



18 FOCUS

Symbiosis

18 Getting to the Root of Things

Plants have lived in close community with certain fungi for millions of years. The microorganisms provide them with vital mineral salts such as phosphate, and in return, the fungi are supplied with carbohydrates. How do these unequal partners establish contact with each other? And how do they exchange nutrients?

26 Alliance on a Silken Thread

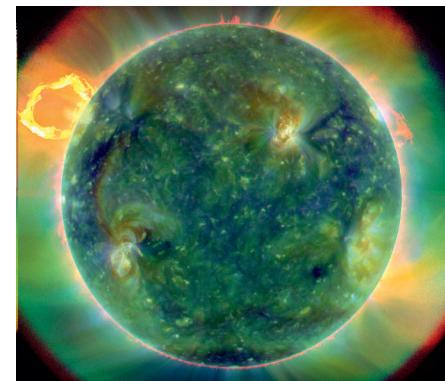
Many insects rely on bacteria for vital support. The microorganisms produce survival cocktails for their larvae, help them break down indigestible food components or supply essential vitamins. Researchers are elucidating fascinating details about the symbiotic relationships between insects and microbes.

34 Power Plants at the Bottom of the Sea

The depths of the ocean are a hostile environment. In a bid to defy these adverse conditions, many organisms have teamed up to form close relationships called symbioses. Scientists keep discovering new symbioses that provide these deep-sea inhabitants with a guaranteed energy supply.

ON THE COVER: The larvae of the beewolf maintain their own pharmaceutical factories – bacteria that produce antibiotics and thus protect them against pests while they overwinter underground. In this composite photo, mass spectrometric imaging was used to make the antibiotics visible and project them onto the cocoon in false colors. Red and yellow areas correspond to sites with a high concentration of antibiotics, and blue and violet indicate low concentrations.

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Sun in turmoil: The Sun spews fountains of gas and particles into space.

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- 12 **The Beauty of Numbers**
Mathematics has influenced many a creative genius. But also mathematics itself contains an element of beauty. Our author pleads the case for how much pleasure the art of mathematics can bring, even to a layperson.

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Cosmos in 3-D: Astrophysicist Sadegh Khochfar shows the model of a galaxy cluster.



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Personal Portrait: Sadegh Khochfar

BIOLOGY & MEDICINE

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The human genome contains two sets of chromosomes: one inherited from the father and one from the mother. Now scientists have sequenced both versions of the human genome separately for the first time and, in the process, discovered that individuals are even more individual than we thought.

MATERIALS & TECHNOLOGY

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For gourmets, they are mainly a nuisance. For biologists, however, they are a treasure trove of information: lobster and crab shells. Their construction principles reveal how arthropods produce versatile material properties.

ENVIRONMENT & CLIMATE

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As a result of climate change, it is very likely that southern Europe will become much drier. Ironically, however, significant global warming could lead to an increase of vegetation in the Sahara. Researchers are simulating the interplay of climate and vegetation.

CULTURE & SOCIETY

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Forest burial sites are taking the place of cemeteries, urns replacing oak coffins – over the past two decades, funerals in Germany have become much more multifaceted; the stolid dignity of old-style interments is out of fashion.

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