**MOLECULAR BIOLOGY**

**Mitosis-specific role of ATR**
The ATR (ataxia telangiectasia mutated and Rad3-related) kinase plays important roles in the S phase and during the DNA damage response to safeguard genome integrity. Kabeche et al. identified a distinct ATR activation pathway in mitosis that is also critical for suppressing genome instability (see the Perspective by Saldivar and Cimprich). ATR is recruited by Aurora A and activated by R loops at centromeres of mitotic chromosomes: this leads to Aurora B activation, which is necessary for accurate chromosome segregation. This mitotic, R loop–driven ATR signaling pathway could potentially be exploited in the search for cancer therapeutics. —SYM

*Science, this issue p. 108; see also p. 30

**SOCIAL SCIENCES**

**Global reciprocity drives cooperation**
Cooperation among nations promotes international trade, law, peace, and environmental protection. But how does cooperation emerge and persist among independent, self-interested, and often competing nations? Frank et al. applied powerful causal inference techniques to a detailed global data set of country interactions from 1995 to 2015 to map international cooperation, influence, and reciprocity. In agreement with predictions from evolutionary game theory, reciprocity among nations, including powerful countries, is pervasive and leads to stable cooperation, even in the face of minor transgressions. —AC


**Coral Reefs**

**Not enough time for recovery**
Coral bleaching occurs when stressful conditions result in the expulsion of the algal partner from the coral. Before anthropogenic climate warming, such events were relatively rare, allowing for recovery of the reef between events. Hughes et al. looked at 100 reefs globally and found that the average interval between bleaching events is now less than half what it was before. Such narrow recovery windows do not allow for full recovery. Furthermore, warming events such as El Niño are warmer than previously, as are general ocean conditions. Such changes are likely to make it more and more difficult for reefs to recover between stressful events. —SNV

*Science, this issue p. 80

**Tinnitus**

**The sound of silence**
Tinnitus reduces the quality of life for millions of sufferers worldwide. Using a guinea pig model of tinnitus induced by noise trauma, Marks et al. delivered precisely timed bimodal auditory-sensory stimulation to induce long-term depression (LTD) in the cochlear nucleus. Twenty minutes of treatment per day reduced physiological and behavioral evidence of tinnitus in the animals. The same bimodal protocol reduced tinnitus loudness in human subjects in a double-blind, sham-controlled, crossover clinical study. Unimodal stimulation did not reduce tinnitus in the animals or the humans. This approach thus holds promise for suppressing chronic tinnitus in patients. —OMS


**Signal Transduction**

**Unconventional thyroid hormone signals**
Thyroid hormone canonically signals through thyroid hormone receptors to enhance transcription of target genes. There is also evidence that thyroid hormone can activate nontranscriptional signaling mechanisms. To sort out the relative importance of canonical and noncanonical signaling, Hones et al. generated mice in which thyroid hormone receptors were altered to prevent DNA binding and transcriptional effects (but noncanonical signaling remained) and compared thyroid hormone action in these animals with that in wild-type mice or mice lacking thyroid hormone receptors entirely. They found that in vivo, several physiological actions of thyroid hormone—including regulation of body temperature, glucose and triglyceride concentrations in the blood, and heart rate—all appear to be mediated by noncanonical or nontranscriptional mechanisms. —LBR


**Biocatalysis**

**Guiding an enzyme all around a ring**
Most compounds of interest for pharmaceuticals, agrochemicals, and cosmetics have many C–H bonds, interspersed with a few carbon bonds to heavier elements that give them their distinct properties. Chemists therefore prize methods that let them selectively modify a variety of C–H bonds. Gilbert et al. report a versatile strategy that relies on a tethered amine to steer an engineered cytochrome P450 enzyme around 11- or 12-membered rings, transforming specific C–H bonds into C–O bonds. Subtle structural variation of the tether through click chemistry tunes the site selectivity. —JSY


**Minor Planets**

**An object from beyond the solar system**
Gravitational interactions occasionally eject small bodies from the solar system, and this process is thought to have been...
PARASITE GENOMICS

Single-cell sequencing of malarial genomes

Infection with the parasite Plasmodium falciparum causes malaria. Individuals may be infected with multiple strains of P. falciparum, some of which may be drug-resistant. Understanding the complexity of these infections may provide information about the diversity of the parasite population and aid in drug-targeting strategies. Overcoming the difficulties caused by AT bias in the Plasmodium genome, Trevino et al. optimized single-cell sequencing for late-stage P. falciparum parasites within infected individuals. From this analysis, they documented at least seven distinct parasitic haplotypes, traced meiotic events and hence relatedness among parasitic lineages, and found distinct single-nucleotide variants that could be used for bulk analysis. —LMZ


Single-cell sequencing of Plasmodium, here released from lysed red blood cells, allows for tracking of variation in the host.

BIOLOGY

Cytoplasmic transfer to tumor cells

Macrophages are innate immune cells that, when recruited to tumors, can promote tumor progression. Macrophage activity and phenotype can be influenced by molecules secreted by tumor cells. To monitor macrophage behavior, Roh-Johnson et al. used time-lapse imaging of a zebrafish model of melanoma. Unexpectedly, macrophages not only bound to but also transferred their cytoplasm into melanoma cells, which promoted metastasis. Macrophage cytoplasmic transfer to melanoma cells also correlated with metastasis in mice. This unusual mechanism of cell-cell signaling raises questions about how such intercellular communication is regulated and what molecules are transferred to melanoma cells to promote their metastasis. —GKA


TRANSLATION

Ribosomes ignore the stop sign

Aminoglycoside antibiotics bind to bacterial ribosomes and inhibit protein synthesis. Eukaryotic ribosomes, in contrast, are not strongly inhibited by these molecules but show errors such as inaccurate translation and read-through of stop codons. Prokhorova et al. determined structures of the eukaryotic ribosome in complex with aminoglycoside antibiotics and investigated how these molecules alter the conformation of the ribosome. They found distinct binding sites for different classes of aminoglycosides and multiple possible binding sites on each ribosome. The conformational changes induced by these molecules suggest multiple mechanisms by which the antibiotics interfere with eukaryotic translation. —MAF


MICROBIOTA

Eats leaves and grooms

The gut microbiota influences many aspects of mammalian development and physiology. Yet we have a poor understanding of how the gut microbiota is acquired and assembled. We know that social networks are important for the transmission of pathogens, but are they also implicated in transmission of symbionts? Perofsky et al. investigated the microbiota of a social primate, a lemur species called Verreaux’s sifaka, living in the wild in Madagascar. These lemurs eat leaves and have a distinctive microbiota capable of digesting and detoxifying plant matter. The authors found that sex, dominance, and age influenced gut microbial composition, but social group membership explained 58% of the variation. Grooming and scent-marking are essential for lemur social cohesion, and commensal microbes are transferred between individuals through this type of intimate contact, rather than being regulated by genetics or diet. —CA


Social interaction among Verreaux’s sifaka is responsible for transmission of gut microbes that are essential for digestion of their leaf-based diet.