together multiple receptors. They engineered T cells that can recognize up to three target antigens expressed on or inside cancer cells and integrated these inputs to achieve NOT, AND, and OR logic. The engineered cells achieved precise recognition of targeted cancer cells. —VV

Science, this issue p. 1099

SEX DETERMINATION
Paternal factor specifies female wasps
Not all animals have specialized sex chromosomes to determine their sex. In hymenopteran insects, for example, unfertilized eggs become males and fertilized eggs become females. Prior work showed that the paternal genome provides instruction for female development. Zou et al. identified a sex determination instructor gene, wasp overruler of masculinization, with parent-of-origin effect, in the parasitoid Nasonia vitripennis. It is only transcribed from the paternally provided genome in fertilized eggs to initiate female development. This discovery provides insights into the molecular basis and evolution of sex determination. —BAP

Science, this issue p. 1115

MARINE ROBOTICS
Deep dive
Mapping the ocean’s biochemistry will lead to a better understanding of Earth’s biogeochemical cycles. Breier et al. developed an untethered autonomous underwater vehicle, which they named Clio, to map vertical profiles of the water column through high-resolution sensor surveys and sample-return missions. Clio could controllably descend through the water column at a rate of 0.8 meters per second with a maximum depth of 6000 meters. In 2019, Clio was deployed to map 1144 kilometers of the Sargasso Sea to a depth of 1000 meters. —MML


Drugs
Helping asthmatics breathe better
β2-adrenoreceptor agonists used for acute relief of airway constriction in asthmatic patients become less effective with repeated use because of receptor desensitization. They also increase the risk of death. Using cells, lung slices, and mouse models of asthma, Wang et al. showed that osthole, a compound derived from a traditional Chinese medicine, promoted airway relaxation through mechanisms other than activating β2-adrenoreceptors. These results suggest that variants of osthole could be developed to induce bronchodilation without desensitizing receptors or increasing the risk of death. —WW


Education
Preaching outside of the choir
Workshops and training programs centered on sharing evidence-based instructional practices (EBIPs) for better engaging students in science, technology, engineering, and mathematics (STEM) learning are widely available. However, how and whether faculty share their new knowledge with their colleagues remain unclear. Lane et al. conducted a multi-institutional study to determine who EBIP users talked to about their teaching practices. Interview, survey, and social network analyses revealed that faculty who implemented EBIPs preferentially talked to each other, essentially slowing the pace of EBIP adoption. This analysis confirms that faculty teaching interactions are critical in promoting institutional change in higher education and that a systems approach to altering educational structures, environments, and policies is needed to engage the full range of faculty in teaching conversations. —MMc


Biotechnology
PORE-cupine for RNA structures
Unlike DNA, RNA can fold into a staggering number of distinct structures that perform diverse functions. Some structures transfer genetic information, and others regulate their own activities and life spans to act as catalysts for crucial reactions inside the cell. Our ability to visualize or predict the RNA structures that a cell can make is limited, hindering exploitation for RNA therapeutics. Aw et al. improved on a technology that uses nanopore technology to sequence RNA by measuring the changing current as the RNA nucleotides are pulled through the nanopore. This “PORE-cupine” technology incorporates structural probing by chemical modification and machine learning to capture structural

IN OTHER JOURNALS
Edited by Caroline Ash and Jesse Smith

As the climate changes, mixed-grass prairie becomes vulnerable to dust-bowl formation.

Researchers launch Clio, an autonomous deep-ocean exploration and sample-collection vehicle.

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**PLANT SCIENCE**

**Photosynthesis and the Dust Bowl**

In the 1930s, the central United States turned into a dust bowl, which disrupted agriculture, economies, social structures, and ecosystems and may hold lessons for a future of increasing climate instability. Knapp et al. replicated some of the Dust Bowl conditions in Kansas and Wyoming to determine why a grass characterized by the C3 photosynthetic pathway replaced seemingly better-adapted C4 grasses during the drought despite its preference for cooler temperature and higher soil moisture. The key lies in the timing of precipitation. Drier summer months and wetter cool months during this 4-year period favored the growth of the C3 grasses, which outcompeted the C4 grasses. —PJH


**NEUROSCIENCE**

**How a brain controls a computer**

Most brain-computer interfaces (BCIs) that use neuron recordings have analyzed the activity of those neurons that contribute directly to the decoded BCI output. Liu and Schieber found that although only a few primary motor cortex (M1) units controlled a closed-loop BCI, substantial numbers of non-BCI units were likewise modulated in relation to the task, not only in frontal motor areas (area M1 and the dorsal and ventral premotor cortex) but also in parietal areas (somatosensory cortex and the anterior intraparietal area). All of these cortical areas thus participated both in natural control of voluntary limb movement and in a more general system for closed-loop control of an effector being moved to a visual target. Harnessing the activity of units from multiple cortical areas might help in the development of next-generation BCIs. —PRS


**KIDNEY DISEASE**

**Weighing in on chronic kidney disease**

Previous studies have reported correlations between adiposity and chronic kidney disease, but it is not clear whether this is an independent association or if there is a causal relationship. To address this question systematically, Zhu et al. analyzed prospectively collected data from almost 300,000 participants in the UK Biobank. By taking advantage of Mendelian randomization, the authors showed that diabetes and high blood pressure, which are known kidney disease risk factors, played an even larger role than expected. However, adiposity itself was also an independent causative factor for the development of chronic kidney disease. —YN


**STELLAR POPULATIONS**

**Too hot for helium to handle**

Helium has a high ionization potential of 24.6 electron volts. Galaxies that have emission lines of He II in their spectra must contain sufficiently hot sources, such as extremely massive stars, to ionize interstellar helium. Pérez-Montero et al. modeled multiple emission lines in the spectra of a sample of galaxies that each show He II emission. They found that the effective temperatures of the radiation fields were higher than can be explained by conventional stellar population models. The authors argue that populations of Wolf-Rayet stars with low abundances of elements heavier than helium, surrounded by clumpy gas, can explain the observations. —KTS


**NANOMATERIALS**

**Kinetic control of hierarchical growth**

Sequential seeding of nanocrystals can be used to control and develop complex shapes during growth. Smith et al. explored the effects of limiting adatom addition versus diffusion for gold or palladium grown on gold seeds. Fast growth conditions promote branched nanocrystals along the [111] directions. The addition of hydrochloric acid lowered the pH and increased the halide concentration, slowing the rate of metal precursor reduction. Fast growth promoted concave shapes, whereas slower growth favored convex ones. By using the production of one growth cycle as the seed for the next one, 85 distinct hierarchical shapes were grown. —MSL


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Kinetic control of hierarchical growth
Marc S. Lavine

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