

***NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH
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February, 2020

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Bulletin of Environmental Contamination and Toxicology

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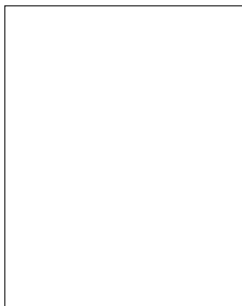
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Journal of Occupational and Environmental Medicine. 62(2):93-97, February 2020.

[Nerve Function Impairment After Acute Vibration Exposure](#)

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Journal of Occupational and Environmental Medicine. 62(2):124-129, February 2020.

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Journal of Occupational and Environmental Medicine. 62(2):98-107, February 2020.

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Deployment Exposures, Biomarkers, and Risk of Adverse Health Outcomes Guest Editors: Timothy M. Mallon, MD, MPH and Joel C. Gaydos, MD, MPH

Published December 2019

Current Issue Highlights

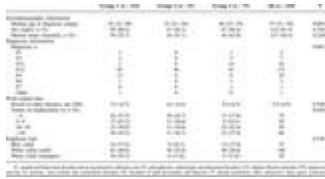
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[Preadmission Exposure to Air Pollution and 90-Day Mortality in Critically ill Patients: A Retrospective Study](#)

Im, Chami; Kim, Dong Hyun; Oh, Tak Kyu

Journal of Occupational and Environmental Medicine. 62(2):93-97, February 2020.



	Model 1	Model 2	Model 3	Model 4
Age				
Gender				
Education				
Income				
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Work duration				
Previous absences				
Constant				
N				

Number of Previous Absences Is a Predictor of Sustained Attendance After Return-to-Work in Workers With Absence due to Common Mental Disorders: A Cohort 3-Year Study

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	Model 1	Model 2	Model 3	Model 4
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Direct, Absenteeism, and Disability Cost Burden of Obesity Among Privately Insured Employees: A Comparison of Healthcare Industry Versus Other Major Industries in the United States

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Journal of Occupational and Environmental Medicine. 62(2):98-107, February 2020.

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Journal of Occupational and Environmental Medicine. 62(2):e78-e79, February 2020.

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Journal of Occupational and Environmental Medicine. 62(2):e80-e81, February 2020.

Response to the Relationship of the Amount of Physical Therapy to Time Lost From Work and Costs in the Workers’ Compensation System

Leung, Nina; Tao, Xuguang; Bernacki, Edward J.

Journal of Occupational and Environmental Medicine. 62(2):e82, February 2020.

Nature

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[Calling all coronavirus researchers: keep sharing, stay open](#)

As the new coronavirus continues its deadly spread, researchers must ensure that their work on this outbreak is shared rapidly and openly.

- Editorial | 05 February 2020

[The era of massive cancer sequencing projects has reached a turning point](#)

The future of cancer genomics lies in the clinic.

- Editorial | 05 February 2020

[Nature will publish peer review reports as a trial](#)

Research involves deep discussions between authors and reviewers. Starting this week, readers of some Nature Research journals will be able to see this up close.

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News & Views

- News & Views | 05 February 2020

[Global genomics project unravels cancer's complexity at unprecedented scale](#)

A massive international effort has yielded multifaceted studies of more than 2,600 tumours from 38 tissues, generating a wealth of insights into the genetic basis of cancer.

- Marcin Cieslik & Arul M. Chinnaiyan

- News & Views | 05 February 2020

[A platform for making and transferring oxide films](#)

Crystalline films of technologically useful oxide materials have been grown by a method based on surface-modified substrates. Unlike usual oxide films, these can be easily transferred to any material.

- Atsushi Tsukazaki

- News & Views | 22 January 2020
[Reactivation of latent HIV moves shock-and-kill treatments forward](#)
 HIV-1 can evade the immune system by hiding out in a dormant form. Two studies describe interventions that can effectively reactivate the latent virus in animals, potentially rendering it vulnerable to immune-mediated death.
 - Mathias Lichterfeld

- News & Views | 05 February 2020
[Muon colliders come a step closer](#)
 Particle colliders that use elementary particles called muons could outperform conventional colliders, while requiring much smaller facilities. Muon cooling, a milestone on the road to these muon colliders, has now been achieved.
 - Robert D. Ryne

- News & Views | 03 February 2020
[Early climate models successfully predicted global warming](#)
 Climate models published between 1970 and 2007 provided accurate forecasts of subsequently observed global surface warming. This finding shows the value of using global observations to vet climate models as the planet warms.
 - Jennifer E. Kay

- News & Views | 29 January 2020
[Brain tumours manipulate neighbouring synapses](#)
 The growth of a brain tumour can be affected by the activity of its neighbouring neurons. The finding that such tumours send signals that boost connections between these neurons reveals a pathway that drives cancer growth.
 - Nicola J. Allen

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[An orbital water-ice cycle on comet 67P from colour changes](#)
 Spectral analysis of the VIRTIS dataset shows two opposite seasonal colour cycles in the coma and on the surface of comet 67P/Churyumov–Gerasimenko, indicating an orbital water-ice cycle.
 - Gianrico Filacchione, Fabrizio Capaccioni & Stefano Mottola

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[Demonstration of cooling by the Muon Ionization Cooling Experiment](#)
 Ionization cooling, a technique that delivers high-brightness muon beams for the study of phenomena at energy scales beyond those of the Large Hadron Collider, is demonstrated by the Muon Ionization Cooling Experiment.
 - M. Bogomilov, R. Tsenov & C. Heidt

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[Coherent laser spectroscopy of highly charged ions using quantum logic](#)
 The precision of laser spectroscopy of highly charged ions is improved by eight orders of magnitude by cooling trapped, highly charged ions and using quantum logic spectroscopy, thereby enabling tests of fundamental physics.
 - P. Micke, T. Leopold & P. O. Schmidt

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[Quantum crystal structure in the 250-kelvin superconducting lanthanum hydride](#)
 Quantum atomic fluctuations have a crucial role in stabilizing the crystal structure of the high-pressure superconducting phase of lanthanum hydride.
 - Ion Errea, Francesco Belli & José A. Flores-Livas

- Article | 27 January 2020
[Spin current from sub-terahertz-generated antiferromagnetic magnons](#)
 Pure spin currents are simultaneously generated and detected electrically through sub-terahertz magnons in the antiferromagnetic insulator Cr_2O_3 , demonstrating the potential of magnon excitations in antiferromagnets for high-frequency spintronic devices.
 - Junxue Li, C. Blake Wilson & Jing Shi

- Article | 05 February 2020
[Heterogeneous integration of single-crystalline complex-oxide membranes](#)
 A universal mechanical exfoliation method of creating freestanding membranes of complex-oxide materials with different crystal structures and orientations and stacking them to produce a range of artificial heterostructures with hybridized physical properties is described.
 - Hyun S. Kum, Hyungwoo Lee & Jeehwan Kim

- Article | 05 February 2020 | Open Access
[Pan-cancer analysis of whole genomes](#)
 The flagship paper of the ICGC/TCGA Pan-Cancer Analysis of Whole Genomes Consortium describes the generation of the integrative analyses of 2,658 cancer whole genomes and their matching normal tissues across 38

tumour types, the structures for international data sharing and standardized analyses, and the main scientific findings from across the consortium studies.

- Peter J. Campbell, Gad Getz & Jiashan Zhang

- Article | 05 February 2020 | Open Access
[The repertoire of mutational signatures in human cancer](#)
The characterization of 4,645 whole-genome and 19,184 exome sequences, covering most types of cancer, identifies 81 single-base substitution, doublet-base substitution and small-insertion-and-deletion mutational signatures, providing a systematic overview of the mutational processes that contribute to cancer development.
- Ludmil B. Alexandrov, Jaegil Kim & Michael R. Stratton

- Article | 05 February 2020 | Open Access
[Analyses of non-coding somatic drivers in 2,658 cancer whole genomes](#)
Analyses of 2,658 whole genomes across 38 types of cancer identify the contribution of non-coding point mutations and structural variants to driving cancer.
- Esther Rheinbay, Morten Muhligh Nielsen & Gad Getz

- Article | 05 February 2020 | Open Access
[Patterns of somatic structural variation in human cancer genomes](#)
Whole-genome sequencing data from more than 2,500 cancers of 38 tumour types reveal 16 signatures that can be used to classify somatic structural variants, highlighting the diversity of genomic rearrangements in cancer.
- Yilong Li, Nicola D. Roberts & Peter J. Campbell

- Article | 06 February 2020 | Open Access
[The evolutionary history of 2,658 cancers](#)
Whole-genome sequencing data for 2,778 cancer samples from 2,658 unique donors across 38 cancer types is used to reconstruct the evolutionary history of cancer, revealing that driver mutations can precede diagnosis by several years to decades.
- Moritz Gerstung, Clemency Jolly & Peter Van Loo

- Article | 05 February 2020 | Open Access
[Genomic basis for RNA alterations in cancer](#)
Integrative analyses of transcriptome and whole-genome sequencing data for 1,188 tumours across 27 types of cancer are used to provide a comprehensive catalogue of RNA-level alterations in cancer.
- Claudia Calabrese, Natalie R. Davidson & Zemin Zhang

- Article | 29 January 2020
[The pheromone darcin drives a circuit for innate and reinforced behaviours](#)
 A neural circuit activated by the male pheromone, darcin, mediates a complex and variable array of innate and reinforced behaviours that may promote mate encounters and mate selection.
 - Ebru Demir, Kenneth Li & Richard Axel

- Article | 29 January 2020
[Cell stress in cortical organoids impairs molecular subtype specification](#)
 Single-cell RNA sequencing clarifies the development and specification of neurons in the human cortex and shows that cell stress impairs this process in cortical organoids.
 - Aparna Bhaduri, Madeline G. Andrews & Arnold R. Kriegstein

- Article | 22 January 2020
[Targeting of temperate phages drives loss of type I CRISPR–Cas systems](#)
 CRISPR–Cas systems cannot eliminate temperate bacteriophages from bacterial populations and—in this context—the systems impose immunopathological costs on the host, creating selective pressures that may explain their patchy distribution in bacteria.
 - Clare Rollie, Anne Chevallereau & Edze R. Westra

- Article | 22 January 2020
[Robust and persistent reactivation of SIV and HIV by N-803 and depletion of CD8⁺ cells](#)
 The interleukin-15 superagonist N-803, combined with the depletion of CD8⁺ lymphocytes, induced a robust and persistent reactivation of the virus in vivo in both antiretroviral-therapy-treated SIV-infected macaques and HIV-infected humanized mice.
 - Julia Bergild McBrien, Maud Mavigner & Guido Silvestri

- Article | 22 January 2020
[Systemic HIV and SIV latency reversal via non-canonical NF-κB signalling in vivo](#)
 Activation of the non-canonical NF-κB signalling pathway by AZD5582 results in the induction of HIV and SIV RNA expression in the blood and tissues of antiretroviral-therapy-treated humanized mice and rhesus macaques.
 - Christopher C. Nixon, Maud Mavigner & J. Victor Garcia

- Article | 29 January 2020
[PIK3CA variants selectively initiate brain hyperactivity during gliomagenesis](#)
 Glioblastoma tumours expressing oncogenic PIK3CA variants secrete the glycan GPC3, which promotes the formation of neural synapses, brain synaptic hyperexcitability and gliomagenesis.
 - Kwanha Yu, Chia-Ching John Lin & Benjamin Deneen
- Article | 22 January 2020
[Constructing protein polyhedra via orthogonal chemical interactions](#)
 An inorganic chemical approach to biomolecular design is used to generate ‘cages’ that can simultaneously promote symmetry and multiple modes of protein interactions.
 - Eyal Golub, Rohit H. Subramanian & F. Akif Tezcan

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This Week

Editorial

- Editorial | 11 February 2020
[As coronavirus spreads, the time to think about the next epidemic is now](#)
 World leaders and international donors must strengthen the most vulnerable nations’ health-care systems.
 - Editorial | 12 February 2020
[Irreproducibility is not a sign of failure, but an inspiration for fresh ideas](#)
 The history of metrology holds valuable lessons for initiatives to reproduce results — and for efforts to enhance trust in research.
 - Editorial | 07 February 2020
[Combat burnout: respect the out-of-office message](#)
 Employers must do more to support researchers when they take a break.

Research

News & Views

- News & Views | 12 February 2020
Quantum cascade laser lives on the edge
Devices known as quantum cascade lasers produce useful terahertz radiation, but are typically highly sensitive to fabrication defects. This limitation has now been overcome using a property called topological robustness.
 - Sunil Mittal & Edo Waks
- News & Views | 29 January 2020
Protein structure reveals how a malaria parasite imports a wide range of sugars
Unlike many sugar-transporting proteins, a transporter in one species of malaria parasite can import several types of sugar equally effectively, aiding the parasite's survival. The structure of this protein reveals the reason for its versatility.
 - Thorsten Althoff & Jeff Abramson
- News & Views | 12 February 2020
Ordered absences observed in porous framework materials
Prussian blue analogues are archetypes of coordination solids, in which metal ions are bridged by ligands to form extended network structures. An analysis reveals a surprising ordering of the gaps found in their crystal lattices.
 - Adam Jaffe & Jeffrey R. Long
- News & Views | 05 February 2020
Neurodegenerative diseases distinguished through protein-structure analysis
Parkinson's disease and multiple system atrophy involve the protein α -synuclein. Proof that aggregated α -synuclein adopts a different structure in each case suggests that its conformation underlies the distinct disorders.
 - Juan Atilio Gerez & Roland Riek
- News & Views | 29 January 2020
Smoke signals in the DNA of normal lung cells
Healthy cells in smokers' lungs have a high burden of mutations, similar to the mutational profile of lung cancer. Surprisingly, ex-smokers' lungs have a large fraction of healthy cells with nearly normal profiles.
 - Gerd P. Pfeifer

- News & Views Forum | 10 February 2020
Scrutinizing the effects of digital technology on mental health
Does time spent using digital technology and social media have an adverse effect on mental health, especially that of adolescents? Here, two scientists discuss the question, and how digital devices might be used to improve well-being.
- Jonathan Haidt & Nick Allen

Reviews

- Review Article | 12 February 2020
The promise and challenge of therapeutic genome editing
The scientific, technical and ethical aspects of using CRISPR technology for therapeutic applications in humans are discussed, highlighting both opportunities and challenges of this technology to treat, cure and prevent genetic disease.
- Jennifer A. Doudna

Articles

- Article | 07 January 2020
A Galactic-scale gas wave in the solar neighbourhood
The three-dimensional structure of all cloud complexes in the solar neighbourhood is revealed, showing a narrow and coherent 2.7-kpc arrangement of dense gas, in disagreement with the Gould Belt model.
- João Alves, Catherine Zucker & Gregory M. Green

- Article | 12 February 2020
Entanglement of two quantum memories via fibres over dozens of kilometres
The entanglement of two atomic-ensemble quantum memories via optical fibres, enabled by the use of cavity enhancement and quantum frequency conversion, is demonstrated over dozens of kilometres.
- Yong Yu, Fei Ma & Jian-Wei Pan

- Article | 12 February 2020
Electrically pumped topological laser with valley edge modes
A topological laser based on the valley degree of freedom in a compact photonic crystal can be pumped electrically, bringing topological physics concepts closer to real-life applications.
- Yongquan Zeng, Udvash Chattopadhyay & Qi Jie Wang

- Article | 03 February 2020
Li metal deposition and stripping in a solid-state battery via Coble creep
 By containing lithium metal within oriented tubes of a mixed ionic-electronic conductor, a 3D anode for lithium metal batteries is produced that overcomes chemomechanical stability issues at the electrolyte interface.
 - Yuming Chen, Ziqiang Wang & Ju Li

- Article | 12 February 2020
Hidden diversity of vacancy networks in Prussian blue analogues
 The growth of single-crystal Prussian blue analogues and their analysis using X-ray diffuse scattering reveals diverse, non-random vacancy arrangements and information about the micropore-network characteristics of these materials.
 - Arkadiy Simonov, Trees De Baerdemaeker & Andrew L. Goodwin

- Article | 12 February 2020
Premature mortality related to United States cross-state air pollution
 This analysis of the exchange of air pollution amongst the contiguous United States finds that, on average, around half of the early deaths caused by a state's air pollution occurs outside that state, with different contributions by different emission sectors and chemical species.
 - Irene C. Dedoussi, Sebastian D. Eastham & Steven R. H. Barrett

- Article | 29 January 2020
Tobacco smoking and somatic mutations in human bronchial epithelium
 Whole-genome sequencing of normal bronchial epithelium from 16 individuals shows that tobacco smoking increases genomic heterogeneity, mutational burden and driver mutations, whereas stopping smoking promotes replenishment of the epithelium with near-normal cells.
 - Kenichi Yoshida, Kate H. C. Gowers & Peter J. Campbell

- Article | 05 February 2020
Discriminating α -synuclein strains in Parkinson's disease and multiple system atrophy
 Protein misfolding cyclic amplification (PMCA) technology can discriminate between patients with Parkinson's disease and patients with multiple system atrophy on the basis of the characteristics of the α -synuclein aggregates in the cerebrospinal fluid.
 - Mohammad Shahnawaz, Abhisek Mukherjee & Claudio Soto

- Article | 05 February 2020
Live-animal imaging of native haematopoietic stem and progenitor cells
 A dual genetic strategy enables the labelling and in vivo imaging of native long-term haematopoietic stem cells in the mouse calvarial bone marrow.
 - Constantina Christodoulou, Joel A. Spencer & Fernando D. Camargo

- Article | 05 February 2020
Neuronal programming by microbiota regulates intestinal physiology
 In a mouse model, aryl hydrocarbon receptor signalling in enteric neurons is revealed as a mechanism that helps to maintain gut homeostasis by integrating the luminal environment with the physiology of intestinal neural circuits.
 - Yuuki Obata, Álvaro Castaño & Vassilis Pachnis

- Article | 05 February 2020
The guidance receptor plexin D1 is a mechanosensor in endothelial cells
 PLXND1 is a mechanosensor that is required for endothelial cells to respond to shear stress both in vitro and in vivo by regulating the site-specific distribution of atherosclerotic lesions.
 - Vedanta Mehta, Kar-Lai Pang & Ellie Tzima

- Article | 05 February 2020
Stress- and ubiquitylation-dependent phase separation of the proteasome
 Hyperosmotic stress leads to a phase separation of the proteasome, triggered by interactions between RAD23B and ubiquitylated proteins, which bring together p97 and proteasome-associated proteins into nuclear proteolytic foci.
 - Sayaka Yasuda, Hikaru Tsuchiya & Yasushi Saeki

- Article | 05 February 2020
Phase separation organizes the site of autophagosome formation
 The pre-autophagosomal structure in yeast is a liquid-like condensate of Atg proteins whose phase separation may have a critical, active role in autophagy.
 - Yuko Fujioka, Jahangir Md. Alam & Nobuo N. Noda

- Article | 22 January 2020
Selective inhibition of the BD2 bromodomain of BET proteins in prostate cancer
 ABBV-744, a selective inhibitor of the BD2 domains of BET family proteins, is effective against prostate cancer in mouse xenograft models, with lower toxicities than the dual-bromodomain BET inhibitor ABBV-075.
 - Emily J. Faivre, Keith F. McDaniel & Yu Shen

- Article | 29 January 2020
Zucchini consensus motifs determine the mechanism of pre-piRNA production
 A silkworm model recapitulates key steps of Zucchini-mediated cleavage of pre-pre-piRNA and provides insights into Zucchini-mediated and -independent pathways that generate pre-piRNAs, which converge to a common piRNA maturation step.
 - Natsuko Izumi, Keisuke Shoji & Yukihide Tomari

- Article | 29 January 2020
Processive extrusion of polypeptide loops by a Hsp100 disaggregase
 A combination of optical tweezers and fluorescent-particle tracking is used to dissect the dynamics of the Hsp100 disaggregase ClpB, and show that the processive extrusion of polypeptide loops is the mechanistic basis of its activity.
 - Mario J. Avellaneda, Kamila B. Franke & Sander J. Tans

- Article | 29 January 2020
The molecular basis for sugar import in malaria parasites
 Crystal structure of the *Plasmodium falciparum* hexose transporter PfHT1 reveals the molecular basis of its ability to transport multiple types of sugar as efficiently as the dedicated mammalian glucose and fructose transporters.
 - Abdul Aziz Qureshi, Albert Suades & David Drew

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This Week

Editorial

- Editorial | 18 February 2020
The United Nations must get its new biodiversity targets right
 Global goals to reduce biodiversity loss will be revised this year. All eyes are on China, which must ensure the new targets are measurable and meaningful.

- Editorial | 19 February 2020

Will the latest UK Research Excellence Framework turn out to be the last?

The REF is unpopular but researchers should beware unintended consequences if it is abolished.

Research

News & Views

- News & Views | 05 February 2020

How to silence an X chromosome

The non-coding RNA *Xist* has been shown to enlist the SPEN protein to recruit a team of protein complexes — initiating the process that prevents transcription of one of the two X chromosomes found in female mammalian cells.

- Jackson B. Trotman & J. Mauro Calabrese

- News & Views | 14 February 2020

Why surface roughness is similar at different scales

Most surfaces are rough at many length scales. Simulations show that this characteristic originates at the atomic level in metal-based materials when smooth blocks of these materials are compressed.

- Astrid S. de Wijn

- News & Views | 12 February 2020

Loss of p53 protein strikes a nerve to aid tumour growth

Tumours often grow entangled among neurons, which makes the cancer difficult to treat. The finding that cancer cells hijack neighbouring neurons to promote tumour growth suggests new therapeutic targets.

- Marco Napoli & Elsa R. Flores

- News & Views | 19 February 2020

Fundamental symmetry tested using antihydrogen

The breaking of a property of nature called charge–parity–time symmetry might explain the observed lack of antimatter in the Universe. Scientists have now hunted for such symmetry breaking using the antimatter atom antihydrogen.

- Randolph Pohl

- News & Views | 17 February 2020
30 years of the iron hypothesis of ice ages
In 1990, an oceanographer who had never worked on climate science proposed that ice-age cooling has been amplified by increased concentrations of iron in the sea — and instigated an explosion of research.
- Heather Stoll
- News & Views | 12 February 2020
Transfer of ubiquitin protein caught in the act
A process termed ubiquitination mediates the regulated destruction of cellular proteins, thereby preventing disease or infection. Structural data now reveal how a crucial regulator of ubiquitination enzymes coordinates this process.
- Raymond J. Deshaies & Nathan W. Pierce

Articles

- Article | 19 February 2020 | Open Access
Investigation of the fine structure of antihydrogen
Precision measurements of the 1S–2P transition in antihydrogen that take into account the standard Zeeman and hyperfine effects confirm the predictions of quantum electrodynamics.
- M. Ahmadi, B. X. R. Alves & J. S. Wurtele
- Article | 19 February 2020
Measurement of the quantum geometric tensor and of the anomalous Hall drift
Direct measurement of the Berry curvature and the quantum metric of photonic modes in a high-finesse planar microcavity is achieved, enabling quantitative prediction of the independently measured anomalous Hall drift.
- A. Gianfrate, O. Bleu & G. Malpuech
- Article | 10 February 2020
Attosecond pulse shaping using a seeded free-electron laser
Generation of intense attosecond waveforms with independently controllable amplitude and phase is performed by using a seeded free-electron laser.
- Praveen Kumar Maroju, Cesare Grazioli & Giuseppe Sansone
- Article | 05 February 2020
A droplet-based electricity generator with high instantaneous power density
A device involving a polytetrafluoroethylene film, an indium tin oxide substrate and an aluminium electrode allows improved electricity generation

from water droplets, which bridge the previously disconnected circuit components.

- Wanghui Xu, Huanxi Zheng & Zuankai Wang

- Article | 19 February 2020
Closed-loop optimization of fast-charging protocols for batteries with machine learning
A closed-loop machine learning methodology of optimizing fast-charging protocols for lithium-ion batteries can identify high-lifetime charging protocols accurately and efficiently, considerably reducing the experimental time compared to simpler approaches.
- Peter M. Attia, Aditya Grover & William C. Chueh

- Article | 15 January 2020
Synthesis of rare sugar isomers through site-selective epimerization
Various rare sugars that cannot be isolated from natural sources are synthesized using light-driven epimerization, a process which may find application in other synthetic scenarios.
- Yong Wang, Hayden M. Carder & Alison E. Wendlandt

- Article | 19 February 2020
Preindustrial ¹⁴CH₄ indicates greater anthropogenic fossil CH₄ emissions
Isotopic evidence from ice cores indicates that preindustrial-era geological methane emissions were lower than previously thought, suggesting that present-day emissions of methane from fossil fuels are underestimated.
- Benjamin Hmiel, V. V. Petrenko & E. Dlugokencky

- Article | 12 February 2020
A claustrum in reptiles and its role in slow-wave sleep
A structure homologous to the mammalian claustrum exists in reptiles and has a role in generating sharp waves in the brain during slow-wave sleep.
- Hiroaki Norimoto, Lorenz A. Fenk & Gilles Laurent

- Article | 29 January 2020
ATP13A2 deficiency disrupts lysosomal polyamine export
The lysosomal polyamine transporter ATP13A2 controls the cellular polyamine content, and impaired lysosomal polyamine export represents a lysosome-dependent cell death pathway that may be implicated in ATP13A2-associated neurodegeneration.
- Sarah van Veen, Shaun Martin & Peter Vangheluwe

- Article | 12 February 2020 | Open Access
Clades of huge phages from across Earth's ecosystems
 Genomic analyses of major clades of huge phages sampled from across Earth's ecosystems show that they have diverse genetic inventories, including a variety of CRISPR–Cas systems and translation-relevant genes.
 - Basem Al-Shayeb, Rohan Sachdeva & Jillian F. Banfield

- Article | 22 January 2020 | Open Access
Giant virus diversity and host interactions through global metagenomics
 Analysis of metagenomics data revealed that large and giant viruses are globally widely distributed and are associated with most major eukaryotic lineages.
 - Frederik Schulz, Simon Roux & Tanja Woyke

- Article | 05 February 2020
AQP5 enriches for stem cells and cancer origins in the distal stomach
 AQP5 is identified as a marker for pyloric stem cells in humans and mice, and stem cells in the AQP5⁺ compartment are shown to be a source of invasive gastric cancer in mouse models.
 - Si Hui Tan, Yada Swathi & Nick Barker

- Article | 25 December 2019
GDF15 mediates the effects of metformin on body weight and energy balance
 In mouse studies, metformin treatment results in increased secretion of growth/differentiation factor 15 (GDF15), which prevents weight gain in response to high-fat diet, and GDF15-independent lowering of circulating blood glucose.
 - Anthony P. Coll, Michael Chen & Stephen O'Rahilly

- Article | 12 February 2020
Loss of p53 drives neuron reprogramming in head and neck cancer
 MicroRNAs from head and neck cancer cells, shuttled to sensory neurons by extracellular vesicles, cause a shift to an adrenergic neuronal phenotype that promotes tumour progression.
 - Moran Amit, Hideaki Takahashi & Jeffrey N. Myers

- Article | 05 February 2020
SPEN integrates transcriptional and epigenetic control of X-inactivation
 The transcriptional repressor SPEN bridges the non-coding RNA *Xist* to transcription machinery, histone deacetylases and chromatin remodelling factors to initiate X-chromosome inactivation.
 - François Dossin, Inês Pinheiro & Edith Heard

- Article | 12 February 2020
NEDD8 nucleates a multivalent cullin–RING–UBE2D ubiquitin ligation assembly
 A cryo-electron microscopy structure provides insights into the activation of cullin–RING E3 ligases by NEDD8 and the consequent catalysis of ubiquitylation reactions.
 - Kheewoong Baek, David T. Krist & Brenda A. Schulman

- Article | 19 December 2019
Insights into the assembly and activation of the microtubule nucleator γ -TuRC
 The cryo-EM structure of the γ -tubulin ring complex (γ -TuRC) from *Xenopus laevis* provides insights into the molecular organization of the complex, and shows that actin is a structural component that is functionally relevant to microtubule nucleation.
 - Peng Liu, Erik Zupa & Elmar Schiebel

- Article | 06 January 2020
The structural basis for cohesin–CTCF-anchored loops
 The crystal structure of the SA2–SCC1 subunits of human cohesin in complex with CTCF reveals the molecular basis of the cohesin–CTCF interaction that enables the dynamic regulation of chromatin folding.
 - Yan Li, Judith H. I. Haarhuis & Daniel Panne

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This Week

Editorial

- Editorial | 26 February 2020
Economists and scientists: solve big societal problems by working together
 Economics and natural-science disciplines are reuniting. It's about time.
 - Editorial | 25 February 2020
In praise of replication studies and null results
 More funders and publishers must support such work and emphasize its value to the research community.

- Editorial | 26 February 2020
Open up research about Tutankhamun's tomb

A controversy over the possible presence of rooms around the tomb needs findings to be published in the open literature.

Research

News & Views

- News & Views | 12 February 2020
Tension in tumour cells keeps metabolism high
Tumours are often stiffer than normal tissues and show abnormally fast metabolism of glucose. It emerges that the link between these two traits involves tension in a network of protein filaments in cells.
 - Nadia M. E. Ayad & Valerie M. Weaver
- News & Views | 19 February 2020
How plant cells sense the outside world through hydrogen peroxide
The discovery of a sensor that detects hydrogen peroxide at the surface of a cell provides insights into the mechanisms by which plant cells perceive and respond to environmental stress.
 - Christine H. Foyer
- News & Views | 05 February 2020
Molecular architecture of the key precursor of thyroid hormones revealed
The structure of thyroglobulin, the enormous protein that acts as a precursor for thyroid hormones, has been determined, and its hormone-forming tyrosine amino-acid residues have been identified.
 - Nancy Carrasco
- News & Views | 26 February 2020
Metallic glasses rejuvenated to harden under strain
Metallic glasses are much stronger than conventional metals, but form certain instabilities under stress that lead to fracture. A process known as rejuvenation has been shown to solve this problem.
 - Frans Spaepen

- News & Views | 24 February 2020
[A decade of questions about the fluidity of cell identity](#)
 A method for directly converting connective-tissue cells into neurons opened up a new branch of research into cell-based therapies and called into question long-held beliefs about how development affects a cell's identity.
 - Giacomo Masserdotti & Magdalena Götz
- News & Views | 26 February 2020
[High-energy-electron scattering probes the strong nuclear interaction at close range](#)
 The dense soup of matter in the core of neutron stars is hard to model, but particle-accelerator experiments in which energetic electrons scatter off atomic nuclei could help to explore this high-density regime.
 - Alexandra Gade

Articles

- Article | 26 February 2020
[Probing the core of the strong nuclear interaction](#)
 High-energy electron scattering that can isolate pairs of nucleons in high-momentum configurations reveals a transition to spin-independent scalar forces at small separation distances, supporting the use of point-like nucleon models to describe dense nuclear systems.
 - A. Schmidt, J. R. Pybus & X. Zheng
- Article | 26 February 2020
[Spontaneous gyrotropic electronic order in a transition-metal dichalcogenide](#)
 Optical chiral induction and spontaneous gyrotropic electronic order are realized in the transition-metal chalcogenide 1T-TiSe₂ by using illumination with mid-infrared circularly polarized light and simultaneous cooling below the critical temperature.
 - Su-Yang Xu, Qiong Ma & Nuh Gedik
- Article | 17 February 2020
[Power generation from ambient humidity using protein nanowires](#)
 A new type of energy-harvesting device, based on protein nanowires from the microbe *Geobacter sulfurreducens*, can generate a sustained power output by producing a moisture gradient across the nanowire film using natural humidity.
 - Xiaomeng Liu, Hongyan Gao & Jun Yao

- Article | 19 February 2020
[On-device lead sequestration for perovskite solar cells](#)
 Using lead-absorbing materials to coat the front and back of perovskite solar cells can prevent lead leaching from damaged devices, without affecting the device performance or long-term operation stability.
 - Xun Li, Fei Zhang & Tao Xu

- Article | 26 February 2020
[Strain-hardening and suppression of shear-banding in rejuvenated bulk metallic glass](#)
 Bulk metallic glasses can acquire the ability to strain-harden through a mechanical rejuvenation treatment at room temperature that retains their non-crystalline structure.
 - J. Pan, Yu. P. Ivanov & A. L. Greer

- Article | 26 February 2020
[Actinide 2-metallabiphenylenes that satisfy Hückel's rule](#)
 The synthesis of uranium- and thorium-containing metallabiphenylenes demonstrates the ability of the actinides to stabilize aromatic/antiaromatic structures where transition metals have failed.
 - Justin K. Pagano, Jing Xie & Jaqueline L. Kiplinger

- Article | 26 February 2020
[Ice front blocking of ocean heat transport to an Antarctic ice shelf](#)
 The front of the Getz Ice Shelf in West Antarctica creates an abrupt topographic step that deflects ocean currents, suppressing 70% of the heat delivery to the ice sheet.
 - A. K. Wåhlin, N. Steiger & S. Viboud

- Article | 12 February 2020
[The strength and pattern of natural selection on gene expression in rice](#)
 Phenotypic selection analysis is used to estimate the type and strength of selection that acts on more than 15,000 transcripts in rice (*Oryza sativa*), which provides insight into the adaptive evolutionary role of selection on gene expression.
 - Simon C. Groen, Irina Čalić & Michael D. Purugganan

- Article | 19 February 2020
[Hydrogen peroxide sensor HPCA1 is an LRR receptor kinase in Arabidopsis](#)
 HPCA1, a member of a previously uncharacterized subfamily of leucine-rich-repeat receptor-like kinases, is the hydrogen-peroxide sensor at the plasma membrane in *Arabidopsis*.
 - Xun Li, Fei Zhang & Tao Xu

- Feihua Wu, Yuan Chi & Zhen-Ming Pei

- Article | 12 February 2020
[Evolution-guided discovery of antibiotics that inhibit peptidoglycan remodelling](#)
 The glycopeptide antibiotic-related compounds complestatin and corbomycin function by binding to peptidoglycan and blocking the action of autolysins—peptidoglycan hydrolase enzymes that remodel the cell wall during growth.
- Elizabeth J. Culp, Nicholas Waglechner & Gerard D. Wright

- Article | 19 February 2020
[Bacterial coexistence driven by motility and spatial competition](#)
 In mixed bacterial populations that colonize nutrient patches, a growth–migration trade-off can lead to spatial exclusion that provides an advantage to populations that become rare, thereby stabilizing the community.
- Sebastian Gude, Erçağ Pinçe & Sander J. Tans

- Article | 12 February 2020
[MAFG-driven astrocytes promote CNS inflammation](#)
 Single-cell RNA sequencing of cells from humans with multiple sclerosis and mice with a model of the disease identifies a population of disease-promoting astrocytes in which anti-oxidant and anti-inflammatory proteins are suppressed.
- Michael A. Wheeler, Iain C. Clark & Francisco J. Quintana

- Article | 12 February 2020
[IL-15, gluten and HLA-DQ8 drive tissue destruction in coeliac disease](#)
 An HLA- and gluten-dependent mouse model of coeliac disease with villous atrophy provides evidence for the cooperative role of IL-15 and gluten-specific CD4⁺ T cells in licensing the full activation of cytotoxic T cells that are necessary for inducing epithelial damage.
- Valérie Abadie, Sangman M. Kim & Bana Jabri

- Article | 12 February 2020
[TLR9 and beclin 1 crosstalk regulates muscle AMPK activation in exercise](#)
 In mice, the interaction of the innate immune sensor TLR9 with beclin 1 is shown to have a role in glucose metabolism and AMPK activation in skeletal muscle during exercise.
- Yang Liu, Phong T. Nguyen & Beth Levine

- Article | 19 February 2020
[γδ T cells and adipocyte IL-17RC control fat innervation and thermogenesis](#)
 Vγ6⁺ Vδ1⁺ γδ T cells control tolerance to cold by activating adipocyte IL-17RC and promoting sympathetic innervation of thermogenic adipose tissue in mice.
 - Bo Hu, Chengcheng Jin & Bruce M. Spiegelman

- Article | 20 January 2020
[The single-cell pathology landscape of breast cancer](#)
 A single-cell, spatially resolved analysis of breast cancer demonstrates the heterogeneity of tumour and stroma tissue and provides a more-detailed method of patient classification than the current histology-based system.
 - Hartland W. Jackson, Jana R. Fischer & Bernd Bodenmiller

- Article | 12 February 2020
[Mechanical regulation of glycolysis via cytoskeleton architecture](#)
 Glycolysis in normal epithelial cells responds to microenvironmental mechanics via the modulation of actin bundles that sequester the phosphofructokinase-targeting ubiquitin ligase TRIM21, a process superseded by persistent actin bundles in cancer cells.
 - Jin Suk Park, Christoph J. Burckhardt & Gaudenz Danuser

- Article | 05 February 2020
[The structure of human thyroglobulin](#)
 The cryo-electron microscopy structure of human thyroglobulin reveals that proximity, flexibility and solvent exposure are key characteristics of its homonogenic tyrosine pairs, and provides a framework for understanding the formation of thyroid hormones.
 - Francesca Coscia, Ajda Taler-Verčič & Jan Löwe



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now discovered the gene that promotes this branching response to nitrogen. Future breeding efforts will use natural gene variants to increase grain yield and reduce fertilizer need, thus boosting agricultural sustainability. See page 641. *Photo: Chris Stenger/Minden Pictures*

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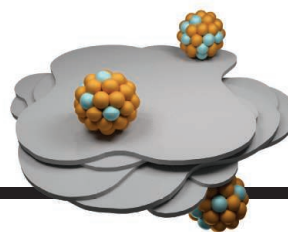
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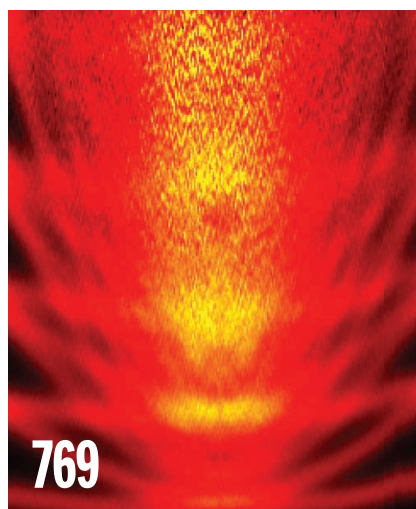
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A satiny parrot snake (*Leptophis depressirostris*) preys on a frog. Tropical snake diversity declined after a fungal pathogen led to mass mortality of amphibians, a key food source. Snakes are generally rare and difficult

to detect, but researchers estimate a high probability that the snake community is now smaller and more homogeneous, with lower occurrence rates and poorer body conditions for many species. See page 814.
Photo: Bence Mate/Minden Pictures

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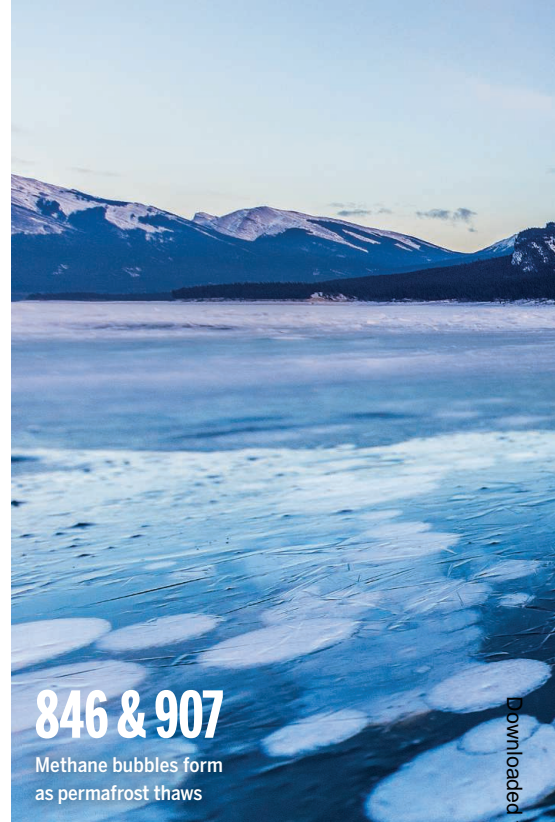
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American witch hazel (*Hamamelis virginiana*) flowers encased in ice from a late winter storm. The effects of climate change on biological systems may be especially pronounced in winter. The Gordon Research

Conference on the Biology of Winter will be held from 21 to 26 June 2020 in Waterville Valley, New Hampshire. See page 922 for the Gordon Research Conference schedule and preliminary programs. *Photo: Brent J. Sinclair*

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