In this issue . . .

Memory formation in crabs

A key factor in the survival of animals in the wild is the ability to learn and remember places associated with danger and reward. Experiments on learning and memory in animals have focused on these attributes by exploiting aversive or appetitive memory responses. Martín Klappenbach et al. (pp. E4666–E4675) placed Neohelice granulata crabs in aversive and appetitive learning scenarios to study memory formation. In a series of training exercises, the authors exposed the crabs to appetitive settings, in which the crabs received low, middle, or high amounts of food, or to aversive settings, in which the crabs were exposed to low, middle, or high levels of danger. The authors recorded observations on the crabs’ exploratory and escape behaviors, which were associated with appetitive and aversive memory responses, respectively. The crabs were then placed in an experimental scenario in which appetitive and aversive stimuli occurred simultaneously. In this setting, the authors observed interference in the expression of an appetitive or aversive memory response. Statistical analysis revealed that the prevailing response depended on the strength of the appetitive or aversive stimulus during the training exercise as well as the animal’s motivational state. According to the authors, learned appetitive and aversive information might be stored independently and expressed in an opportunistic manner. — C.S.

Bacterial endosymbionts in coconut beetles

Bacterial endosymbionts in arthropods are typically inherited maternally, and thus manipulate host reproduction to increase the fitness of infected females. Two genera of endosymbionts, Wolbachia and Cardinium, induce cytoplasmic instability (CI) in their hosts, whereby uninfected females produce few or no offspring when they mate with infected males. Shun-ichiro Takano et al. (pp. 6110–6115) identified a third endosymbiont capable of inducing CI in the coconut beetle, an invasive pest of coconut palms. Coconut beetles exist in two clades, known as the Asian and Pacific clades, and matings between the two clades yield lower egg hatch rates than matings within the same clade. Genome sequencing identified a Wolbachia endosymbiont within Asian clade beetles and a previously undescribed endosymbiont within Pacific beetles. Egg hatch rates for interclade matings increased to levels similar to those
of intraclade matings when males were treated with antibiotic to eliminate endosymbionts. However, treating only females failed to increase hatch rates for interclade matings and drastically reduced rates for intraclade matings. In interclade matings involving untreated Pacific males or Pacific–Pacific matings involving treated females, no eggs hatched. According to the authors, the Pacific clade endosymbiont induces complete CI and may be useful as a biological control agent against coconut beetles. — B.D.

Freeze-dried sperm on the International Space Station

The average daily radiation dose on the International Space Station (ISS) is about 100 times stronger than that on Earth, and the effect of this radiation on germ cells could pose serious reproductive problems for space-dwelling organisms, including humans. Sayaka Wakayama et al. (pp. 5988–5993) dispatched samples of freeze-dried mouse spermatozoa to be stored on the ISS for 288 days, from August 2013 to May 2014. Following the samples’ return to Earth, the spermatozoa were compared with control samples preserved on Earth during the same period under similar conditions. The authors found evidence of slightly increased DNA damage in the space-preserved samples, compared with the control samples. Embryos fertilized in vitro with sperm from either space-preserved or control samples were transferred into females, and the mean birth rates of pups derived from space-preserved sperm samples were comparable to those of pups derived from control samples. The sex ratio of pups from space-preserved spermatozoa was within the normal range, whole genome analysis revealed only minor differences from control pups, and the pups from space-preserved spermatozoa developed into adults with normal fertility, suggesting that the DNA damage observed in the space-preserved sperm samples was largely repaired in embryos after fertilization. According to the authors, the results demonstrate the possibility of producing healthy mammalian offspring from spermatozoa preserved in space. — B.D.

Plastic pileup on remote South Pacific island

Plastic pollution has become ubiquitous across the world’s oceans, but the extent of marine plastic pollution remains relatively unknown. Jennifer Lavers and Alexander Bond (pp. 6052–6055) documented the anthropogenic debris—99.8% of which was plastic—and the accumulation rate of plastic pollution on Henderson Island, a remote, uninhabited South Pacific island, during a 2015 beach survey. The authors found approximately 21–672 pieces of debris per square meter on the beach. Approximately 53–4,497 items per square meter were buried to a depth of 10 cm, and buried debris accounted for approximately 68% of debris. The authors estimate the existence of 37.7 million pieces of plastic debris weighing a combined 17.6 tons on the island. Furthermore, the authors found that 17–268 new items washed onto a 10 × 0.2 m section of beach every day over 6 consecutive days. The authors suggest that high frequencies of Asian and South American plastics may reflect fishing activities in surrounding waters and oceanic current patterns. According to the authors, uncovering the abundance, diversity, and sources of marine plastic could help mitigate plastic pollution. — L.C.