

Electric eel energy storage device

What is the power of an electric eel?

The authors declare no conflict of interest. Abstract The electric eel is known as the most powerful creature to generate electricity with a discharge voltage up to 860 V and peak current up to 1 A. These surprising properties are the results...

What is eel *Electrophorus electricus*?

In particular, the electric eel *Electrophorus electricus* is a system optimized by natural selection for power generation from ionic gradients^{8,9}; its specialized electric organs can generate discharges of 100 W entirely from the flux of small ions¹⁰.

What does a eel's electric organ show?

The eel's electric organ demonstrates that organic electrical power sources inside living organisms can operate with desirable power characteristics by using metabolically available energy.

Why do eels use low ionic strength?

Also, their use of a solution of low ionic strength increases the overall internal resistance of the artificial electric organ, thus limiting its power. In an eel's electric organs, Na^+ and K^+ gradients are maintained by Na^+/K^+ -ATPase proteins, which use ATP as their energy source.

How many volts can a large electric eel generate?

Large electric eels stack thousands of electrocytes in series and can generate potential differences of over 600 V (ref. 2); parallel arrangement of multiple stacks enables peak currents that approach 1 A at short circuit^{8,13}.

Why do we need electric eel biomimetics?

These surprising properties are the results of billions of years of evolution on the electrical biological structure and bulk, and now have triggered great research interest in electric eel biomimetics for designing innovated configurations and components of energy storage and conversion devices.

PANI weight can be controlled by varying the charge during the electro-chemical polymerization. The specific capacitances increased from 9.92 to 213.12 F g⁻¹ after increasing the weight ...

An electric-eel-inspired power concept that uses gradients of ions between miniature polyacrylamide hydrogel compartments bounded by a repeating sequence of cation- and anion-selective hydrogel membranes suggests that artificial electric organs could be used to power next-generation implant materials such as pacemakers, implantable sensors, or ...

A new family of energy-storage devices is created by mimicking the electric eel to obtain a high output voltage. These novel energy-storage devices are flexible, stretchable, and weavable fibers, which satisfies the

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needs of next-generation portable and wearable electronics. The devices are fabricat ...

Learning from how an electric eel can generate its own electricity - 600 volts and 1 ampere of electric current - as a defense against its enemies, an energy source that is self-charging, biocompatible, and environment-friendly has been developed by a group of researchers from Switzerland and the United States.

The electric eel, a type of electric fish is known to generate high potential in order to prey or defense. The mechanisms employed by these animals to perceive their surroundings by using electrostatic field and to generate electricity can naturally inspire researchers to translate such novel mechanisms to TENGs and design innovative TENG-based ...

Bioinspired energy generation systems, particularly focusing on replicating the electrocytes, which are the cells of electric discharging organs of electric eels, have attracted much attention for battery cell development. Motivated by this trend, this study explores the effects of different current collectors (Au, Cu, Ni foils, and multilayer graphene-coated Ni foam) on the ...

Central to this review is the recent progress of electric-eel-inspired innovations and applications for energy storage and conversion, particularly including novel power sources, triboelectric nanogenerators, and nanochannel ion-selective membranes for salinity gradient energy harvesting.

In nature, electric eels can produce transient electrical discharge with a voltage as high as 800 V for predation and defense [1], [2], [3], [4]. The underlying mechanism for bioelectrogenesis in electric organs (EOs) of electric eels is the reverse electrodialysis (RED) induced by the transmembrane ion-concentration gradients of the electrocytes.

Inspired by electric eels, researchers from the University of Oxford have developed a miniature "droplet" battery that could, some day, power tiny bio-integrated devices inside animal bodies.

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As the electric fishes themselves make use of their energy generation for a multitude of tasks, future innovation, through the mimicking the energy production of the electric eel, can lead to the development of novel inventions related to large scale energy generation (e.g. lights, autos) or devices used in combination with existing power ...

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gradient-induced ion flux, which provides an excellent prototype to inspire ...

Michael Faraday used eels to investigate the nature of electricity and eel anatomy helped inspire Volta to create the first battery. Biologists have determined that a six-foot electric eel can generate about 600 volts of electricity, which is five times more than an outlet in the United States.

In the past decades, energy storage and conversion devices, ... In nature, electric fishes (i.e. electric eel) can produce electricity by using electric organs (EOs), which are composed of electrocytes. The EOs originate from myogenic precursors and are formed from different skeletal muscles [28, 29]. The output voltages of electric fish can be ...

Printed energy storage devices such as lithium-ion batteries (3, 4) and alkaline batteries (5, 6) have been extensively studied to power next-generation devices. However, most of these energy storage systems contain hazardous or flammable components and thus cannot meet the safety and environmental requirements for green power sources, which ...

Miniaturized energy storage devices with cost-effectiveness, green processability, and scalable manufacturing capability are crucial for reducing burdens on environmental issues. ... Figure 5c illustrates the structure and mechanism of the eel's electric organ and the implementation of an artificial electric organ prototype from biocompatible ...

Electric eels, which slither along the muddy bottoms of ponds and streams in the Amazon and Orinoco river basins of South America, can cause a shock powerful enough to knock a horse off its feet ...

Nature - The electric eel can generate electrical discharges of 100 watts to stun prey, but should you X-ray an eel, you wouldn't find a battery pack inside. ... Devices for energy harvesting ...

Download scientific diagram | Soft and flexible solid-state energy storage system inspired by electric eels. a) Voltage generation mechanism in living electric eels. Electric eels generate ...

Inspired by electric eels, researchers from the University of Oxford have developed a miniature "droplet" battery that could, some day, power tiny bio-integrated devices ...

Electric eels in nature can generate high voltage with hundreds of volts based on the mechanism of gradient-induced ion flux, which provides an excellent prototype to inspire the exploration of more efficient and green energy generation strategies in artificial systems. ... [15,16] and energy storage devices [17-20]. Although some noted ...

The bioelectrical behavior of electric eels is surveyed, followed by the physiological structure to reveal the discharge characteristics and principles of electric organs and electrocytes, and central to this review is the recent progress of electric-eel-inspired innovations and applications for energy storage and conversion.

Expand

Electricity-generating devices are among the most popular recent topics due to increasing global energy requirements, which have propelled many researchers to investigate different approaches. One approach involves electroreceptive animals. In this regard, we proposed a polymer-based energy generator converting Gibbs free energy into usable ...

These cells, arranged in series and parallel, are responsible for generating electric energy [12]. When an electric eel is ready to discharge electricity during hunting or defensive position, ion channels are activated to release ions, which causes electric potential [13]. The electric generation mechanism of electric eels is a complex process ...

Central to this review is the recent progress of electric-eel-inspired innovations and applications for energy storage and conversion, particularly including novel power sources, triboelectric ...

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