REPAIR AND REGENERATION

By Beverly A. Purnell and Pamela J. Hines
Life brings minor ravages in the form of wrinkles and creaky knees, as well as the major sequelae of disease or injury such as blindness, wounds that will not heal, and hearts losing function. The body does its best to deal with each challenge. But unlike the facile reconstruction of missing axolotl and planarian parts, our innate regenerative powers have limits. We are left with scars, diminished mobility, and weakened function. This special issue highlights areas of active research to understand mechanisms of repair and regeneration, with an eye toward therapeutic applications.

Active stem cell populations make relatively swift work of refreshing the gut. However, other tissues and organs, such as the mammalian heart and central nervous system, are not so readily rebuilt. Methods to reprogram stem cells are now plentiful, but we also need methods to stimulate cellular regenerative capacity and enhance cell survival. Modulation of the immune system can both help and hinder repair and regeneration. When regeneration is limited, tissue transplantation and bioengineered prosthetics offer alternative routes. Even single-celled organisms such as *Stentor*, which can stop cytoplasmic oozing and then reconstruct complex subcellular structures, carry lessons on repair. Emerging concepts and methodological advances take us ever closer to the goal of rebuilding or even enhancing the body.

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Time series (upper left to lower right) of the repair of a laser-induced wound in the *Drosophila* wing epithelium (green webbing), showing the recruitment of macrophages (green with red nuclei) to the injured site.
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