Rare regeneration fixes pierced mouse ears

A laboratory mishap has revealed a super-healing mouse, a rare example of a mammal that regenerates complex, scarfree tissue.

In a matter of weeks, mice of a well-known laboratory strain called MRL can regrow perfect tissue, including cartilage, to close large holes punched in their ears, reports immunologist Ellen Heber-Katz of the Wistar Institute in Philadelphia. Other mice just heal around the rim, leaving the hole open.

The MRL mouse may provide a new way of studying regeneration, says Heber-Katz, possibly taking researchers a step closer to realizing the dream of enabling people to regrow lost limbs. She described her group's findings in Philadelphia last week at the annual meeting of the American Association for the Advancement of Science. A full account is scheduled to appear in CLINICAL IMMUNOLOGY AND IMMUNOPATHOLOGY.

Researchers customarily put holes in the ears of laboratory mice to identify them. One day, Heber-Katz was horrified to notice that a number of MRL mice being used in a study of multiple sclerosis had no holes in their ears. The scientist responsible for marking the mice was certain she hadn't forgotten this essential step. The puzzled researchers once again punched holes in the animals' ears. The holes closed in about 3 weeks.

After attending a lecture on regeneration in amphibians, "I realized that [regeneration] was exactly what we were seeing," Heber-Katz says. She later learned that other researchers had noticed the quirk in mice, but she found no systematic investigations of it.

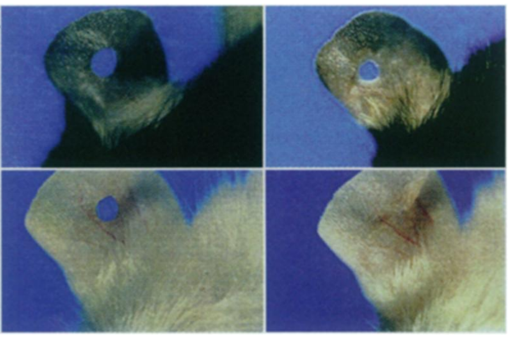
While studying sections of ear tissue at various stages of recovery, Heber-Katz observed hallmarks not just of wound repair but also of true regeneration. She found blastemas, blobs of rapidly dividing immature cells, and evidence that a key protein layer, the extracellular matrix, breaks down, allowing tissues to regrow.

"That process has a lot of similarities to what we see in amphibians," says David L. Stocum at Indiana University–Purdue University in Indianapolis.

In general, amphibians far outstrip mammals when it comes to regenerative powers (SN: 11/1/97, p. 280). People do manage to recreate some tissues, like bone, if an injury is not too severe. On rare occasions, severed fingertips regrow. Moose, elk, and deer resprout antlers, and rabbits can repair ear holes, like the MRL mice.

Heber-Katz noticed that regenerative powers in mice dwindle with age. When she injected old mice with antibodies that block receptors for immune system components known as alpha-beta T cells, the elders could regrow tissue like any youngster. When the scientists genetically engineered mice to lack the genes for these receptors, the animals regenerated the tissue far better than normal.

The T cell system may choke off regeneration, Heber-Katz says. She speculates that mammals may have paid a heavy price—the power to regenerate—when their deluxe immune systems developed. *—S. Milius*



D. Thayer

Perhaps a new, and rare, mammalian model for tissue regeneration: While a control mouse just heals the rim of a wound (top, left to right), the MRL mouse regrows scarfree ear tissue in a few weeks (bottom, left to right).

Gamma-ray bursts: Farther and brighter?

Typically lasting just 10 seconds, a gamma-ray burst unleashes more energy than the sun will in its 10-billion-year lifetime. A new study suggests that these mysterious flashes are even more dazzling than many astronomers had imagined—they may be 20 times more energetic, and some may originate from the first galaxies in the cosmos.

That's the consensus reached by a group of astrophysicists after analyzing the properties of hundreds of bursts.

The team adopted the widely held belief that these ephemeral flashes are linked to the demise of massive stars. Heavyweight stars live life in the fast lane, burning brightly but dying quickly. Because they die so soon after they are born, the death rate of these stars—and by association, the generation of gamma-ray bursts—should closely track the rate of star formation in the universe, the researchers reasoned.

Over the past few years, detailed surveys from several telescopes have enabled astronomers to map the history of star formation. These surveys suggest that the universe produced more than half its stars by the time it was half its current age.

Matching the inferred rate of star formation to both the rate and spectra of observed gamma-ray bursts, and assuming that gamma-ray bursts all have about the same intrinsic luminosity, Ralph A.M.J. Wijers of the University of Cambridge in England and his colleagues calculate that radiation from the bursts that appear dimmest has traveled for 15 billion years—nearly the entire age of the universe. If true, these flashes would beat out quasar light as signs of the most distant known objects.

"If our result is correct, we might be able to detect gamma-ray bursts from the deaths of the first stars that ever formed and perhaps find out when they formed," says study collaborator Jasjeet S. Bagla of Cambridge. Wijers and Bagla, along with Joshua S. Bloom of the California Institute of Technology in Pasadena and Priyamvada Natarajan of the University of Toronto's Canadian Institute of Theoretical Astrophysics, describe their work in the Feb. 11 MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY.

Although spacecraft have recorded gamma-ray bursts since the 1960s, researchers had no proof until last year that any of the bursts were associated with galaxies even a few billion light-years distant (SN: 3/22/97, p. 174). If many of the bursts come from galaxies farther away, their faintness could explain why only a few host galaxies have been found.

The researchers "have pieced together a scenario that accords with the data, but it might not be the whole story, and it might not even be the right story," notes gamma-ray theorist Charles D. Dermer of the Naval Research Laboratory in Washington, D.C.

Dermer estimates that in at least 1 of every 100 galaxies, a gamma-ray burst should have occurred within the past million years. If Wijers and his colleagues are correct, the interstellar medium in these galaxies should bear obvious scars from the energetic eruptions, which are equivalent to the simultaneous explosion of 1,000 supernovas, he notes.

In one popular model, the dense remnants of two dead stars collide to create a gamma-ray burst. The stars may take so long to spiral toward each other that the burst rate becomes divorced from the star formation rate, Dermer believes.

Nonetheless, he says, the new study merits follow-up and may spur the development of sensitive detectors to study the weakest, presumably most distant flashes. *—R. Cowen*