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In This Issue

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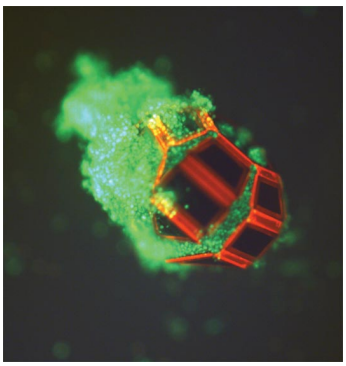
ENGINEERING

Tether-free microgrippers

"Microgrippers" are tiny mechanical devices that can be used for micromanipulation or to perform biopsies. Conventional microgrippers are controlled by wire or pneumatics through thin tubes, although the physical connections in such devices can limit their maneuverability. Timothy Leong *et al.* have developed microgrippers that are free of constraining tubes or wires. Patterned by photolithography with metallic-polymer joints, the authors' microgrippers resemble submillimeter-sized crabs, using a design inspired by the joints of arthropods. The gripping action arises from a prestressed bimetallic layer that is prevented from flexing by a segment of organic polymer at each joint. The polymer can be softened, and the tension released, by increasing the temperature above 40 °C, by introducing the microgripper into a caustic solution, or by exposing the microgripper to a variety of common biological reagents such as L-glutamine. At present, the gripping action is irreversible under biological conditions and may be triggered by too many factors to be a reliable surgical tool. However, the authors show that the microgripper can be manipulated by magnets and is strong enough to excise tissue in an in vitro model of a bladder biopsy. — K.M.



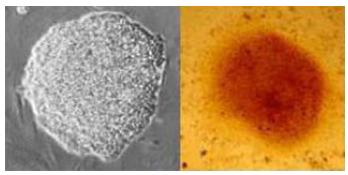
Microgripper captures live cells.

"Tetherless thermobiochemically actuated microgrippers" by Timothy G. Leong, Christina L. Randall, Bryan R. Benson, Noy Bassik, George M. Stern, and David H. Gracias (see pages 703–708)

DEVELOPMENTAL BIOLOGY

Stem cell treatment for hemophilia

Gene therapies for hemophilia A have failed for a variety of reasons, including immune system rejection by the recipient. Dan Xu *et al.* report that induced pluripotent stem cells (iPS) may circumvent the immune response while still providing therapeutic amounts of the missing Factor VIII protein critical to blood clotting. The authors reversed the hemophilia A phenotype by injecting endothelial progenitor cells derived from iPS from a closely related mouse breed into the livers of hemophiliac mice. At intervals between 7 and 90 days after injection, the authors subjected the treated and control mice to a tail-clip bleeding assay. Untreated mice died within several hours, but the tail clip had no noticeable effect on the lifespan of the treated mice. Plasma levels of Factor VIII in treated mice reached only 8–16% of those in wild-type mice; however, these levels effectively prevented the hemophilia mice from bleeding to death. The authors say these results appear to be applicable to humans and that similar stem cell therapies may be effective for other monogenic human diseases. — C.A.



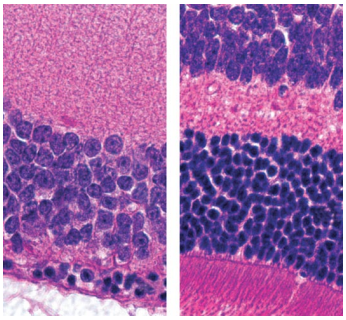
Tail tip fibroblasts after 20 days (*Left*), stained for ES-alkaline phosphatase (*Right*).

"Phenotypic correction of murine hemophilia A using an iPS cell-based therapy" by Dan Xu, Zaida Alipio, Louis M. Fink, Dorothy M. Adcock, Jianchang Yang, David C. Ward, and Yupo Ma (see pages 808–813)

MEDICAL SCIENCES

DNA repair enzyme contributes to vision loss

Every year, millions of people around the world suffer from vision loss due to retinitis pigmentosa, a condition in which the retina degenerates. Mutations in at least 45 different genes, including those responsible for cell signaling, vitamin metabolism, and protein trafficking, have been associated with the disease, indicating a strong genetic component. Lisiane Meira *et al.* identified an enzyme involved in DNA repair that induces cell death in retinal photoreceptor cells. According to the authors, alkyladenine DNA glycosylase (Aag) is a critical part of the base excision repair machinery, which removes damaged nucle-



Wild-type (*Left*) and Aag-treated (*Right*) mouse eyes after induced retinal degeneration.

otides from the genome. In the presence of the DNA alkylating agents methyl nitrosourea and methanesulfonate, which mimic the cellular stress conditions that precede retinal degeneration, mice with functional Aag enzymes lost rod and cone photoreceptor cells; animals that lacked the protein or had intermediate levels were protected from this degeneration. The lack of Aag suppressed retinal damage in both developing and mature mouse eyes, and the genetic reintroduction of the enzyme in *Aag*-null animals restored this sensitivity. Thus Aag may be an important factor in the development of environmentally induced human retinal degenerative diseases in children and adults, suggesting that the research could aid in the development of therapeutics to treat vision loss, according to the authors. — F.A.

"Aag-initiated base excision repair drives alkylation-induced retinal degeneration in mice" by Lisiane B. Meira, Catherine A. Moroski-Erkul, Stephanie L. Green, Jennifer A. Calvo, Roderick T. Bronson, Dharini Shah, and Leona D. Samson (see pages 888–893)

PSYCHOLOGY

Individual recognition in domestic horses

Although individual recognition is believed to be widespread across animal taxa, it is difficult to demonstrate conclusively. Using a cross-modal expectancy violation paradigm, Leanne Proops *et al.* show that domestic horses may be capable of recognizing the call of an individual animal from within their herd. The authors observed the responses of 24 horses to calls from other horses to see if the animals were capable of cross-modal cognitive processes similar to those used by humans to recognize familiar individual voices. Their model was based on an individual's ability to simultaneously retrieve stored auditory, visual, and olfactory information that is unique to an individual. Proops *et al.* analyzed individual horses while leading a herd member out of view and then playing the call of the removed horse over a loudspeaker or the call of a different horse. When horses were shown a herd member and then exposed to the call of a different horse, they responded more quickly and looked in the direction of the call longer than when the call matched the horse previously shown. The authors suggest that the sound of the different horse violated the subject horse's expectations by conflicting with stored sensory cues about the herd member. The study provides an example of a nonhuman animal that can recognize individual vocalizations by combining cues from multiple senses, according to the authors. — J.L.

Domesticated horses can recognize individual calls.

*"Cross-modal individual recognition in domestic horses (*Equus caballus*)" by Leanne Proops, Karen McComb, and David Reby* (see pages 947–951)

SUSTAINABILITY SCIENCE

Harvesting by humans causes rapid trait changes in prey

Agents of natural selection, including predators, continually reshape the observable traits of populations. Human predators such as fishers and hunters, however, typically target larger, reproductive-aged adult animals and kill their prey in greater proportions than other predators. By combining data from previously published studies on 40 human-harvested systems (fishes, ungulates, invertebrates, and plants), Chris Darimont *et al*. compared rates of phenotypic change in human-harvested populations to natural systems of trait change and to systems that experienced other human disturbances. Overall, rates of change for human-harvested populations outpaced change due to natural agents by ≈300% and other anthropogenic agents by 50%. Commercial harvesting systems showed the greatest effect, according to the authors. Human-harvested organisms show some of the most rapid trait changes ever observed in wild populations, providing new insight into how quickly organisms are capable of changing. Declines in morphological traits of ≈20%, and life history changes of ≈25% of a plant or animal population, could cause irreparable damage to harvested populations, harvest systems, and associated ecosystems, the authors say. — C.A.

Human-harvested sockeye salmon. (Photo courtesy of Andrew Hendry.)

"Human predators outpace other agents of trait change in the wild" by Chris T. Darimont, Stephanie M. Carlson, Michael T. Kinnison, Paul C. Paquet, Thomas E. Reimchen, and Christopher C. Wilmers (see pages 952–954)