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Discoveries!

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Antimicrobial substances identified in Komodo dragon blood

Journal of Proteome Research

Compounds in Komodo dragon blood could lead to the development of new antibiotics.
Credit: Kent Vliet
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In a land where survival is precarious, Komodo dragons thrive despite being exposed to scads of bacteria that would kill less hardy creatures. Now in a study published in the *Journal of Proteome Research*, scientists report that they have detected antimicrobial protein fragments in the lizard's blood that appear to help them resist deadly infections. The discovery could lead to the development of new drugs capable of combating bacteria that have become resistant to antibiotics.

The world's largest lizard, Komodo dragons live on five small islands in Indonesia. The saliva of these creatures contains at least 57 species of bacteria, which are believed to contribute to the demise of their prey. Yet, the Komodo dragon appears resistant to these bacteria, and serum from these animals has been shown to have antibacterial activity. Substances known as cationic antimicrobial peptides (CAMPs) are produced by nearly all living creatures and are an essential part of the innate immune system. So, Barney Bishop, Monique van Hoek and colleagues at the College of Science at George Mason University wondered whether they could isolate CAMPs from Komodo dragon blood, as they previously had done with alligator blood to expand the library of known CAMPs for therapeutic studies.

The team used an approach known as bioprospecting. They incubated Komodo dragon blood with negatively charged hydrogel particles that they developed to capture the peptides, which are positively charged. With this method, they identified and sequenced 48 potential CAMPs with mass spectrometry. All but one of these was derived from histone proteins, which are known to have antimicrobial activities. Eight were synthesized and tested against *Pseudomonas aeruginosa* and *Staphylococcus aureus.* Seven of the peptides showed significant potency against both bacteria. The eighth was only effective against *P. aeruginosa.* The researchers conclude that Komodo dragon blood plasma contains a host of potentially viable antimicrobial peptides that could help lead to new therapeutics.

The authors acknowledge funding from the Defense Threat Reduction Agency (DTRA).

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See-through heating pad could help prevent burns from thermotherapy (video)

ACS Applied Materials & Interfaces

To soothe aches and pains, many people turn to heating pads, patches or creams. Although a common practice, thermotherapy can cause burns. Now researchers are developing a transparent heating pad that allows users to see through it to monitor their skin's color and prevent such injuries. They report their approach in the journal *ACS Applied Materials & Interfaces*.

A clear thermotherapy pad made with silver nanowires could allow users to see how their skin reacts to the device's heat.
Credit: American Chemical Society
See how the heating pad works in this Headline Science video.

Thermotherapy pads help treat a range of conditions including rheumatoid arthritis. But they've been known to cause burns, particularly among people who fall asleep with their heating pads on or among the elderly or others who might not be very sensitive to heat. Part of the problem is that commercial heating pads are opaque, and users can't see how their skin is reacting to the therapy. Other researchers have developed transparent alternatives, but they were ultimately too stiff, costly or brittle. Wei Lan and colleagues wanted to address this problem by developing a flexible, see-through device.

To make their thermotherapy pad, the researchers embedded conductive silver nanowires in a thin polyvinyl alcohol film. They then enveloped the film and a copper electrode in biocompatible polydimethylsiloxane, a type of silicone, to insulate the heating element and protect a user's skin. Testing showed that the transparent device heated quickly when 3 volts were applied, which is the typical voltage of coin-cell batteries used in watches, remotes and other small electronics. It was also very flexible and worked well even after being bent 10,000 times.

The authors acknowledge funding from the Natural Science Foundation of Gansu Province, the State Key Laboratory of Advanced Processing and Recycling of Non-ferrous Metals, Lanzhou University of Technology and the Scientific Research Foundation for the Returned Overseas Chinese Scholars, State Education Ministry.

See how the heating pad works in this Headline Science video.

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Some marine creatures may be more resilient to future, harsher ocean conditions than expected

Environmental Science & Technology

Despite the harsher ocean conditions predicted for the future, some marine animals could adapt better than expected.
Credit: ixpert/Shutterstock.com

As the world continually emits carbon dioxide into the atmosphere, the oceans are taking a hit, absorbing some of it and growing more acidic. Among other effects, scientists have found that coral reefs and oyster hatcheries are deteriorating as a result. However, scientists studying a type of sea snail report a bit of bright news in the ACS journal *Environmental Science & Technology*: The animal can adapt by rejiggering its shell-making process and other functions.

A lower pH in ocean waters means fewer carbonate ions are available to calcifying organisms, such as coral reefs and oysters, which need the ions to produce shells and skeletons. While ocean acidification appears to cause damage to many calcifying organisms, recent studies have suggested that some of those organisms may be more resistant to acidification than previously thought. Sean D. Connell and colleagues wanted to find out how this might be possible.

The researchers exposed sea snails called periwinkles to the ocean conditions predicted for 2100, when some waters at a pH of 8.10 today are expected to reach a pH of 7.85. Although the animals' metabolism declined, they were able to speed up their shell-making by producing less-dense inner shells. In addition, they developed less-soluble shells, which are more resistant to future, harsher ocean conditions. The researchers say these changes suggest that the periwinkle, and potentially other calcifying organisms, could have the ability to adapt to the acidifying oceans.

The authors acknowledge funding from the University of Adelaide and the Australian Research Council.

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Harnessing the energy of fireworks for fuel

Energy & Fuels

Scientists turn to power-packed fireworks to develop new fuels.
Credit: thechatat/Shutterstock.com

The world relies heavily on gasoline and other hydrocarbons to power its cars and trucks. In search of an alternative fuel type, some researchers are turning to the stuff of fireworks and explosives: metal powders. And now one team is reporting a method to produce a metal nanopowder fuel with high-energy content that is stable in air and doesn't go boom until ignited. Their study appears in the ACS journal *Energy & Fuels*.

Hydrocarbon fuels are liquid at room temperature, are simple to store, and their energy can be used easily in cars and trucks. Metal powders, which can contain large amounts of energy, have long been used as a fuel in explosives, propellants and pyrotechnics. It might seem counterintuitive to develop them as a fuel for vehicles, but some researchers have proposed to do just that. A major challenge is that high-energy metal nanopowder fuels tend to be unstable and ignite on contact with air. Albert Epshteyn and colleagues wanted to find a way to harness and control them, producing a fuel with both high-energy content and good air stability.

The researchers developed a method using an ultrasound-mediated chemical process to combine the metals titanium, aluminum and boron with a sprinkle of hydrogen in a mixed-metal nanopowder fuel. The resulting material was both more stable and had a higher energy content than the standard nano-aluminum fuels. With an energy density of at least 89 kilojoules/milliliter, which is significantly superior to hydrocarbons' 33 kilojoules/milliliter, this new titanium-aluminum-boron nanopowder packs a big punch in a small package.

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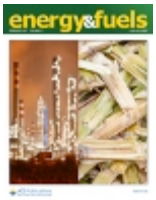

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