

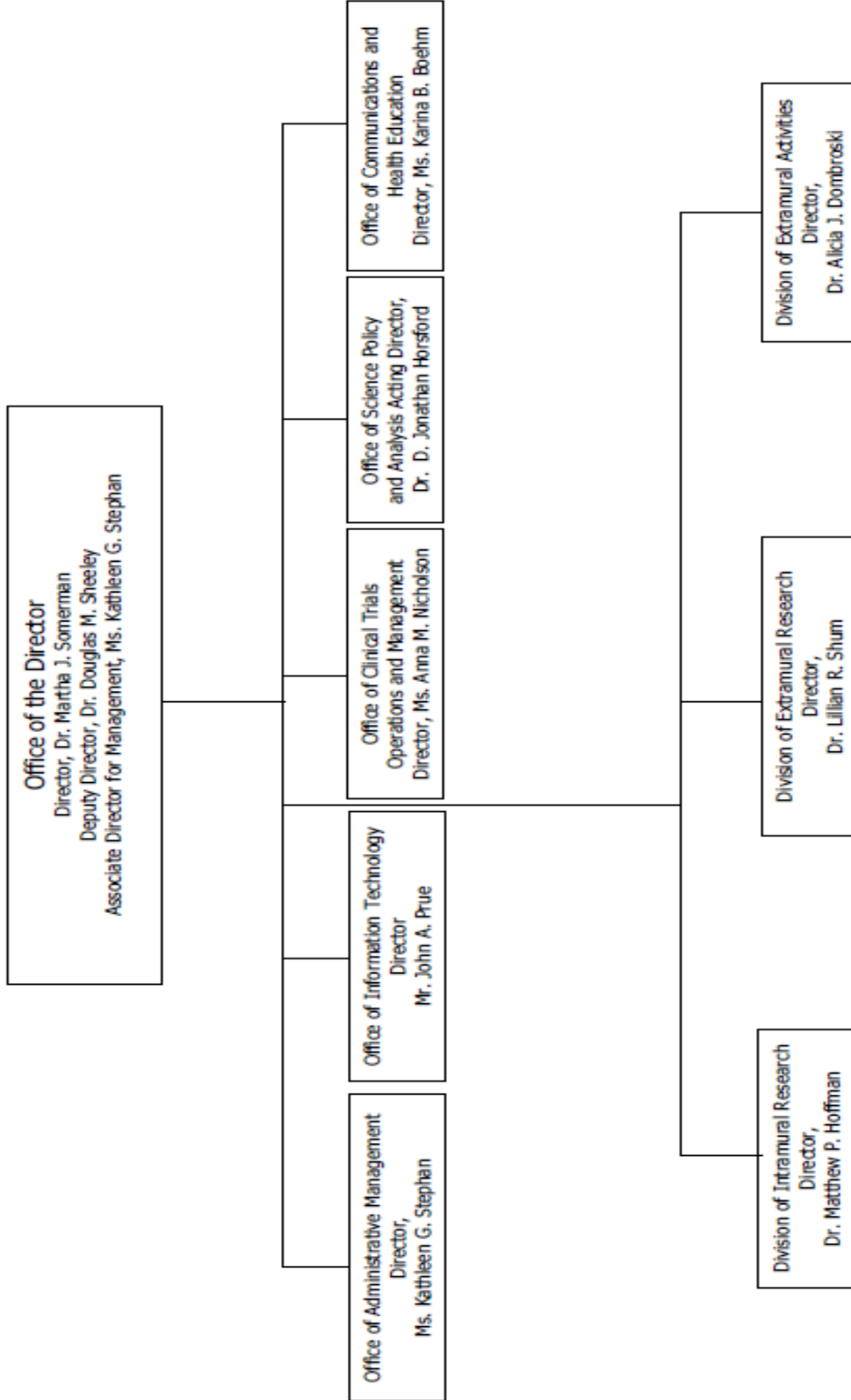
DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

National Institute of Dental and Craniofacial Research (NIDCR)

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National Institute of Dental and Craniofacial Research



NATIONAL INSTITUTES OF HEALTH

National Institute of Dental and Craniofacial Research

For carrying out section 301 and title IV of the PHS Act with respect to dental and craniofacial diseases, [~~\$461,781,000~~]*\$397,493,000*.

NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research

Amounts Available for Obligation¹
(Dollars in Thousands)

Source of Funding	FY 2018 Final	FY 2019 Enacted	FY 2020 President's Budget
Appropriation	\$447,735	\$461,781	\$397,493
Mandatory Appropriation: (non-add)			
<i>Type 1 Diabetes</i>	(0)	(0)	(0)
<i>Other Mandatory financing</i>	(0)	(0)	(0)
Rescission	0	0	0
Sequestration	0	0	0
Secretary's Transfer	-1,052	0	0
Subtotal, adjusted appropriation	\$446,683	\$461,781	\$397,493
OAR HIV/AIDS Transfers	0	0	0
Subtotal, adjusted budget authority	\$446,683	\$461,781	\$397,493
Unobligated balance, start of year	0	0	0
Unobligated balance, end of year	0	0	0
Subtotal, adjusted budget authority	\$446,683	\$461,781	\$397,493
Unobligated balance lapsing	-27	0	0
Total obligations	\$446,656	\$461,781	\$397,493

¹ Excludes the following amounts (in thousands) for reimbursable activities carried out by this account:
FY 2018 - \$1,038 FY 2019 - \$1,200 FY 2020 - \$1,200

**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Budget Mechanism - Total¹
(Dollars in Thousands)

MECHANISM	FY 2018 Final		FY 2019 Enacted		FY 2020 President's Budget		FY 2020 +/- FY 2019 Enacted	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
<u>Research Projects:</u>								
Noncompeting	412	\$208,643	454	\$205,531	456	\$196,064	2	-\$9,468
Administrative Supplements	(29)	1,666	(40)	3,000	(35)	2,709	(-5)	-291
<u>Competing:</u>								
Renewal	30	15,211	33	17,011	21	10,143	-12	-6,868
New	171	60,200	190	66,977	120	40,499	-70	-26,478
Supplements	0	0	0	0	0	0	0	0
Subtotal, Competing	201	\$75,411	223	\$83,988	141	\$50,642	-82	-\$33,346
Subtotal, RPGs	613	\$285,720	677	\$292,519	597	\$249,415	-80	-\$43,105
SBIR/STTR	25	12,704	26	13,122	22	11,236	-4	-1,886
Research Project Grants	638	\$298,424	703	\$305,642	619	\$260,651	-84	-\$44,991
<u>Research Centers:</u>								
Specialized/Comprehensive	1	\$3,091	1	\$3,306	1	\$2,909	0	-\$397
Clinical Research	0	0	0	0	0	0	0	0
Biotechnology	0	0	0	0	0	0	0	0
Comparative Medicine	0	0	0	0	0	0	0	0
Research Centers in Minority Institutions	0	0	0	0	0	0	0	0
Research Centers	1	\$3,091	1	\$3,306	1	\$2,909	0	-\$397
<u>Other Research:</u>								
Research Careers	56	\$8,429	57	\$8,606	50	\$7,573	-7	-\$1,033
Cancer Education	0	0	0	0	0	0	0	0
Cooperative Clinical Research	0	0	0	0	0	0	0	0
Biomedical Research Support	0	0	0	0	0	0	0	0
Minority Biomedical Research Support	0	97	0	97	0	97	0	0
Other	24	9,116	27	9,571	24	8,422	-3	-1,148
Other Research	80	\$17,642	84	\$18,274	74	\$16,093	-10	-\$2,181
Total Research Grants	719	\$319,158	788	\$327,222	694	\$279,653	-94	-\$47,568
<u>Ruth L Kirchstein Training Awards:</u>								
	<u>FTTPs</u>		<u>FTTPs</u>		<u>FTTPs</u>		<u>FTTPs</u>	
Individual Awards	114	\$5,246	116	\$5,484	104	\$4,935	-12	-\$548
Institutional Awards	131	6,474	133	6,743	120	6,069	-13	-674
Total Research Training	245	\$11,720	249	\$12,227	224	\$11,004	-25	-\$1,223
Research & Develop. Contracts <i>(SBIR/STTR) (non-add)</i>	17 <i>(0)</i>	\$19,443 <i>(25)</i>	18 <i>(0)</i>	\$22,706 <i>(130)</i>	17 <i>(0)</i>	\$19,981 <i>(130)</i>	-1 <i>(0)</i>	-\$2,725 <i>(0)</i>
Intramural Research	139	68,299	144	70,341	144	60,494	0	-9,848
Res. Management & Support <i>Res. Management & Support (SBIR Admin) (non-add)</i>	89 <i>(0)</i>	28,064 <i>(0)</i>	91 <i>(0)</i>	29,285 <i>(0)</i>	91 <i>(0)</i>	26,361 <i>(0)</i>	0 <i>(0)</i>	-2,924 <i>(0)</i>
Construction		0		0		0		0
Buildings and Facilities		0		0		0		0
Total, NIDCR	228	\$446,683	235	\$461,781	235	\$397,493	0	-\$64,288

¹ All items in italics and brackets are non-add entries.

Major Changes in the Fiscal Year 2020 President's Budget Request

Major changes by budget mechanism and/or budget detail are briefly described below. The FY 2020 President's Budget for NIDCR is \$397.5 million, a decrease of \$64.3 million from the FY 2019 Enacted level.

Research Project Grants (RPGs) (-\$45.0 million; total \$260.7 million):

NIDCR will cut funding for non-competing RPGs by 10 percent which is a \$21.4 million reduction from their full funding level. Competing RPGs will decrease by 39.7 percent or 82 grants compared to the FY 2019 enacted level of 223 awards, and the amount to support competing awards will decrease by \$33.3 million from the FY 2019 enacted level. Investments in ongoing research will be reduced. This reduction will be distributed across the entire spectrum of basic, translational, and clinical research. The number of Early Stage Investigators supported will be reduced.

Other Research (-\$2.2 million; total \$16.1 million):

NIDCR will reduce funding by 10 percent for non-competing grants within the Dental, Oral and Craniofacial Tissue Regeneration Consortium (DOCTRC) Resource Centers. This program is intended to provide nation-wide resources for research in unmet and challenging clinical needs in tissue regeneration.

Research Training (-\$1.2 million; total \$11.0 million):

NIDCR will reduce funding by 10 percent for research training, distributed across basic, translational, and clinical scientists focused on dental, oral, and craniofacial research.

**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Summary of Changes

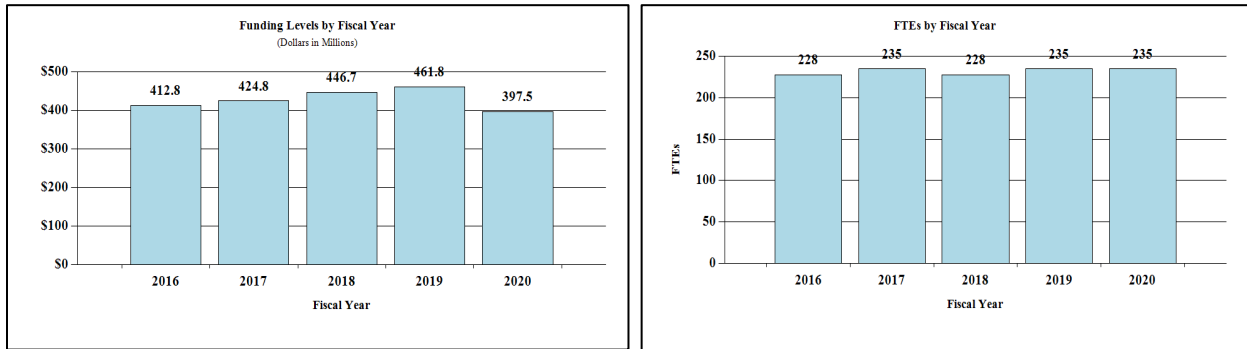
(Dollars in Thousands)

FY 2019 Enacted	\$461,781
FY 2020 President's Budget	\$397,493
Net change	-\$64,288
CHANGES	FY 2020 President's Budget
	Change from FY 2019 Enacted
	FTEs Budget Authority
FTEs Budget Authority	FTEs Budget Authority
A. Built-in:	
1. Intramural Research:	
a. Annualization of January 2019 pay increase & benefits	\$25,290
b. January FY 2020 pay increase & benefits	25,290
c. Paid days adjustment	25,290
d. Differences attributable to change in FTE	25,290
e. Payment for centrally furnished services	11,129
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs	24,075
Subtotal	-\$133
2. <u>Research Management and Support:</u>	
a. Annualization of January 2019 pay increase & benefits	\$14,750
b. January FY 2020 pay increase & benefits	14,750
c. Paid days adjustment	14,750
d. Differences attributable to change in FTE	14,750
e. Payment for centrally furnished services	2,532
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs	9,079
Subtotal	\$68
Subtotal, Built-in	-\$66

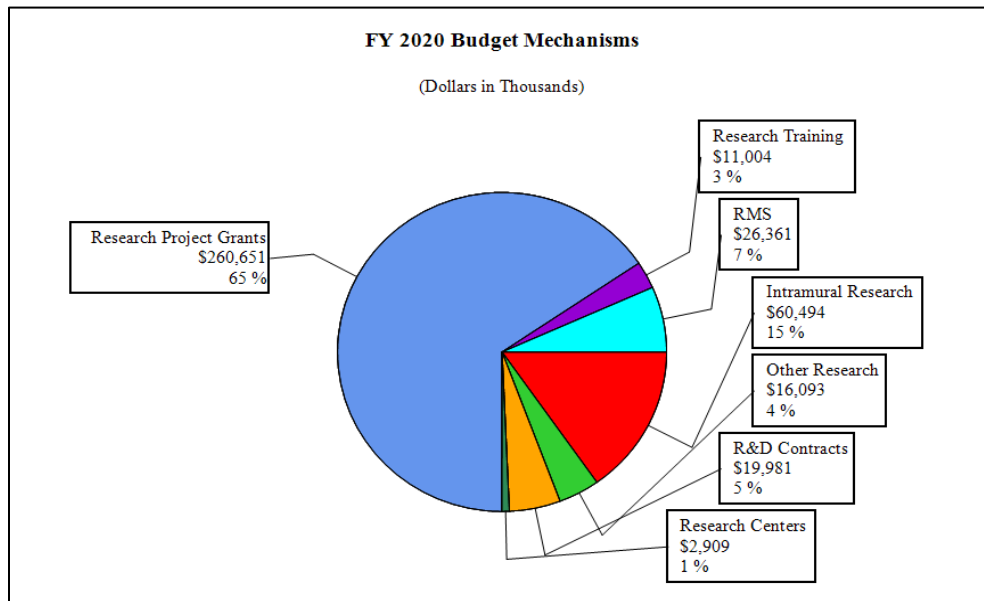
CHANGES	FY 2020 President's Budget		Change from FY 2019 Enacted	
	No.	Amount	No.	Amount
B. Program:				
1. <u>Research Project Grants:</u>				
a. Noncompeting	456	\$198,773	2	-\$9,759
b. Competing	141	50,642	-82	-33,346
c. SBIR/STTR	22	11,236	-4	-1,886
Subtotal, RPGs	619	\$260,651	-84	-\$44,991
2. Research Centers	1	\$2,909	0	-\$397
3. Other Research	74	16,093	-10	-2,181
4. Research Training	224	11,004	-25	-1,223
5. Research and development contracts	17	19,981	-1	-2,725
Subtotal, Extramural		\$310,639		-\$51,516
6. Intramural Research	144	\$60,494	0	-\$9,714
7. Research Management and Support	91	26,361	0	-2,992
8. Construction		0		0
9. Buildings and Facilities		0		0
Subtotal, Program	235	\$397,493	0	-\$64,222
Total changes				-\$64,288

Fiscal Year 2020 Budget Graphs

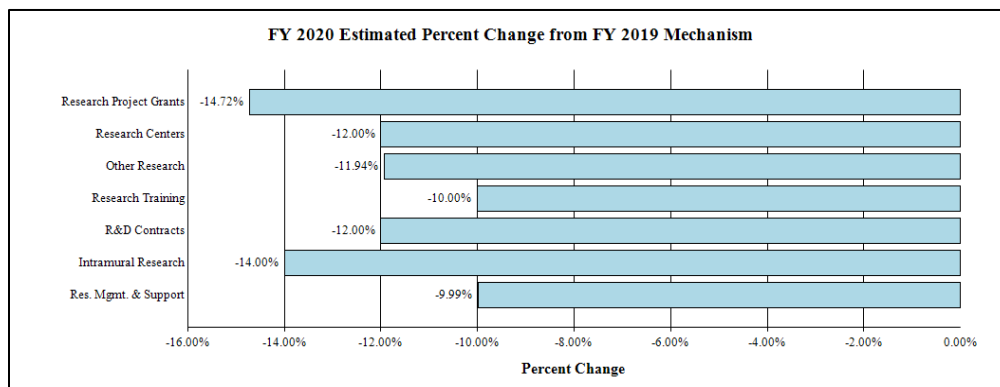
History of Budget Authority and FTEs:



Distribution by Mechanism:



Change by Selected Mechanism:



**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Budget Authority by Activity¹
(Dollars in Thousands)

	FY 2018 Final		FY 2019 Enacted		FY 2020 President's Budget		FY 2020 +/- FY2019 CR	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
<u>Extramural Research</u>								
<u>Detail</u>								
Oral and Craniofacial Biology		\$204,688		\$211,603		\$181,503		-\$30,100
Clinical Research		71,555		73,972		63,449		-10,522
Behavioral and Social Sciences		18,495		19,119		16,400		-2,720
Genetics and Genomics		55,583		57,461		49,287		-8,174
Subtotal, Extramural		\$350,320		\$362,155		\$310,639		-\$51,516
Intramural Research	139	\$68,299	144	\$70,341	144	\$60,494	0	-\$9,848
Research Management & Support	89	\$28,064	91	\$29,285	91	\$26,361	0	-\$2,924
TOTAL	228	\$446,683	235	\$461,781	235	\$397,493	0	-\$64,288

¹ Includes FTEs whose payroll obligations are supported by the NIH Common Fund.

**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2019 Amount Authorized	FY 2019 Enacted	2020 Amount Authorized	FY 2020 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	\$461,781,000	Indefinite	\$397,493,000
National Institute of Dental and Craniofacial Research	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				\$461,781,000		\$397,493,000

**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2011	\$423,511,000		\$422,845,000	\$413,236,000
Rescission				\$3,628,459
2012	\$420,369,000	\$420,369,000	\$404,997,000	\$411,488,000
Rescission				\$777,712
2013	\$408,212,000		\$409,449,000	\$410,710,288
Rescission				\$821,421
Sequestration				(\$20,614,832)
2014	\$411,515,000		\$409,947,000	\$398,650,000
Rescission				\$0
2015	\$397,131,000			\$399,886,000
Rescission				\$0
2016	\$406,746,000	\$404,847,000	\$415,169,000	\$415,582,000
Rescission				\$0
2017 ¹	\$413,396,000	\$425,578,000	\$430,544,000	\$425,751,000
Rescission				\$0
2018	\$320,749,000	\$432,363,000	\$439,738,000	\$447,735,000
Rescission				
2019	\$413,196,000	\$453,082,000	\$462,024,000	\$461,781,000
Rescission				\$0
2020	\$397,493,000			

¹ Budget Estimate to Congress includes mandatory financing.

Justification of Budget Request

National Institute of Dental and Craniofacial Research

Authorizing Legislation: Section 301 and title IV of the Public Health Service Act, as amended.

Budget Authority (BA):

	FY 2018	FY 2019	FY 2020	FY 2020 +/-
	<u>Final</u>	<u>Enacted</u>	<u>President's</u> <u>Budget</u>	<u>FY 2019</u>
BA	\$447,735,000	\$461,781,000	\$397,493,000	-\$64,288,000
FTE	228	235	235	0

Program funds are allocated as follows: Competitive Grants/Cooperative Agreements; Contracts; Direct Federal/Intramural and Other.

Director's Overview

The National Institute of Dental and Craniofacial Research (NIDCR) improves the nation's dental, oral, and craniofacial health by conducting and supporting research that advances prevention and treatment of oral diseases. This rigorously prioritized research illuminates the biological, behavioral, and social factors underlying oral health and disease. NIDCR continues its commitment to train the next generation of scientists, increasing the strength and diversity of the research workforce. The Institute fosters partnerships among scientists, clinicians, and stakeholders to accelerate scientific breakthroughs.

Transformational Tools and Technologies

NIDCR is advancing digital dentistry, including imaging, computer-aided design, and manufacturing technologies. These approaches enhance accuracy, effectiveness, and efficiency in dental practice and directly improve patient care. For example, every year, thousands of people undergo orthognathic surgery, a procedure to correct jaw deformities. Due to the complex structure of the jaw, this surgery requires extensive presurgical planning, including intricate and time-consuming manual mapping of anatomy. A group of NIDCR-supported researchers developed a computer-aided surgical simulation planning tool and streamlined protocol that allow clinicians to plan an entire jaw surgery using a single software system.¹ This tool will speed planning and may improve accuracy and outcomes of orthognathic surgery.

To continue building on evolving advances in digital dentistry, NIDCR launched two initiatives. One program will integrate technologies, such as 3D printing, into clinical practice. The second effort aims to accelerate development and clinical translation of miniaturized oral biodevices, including biosensors, which could be used to rapidly diagnose disease as well as deliver and monitor local and systemic treatments.

¹ www.ncbi.nlm.nih.gov/pubmed/28432489

Building on Basic Science

Carbohydrates are essential for more than energy metabolism. Complex, branched sugar chains called glycans play critical roles in signaling and molecular recognition throughout every aspect of biology, from blood types to infection and immunity. Their structures are difficult to study for all but a handful of specialists, and we are only now beginning to understand their role in human disease processes. In 2015, the NIH Common Fund launched the Glycoscience Program—co-chaired by the NIDCR Director and National Institute of General Medical Sciences Director—to speed the development and distribution of tools and methods that allow more researchers to study the biology of glycans.

NIDCR supports basic research on glycans in its intramural and extramural research programs. In one study, a team of scientists is using a fruit fly model to explore the role of glycans in saliva production and secretion.² Salivary gland cells secrete the components of saliva in specialized compartments called secretory granules. The researchers found that if glycans were not added to the correct locations within secretory granules, the granules did not form correctly—suggesting that glycans are important for saliva production.

Basic science discoveries such as these have built a solid foundation of glycoscience research to enable development of diagnostic methods and therapies for many glycan-related diseases. Earlier this year, an NIDCR-funded small business team showed that a glycan-based oral rinse reduced pain and improved oral function in patients with oral mucosal lesions.³ Another group of scientists and engineers discovered that an FDA-approved nanoparticle drug, ferumoxylol, could be combined with hydrogen peroxide as an oral rinse to break glycan bonds that hold together plaque, the biofilm on teeth that causes cavities.⁴ This discovery has applications beyond oral health, since the mechanism could be used on other biofilms in medicine or industry. NIDCR continues to build on glycoscience discoveries by partnering with other NIH Institutes and Centers to co-fund two small business initiatives to create glycan research tools and foster commercialization in the private sector.

Exploring the Next Frontier

NIDCR celebrated its 70th anniversary in 2018, an opportunity to recognize progress and set goals for the future. In anticipation of this milestone, the Institute launched a strategic visioning initiative, NIDCR 2030, to guide development of research programs. One priority is integrating oral and overall health. NIDCR supports research to understand the shared biological mechanisms of health and disease in the oral region and elsewhere in the body. For example, a team of intramurally- and extramurally-funded NIDCR scientists established that there is a link between rheumatoid arthritis and periodontal disease via a common oral bacterium that causes inflammation in both diseases.⁵

At the practice level, to help physicians understand the connections between oral and overall health, NIDCR published an article on the value of performing oral exams to identify potential health issues.⁶ A video accompanying the article shows healthcare practitioners how to perform

² www.ncbi.nlm.nih.gov/pubmed/30158631

³ www.ncbi.nlm.nih.gov/pubmed/29935927

⁴ www.ncbi.nlm.nih.gov/pubmed/30065293

⁵ www.ncbi.nlm.nih.gov/pubmed/27974664

⁶ www.ncbi.nlm.nih.gov/pubmed/29801162

a concise but thorough oral exam within five minutes.⁷ To emphasize the essential role of the oral health community in addressing the opioid overdose epidemic, the Directors of NIDCR and the National Institute on Drug Abuse co-authored a perspective that outlines research efforts to inform clinical decision-making related to opioid-prescribing practices.⁸

In 2018 the U.S. Surgeon General commissioned NIDCR to lead the production of a Report on Oral Health in America, to be released in 2020, the 20th anniversary of the first Oral Health in America report. NIDCR is working with the U.S. Public Health Service's Oral Health Coordinating Committee, the Centers for Disease Control and Prevention, and other stakeholders to reexamine the state of oral health in Americans across the lifespan. The report will identify opportunities and obstacles in advancing dental, oral, and craniofacial health and serve as a vital resource by establishing guidelines for research priorities and public policy.

Overall Budget Policy: The FY 2020 President's Budget request for NIDCR is \$397.5 million, a decrease of \$64.3 million or 13.9 percent below the FY 2019 Enacted level.

Program Descriptions and Accomplishments

NIDCR's research purview is quite broad; the narratives that follow highlight just some of the Institute's research areas, programs, and initiatives.

Oral and Craniofacial Biology Research

NIDCR supports a comprehensive dental, oral, and craniofacial (DOC) biology research portfolio. The goal of these programs is to provide scientific evidence for advancing the prevention, diagnosis, and treatment of DOC diseases. Basic research in these programs enables development of improved dental restorative materials and oral biodevices, a better understanding of the genetics underlying DOC diseases, insights into connections between oral health and overall health, advances in data collection and analysis, and multidisciplinary investigations into the causes of chronic orofacial pain and overlapping pain conditions. Outlined below are examples of progress and research initiatives from selected NIDCR programs.

Regenerative Medicine Program

NIDCR's regenerative medicine program supports basic, translational, and clinical research to repair and restore damaged or diseased DOC tissues. One significant research challenge is identifying and isolating enriched populations of adult stem cells, a task critical for harnessing their regenerative potential for use in human therapies. A few years ago, NIDCR-supported scientists identified a population of adult skeletal stem cells in mice that could be stimulated to develop into bone or cartilage.⁹ These results led to the discovery of a similar population of human skeletal stem cells,¹⁰ which could be used to develop therapies to repair craniofacial bone or cartilage defects.

⁷ www.youtube.com/watch?v=ReFRAUMuAYM&feature=youtu.be

⁸ www.ncbi.nlm.nih.gov/pubmed/30055662

⁹ www.ncbi.nlm.nih.gov/pubmed/25594184

¹⁰ www.ncbi.nlm.nih.gov/pubmed/30241615

Many scientists refer to the gap between basic research findings and their clinical application as the ‘Valley of Death,’ where many promising therapies fail. Successfully traversing the ‘Valley of Death’ requires expertise in conducting clinical studies, understanding industry requirements, and following complex regulatory guidelines. To provide these missing pieces and help guide regenerative medicine therapies through preclinical studies and into human clinical trials, NIDCR established the Dental, Oral, and Craniofacial Tissue Regeneration Consortium (DOCTRC) in 2015. This consortium is designed to help promising research projects get FDA approvals required to launch clinical trials. The first two phases of this initiative created multidisciplinary research teams—scientists, clinicians, industry partners, regulatory agencies, and commercialization experts—at two resource centers. In preparation for phase three, DOCTRC is supporting over a dozen interdisciplinary translational projects. In one such effort, scientists are creating a safe and effective device for reconstructing temporomandibular joint discs¹¹; in another, researchers are advancing a treatment for periodontal disease that blocks a protein, sclerostin, that impedes bone growth.¹²

Program Portrait: Advancing Immunotherapies to Treat Head and Neck Cancers

FY 2019 Level: \$60.1 million

FY 2020 Level: \$51.7 million

Change: -\$ 8.4 million

NIDCR is an active player in the Beau Biden Cancer Moonshot, whose goal is to dramatically speed efforts to prevent, diagnose, and treat cancer. In December 2017, NIDCR, along with the National Cancer Institute and several other NIH Institutes, created the Cancer Immunotherapy Consortium (CIC), a network of teams focused on discovering new immunotherapy approaches to treat cancer. As a result, NIDCR is now co-funding two basic science studies to discover targets for immunotherapies for head and neck squamous cell cancers (HNSCC).

Sixty thousand people are diagnosed every year with head and neck cancer in the United States.¹³ Unfortunately, only half of them will live beyond five years. Surgery, radiation, and chemotherapies have been mainstays of HNSCC treatment, but some tumors stubbornly resist treatment or respond initially and then return. Moonshot-funded scientists will examine HNSCC cells and characterize vulnerabilities in tumor immunity. Molecules called checkpoint proteins normally regulate immune cells. Cancer cells take advantage of this process by producing large amounts of checkpoint proteins to evade immune cell detection. Checkpoint inhibitor immunotherapies target these proteins, activating the immune system to kill cancer cells. These immunotherapies have already shown promise in treating melanoma and some other cancers. However, HNSCC tumors have a low response rate—20 to 25 percent—to current therapies. The Moonshot studies will focus on identifying pathways that can be targeted to stimulate immune responses against HNSCC tumor cells.

One Moonshot-funded research team is searching for ways to enhance the effectiveness of treatment by combining radiation therapy and immunotherapy. One team’s approach is to precisely target inflammatory signals to overcome the immunosuppressive environment in HNSCC tumors. Another group is determining how cancer neoantigens—molecules that have been mutated within the tumor—can be manipulated so the immune system can recognize them. Knowledge gained from these studies may lead to more precise therapeutic avenues targeting the immune system. Such therapies could be combined with existing treatments to increase success rates in HNSCC.

¹¹ www.doctrc.pitt.edu/wp-content/uploads/2018/07/Almarza.pdf

¹² www.doctrc.pitt.edu/wp-content/uploads/2018/07/Giannobile.pdf

¹³ www.cancer.net/cancer-types/head-and-neck-cancer/statistics

Orofacial Pain Program

Millions of Americans have chronic orofacial pain, which is often caused by temporomandibular joint disorders (TMD), head and neck cancers, and other orofacial conditions.¹⁴ Scientists need to understand the biology of pain to develop safe and non-addictive alternatives to opioids.

Not all pain is the same. Orofacial pain is often more severe and emotionally draining than pain in other areas of the body. However, researchers do not fully understand the biological causes of these differences. Using an animal model, NIDCR-supported scientists found a clue. They discovered that pain signals in the face are transmitted more strongly than non-facial pain signals to the amygdala, a major emotion-processing hub in the brain.¹⁵ This finding may explain the greater severity and emotional toll of orofacial pain. These results could inform therapies that target both physical and emotional aspects of orofacial pain.

Most drugs that enter clinical trials, including painkillers, fail because they are less effective in people than they were in preclinical models in the lab. Pain pathways in animal models may not always be the same in humans. For example, NIDCR-supported scientists found that humans and mice use different types of voltage-gated sodium channels, which are proteins on the surface of nerve cells that transmit pain signals.¹⁶ Consequently, researchers are testing human cells and patients earlier in the research process. This strategy will help investigators focus on the most promising potential treatments before launching expensive, large-scale, time-consuming clinical trials. A group of scientists using this tactic found that pain in a mouse model was lessened by drugs blocking a protein known as epidermal growth factor receptor (EGFR). A small, follow-up study in people with TMD revealed a similar link between EGFR and pain, offering early support for the idea that targeting EGFR might work for clinical pain management.¹⁷

Craniofacial Disorders Program

Craniofacial disorders, such as cleft lip and palate, are the most common birth defects in the United States and have profound, lifelong effects on patients and their families.¹⁸ NIDCR supports basic and translational research to understand the complex genetic, molecular, and environmental factors that disrupt craniofacial development, with the goal of improving diagnosis and treatment of these conditions.

Searching for differences in DNA between people with and without craniofacial disorders is one way to find genes that might be responsible. Once these so-called candidate genes are identified, scientists can use animal models to further study how the genes work. For example, NIDCR-supported researchers found that patients with cleft lip and palate often are missing a copy of the gene *Isthmin 1*. Scientists then showed that disrupting *Isthmin 1* in the aquatic frog *Xenopus laevis* leads to a disorder very similar to cleft palate.¹⁹ These findings may lead to earlier interventions to correct these conditions.

¹⁴ www.cdc.gov/mmwr/volumes/67/wr/mm6736a2.htm

¹⁵ <https://www.ncbi.nlm.nih.gov/pubmed/29184209>

¹⁶ www.ncbi.nlm.nih.gov/pubmed/28424991

¹⁷ www.ncbi.nlm.nih.gov/pubmed/28783046

¹⁸ www.cdc.gov/ncbddd/birthdefects/data.html

¹⁹ www.ncbi.nlm.nih.gov/pubmed/29162626

NIDCR-supported investigators are studying cleft palate in mice engineered to lack functional Pax9, a protein involved in skeletal development. As a result, the mice have abnormal craniofacial, tooth, and limb formation. The scientists observed that Pax9-deficient mice have increased levels of a protein, Dkk1, in tissues that form the palate of the mouth during development. They found that reducing the amount of Dkk1 led to more complete palate formation in some Pax9-deficient mice, suggesting that Pax9 and Dkk1 are important for craniofacial development.^{20,21} Studies to further understand the roles of these proteins in craniofacial development could lead to strategies for early detection, prevention, and therapies for craniofacial disorders.

Oral and Craniofacial Biology Initiative

The immune system's role in fighting infections and cancers, including those of the DOC region, has been well-studied, but less is known about how it works to balance health and disease. A new NIDCR initiative will support research to understand how the immune system remains flexible to maintain oral health, in the absence and presence of disease or injury, in order to develop treatment strategies.

Budget Policy: The FY 2020 President's Budget estimate for this program is \$181.5 million, a decrease of \$30.1 million or 14.2 percent compared to the FY 2019 Enacted level.

Clinical Research

To complement investments in basic DOC research, NIDCR supports a broad range of clinical research activities, including clinical trials, epidemiological studies, practice- and community-based research, and studies of oral health disparities. Highlighted below are examples of progress and initiatives from selected programs within this area.

Periodontal Disease Program

Nearly half of adults in the United States have periodontal disease, an inflammatory condition that can damage tissues and bone that support the teeth, and often results in tooth loss.²² Localized aggressive periodontitis (LAP) is a rare and severe form of periodontal disease that is more common in African American children and adolescents.²³ Because LAP is rare, dentists often do not recognize early signs of disease, hindering timely diagnosis and treatment. To address this problem, NIDCR-supported scientists studied primary (baby) teeth of children with LAP and charted the course of disease progression, which begins with bone loss around the first molars. This new knowledge may allow dentists to identify and treat LAP earlier in children and help prevent loss of adult teeth.

Another team of scientists is studying LAP epigenetics, the reversible, chemical modifications to DNA that turn genes on or off. Researchers found that people with LAP had epigenetic changes near genes that are part of the Toll-like receptor pathway, which plays a key role in immune responses. Further studies of these epigenetic changes may reveal how LAP progresses so quickly and why certain people are more likely to have the disease. Better understanding of the

²⁰ www.ncbi.nlm.nih.gov/pubmed/28893947

²¹ www.ncbi.nlm.nih.gov/pubmed/28692808

²² www.ncbi.nlm.nih.gov/pubmed/25688694

²³ www.ncbi.nlm.nih.gov/pubmed/29087795

mechanisms of oral inflammation could lead to strategies to prevent and treat not only LAP, but other types of oral diseases.²⁴

Program Portrait: Accelerating Evidence-Based Practices into Day-to-Day Dentistry

FY 2019 Level: \$6.6 million

FY 2020 Level: \$5.7 million

Change: -\$0.9 million

The journey of a new treatment or intervention from lab to dental chair can take almost a decade before patients can benefit. One way to address this challenge is to conduct studies in a practice-based setting, which brings research to patients and practitioners in the real-world environment of a dental practice. Practice-based research results are adopted more quickly into clinical practice.

Fourteen years ago, NIDCR launched the National Dental Practice-Based Research Network (National Dental PBRN) to answer questions of everyday relevance to dental practitioners and their patients. Since then, more than 7,000 dental practitioners and 60,000 patients in all 50 States have participated in more than 50 studies. The studies have expanded the profession's evidence base and have covered topics including cracked teeth, management of chronic toothache, pain and functional outcomes of temporomandibular joint disorder management, and prevalence of persistent pain after root canals. Study findings have guided practitioners in identifying risk factors for the development of oral conditions and have led to more effective treatments and preventive approaches. For example, a study addressing the nationwide opioid overdose crisis suggested that prescription drug monitoring programs and patient education may lower the risk of subsequent opioid misuse. Overall, the findings from practice-based research have provided evidence to better inform oral health treatment decisions.

Building on the momentum of previous investments, the third phase of the National Dental PBRN will add a Specialty Node to recruit and engage dental specialists, as well as a Patient Population Node to link practitioners with specific practices and patients. The work of the National Dental PBRN dovetails with other NIDCR investments in implementation science that identify and overcome barriers that delay the use of evidence-based clinical practices.

Oral Cancer Program

A leading cause of a type of oral cancer, called oropharyngeal cancer, is human papillomavirus (HPV)—the same virus that causes cervical cancer. Oropharyngeal cancer affects the back of the throat, including the base of the tongue and the tonsils. The incidence of HPV-associated oropharyngeal cancers has risen significantly in recent decades, particularly among men.²⁵ In response to this public health concern, the HPV vaccine is being used to prevent infection and HPV-associated cancers. Although the vaccine prevents HPV-associated cervical cancers, scientists were not sure whether the HPV vaccine prevents oral HPV infection and oropharyngeal cancer. By examining data from over 2,500 young adults from across the country, NIDCR-supported scientists showed that the vaccine significantly reduced the number of young adults with oral HPV infections. These findings reinforce the importance of vaccinating young adults, especially males, to help prevent oral HPV infection and oropharyngeal cancers.

Research suggests there is a link between oral HPV infection and periodontal disease as well, although the mechanism is unclear. NIDCR-supported scientists found that patients with severe

²⁴ www.ncbi.nlm.nih.gov/pubmed/28883894

²⁵ www.ncbi.nlm.nih.gov/pubmed/29182497

periodontal disease are more likely to be infected with HPV.²⁶ Researchers are delving deeper into the mechanisms of HPV infection and periodontal disease to determine if periodontal disease contributes to persistence of oral HPV infection and development of HPV-associated diseases.

Clinical Research Initiatives

NIDCR is launching two initiatives related to oral health in vulnerable populations. People living with HIV/AIDS have increased rates and severity of oral diseases. One initiative supports research to understand the combined effects of HIV/AIDS, HIV therapies, oral diseases, and co-occurring non-communicable diseases on oral health. Scientists will use this information to identify approaches to prevent and treat oral diseases in these people. Adolescents—particularly those from low-income and racial/ethnic minority groups—exhibit a higher occurrence of dental caries and other oral diseases than younger children. A second initiative encourages interdisciplinary research to find out why these differences exist and develop strategies to improve adolescents’ oral health and reduce health disparities.

Budget Policy: The FY 2020 President’s Budget estimate for this program is \$63.4 million, a decrease of \$10.5 million or 14.2 percent compared to the FY 2019 Enacted level.

Behavioral and Social Sciences Research

NIDCR’s investments in behavioral and social sciences research are leading to the development and implementation of evidence-based strategies to improve oral and overall health across the lifespan. NIDCR-supported studies help us understand how behavioral and social factors impact oral health, and what methods work best to influence decision-making and behavior. Future research in this area will address disparities and inequalities in oral health through an understanding of social determinants of health, social networks, and systems within communities. Highlighted below are selected examples of progress from programs and initiatives within this research area.

Programs for Vulnerable Populations

People with autism spectrum disorders (ASD) have sensory processing difficulties and can feel overwhelmed in an environment with lots of sounds, smells, and visual stimulation such as those found in a dental office. As a result, ASD children are less likely to receive routine oral care in a typical dental setting, leading to a greater risk for oral disease and increased costs for treatment. NIDCR-supported scientists designed a sensory-adapted dental environment (SADE) to make dental clinics more accessible and comfortable for children with ASD.²⁷ The SADE includes dimmed lighting, moving projections on the ceiling, soothing music, and use of a weighted butterfly vest with wings that wrap around the child to provide calming sensations. A clinical trial is underway comparing the SADE clinic to a traditional dental clinic serving children with ASD. Building on the success of the SADE project, NIDCR is supporting an expansion of this study to help children with Down syndrome, since these children may also have mental and physical challenges that have implications for oral care. This work is part of the trans-NIH INCLUDE (INvestigation of Co-occurring Conditions across the Lifespan to Understand Down SyndromE) initiative supporting research that addresses critical health and quality-of-life needs

²⁶ www.ncbi.nlm.nih.gov/pubmed/29555599

²⁷ projectreporter.nih.gov/project_info_description.cfm?aid=9694299

for people with Down syndrome. These research advances will help equip dental clinics with cost-effective tools that improve accessibility of routine dental care for populations with special needs.

Older adults—especially those with cognitive decline—also experience unique oral health needs and challenges that can be addressed through behavioral health research. Older adults’ declining independence and use of multiple medications can negatively impact their oral health and quality of life. Through a partnership between NIDCR and the NIH Initiative on Alzheimer’s Disease and Related Disorders, scientists are evaluating a partner-assisted oral care program designed to help elderly dementia patients improve and maintain oral hygiene and positive oral health behaviors.²⁸ In addition to assessing overall effectiveness of the program, researchers are examining changes in oral health communication, knowledge, and self-efficacy for both participants and care partners.

Behavioral and Social Sciences Initiatives

NIDCR launched the Interdisciplinary Collaborations to Promote Research in Oral Health and Aging initiative in 2017. Research in this area is designed to validate innovative approaches that enhance oral health and well-being of older adults. The first phase of this initiative encouraged research on the biology of aging in DOC tissues as they relate to parallel processes in other tissues and organs. The latest phase was announced in 2018 and focuses on clinical research addressing the causes and management of DOC diseases associated with aging.

Budget Policy: The FY 2020 President’s Budget estimate for this program is \$16.4 million, a decrease of \$2.7 million or 14.2 percent compared to the FY 2019 Enacted level.

Translational Genetics and Genomics

The Translational Genetics and Genomics program supports the transfer of discoveries in genetics, genomics, and developmental biology into improved prevention and treatment of DOC disorders. In addition, the program supports research in emerging data science fields that require the development of tools and technologies to collect, integrate, and disseminate large sets of data. This portfolio includes studies that range from uncovering molecular mechanisms in model organisms and humans to population-level studies, with the aim of translating basic science into clinical practice.

Budget Policy: The FY 2020 President’s Budget estimate for this program is \$49.3 million, a decrease of \$8.2 million or 14.2 percent compared to the FY 2019 Enacted level.

Intramural Research

Scientists in NIDCR’s intramural research division conduct cutting-edge basic, translational, and clinical DOC research. Taking advantage of the NIH Clinical Center and collaborations with extramural investigators, intramural scientists study the biology of pain, itch, and taste; oral and craniofacial genetics and development; immunology of the mucosal system; salivary gland development and function; and stem cell biology and tissue regeneration. A cornerstone of the intramural division is a strong focus on training the next generation of researchers by recruiting

²⁸ projectreporter.nih.gov/project_info_description.cfm?aid=9438210

highly talented trainees from diverse backgrounds. Highlighted below are selected examples of intramural research advances and initiatives.

Program Portrait: Training the Next Generation of Oral Health Clinician-Scientists

FY 2019 Level: \$0.3 million

FY 2020 Level: \$0.3 million

Change: \$0.0 million

NIDCR continues to prioritize oral health research training by creating opportunities to support scientists at the beginning of their careers. In 2010, recognizing a critical need for dentist scientists who could bridge the gap between the lab and clinical practice, NIDCR established the Dental Clinical Research Fellowship. This training program is part of the Clinical Research Center in the Institute's intramural research division, located on the NIH campus in Bethesda, Maryland.

The Dental Clinical Research Fellowship offers dentists customized two-to-four-year mentored training in the latest basic, translational, and clinical research methods. The goal is to prepare them for independent careers in dental, oral, and craniofacial research and equip them to successfully compete for research funding. Investigators in NIDCR's intramural research division and other NIH Institutes mentor fellows to help them develop a clinical or translational research study aligned with ongoing basic science laboratory projects. The program encourages multidisciplinary collaboration with other Institutes by supporting projects that explore the critical role of oral health, oral diseases, and dental research in relationship to overall health.

The Fellowship Program also has a unique resource in the NIH Clinical Center's Dental Clinic, where fellows engage in research and patient care through active clinical research protocols supported by NIDCR and other NIH Institutes. This clinical experience gives fellows the opportunity to observe, first hand, the connections between oral health and overall health. Since 2010, 16 fellows—more than half of them women—have participated in the program and gone on to research careers in academia, industry, NIH, and elsewhere in the Federal Government. NIDCR will continue to support this program to ensure that dentist scientists receive the necessary training to become the next generation of leaders in oral health research.

Salivary Gland Biology Program

NIDCR intramural researchers study salivary gland development and function. Dry mouth occurs when salivary glands do not make enough saliva, and can lead to pain, tooth decay, tooth loss, mouth sores, and periodontal disease. Intramural projects span basic to clinical research, with the goal of developing therapies to prevent salivary gland damage, improve saliva secretion, and regenerate diseased or damaged salivary glands.

Head and neck cancer radiation therapy can irreversibly damage salivary glands and is a common cause of chronic dry mouth. One group of NIDCR intramural scientists showed that radiation lowers levels of the protein STIM1, which may lead to decreased saliva secretion and dry mouth.²⁹ The researchers used a technique called gene therapy to increase the levels of STIM1 in radiation-damaged salivary glands of mice. Treated mice had improved saliva secretion, suggesting that increasing STIM1 might restore salivary gland function in humans after radiation therapy.

A second group of NIDCR intramural scientists are testing a gene therapy treatment for Sjögren's syndrome, an autoimmune disease that damages salivary glands and causes dry mouth.

²⁹ www.ncbi.nlm.nih.gov/pubmed/28588080

The investigators found that the protein mutated in cystic fibrosis, called CFTR, does not function properly in salivary glands of a Sjögren's syndrome mouse model and that this disruption may underlie decreased salivary flow.³⁰ Gene therapy to add CFTR to the salivary gland duct, which carries saliva from the salivary gland to the mouth, restored salivary gland function in the mice. The researchers also showed that drugs that improve CFTR function in cystic fibrosis patients repaired the salivary gland duct and increased saliva secretion in the Sjögren's syndrome mouse model. These findings have brought us closer to developing more effective ways to prevent and treat chronic dry mouth.

Intramural Research Training Initiative

The intramural research division of NIDCR supports training and development of early-career scientists, with opportunities from the high school to postdoctoral levels. In 2018, NIDCR established the Director's Postdoctoral Fellowship to Enhance Diversity in Dental, Oral, and Craniofacial Research to support scientists from diverse backgrounds and life experiences—bringing different perspectives, creativity, and individual enterprise to address complex scientific problems. This initiative is designed to enable underserved or underrepresented populations to participate in and benefit from health research, enhancing public trust and improving the quality of health and wellness for all communities.

Budget Policy: The FY 2020 President's Budget estimate for this program is \$60.5 million, a decrease of \$9.8 million or 14.0 percent compared to the FY 2019 Enacted level.

Research Management and Support

NIDCR research management and support (RMS) personnel support and enable the success of all NIDCR-funded programs. The Institute uses a data-driven approach to decision-making, which improves administrative efficiency by streamlining and harmonizing RMS activities. RMS personnel serve as liaisons with grantees, provide stewardship for research training and career development programs, analyze and advance science policy, coordinate program planning and evaluation, lead stakeholder outreach and communications, and oversee NIDCR's fellowship in oral health informatics.

Budget Policy: The FY 2020 President's Budget estimate for this program is \$26.4 million, a decrease of \$2.9 million or 10.0 percent compared to the FY 2019 Enacted level.

³⁰ www.ncbi.nlm.nih.gov/pubmed/28634110

NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research

Budget Authority by Object Class¹
(Dollars in Thousands)

	FY 2019 Enacted	FY 2020 President's Budget	FY 2020 +/- FY 2019
Total compensable workyears:			
Full-time equivalent	235	235	0
Full-time equivalent of overtime and holiday hours	0	0	0
Average ES salary	\$193	\$197	\$4
Average GM/GS grade	11.7	11.7	0.0
Average GM/GS salary	\$105	\$107	\$2
Average salary, grade established by act of July 1, 1944 (42 U.S.C. 207)	\$118	\$121	\$3
Average salary of ungraded positions	\$147	\$150	\$3
OBJECT CLASSES	FY 2019 Enacted	FY 2020 President's Budget	FY 2020 +/- FY 2019
11.1 Personnel Compensation			
Full-Time Permanent	15,603	15,662	59
11.3 Other Than Full-Time Permanent	10,539	10,579	40
11.5 Other Personnel Compensation	699	701	3
11.7 Military Personnel	246	254	8
11.8 Special Personnel Services Payments	3,572	3,585	14
11.9 Subtotal Personnel Compensation	\$30,658	\$30,782	\$124
12.1 Civilian Personnel Benefits	8,978	9,148	170
12.2 Military Personnel Benefits	107	111	4
13.0 Benefits to Former Personnel	0	0	0
Subtotal Pay Costs	\$39,743	\$40,040	\$297
21.0 Travel & Transportation of Persons	598	436	-162
22.0 Transportation of Things	74	54	-20
23.1 Rental Payments to GSA	0	0	0
23.2 Rental Payments to Others	5	4	-1
23.3 Communications, Utilities & Misc. Charges	253	185	-69
24.0 Printing & Reproduction	1	1	0
25.1 Consulting Services	2,326	1,697	-629
25.2 Other Services	6,719	5,084	-1,635
25.3 Purchase of goods and services from government accounts	54,435	44,914	-9,521
25.4 Operation & Maintenance of Facilities	18	13	-5
25.5 R&D Contracts	8,724	7,548	-1,176
25.6 Medical Care	172	125	-47
25.7 Operation & Maintenance of Equipment	1,056	769	-287
25.8 Subsistence & Support of Persons	18	13	-5
25.0 Subtotal Other Contractual Services	\$73,470	\$60,165	-\$13,305
26.0 Supplies & Materials	4,215	3,064	-1,152
31.0 Equipment	3,974	2,889	-1,085
32.0 Land and Structures	0	0	0
33.0 Investments & Loans	0	0	0
41.0 Grants, Subsidies & Contributions	339,448	290,657	-48,791
42.0 Insurance Claims & Indemnities	0	0	0
43.0 Interest & Dividends	0	0	0
44.0 Refunds	0	0	0
Subtotal Non-Pay Costs	\$422,038	\$357,453	-\$64,585
Total Budget Authority by Object Class	\$461,781	\$397,493	-\$64,288

¹ Includes FTEs whose payroll obligations are supported by the NIH Common Fund.

NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research

Salaries and Expenses
(Dollars in Thousands)

OBJECT CLASSES	FY 2019 Enacted	FY 2020 President's Budget	FY 2020 +/- FY 2019
Personnel Compensation			
Full-Time Permanent (11.1)	\$15,603	\$15,662	\$59
Other Than Full-Time Permanent (11.3)	10,539	10,579	40
Other Personnel Compensation (11.5)	699	701	2
Military Personnel (11.7)	246	254	8
Special Personnel Services Payments (11.8)	3,572	3,585	14
Subtotal Personnel Compensation (11.9)	\$30,658	\$30,782	\$124
Civilian Personnel Benefits (12.1)	\$8,978	\$9,148	\$170
Military Personnel Benefits (12.2)	107	111	4
Benefits to Former Personnel (13.0)	0	0	0
Subtotal Pay Costs	\$39,743	\$40,040	\$297
Travel & Transportation of Persons (21.0)	\$598	\$436	-\$162
Transportation of Things (22.0)	74	54	-20
Rental Payments to Others (23.2)	5	4	-1
Communications, Utilities & Misc. Charges (23.3)	253	185	-69
Printing & Reproduction (24.0)	1	1	0
Other Contractual Services:			
Consultant Services (25.1)	2,326	1,697	-629
Other Services (25.2)	6,719	5,084	-1,635
Purchases from government accounts (25.3)	54,435	44,914	-9,521
Operation & Maintenance of Facilities (25.4)	18	13	-5
Operation & Maintenance of Equipment (25.7)	1,056	769	-287
Subsistence & Support of Persons (25.8)	18	13	-5
Subtotal Other Contractual Services	\$64,573	\$52,491	-\$12,082
Supplies & Materials (26.0)	\$4,215	\$3,064	-\$1,152
Subtotal Non-Pay Costs	\$69,719	\$56,234	-\$13,485
Total Administrative Costs	\$109,462	\$96,273	-\$13,189

**NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research**

Detail of Full-Time Equivalent Employment (FTE)

OFFICE/DIVISION	FY 2018 Final			FY 2019 Enacted			FY 2020 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Division of Extramural Activities									
Direct:	17	-	17	18	-	18	18	-	18
Reimbursable:	1	-	1	1	-	1	1	-	1
Total:	18	-	18	19	-	19	19	-	19
Division of Extramural Research									
Direct:	26	-	26	26	-	26	26	-	26
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	26	-	26	26	-	26	26	-	26
Division of Intramural Research									
Direct:	133	1	134	137	-	137	137	-	137
Reimbursable:	5	-	5	8	-	8	8	-	8
Total:	138	1	139	145	-	145	145	-	145
Office of Administrative Management									
Direct:	14	-	14	14	-	14	14	-	14
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	14	-	14	14	-	14	14	-	14
Office of Clinical Trial Operations and Management									
Direct:	2	-	2	2	-	2	2	-	2
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	2	-	2	2	-	2	2	-	2
Office of Communication and Health Education									
Direct:	8	-	8	8	-	8	8	-	8
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	8	-	8	8	-	8	8	-	8
Office of Information Technology									
Direct:	7	-	7	8	-	8	8	-	8
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	7	-	7	8	-	8	8	-	8
Office of Science Policy and Analysis									
Direct:	7	1	8	6	1	7	6	1	7
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	7	1	8	6	1	7	6	1	7
Office of the Director									
Direct:	6	-	6	6	-	6	6	-	6
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	6	-	6	6	-	6	6	-	6
Total	226	2	228	234	1	235	234	1	235
Includes FTEs whose payroll obligations are supported by the NIH Common Fund.									
FTEs supported by funds from Cooperative Research and Development Agreements.	0	0	0	0	0	0	0	0	0
FISCAL YEAR	Average GS Grade								
2016	11.7								
2017	11.8								
2018	11.8								
2019	11.7								
2020	11.7								

NATIONAL INSTITUTES OF HEALTH
National Institute of Dental and Craniofacial Research

Detail of Positions¹

GRADE	FY 2018 Final	FY 2019 Enacted	FY 2020 President's Budget
Total, ES Positions	1	1	1
Total, ES Salary	189,600	193,202	196,872
GM/GS-15	12	14	14
GM/GS-14	24	27	27
GM/GS-13	37	41	41
GS-12	34	32	32
GS-11	15	17	17
GS-10	0	0	0
GS-9	9	9	9
GS-8	9	9	9
GS-7	9	11	11
GS-6	2	5	5
GS-5	0	0	0
GS-4	0	0	0
GS-3	1	1	1
GS-2	1	1	1
GS-1	0	0	0
Subtotal	153	167	167
Grades established by Act of July 1, 1944 (42 U.S.C. 207)	0	0	0
Assistant Surgeon General	0	0	0
Director Grade	2	2	2
Senior Grade	0	0	0
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	2	2	2
Ungraded	84	85	85
Total permanent positions	153	167	167
Total positions, end of year	237	256	256
Total full-time equivalent (FTE) employment, end of year	228	235	235
Average ES salary	189,600	193,202	196,872
Average GM/GS grade	11.8	11.7	11.7
Average GM/GS salary	103,101	105,060	107,056

¹ Includes FTEs whose payroll obligations are supported by the NIH Common Fund.