RESEARCH HIGHLIGHTS

IMMUNOLOGY

Timely defence

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0906361106 (2009)

Many activities of the immune system follow rhythmic daily cycles. Now researchers have found that some immune cells have their own circadian clocks.

Achim Kramer of the Charité Medical University in Berlin and his colleagues took immune cells and tissues from mice at regular intervals throughout the day. They found that macrophages — cells that form part of the immune system's first line of defence against bacterial infections — from the spleen, lymph nodes and abdominal area express circadian clock genes. In addition, they showed that about 8% of macrophage genes are expressed rhythmically.

The authors also report that the secretion of immune modulators by spleen macrophages in response to bacterial toxins follows circadian rhythms.

BIOLOGY

Beetle-juice antifreeze

Proc. Natl Acad. Sci. USA **106,** 20210–20215 (2009)

Many animals survive extreme cold by producing 'antifreeze' compounds that inhibit ice growth. The compounds described so far have all been proteins.

Kent Walters at the University of Notre Dame in Indiana and his colleagues have now characterized the first animal antifreeze that contains little or no protein.

They isolated the compound from the darkling beetle *Upis ceramboides* (pictured below), which can withstand temperatures as low as −60° C, allowing it to live in harsh climates like that of Alaska. Analysis showed it to comprise a xylomannan saccharide with a fatty acid component.

S. SHARMA

Chess obeys the law

Phys. Rev. Lett. **103,** 218701 (2009)

In a large sample of texts, 'the' is the most frequently used word. Coming in second is 'of', which is used about half as often. 'And' — in third place — is used about one-third as often, and so on. This curious relationship is known as Zipf's law after the linguist George Kingsley Zipf.

Various phenomena follow formulations of Zipf's law, and chess can now be added to the list. Bernd Blasius of the University of Oldenburg in Germany and Ralf Tönjes of Ochanomizu University in Tokyo analysed the first 40 moves of more than a million chess games recorded in an online database. They found that the frequency of the most common moves followed the law. They add that board games could help physicists to develop new statistical tools.

A. BARRIENTOS /AP PHOTO

ENVIRONMENTAL CHEMISTRY

Plucking pollutants

Environ. Sci. Technol. doi:10.1021/es902407g (2009)

DNA fragments offer an effective way to extract arsenic from contaminated groundwater, a team in South Korea reports.

Jiho Min at Chonbuk National University, Yang-Hoon Kim at Chungbuk University and their colleagues designed an aptamer — a short, single strand of DNA that can bind to a specific molecule — for the purpose. The aptamer was able to efficiently remove arsenic from samples of groundwater collected in different areas of Vietnam, where arsenic levels are often higher than the US Environmental Protection Agency's recommended maximum.

Aptamer devices could be made with cheap materials such as silicon, the authors say.

GENETICS

One on one

Science **326,** 1231–1235 (2009)

Human cells, with their two sets of chromosomes, do not lend themselves to large-scale genetic screens as simple model organisms such as yeast have so profitably done.

Thijn Brummelkamp at the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts, and his colleagues have devised a way around the problem. Using a cell line with only one copy of most human chromosomes, they inactivated various genes using a method called insertional mutagenesis. The researchers then screened cells that were resistant to particular pathogens to see which genes invaders might rely on to attack.

Using the technique, the team identified two host genes used by the influenza H1N1 virus to infect cells, as well as genes exploited by other bacterial toxins to kill host cells. The authors say the method could help in developing new antiviral therapies.

NEUROSCIENCE

Brain's immune connection

Neuron **64,** 463-470 (2009)

Connections between neurons strengthen or break during brain development. Unexpectedly, key cell-surface proteins involved in immunity seem to regulate some of this plasticity.

Carla Shatz of Stanford University in Palo Alto, California, and her colleagues found that two members of the family of major histocompatibility complex class I (MHC I) proteins limit the 'tuning up' of circuitry involved in visual processing. Mice in which the genes for these two proteins