛾为寻找雌蛾，循着雌蛾留下的气味可从几公里的远处飞过来。雄蚕蛾平时是不会飞的。但一旦嗅到雌蚕蛾发出的费洛蒙味道就会立即行动，准确到达雌蚕蛾身边。

神崎教授指出，以往的仿生学是人类通过对自然的观察来模仿所掌握的模式和形状。如果能在计算机上再现昆虫的大脑，则可以了解昆虫的大脑对于刺激会作何反应，从而探明其机制。

从昆虫脑里提取电信号

如何再现昆虫的大脑呢？首先，在昆虫大脑中的各神经细胞内插入微小电极。然后，向昆虫施加刺激，分析神经细胞如何发出信号，从而辨明各神经细胞发挥的作用。同时，神经电路的物理构造通过注入色素实现可视化。



这还不够，因为脑细胞是时刻变化的。以人为例，最初需要边思考边笨拙地使用棒球棒和驾驶汽车，当熟练之后就会逐渐变得像是自己身体的一部分似的可以随意使用。这是因为大脑随着学习发生了变化。

跟人类一样，昆虫也会根据周围的环境学习。有些实验如实地反映了这种情况，比如让蚕蛾操控机器人。下面的照片所示：把蚕蛾放在机器人内部的球上。蚕蛾一爬动，球就会转起来。根据这个动作，机器人也会像蚕蛾一样动起来。

实验人员搞了个恶作剧，做了一些调整，即使蚕蛾向前进，机器人依然向右拐。结果，蚕蛾调整了自己的动作，巧妙地使机器人到达了目的地——费洛蒙源。这是因为蚕蛾掌握了机器人容易右拐的特性，自己进行了行为调整。

神崎教授的研究团队进一步推进研究，从昆虫脑里提

latter one. The scent can be a few miles away. The male moth cannot fly, but when smelling the scent from the female moth, it can immediately and accurately reach the site of the female moth.

A professor changes a gene of the olfactory receptor cell, letting it respond to the specific odor and produce light. The high precision smell sensor is highly expected in the purpose of the practical use. The professor pointed out that the previous bionics is to stimulate the model and shape known in the observation. If the computer reproduces the insect brain, then we can understand how this kind of brain respond to the stimulus and which the mechanism is.

Extract the electric signal from the insect brain

How to reproduce the insect brain? First of all, we can insert the tiny electrode in the nerve cell in the insect brain. Then, exert the stimulus to the insect, analyze the signal produced from the nerve cell, so as to understand the role of the nerve cell. At the same time, neural circuit physical structure can be visualized by injecting pigment.

It is not enough, because brain cells change all the time. Take the human as example. After skilfully driving a car or using the baseball bat, we people can feel that the relevant actions seem to be part of our body. This is because the brain changes in learning.

Like humans, insects can learn from the surrounding environment. Some experiments faithfully reflect this kind of situation. For example, let the silkworm operates a robot. The silkworm is placed in a ball in the robot. When the silkworm moves, then the ball will rotate. According to the action, the robot can rotate like the silkworm.

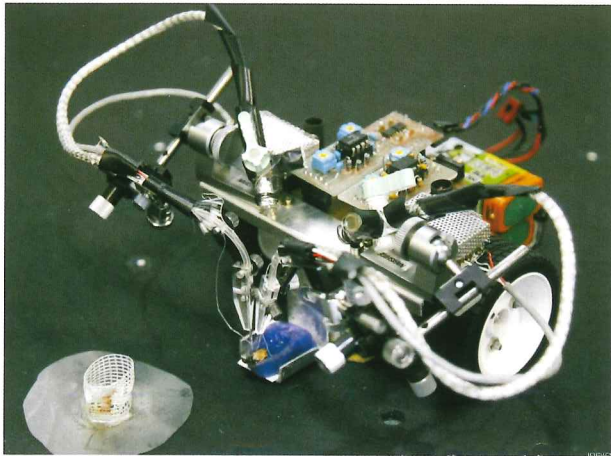
The male silkworm operates the robot and reach the site of the female silkworm.

Experimenters had a prank. They made some adjustments. Even if the silkworm moth went forward, the robot still turned right. As a result, the silkworm moth adjusted its own action, cleverly allowing the robot to reach the site of the female silkworm. This is because the silkworm moth had mastered the characteristics of the right turn for the robot, and adjusted its own behavior.

The above professor's research team had the further research. They extracted the electric signal from the insect and made a device used to drive the robot. This device was equipped with the silkworm head having tentacles and compound eyes. The silkworm head did not died at once when immersed in a special liquid. The researchers used the signal from the silkworm brain to move the robot.

As a result, it can record the learning of the insect. By this, the





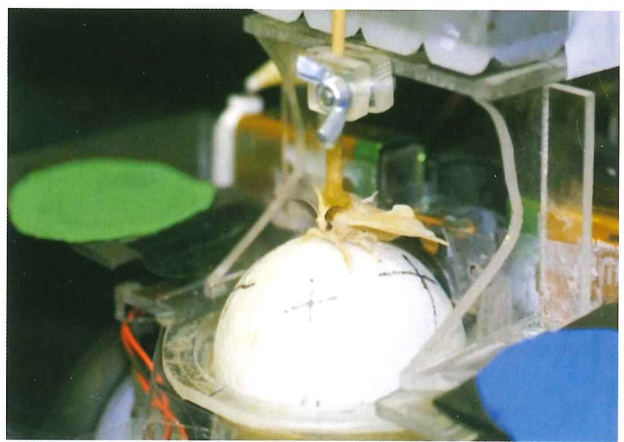
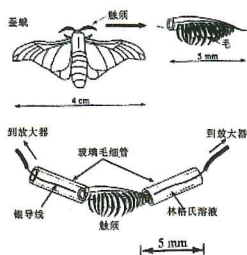
会立即死亡。研究人员就用蚕蛾大脑发出的信号驱动马达，移动了机器人（体）。

由此，可以实时记录当昆虫学习周围情况的变化时，脑神经信号会如何变化。研究人员根据该数据推测学习过程中的脑内变化。用超级计算机再现了脑的嗅觉和运动系统，从而更接近实际昆虫的大脑。蚕蛾具备超高的嗅觉，能以秒为单位检测到浓度为10亿分之1的气味。目前的人工传感器要想检测到同等水平浓度的气味需要约10分钟。该技术有望最快实用化的是大脑的气味检测功能及应用。

神崎教授通过改变基因，使蚕蛾的嗅觉受体细胞对费洛蒙以外的特定气味发生反应并发光。目前正在制作提取细胞，使之成为对气味发生反应并发光的传感器。其目的是将其“用于探测毒品和爆炸物等”。

再现昆虫大脑的研究是为将来再现人脑迈出的第一步。通过逼近人脑，未来机器人技术的关键——人工智能的性能可实现飞跃性提高。此外，还能为脑神经系统的疾病治疗开拓道路，比如用其他回路弥补坏死神经回路的功能等。

与生物大脑具备同等功能的汽车和机器人，与人类共存的社会，也许并不遥远。

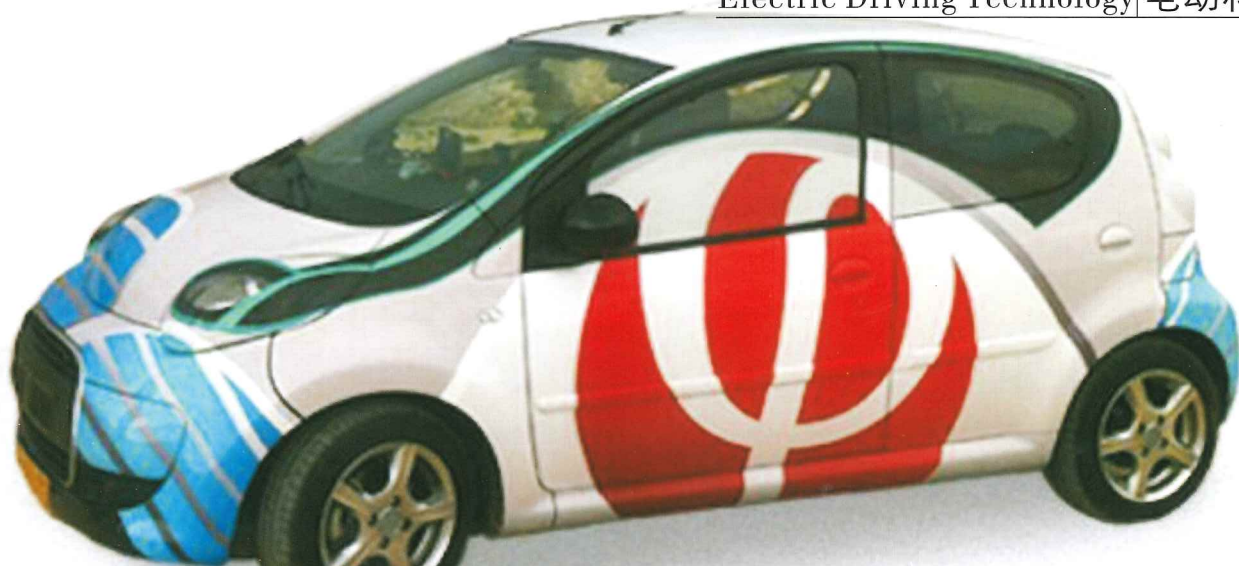


change of the brain nerve signals is understood. Researchers predict the change of the learning process in the brain according to the data. They use the super computer to recreate the brain's sense of smell and motor system, which is closer to the actual insect brain. Silkworm moth has high sense of smell and detect the taste in seconds at the concentration of 1 per 1 billion parts. The current artificial sensors need about 10 min to detect the smell of the same level concentration. The technology is expected to be practically used soon.

The professor changes the relevant gene, so as to let the olfactory receptor cells respond to the specific taste rather than pheromones and emit light. Now he is processing the extracted cells and makes a sensor. It is aimed to be used as a detector for the drugs and explosives, and etc.

The above study and similar studies are the first step to reproduce the human brain in the future. Through the closeness to the brain, the key to the future robot technology – artificial intelligence can realize leap to improve performance. In addition, a path can be opened for the medical treatment of the diseases in the brain nerve system, such as the other circuit used to make up the necrotic circuit and etc.

The cars and robots having similarity to biological brains may not be far away, in which they will be coexist with our human society.



空气水能发电梦想成真

Dream to Generate Power via Air and Water Comes True

文/ 达晓明 Text / Da Xiaoming

有人说，电池是个很邪恶的东西！

现在的电子设备，即将流行的电动汽车，都离不开电池。但是这玩意儿电量有限，用完了得找地方充电，真没别的办法可想！电动汽车要想真正做到大众化，续航问题就一定得解决好。

现在的电动汽车动力电池麻烦多多。纯电动车最火的就算是Tesla（特斯拉）。为啥火？不单单因为酷炫的外表和带有未来感的驾驶舱，电池续航能达到400公里以上，这是一般电动汽车没法比的。所以特别受欢迎！油电混合动力汽车之所以花这么大成本来搞成油电混合，无非就是怕电池电量用光了车子“瘫痪”在半路上。电池是个很头疼的问题！

如今，这个问题快被解决了。而且貌似能很完美地被解决掉！文章开头的配图就是解决这个问题的神器。

这是一种依靠空气中的水分子与特制铝板产生化学反应发电并为汽车供电的新型空气水能电池组。大家不要惊呆了！？

为什么说是完美解决呢？因为这玩意儿用的是水，通过行驶过程中压缩机吸收空气中的水分子或者直接往电池里灌水来发电。发电过程中碳的排放几乎是零。

而且，占的地方也不大，50块ipad mini那么大的铝板组成的一个独立电池组可以为汽车提供25公里左右的续航，汽车后备箱那么大一块儿电池组差不多可以为电动汽车增加大约1000英里（差不多1600公里）的超时续航。这玩意儿是一帮以色列人设计制造的！以色列竟然是科技狂人泛滥的国度啊！

不过，这套技术还没有完全成熟，现在有一个最大的问题是它的快速更换问题。这套电池组可不能循环充电，它是以一种备用电池组的方式装置在汽车上的，用没电了你就得更换里面的铝板。要想真正普及，得有很多“铝板”，得有很多“铝板组”电池，得有很多电池工厂量产才行。此是后话！

官方介绍说大概这个问题会在2017年解决。也不是什么很遥远的事吧？！让绿色能源赶紧到来吧！

Someone says that the battery is very evil!

Now electronic equipment including popular electric cars cannot leave the battery. But this equipment is limited in power so often needs a charge. To let electric cars be really popular, the problem of mileage should be addressed.

Now the electric vehicle power battery has a lot of trouble. Among pure electric vehicles, the most popular is Tesla. Why is it popular? It is cool in appearance and has a futurist driving-cab and battery power lasting more than 400 kilometers. The purpose of the petrol-electric hybrid vehicle developed is to let the car continue to run in case of the battery power running out. The battery is a very headache problem!

Nowadays, the problem is solved. A solution is good as showed in the picture at the start of the article.

This is a kind of air-water power battery using the special aluminum plate in which the chemical reaction appears to provide power for the car. Is it a surprise for us?

Why do we say that it is a perfect solution? It uses water. During a driving, the air compressor absorbs water molecules from air or water is directly infused into the batter, so that the power is generated. As a result, the power generation does not almost produce carbon emissions.

This new battery is small. The aluminum plate whose size is similar to 50 pieces of IPAD MINI constitutes a separate battery pack which can provide a mileage of 25 km for a car. This stuff is designed and manufactured by a bunch of people from Israel! Ah, Israel turns out to be a country full of science geeks!

However, this technology is not fully mature. The biggest problem is that it is not quickly changed. This battery cannot be charged cyclically. It is as a set of standby battery pack in the car. If there is no power, then you need to change the aluminum plate. To really popularize it, we need more aluminum plates, which may need battery factories. This is another story!

The official saying goes that this big problem will be solved in 2017. Isn't very far away? ! Let green energy come quickly!

