## › RESEARCH IN BRIEF

### City rats to the rescue

The rats of New York City aren't considered the cleanest of animals out there. They can carry a myriad of microbes and viruses that are potentially harmful to human health, but that's not entirely bad news. A few years ago, a hepacivirus related to hepatitis C was identified in the Big Apple's rats. Hepatitis C has no vaccine and few available animal models. But using the virus isolated from rats, researchers at Rockefeller University were able to induce acute infections in healthy mice and chronic symptoms in immunocompromised ones, thus establishing new models to help understand how liver viruses interact with the immune system (*Science* **357**, 204–208; 2017).

### Hiding helminths

Parasitic helminth worms are a severe burden across the globe, particularly in developing regions that lack adequate sanitation. Researchers have tried to develop vaccines targeted to proteins on the worms' outer covering, but with limited effect. A new study from the University of Valencia looks at how helminths are able to evade the immune system (*PLoS Negl. Trop. Dis.* **11**, e0005773; 2017).

The researchers isolated the model helminth, *Echinostoma caproni*, from experimentally infected mice and used a double indirect immunofluorescence staining technique to tag any murine antibodies present. Over about thirty minutes, the concentration of antibodies decreased, but not in the way previously hypothesized. Rather than shedding their antibody burden, the worms secreted a substance that instead seemed to trap the antibodies out of reach of the immune system.

### When one strain is not enough...

Diversity rules in people, but not necessarily mouse strains. To capture more genetic variability, researchers at UCLA established the Hybrid Mouse Diversity Panel (HMDP), a collection of well-characterized mouse strains meant to mimic human Genome-Wide Association Studies. Two new papers pull from the panel.

The first studied hearts from 120 HMDP strains for mononuclear diploid cardiomyocytes (MDCMs), linked to the regenerative abilities of animals like zebrafish and newts (*Nat. Genet.* **49**, 1346–1353; 2017). The second paper used 83 strains to measure macrophage response to a lipopolysaccharide challenge, which simulates a gram-negative bacterial infection (*Nat. Commun.* **8**, 16041; 2017).

Both found significant variation between strains, and some genetic underpinnings. The heart paper found that strains with more MDCMs were more responsive after cardiac injury; further analysis suggested the *Tnni3k* gene may be behind the variation. To explain macrophage activation (or lack thereof), that team identified predictive gene signatures in the mice that also appear to correlate with human outcomes.

### To the tardigrades

Affectionately referred to as "water bears," tardigrades are known best for their ability to live on the extreme—different species bounce back from being frozen and broiled, exposed to radiation, deprived of oxygen and water, pressurized to the depths of the ocean and depressurized to the vacuum of space, all without ill-effects. Nevertheless, their origins remain a mystery. A Japanese team has taken a closer look, re-assembling the genome of *Hypsibius dujardini* and comparing it to another relative, *Ramazzottius varieornatus* (*PLoS Biol.* **15**, e2002266; 2017). The results challenge previous assertions that tardigrades substantially benefitted from horizontal gene transfer in their evolutionary history, though the team did still see some signs of foreign DNA that may contribute to their ability to withstand extreme desiccation.

## On-demand local anesthesia

As anyone with a cavity knows, going to the dentist can be pain. Local anesthetics, like lidocaine, make drilling into teeth tolerable, but its lasting effects after the procedure can make for awkward conversations at the water cooler back at work. A new study in *Nature Biomedical Engineering* by Daniel S. Kohane's group at Harvard University puts 'on-demand' local anesthesia on the table, potentially allowing patients to control levels of pain relief structured to their specific needs (*Nat. Biomed. Eng.* **1**, 644–653; 2017).

Combining drug-filled liposomes with an ultrasound-triggered 'sonosensitizer' agent, the team shows that brief pulses of targeted ultrasounds are sufficient to disrupt the liposomes, spilling their contents into localized tissue and providing significant pain relief for controlled periods of time in rats.

## Drug kinetics caught in the act

Monitoring drug kinetics *in vivo* is tricky, especially in protected areas like the brain. An ideal system would combine high speed with high sensitivity, and also provide the ability to match drug dynamics with changes in local tissue physiology. A team of researchers have developed a new microsensor that puts check marks on this wishlist (*Nat. Biomed. Eng.* **1**, 654–666; 2017).

The sensor is made from a glass microelectrode that incorporates a small boron-doped tip, and the team demonstrates the sensor's ability to simultaneously measure real-time changes in both applied drug concentrations and underlying electrophysiology in the guinea pig cochlea and rat cortex.

## Testing new brain tools in turtles

The mammalian cerebral cortex sits atop the hierarchy of brain circuits. It is complex, and processes complex information. Cortical neurons are diverse and form thousands of connections with other cells, making the job of systems neuroscientists that wish to crack open circuitry and mechanisms difficult. Using the simpler (and heartier) turtle cortex as a model system, a team from Max Planck Institute for Brain Research in Germany explore new ways to apply existing electrophysiology tools to extract novel information about functional cortical circuitry (*Nat. Methods* **14**, 882–890; 2017).

The team applied dense multi-electrode arrays to an *ex vivo* preparation of turtle brain complete with eyes (for visual stimulation) and visual cortex. Combining the preparation with single-cell intracellular recordings, the team was able to reconstruct, using electrophysiology recordings alone but confirmed with anatomical methods, a spatial map of axonal projection patterns. Their new method could enable much faster and routine reconstruction of functional cortical circuits than is presently possible using anatomical and imaging methods alone.