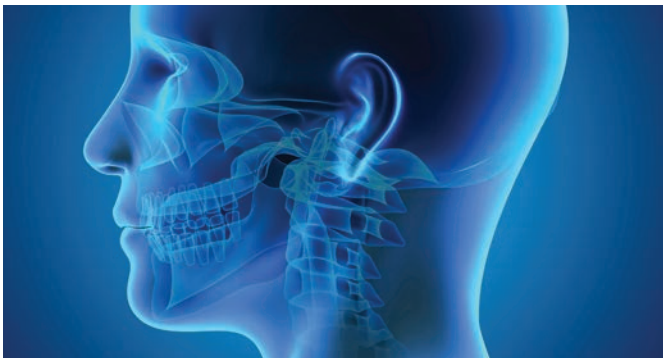
National Institute of Dental and Craniofacial Research

Research Investments & Advances

Discover how NIDCR-funded research is enhancing knowledge and improving public health.

Regenerative Medicine



Overview

Regenerative medicine harnesses the body's growth mechanisms and healing properties to repair or replace damaged cells, tissues, or organs. Researchers are drawing on the fields of stem cell and developmental biology, bioengineering, materials science, and gene editing, among others, to develop safe and effective regenerative therapies. Dental, oral, and craniofacial regenerative medicine holds great promise for treating a variety of injuries, conditions, and diseases, including repair or replacement of teeth, cartilage, joints, bone, and other tissues.

How Is NIDCR Investing in Regenerative Medicine Research?

NIDCR invested over $73 million in basic, translational, and clinical regenerative medicine research in fiscal year 2024.

NIDCR supports research to develop evidence-based regenerative medicine therapies and advance their translation from the laboratory to the clinic.

Examples of NIDCR-supported Research Projects

- **Advancing dental regeneration.** Scientists are working on new ways to help repair and regrow damaged teeth. They are using stem cells from teeth, innovative biomaterials, and targeted therapies to rebuild dental tissues and stimulate tooth development.
- **Characterizing craniofacial anomalies.** Clinical researchers are characterizing craniofacial abnormalities using 3D imaging, functional assays, and genomic analyses that will enable the development of personalized regenerative treatments for these conditions.
- **Developing smart biomaterials.** Scientists are engineering natural and synthetic biomaterials that can respond to certain stimuli and act as scaffolds to support tissue repair. These materials are designed to mimic the body's natural structures (tissue microenvironment) and when incorporated with growth factors and cells, they help support and guide the healing of damaged tissues and organs.
- **Harnessing developmental cues as a template for regeneration.** Researchers are studying the cellular and molecular mechanisms of how tissues and organs develop. The foundational knowledge can provide new avenues for future regenerative medicine approaches to target.

- **Healing wounds to tackle fibrosis.** Head and neck cancer patients can develop excess tissue scarring (fibrosis) on the skin and in salivary glands following radiation therapy. Scientists are investigating the underlying mechanisms of fibrosis and developing restorative treatments, such as deferoxamine, an FDA-approved iron-binding medication delivered via skin patch.
- **Jumpstarting clinical trials.** Clinicians and scientists are accelerating promising regenerative therapies by investing in infrastructure to improve the efficiency of preclinical studies required before testing new treatments in humans. NIDCR established the multidisciplinary Dental, Oral, and Craniofacial Tissue Regeneration Consortium (DOCTRC) to achieve this goal and currently supports two resource centers to facilitate the translation process.
- **Microengineering blood vessels.** Scientists are developing techniques to grow nutrient-carrying blood vessels that more effectively integrate with implanted cells and tissues to help promote survival of engineered tissue.
- **Revolutionizing cell therapy.** Investigators are using adult stem cells, which are specialized cells that can become other types of cells, to repair and replace damaged or missing tissues. They are also developing methods to reprogram existing adult cells into other functional cell types, offering hope for treating dental, oral, and craniofacial injuries and diseases.
- **Targeting the immune system to heal bones.** Scientists are exploring ways to modulate the immune system for bone repair and regeneration. They are developing methods to control harmful inflammation, using biomaterials to deliver therapeutic agents, and engineering streamlined mechanisms for cellular communication to fine-tune the immune system for faster and effective bone repair.
- **Treating dry mouth with gene therapy.** As a treatment for chronic dry mouth, investigators are coaxing salivary gland cells to increase production of a water channel that helps increase the flow of saliva. This regenerative therapy is being tested in a clinical trial on the NIH campus for patients whose salivary glands have been damaged by radiation therapy used for head and neck cancer treatment.

Additional Resources

- **Regenerative Medicine Innovation Project**
  Established by the 21st Century Cures Act to accelerate progress in regenerative medicine, this initiative is a trans-NIH effort, in coordination with FDA.
- National Academy of Medicine Forum on Regenerative Medicine
  NIH participates in this effort to engage in dialogue that addresses challenges in translating experimental regenerative medicine approaches into safe and effective new therapies.

Learn more about NIDCR's research investments and advances in salivary diagnostics, temporomandibular disorders, HPV and oropharyngeal cancer and more at:

www.nidcr.nih.gov/grants-funding/funded-research/research-investments-advances

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