# RESEARCH HIGHLIGHTS

*Selections from the scientific literature*

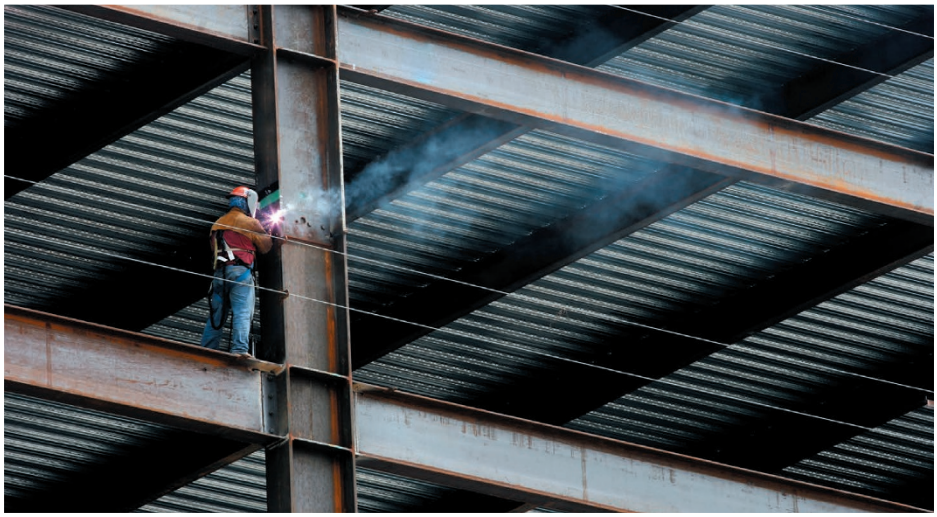
EVOLUTION

## Ancient sea-star lenses found

Tiny lenses that could have allowed sea stars and brittle stars to respond to light may have evolved at least 57 million years earlier than previously thought.

Some sea and brittle stars living today have an array of lenses on their skeletons that are thought to be sensitive to light. Przemysław Gorzelak at the Polish Academy of Sciences in Warsaw, Mariusz Salamon at the University of Silesia in Sosnowiec, Poland, and their colleagues used microscopy and imaging techniques to identify and describe microlenses in fossilized brittle stars (members of the Ophiuroidea) and sea stars (Asteroidea) dating to 136 million years ago. The lenses resemble those found in modern species. Until now, the earliest examples of fossil stars with such lenses were about 79 million years old.

The microlenses evolved long after the brittle- and sea-star lineages diverged, so may have emerged independently in the two groups from shared structures, the authors suggest.
***Evol. Biol.*** **http://doi.org/b2tf (2017)**



GETTY

MATERIALS

## Bone-like steel stops cracks

Steel that mimics the structure of bone is resistant to cracking — a property that could be exploited to produce safer cars, aeroplanes and power plants.

Conventional sheet metals are prone to failure when exposed to repeated stress, because cracks, once formed, easily spread. Inspired by the fracture resistance of bone, Motomichi Koyama of Kyushu University in Fukuoka, Japan, and his colleagues designed an alloy with a similar substructure. The authors packed different metal nanostructures together in a hierarchical way. This helped to deflect and halt the growth of cracks in stress tests, allowing the steel to withstand higher levels and more cycles of applied stress than commonly used steels.
***Science*** 355, **1055–1057 (2017)**

CANCER IMMUNOTHERAPY

## Drug success factor found

The success of a cancer therapy that unleashes immune cells on tumours depends on the cells producing a protein called CD28. The molecule could serve as a biomarker for selecting individuals who are likely to respond to certain immunotherapies.

Drugs that inhibit a protein called PD-1 can boost the proliferation of immune cells called T cells and their anti-cancer activity, but the strategy works in only a fraction of patients. Rafi Ahmed at Emory University in Atlanta, Georgia, and his colleagues found that when they chemically blocked the activity of CD28, which is made by T cells, tumours kept growing in mice, even when the animals were treated with anti-PD-1 drugs. In patients with lung cancer whose T cells proliferated after receiving PD-1 therapy, those cells tended to express CD28.

In a separate study, Ronald Vale at the University of California, San Francisco, Ira Mellman at Genentech in South San Francisco and their colleagues found that PD-1 and CD28 are part of the same biochemical pathway. They report that PD-1 signalling suppresses T-cell function by inactivating CD28 activity.
***Science*** **http://doi.org/b2vs; http://doi.org/b2vt (2017)**

CLIMATE CHANGE

## Warming poses risk to US farming

Agricultural productivity in the United States could return to pre-1980s levels by 2050 as a result of climate change.

Farming in the United States, the world's largest food producer, has grown steadily more efficient since the 1950s, thanks mainly to technological improvements. Xin-Zhong Liang at the University of Maryland in College Park and his colleagues studied the effects of regional climate on the country's farming economy and found that, between 1981 and 2010, fluctuations in temperature and rainfall accounted for 70% of the variation seen in national productivity. The team incorporated these data and current climate projections into a model, and predicted that, in scenarios of medium and high greenhouse-gas emissions, productivity between 2010 and 2040 could drop by 2.8% and 4.3% a