

**National Institute of Dental and Craniofacial Research**  
**FY 2018 Significant Items**

**Topics:**

- [Biomaterials](#)
- [Coordination of New Scientific Information](#)
- [Overlapping Pain Conditions](#)
- [Temporomandibular Disorders \(TMD\)](#)

Please note that the text under each topic heading is the written request from the congressional committee ('The Committee'). NIDCR's response is included under the heading '[Action taken or to be taken](#)'.

## **Biomaterials**

The Committee understands biomaterials are an important section of biomedical research. The Committee encourages NIDCR to consider efforts to encourage an increased focus on the development and innovation of dental materials.

### Action taken or to be taken

The National Institute of Dental and Craniofacial Research (NIDCR) has a history of supporting foundational research on the materials that are used to restore damaged and diseased teeth. Dental restorations made with tooth-colored resin composite materials, while esthetically pleasing, can fail after about eight years and need to be replaced. Some of the main reasons for restoration failure are degradation by oral bacteria, inadequate bonding to the tooth, and cracking or breaking. In 2013, NIDCR invested \$2.8 million to develop innovative biomaterials to double the service life of dental restorations. These studies are producing novel types of compounds with superior mechanical properties that resist degradation and cracking.

NIDCR is funding scientists who are creating self-healing dental materials that contain microcapsules. When cracks form in the dental restoration, the microcapsules break open, releasing a liquid that reacts with particles embedded in the dental material to fill and seal the spaces automatically. NIDCR also supports a small business that is tackling the problem from a different angle by creating a novel dental adhesive with long lasting antimicrobial activity against the bacteria that cause tooth decay. Other NIDCR-supported scientists are using plasma technology to improve the bonding of the dental restoration to the tooth. This plasma, a type of ionized gas, has the added effect of killing cavity causing bacteria before placing the dental restoration.

Looking ahead, NIDCR has begun investing in the development of novel restoratives that are effective for a specific type of tooth decay affecting the root, called Class V lesions. These restorations are much more likely to fail and are common in aging individuals due to recession of their gums. This research will help address the growing need for improved Class V restorations as the demographics of the country continues to change.

## **Coordination of New Scientific Information**

The mission of NIDCR is to improve the Nation's oral, dental and craniofacial health through research and research training. NIDCR accomplishes its mission by performing and supporting basic and clinical research; conducting and funding research training and career development programs to ensure that there is an adequate number of talented, well-prepared, and diverse investigators; and coordinating and assisting relevant research and research-related activities. The Committee expects the Institute to systematically coordinate through other HHS agencies to share new scientific information to ensure it reaches the community and providers through various other HHS outreach programs.

### Action taken or to be taken

The National Institute of Dental and Craniofacial Research (NIDCR) recognizes that systematic coordination and dissemination of relevant research and research-related activities is an absolute necessity if we are to ensure that all populations benefit from the Nation's investments in scientific discoveries.

NIDCR collaborates with other HHS agencies to share research results with the community and providers. The Institute strongly supports the efforts of the United States Public Health Service (USPHS) Oral Health Coordinating Committee (OHCC), which promotes the oral health of the American public through coordination of policy efforts, research, and programmatic activities within USPHS, across Federal Agencies, and between public and private sectors. NIDCR played a key role in the development of the 2014-2016 OHCC Oral Health Strategic Framework, a roadmap that provides agency and community stakeholders with actionable goals and strategies to advance oral health. In FY 2016 NIDCR collaborated with members from several agencies in the broad dissemination of information about the Framework through a joint webinar. NIDCR-funded research is aligned with specific goals and strategies throughout the Framework. Notably, studies to help prevent disease and promote oral health, to eliminate disparities, and to increase the dissemination of oral health information and improve health literacy.

Another example of outreach to the oral health community and providers is the Interagency Pain Research Coordinating Committee (IPRCC), a Federal advisory committee created on behalf of HHS by the NIH to enhance pain research efforts and promote collaboration across the government, with the ultimate goals of advancing the fundamental understanding of pain and improving pain-related treatment approaches. The Committee is composed of both Federal members, including the NIDCR Director, and non-Federal members from the scientific and medical communities, members of the public, and stakeholder groups. In 2011, in recognition of the public health problem of pain in America, the Institute of Medicine, now the National Academy of Medicine, called for a coordinated national effort of public and private organizations to transform how the nation understands and approaches pain management and prevention. In response, HHS tasked the IPRCC with creating a National Pain Strategy (NPS) that recognizes access to safe and effective care for people suffering from pain as a public health priority. The NPS was released in the spring of 2016. The IPRCC is now in the process of developing a national pain research strategy, focused on prevention of acute and chronic pain, acute pain and acute pain management, the transition from acute to chronic pain, chronic pain and chronic pain management, and the cross-cutting theme of health disparities.

## **Overlapping Pain Conditions**

The Committee commends the NIDCR for its ongoing support for the Orofacial Pain Prospective Evaluation and Risk Assessment program, which is yielding valuable information on many physiological aspects of temporomandibular disorders and overlapping pain conditions. The Committee encourages continued research on overlapping pain conditions and increased collaboration across NIH Institutes on epidemiological, basic, clinical and translational research related to pain conditions.

### Action taken or to be taken

The National Institute of Dental and Craniofacial Research (NIDCR) actively collaborates with other NIH Institutes, Centers, and Offices (ICOs) to support research on temporomandibular disorders (TMDs) and overlapping pain conditions. In 2014 NIDCR, along with eight other NIH ICOs, released an initiative to encourage studies that will increase our understanding of multiple chronic overlapping pain conditions. One of the projects that resulted from this initiative is using stored bio-specimens from the NIDCR-funded Orofacial Pain: Prospective Evaluation and Risk Assessment (OPPERA) study to examine the role of proteins, microRNAs (small RNA molecules that can change gene activity), and genes in the development of TMDs and five overlapping pain conditions (migraine, low back pain, irritable bowel syndrome, pelvic pain, and widespread body pain). These new biologic data will be combined with existing psychological and social data to identify the underlying mechanisms common to overlapping pain conditions. In 2016 NIDCR released an initiative to encourage research to understand the genetic basis of variability in an individual's responses to therapeutic pain drugs used in orofacial pain management and adverse events. Findings from these studies could also aid in the treatment of other chronic pain conditions that overlap with TMDs.

To enhance the coordination of pain research across the NIH, a number of ICOs actively participate in the NIH Pain Consortium. The Consortium encourages pain research on topics of shared interest among NIH ICOs. For example, there is a critical need for standardized data elements to accelerate the identification of common risk factors in chronic pain conditions. To begin to address this pressing issue, the Investigator's Meeting on Chronic Overlapping Pain Conditions<sup>1</sup> was held in 2015 to develop a standardized definition for chronic overlapping pain conditions and identify common data elements that could be collected across research studies. Following this meeting the Office of Research on Women's Health (ORWH), NIDCR, and the National Institute of Neurological Disorders and Stroke (NINDS) supported the expansion of a tool called the Complex Medical Symptoms Inventory that collects standardized pain data across relevant chronic pain conditions that often co-occur. Increased use of this new tool will enhance the ability of scientists to collect consistent data across studies and better understand the shared mechanisms of overlapping pain conditions to improve the clinical care and quality of life of individuals living with chronic pain.

<sup>1</sup> [https://painconsortium.nih.gov/Conferences\\_and\\_Seminars/9-16-2014\\_Inv.MtgonCOPC.html](https://painconsortium.nih.gov/Conferences_and_Seminars/9-16-2014_Inv.MtgonCOPC.html)

## **Temporomandibular Disorders (TMD)**

The Committee understands that NIH- funded research has demonstrated that TMD is primarily a multisystem disorder with overlapping co-morbid conditions influenced by multiple biological and environmental factors rather than solely an orofacial pain condition. However, diagnosis and care of patients have not changed to reflect this major paradigm shift. Therefore, the Committee strongly supports research to examine the safety and efficacy of current clinical treatments of TMD, the burden and costs associated with TMD, and the development of future scientific and clinical, professional and policy directions for TMD. Further, the Committee encourages NIH ICs with pertinent expertise on the temporomandibular joint to collaborate and implement the recommendations from the Temporomandibular Joint in Health and Disease Round Table held in 2013. Research to develop safe and effective techniques for joint repair and regeneration is essential. An analysis of problems associated with current joint replacements should provide guidance in these efforts.

### Action taken or to be taken

To provide the evidence base needed to improve temporomandibular joint disorder (TMD) diagnosis and patient care, the National Institute of Dental and Craniofacial Research (NIDCR) funds a diverse research portfolio focused on the development, structure, function, regeneration, and replacement of the temporomandibular joint (TMJ), as well as studies on chronic orofacial pain, which is associated with TMDs. NIDCR-supported scientists have discovered a type of stem cell in the TMJ bone that can be used to regenerate and repair cartilage, a promising discovery that could lead to new approaches to regenerate the TMJ. The Institute also supports research that brings together clinicians, computer scientists, and engineers to develop more precise bone imaging techniques to measure TMJ disease progression and ultimately improve diagnosis and treatment. In addition, promising new coating materials for implant devices are being created to improve joint repair strategies by combatting bacterial infections, enhancing implant biocompatibility with surrounding tissues, and increasing implant performance and wear-resistance.

In collaboration with other NIH Institutes, Centers and Offices (ICO)s, NIDCR is implementing the research recommendations from the 2013 Temporomandibular Joint in Health and Disease Roundtable, including funding studies on the biology of the TMJ in health and disease. NIDCR and NIBIB participate in funding announcements to encourage research grant applications on the “Biology of the Temporomandibular Joint in Health and Disease.” Research on the biology of joint function and the tissues that make up the TMJ will provide the basis for developing safe and effective techniques for joint repair and regeneration. NIDCR-supported scientists are building a model to help identify healthy individuals at risk for developing TMDs by examining whether mechanics, behavior, and genes can be used to predict differences in TMJ disc position and orofacial pain in men and women. And to understand why women are much more likely to have chronic orofacial pain, NIDCR has launched an initiative to encourage studies on the underlying biological factors that lead to differences in the presentation of dental, oral, and craniofacial diseases between men and women. Moving forward, the Institute will encourage investigations on how the nervous system influences the dental and craniofacial skeletal system, including the TMJ, a key research area identified in the Roundtable.

NIDCR recognizes the need to engage with key stakeholders to evaluate the state of TMJ science and identify gaps and opportunities for future investigation and collaboration. To this end, NIDCR senior leadership participated in a first-of-its-kind TMJ Patient Roundtable in 2016.

Participants included patients, patient advocates, industry, clinicians, and representatives from the NIH, the U.S. Food and Drug Administration (FDA), and the Agency for Healthcare Research and Quality (AHRQ). The Roundtable brought these stakeholders together to discuss a number of topics, including advancements in TMJ implants and medical devices, and the development of patient-centered outcomes to improve therapies and clinical care. These types of inclusive discussions are essential to develop future scientific and clinical, professional, and policy directions for TMD. In addition, NIDCR, along with a number of other NIH ICOs, provided funding for a recent meeting of the TMJ Association, bringing together scientists, clinicians, and patients to explore how precision medicine strategies can inform the treatment of TMD and co-occurring pain conditions. As we continue to gain new insights into the biological, environmental, and behavioral influences on an individual's health, precision medicine approaches can be leveraged to treat and prevent TMDs more effectively.