ULTRAFAST OPTICS
Tracking excitations
Illumination can be used to excite a sample from its ground state to a number of excited states. Typically, however, the details of the excitation dynamics are hidden from view because they decay so fast. Piatkowski et al. combined pump-probe transient absorption and two-pulse photoluminescence correlation spectroscopy, allowing them to assess stimulated emission and ground-state bleaching contributions to the transient absorption signal. This approach provides a window on the excitation dynamics within single nanocrystals and should also be useful for ultrafast nanocharacterization of complex samples. —ISO
Science, this issue p. 1240

HUMAN RETINA
Sensing light without forming images
In the rodent retina, intrinsically photosensitive retinal ganglion cells (ipRGCs) entrain circadian rhythms, modulate mood, and signal pupillary accommodation. Such responses are light-driven but not image-based. Working with donated human organ tissues, Mure et al. used electrophysiological approaches to identify ipRGCs in the human retina. The human retina has more cones than the retinas of nocturnal mice and rats. Differences in sensitivity, latency, and duration of responses identified three subtypes of human ipRGCs. —Pjh
Science, this issue p. 1251

CANCER
A childhood tumor—from the beginning
Many adult cancers arise from clonal expansions of mutant cells in normal tissue. These premalignant expansions are defined by somatic mutations shared by the cancers. Whether pediatric cancers originate in a similar way is unknown. Coorens et al. studied Wilms tumor, a childhood kidney cancer. Phylogenetic analyses revealed large clones of mutant cells in histologically and functionally normal kidney tissue long before tumor development. Thus, like adult tumors, Wilms tumor appears to arise from a premalignant tissue bed. —Pak
Science, this issue p. 1247

CANCER
Finding tumor cells and killing them, too
Treatments targeting the androgen receptor are a mainstay of prostate cancer therapy. However, these treatments do not usually cure the disease and eventually lose their effectiveness. A major cause of this therapeutic resistance is the presence of neuroendocrine tumor cells, which are not sensitive to androgen inhibition. Li et al. found that neuroendocrine prostate cancer cells express a chemokine receptor called CXCRI2. The receptor could be used to help identify these cells in tumors and represents a viable therapeutic target. —Yn

ATMOSPHERIC SCIENCE
Here comes the flood
Atmospheric rivers (ARs) are extratropical storms that produce extreme precipitation on the west coasts of the world’s major landmasses. Flood damage causes huge financial losses in U.S. West Coast communities. Now, researchers have found a possible link between ARs and flood damage. Corringer et al. found that increases in AR intensity and duration correspond with an estimated 10-fold increase in flood damages. The authors categorized ARs on a scale of one to five, with stages four and five representing the most intense ARs. This approach could potentially increase the efficiency of emergency preparedness for extreme flooding. —Tm

IN OTHER JOURNALS
Edited by Caroline Ash and Jesse Smith

DENDRITIC CELLS
More DC subtypes revealed
Dendritic cells (DCs) are specialized immune cells that induce antigen-specific immunity and are sentinels for the initiation of T lymphocyte anticancer responses. Mouse DCs have traditionally been classified into two groups, cDC1 and cDC2, but Brown et al. discovered that the cDC2 group is made up of two previously unknown subsets called cDC2A and cDC2B. Using single-cell RNA sequencing, they found that cDC2A and cDC2B can be distinguished by expression of the transcription factors T-bet and RORγT. These subsets seem to have different functions, with cDC2A associated with wound healing and cDC2B linked to a proinflammatory state. Similar DC counterparts were found in human samples, which may provide an explanation for the mixed responses that patients have to cancer immunotherapy. —Pnk
Cell 179, 846 (2019).

NEURODEVELOPMENT
Stabilizing cell-type ratios
Brain development depends both on having enough neurons and on those neurons being connected in the right ways. Willett et al. found that in mice, disruption of excitatory neurons of the cerebellar nuclei, either by inactivating genes encoding specific transcription factors or by dosing the neurons with diphtheria toxin, resulted in an undersized cerebellum. The size disparity was a result of fewer downstream connected cells, including granule cells, Purkinje cells, and interneurons. Despite the cerebellum having too few cells, the ratio of cell types stayed normal. Thus, the number of excitatory cerebellar nuclei neurons defines survival of a matched set of Purkinje cells. The correct ratios of cells needed to establish functional circuits are maintained by a mix of strategies that regulate both proliferation and survival of neurons. —Pjh
eLife 8, e50617 (2019).
MATERIALS SCIENCE
Better fatigue resistance at low cost
Framework or microarchitected materials can be designed to have a combination of strength and stiffness, not through changes in the underlying material but through variations in lattice density and architecture. By looking at the properties of cancellous bone, which is better than compact bone for stress dampening, Torres et al. explored ways to enhance the fatigue properties of microarchitected materials. They found that a key element is the proportion of materials oriented transverse to the applied loads, because these materials act as sacrificial elements during cycling loading. Thus, although there is a tendency to design framework materials to maximize the struts oriented in the direction of expected loading, this can lead to a drastic loss of fatigue resistance and only minimal decrease in the overall density. —MSL

PHYSICS
Imaging heavy Dirac fermions
Most topologically nontrivial materials discovered to date have negligible electron correlations. Strongly correlated topological materials are predicted to have a rich phenomenology; however, identifying such materials and proving their topological character has been tricky. This is particularly true of samarium hexaboride (SmB$_6$), a compound that is theoretically expected to be a topological Kondo insulator, but the multitude of probes used to study it have yielded conflicting results. Pirie et al. applied scanning tunneling spectroscopy to the problem and found evidence of Dirac states with large effective masses, which is in agreement with theory. They were able to reproduce the results for multiple samples synthesized by two different growers. —JS

WORKFORCE
Graduate students under pressure
Although graduate student mental health is a topical issue, there is little empirical research on the subject. Hish et al. used a stress process model to examine the roles of mastery and social support as mediators of stress. Using a validated self-report measure of stress, data relating to stress-burnout and stress-depression relationships were collected from biomedically qualified graduate students. Linear regression models showed that academic stressors were most predictive of burnout, whereas depressive symptoms were best predicted by family and monetary stressors. Furthermore, the relationship between stress and burnout was partially mediated by mastery and advisor support, whereas the stress-depression relationship was partially mediated by mastery, suggesting that future interventions might focus on enhancing mastery and/or improving advisor relationships. —MMc
More DC subtypes revealed
Priscilla N. Kelly

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