DEPARTMENT OF HEALTH AND HUMAN SERVICES

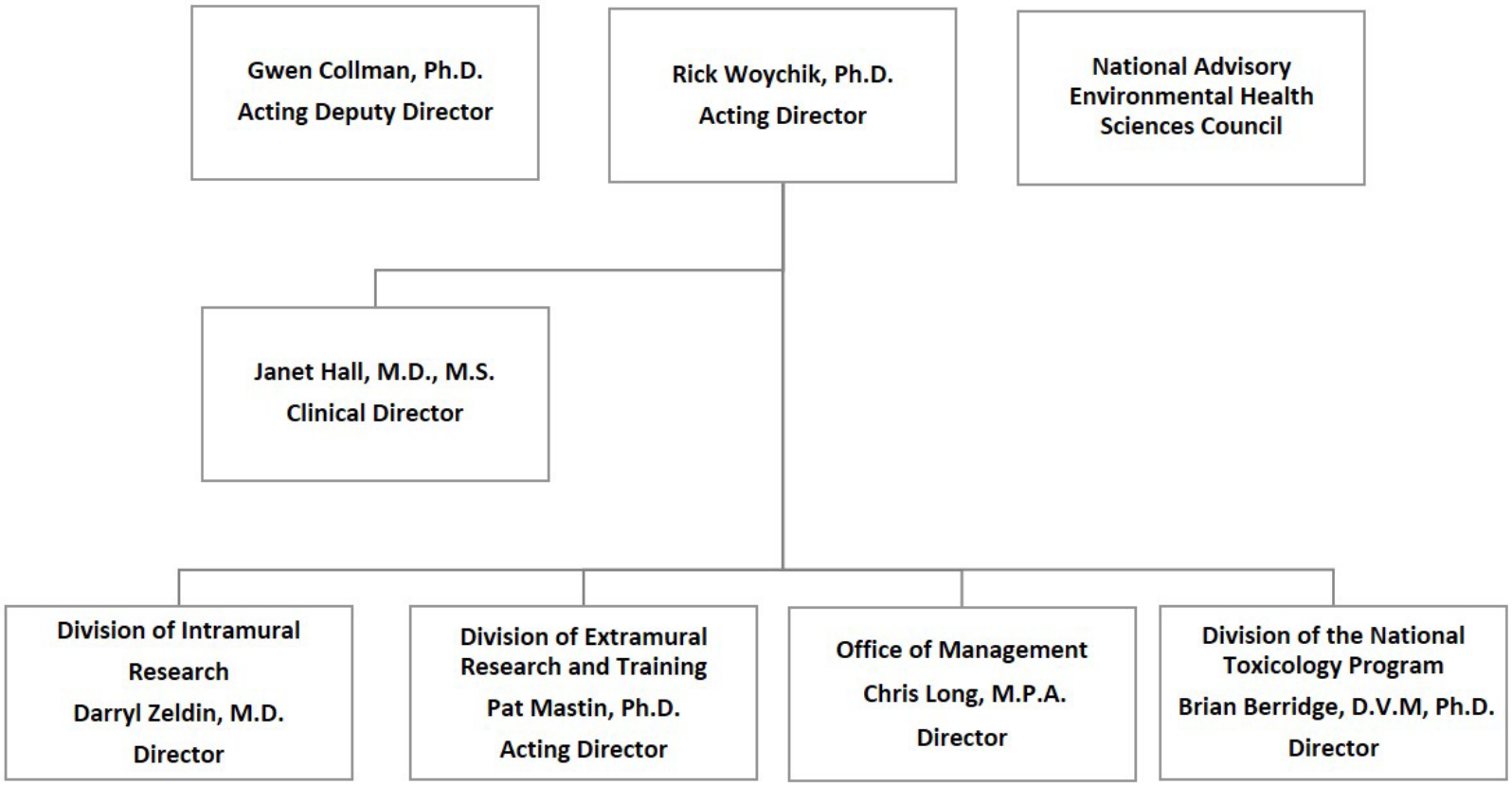
NATIONAL INSTITUTES OF HEALTH

National Institute of Environmental Health Sciences (NIEHS)

NATIONAL INSTITUTES OF HEALTH

National Institute of Environmental Health Sciences

Organization Structure



NATIONAL INSTITUTES OF HEALTH

National Institute of Environmental Health Sciences

For carrying out section 301 and title IV of the PHS Act with respect to environmental health sciences, [$802,598,000]*$730,147,000*. (Department of Health and Human Services Appropriations Act, 2020.)

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Amounts Available for Obligation[1]

(Dollars in Thousands)

Source of Funding	FY 2019 Final	FY 2020 Enacted	FY 2021 President's Budget
Appropriation	$774,707	$802,598	$730,147
Mandatory Appropriation: (non-add)			
Type 1 Diabetes	*(0)*	*(0)*	*(0)*
Other Mandatory financing	*(0)*	*(0)*	*(0)*
Rescission	0	0	0
Sequestration	0	0	0
Secretary's Transfer	-2,661	0	0
Subtotal, adjusted appropriation	$772,046	$802,598	$730,147
OAR HIV/AIDS Transfers	-80	0	0
HEAL Transfer from NINDS	0	0	0
Subtotal, adjusted budget authority	$771,966	$802,598	$730,147
Unobligated balance, start of year	0	0	0
Unobligated balance, end of year	0	0	0
Subtotal, adjusted budget authority	$771,966	$802,598	$730,147
Unobligated balance lapsing	-161	0	0
Total obligations	$771,805	$802,598	$730,147

[1] Excludes the following amounts (in thousands) for reimbursable activities carried out by this account:
FY 2019 - $8,236 FY 2020 - $12,000 FY 2021 - $12,000

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Budget Mechanism - Total[1]

(Dollars in Thousands)

MECHANISM	FY 2019 Final		FY 2020 Enacted		FY 2021 President's Budget		FY 2021 +/- FY 2020 Enacted	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	467	$202,605	454	$203,055	447	$188,245	-7	-$14,810
Administrative Supplements	*(35)*	4,541	*(35)*	4,000	*(9)*	1,000	*(-26)*	-3,000
Competing:								
Renewal	14	5,997	12	5,567	12	5,177	0	-390
New	137	56,378	161	65,714	161	61,118	0	-4,596
Supplements	0	0	0	0	0	0	0	0
Subtotal, Competing	151	$62,374	173	$71,281	173	$66,295	0	-$4,986
Subtotal, RPGs	618	$269,520	627	$278,336	620	$255,540	-7	-$22,796
SBIR/STTR	46	19,037	50	20,305	48	19,760	-2	-545
Research Project Grants	664	$288,557	677	$298,640	668	$275,300	-9	-$23,340
Research Centers:								
Specialized/Comprehensive	28	$36,637	27	$35,778	23	$30,534	-4	-$5,244
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	28	$36,637	27	$35,778	23	$30,534	-4	-$5,244
Other Research:								
Research Careers	46	$6,661	48	$6,927	41	$5,912	-7	-$1,015
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	198	0	196	0	168	0	-29
Other	59	18,026	73	22,484	62	19,188	-11	-3,295
Other Research	105	$24,885	121	$29,607	103	$25,268	-18	-$4,339
Total Research Grants	797	$350,079	825	$364,025	794	$331,102	-31	-$32,923
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	41	$1,664	52	$2,100	52	$1,953	0	-$147
Institutional Awards	380	14,332	369	13,897	369	12,646	0	-1,251
Total Research Training	421	$15,997	421	$15,997	421	$14,599	0	-$1,398
Research & Develop. Contracts	64	$156,135	65	$163,819	58	$148,217	-7	-$15,602
(SBIR/STTR) (non-add)	*(0)*	*(231)*	*(0)*	*(240)*	*(0)*	*(228)*	*(0)*	*(-12)*
Intramural Research	479	220,393	527	228,337	527	207,330	0	-21,007
Res. Management & Support	132	29,362	135	30,420	135	28,899	0	-1,521
Res. Management & Support (SBIR Admin) (non-add)	*(0)*	*(150)*	*(0)*	*(167)*	*(0)*	*(158)*	*(0)*	*(-8)*
Construction		0		0		0		0
Buildings and Facilities		0		0		0		0
Total, NIEHS	611	$771,966	662	$802,598	662	$730,147	0	-$72,451

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

Major Changes in the Fiscal Year 2021 President's Budget Request

Major changes by budget mechanism and/or budget activity detail are briefly described below. The FY 2021 President's Budget for NIEHS is $730.1 million, which is $72.5 million below the FY 2020 Enacted level.

Research Project Grants (RPGs) (-$23.3 million; total $275.3 million):
NIEHS plans to support a total of 668 RPG awards in FY 2021. Noncompeting RPGs will decrease by 7 awards and $14.8 million from the FY 2020 Enacted level. The number of competing RPG awards will remain consistent with FY 2020 levels while the amount allocated will decrease by $5.0 million. NIEHS will continue to support new investigators in FY 2021.

Funding reductions have been distributed across all budget activities.

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Summary of Changes

(Dollars in Thousands)

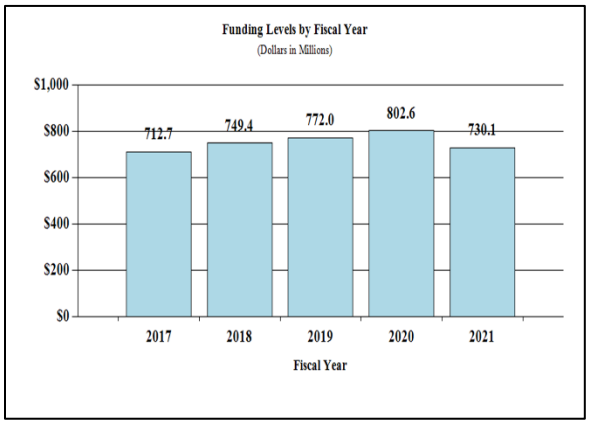
FY 2020 Enacted	$802,598
FY 2021 President's Budget	$730,147
Net change	-$72,451

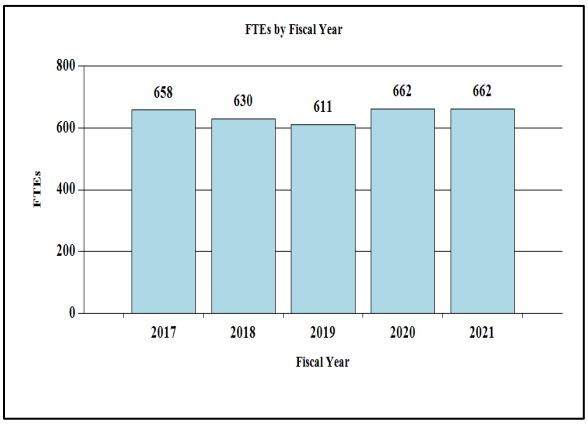
CHANGES	FY 2021 President's Budget FTEs	FY 2021 President's Budget Budget Authority	Change from FY 2020 Enacted FTEs	Change from FY 2020 Enacted Budget Authority
A. Built-in:				
1. Intramural Research:				
a. Annualization of January 2020 pay increase & benefits		$90,377		$579
b. January FY 2021 pay increase & benefits		90,377		1,378
c. Paid days adjustment		90,377		-337
d. Differences attributable to change in FTE		90,377		0
e. Payment for centrally furnished services		24,860		-2,686
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		92,093		120
Subtotal				-$946
2. Research Management and Support:				
a. Annualization of January 2020 pay increase & benefits		$18,764		$118
b. January FY 2021 pay increase & benefits		18,764		297
c. Paid days adjustment		18,764		-70
d. Differences attributable to change in FTE		18,764		0
e. Payment for centrally furnished services		2,965		-320
f. Cost of laboratory supplies, materials, other expenses, and non-recurring costs		7,170		30
Subtotal				$55
Subtotal, Built-in				-$891

CHANGES	FY 2021 President's Budget No.	FY 2021 President's Budget Amount	Change from FY 2020 Enacted No.	Change from FY 2020 Enacted Amount
B. Program:				
1. Research Project Grants:				
a. Noncompeting	447	$189,245	-7	-$17,810
b. Competing	173	66,295	0	-4,986
c. SBIR/STTR	48	19,760	-2	-545
Subtotal, RPGs	668	$275,300	-9	-$23,340
2. Research Centers	23	$30,534	-4	-$5,244
3. Other Research	103	25,268	-18	-4,339
4. Research Training	421	14,599	0	-1,398
5. Research and development contracts	58	148,217	-7	-15,602
Subtotal, Extramural		$493,918		-$49,923
	FTEs		FTEs	
6. Intramural Research	527	$207,330	0	-$20,061
7. Research Management and Support	135	28,899	0	-1,576
8. Construction		0		0
9. Buildings and Facilities		0		0
Subtotal, Program	662	$730,147	0	-$71,560
Total changes				-$72,451

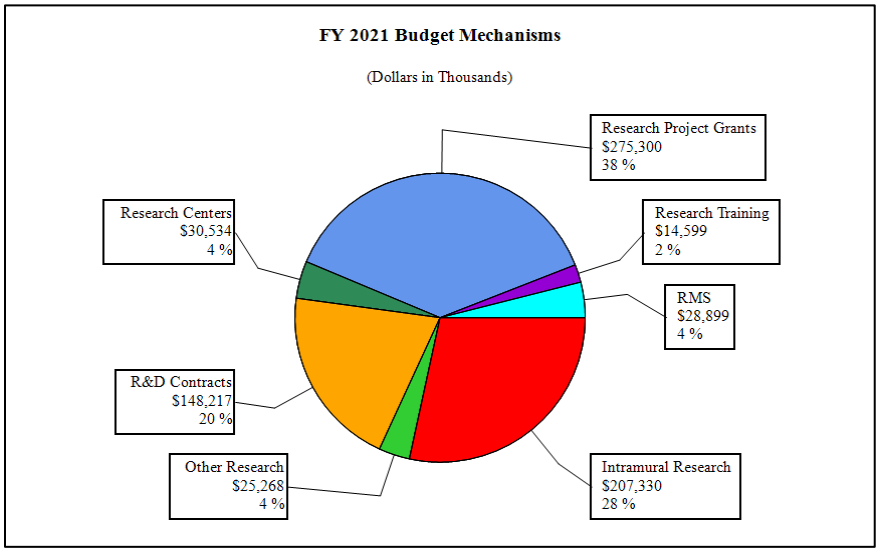
Fiscal Year 2021 Budget Graphs

History of Budget Authority and FTEs:

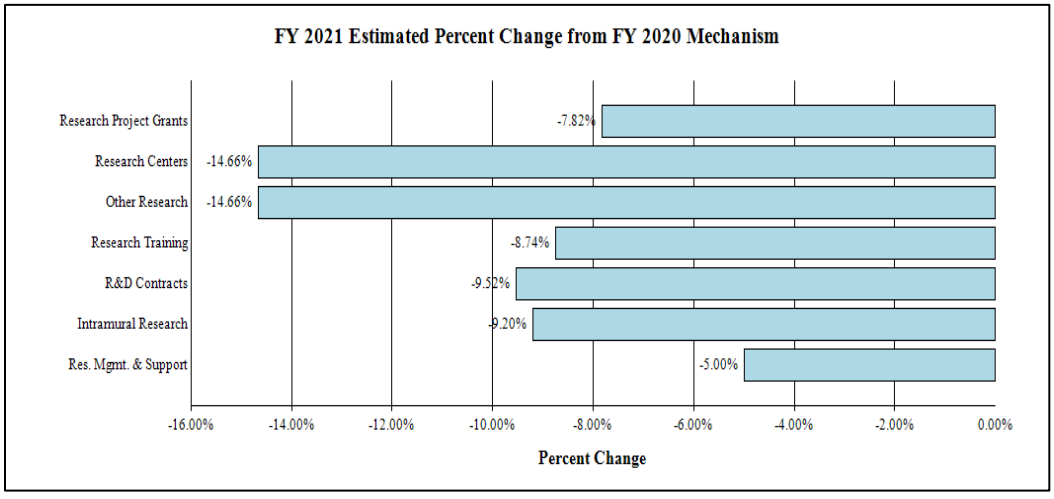




Distribution by Mechanism (dollars in thousands):



Change by Selected Mechanism:



NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Budget Authority by Activity[1]

(Dollars in Thousands)

	FY 2019 Final		FY 2020 Enacted		FY 2021 President's Budget		FY 2021 +/- FY2020	
Extramural Research	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
Detail								
Fundamental Research		$201,930		$206,962		$188,693		-$18,269
Exposure Research		108,124		114,085		103,196		-10,889
Translational Research and Special Populations		100,683		102,850		94,280		-8,570
Predictive Toxicology		92,020		100,077		89,809		-10,267
Training and Education		19,454		19,867		17,940		-1,927
Subtotal, Extramural		**$522,211**		**$543,841**		**$493,918**		**-$49,923**
Intramural Research	**479**	**$220,393**	**527**	**$228,337**	**527**	**$207,330**	**0**	**-$21,007**
Research Management & Support	**132**	**$29,362**	**135**	**$30,420**	**135**	**$28,899**	**0**	**-$1,521**
TOTAL	**611**	**$771,966**	**662**	**$802,598**	**662**	**$730,147**	**0**	**-$72,451**

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

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2020 Amount Authorized	FY 2020 Enacted	2021 Amount Authorized	FY 2021 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	$802,598,000	Indefinite	$730,147,000
National Institute of Environmental Health Sciences	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				$802,598,000		$730,147,000

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2012	$700,537,000	$700,537,000	$676,033,000	$686,869,000
Rescission				$1,298,182
2013	$684,030,000		$686,103,000	$685,570,818
Rescission				$1,371,142
Sequestration				($34,410,941)
2014	$691,348,000		$686,753,000	$665,439,000
Rescission				$0
2015	$665,080,000			$667,502,000
Rescission				$0
2016	$681,782,000	$675,783,000	$695,900,000	$693,702,000
Rescission				$0
2017[1]	$693,533,000	$710,387,000	$722,301,000	$714,261,000
Rescission				$0
2018	$533,537,000	$725,387,000	$737,727,000	$751,143,000
Rescission				$0
2019	$693,199,000	$760,113,000	$775,115,000	$774,707,000
Rescission				$0
2020	$666,854,000	$812,570,000	$815,729,000	$802,598,000
Rescission				$0
2021	$730,147,000			

[1] Budget Estimate to Congress includes mandatory financing.

Justification of Budget Request

National Institute of Environmental Health Sciences

Authorizing Legislation: Section 301 and title IV of the Public Health Service Act, as amended.
Budget Authority (BA):

	FY 2019 Final	FY 2020 Enacted	FY 2021 President's Budget	FY 2021 +/- FY 2020
BA	$771,966,000	$802,598,000	$730,147,000	-$72,451,000
FTE	611	662	662	0

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

Mission Statement: The mission of the National Institute of Environmental Health Sciences (NIEHS) is to discover how the environment affects people in order to promote healthier lives.

Director's Overview: Environmental Health Sciences—Innovating Toward Precision in Predicting Risk and Preventing Disease

The field of environmental health sciences began decades ago with a focus on understanding individual agents in our environment that might harm human health. Since then, changes in manufacturing, agriculture, consumer behaviors, and lifestyles have increased the use of such agents exponentially; we now understand that our environmental exposures are ubiquitous, constant, and concurrent. Early efforts in the field were oriented toward identifying the most common environmental chemicals and applying basic science to determine their hazard potential to human health. NIEHS scientists built on this foundation to develop credible models for determining the effects of such chemicals at the biological, molecular, and genetic levels. More recently, investigators are applying data science and other innovative technologies to tease apart the complex effects of the environmental mixtures we are exposed to, and then translating this knowledge into ways to predict how such exposures may affect our risk of disease and disability across our lifetimes. Multidisciplinary teams are also translating results of this work into interventions that will protect health at both the individual and population levels. Today, just as decades ago, the goal of the environmental health sciences is the prevention of illness and disease and the continued improvement of health and quality of life for all people.

Where were we 20 years ago?
Traditional toxicology testing two decades ago involved two-year animal studies (typically rodent), the results of which were extrapolated to predict what might occur in humans exposed to the same chemicals in the same way (typically, acute exposures as opposed to low-level, chronic exposures). Research was focused on agents such as metals (lead, arsenic), pesticides (dioxin), and air pollution (Chlorofluorocarbons (CFCs), large particulate matter, and secondhand smoke), with the major outcomes of interest being cancer, respiratory diseases, and birth defects.

NIEHS research discoveries at this time were rapidly building the knowledge base for the environmental health sciences. For example, scientists found that early smoking could alter a person's DNA, possibly increasing the risk of lung cancer years later, even after the smoker quits.[1] NIEHS-supported researchers at Johns Hopkins University School of Public Health found a strong correlation between exposure to particulate matter air pollution and death from all causes, including cardiovascular and respiratory illnesses. These analyses strengthen the argument for maintaining air quality standards for particulate matter.[2]

NIEHS research also contributed to the ban on lead from gasoline in the 1990 amendments to the Clean Air Act, and continued to demonstrate the legacy of lead's adverse impacts including discoveries that lead from women's bones can be released during pregnancy and transferred to babies,[3] that prenatal and postnatal lead exposure is linked to aggression and antisocial behavior,[4] and that blood lead levels and IQ scores for children were inversely correlated even at low levels.[5] These findings supported the development of appropriate screening guidelines for blood lead levels in children. In 1998, NIEHS and EPA announced joint funding for the Children's Environmental Health and Disease Prevention Research Centers, a program that continued for 25 years and produced a wealth of knowledge as well as numerous interventions that now protect children's health.[6] Researchers also began to investigate the effects of endocrine-disrupting chemicals such as bisphenol A (BPA), especially effects on reproductive system development and cancer. The accumulation of these data convinced manufacturers to remove BPA voluntarily from products such as drinking bottles and children's toys and led to an eventual ban on the chemical in such products by the FDA.

During this period, interest began to grow about the potential role of environmental exposures in diseases on the other end of the age spectrum as well, including Alzheimer's Disease and Parkinson's Disease. NIEHS-supported researchers have continued to peel back layers of

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[1] Wiencke JK, Thurston SW, Kelsey KT, Varkonyi A, Wain JC, Mark EJ, Christiani DC. 1999. Early age at smoking initiation and tobacco carcinogen DNA damage in the lung. J Natl Cancer Inst 91(7):614-619. PMID: 10203280. https://www.ncbi.nlm.nih.gov/pubmed/?term=10203280

[2] Dominici F, McDermott A, Zeger SL, Samet JM. 2003. National maps of the effects of particulate matter on mortality: Exploring geographical variation. Environ Health Perspect 111(1):39-44. PMID: 1241304. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241304/

[3] Gulson BL, Jameson CW, Mahaffey KR, Mizon KJ, Patison N, Law AJ, Korsch MJ, Salter MA. 1998. Relationships of lead in breast milk to lead in blood, urine, and diet of the infant and mother. Environ Health Perspect 106(10):667-674. PMID: 1533188. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1533188/

[4] Dietrich KN, Ris MD, Succop PA, Berger OG, Bornschein RL. 2001. Early exposure to lead and juvenile delinquency. Neurotoxicol Teratol 23(6):511-518. PMID: 1179251. https://www.ncbi.nlm.nih.gov/pubmed/11792521

[5] Canfield RL, Henderson CR Jr, et al. Intellectual impairment in children with blood lead concentrations below 10microg per deciliter. N Engl J Med. 2003 Apr 17;348(16):1517-26. PMID: 12700371. https://www.ncbi.nlm.nih.gov/pubmed/12700371

[6] U.S. Environmental Protection Agency. (2017). NIEHS/EPA Children's Environmental Health and Disease Prevention Research Centers Impact Report: Protecting children's health where they live, learn, and play. EPA Publication No. EPA/600/R-17/407. https://www.epa.gov/sites/production/files/2017-10/documents/niehs_epa_childrens_centers_impact_report_2017_0.pdf?pdf=chidrens-center-report

understanding of the factors that contribute to these diseases, generating knowledge that is informing the development of treatments and interventions.[7, 8]

Where are we today?

Two decades ago, environmental health scientists were just beginning to envision the possibilities of toxicogenomics—the study and understanding of the interactions of a person's genes with exposures in their environment. Today, we have a far better, yet still developing, recognition of the complexity of the ways in which environmental exposures act to affect our health. This recognition requires that researchers incorporate considerations of potential co-factors—including genetics, age, and sex—into their investigations. New understanding has also driven the development of the concept of the "exposome," comprising all of an individual's exposures. That is, to get a complete picture of the effects of environment on health, we can no longer look at the effects of agents solely in isolation but must consider the additive health impacts of combined exposures, knowing that we are constantly surrounded by a continually changing mixture. Toward this end, the NIEHS Powering Research through Innovative methods for Mixtures in Epidemiology program is developing interdisciplinary mixtures research collaborations on cardiovascular disease, obesity, diabetes, cancer, and reproductive and neurological endpoints.

Whereas in the past the majority of studies involved adult subjects, today NIEHS researchers are increasingly focusing on other life stages including prenatal, childhood, puberty, and pregnancy. Findings reveal that vulnerability to harmful effects from certain exposures may depend on when in the lifespan those exposures occur. A recent study at Johns Hopkins University found that children born to mothers with high lead levels were more than four times as likely to be overweight or obese at age eight than children born to mothers with low lead levels. The same study also found that among women who had high lead levels, the risk of their children being obese or overweight decreased if the women had adequate levels of folate 24 to 72 hours after giving birth.[9] In a recent study focused on adolescent environmental exposure, researchers at the Icahn School of Medicine at Mount Sinai found that U.S. children exposed to typical levels of fluoride in drinking water—which is added by 74 percent of public water systems to prevent dental cavities—may experience poorer liver or kidney function.[10] In 2015, NIEHS established the Children's Health Exposure Analysis Resource (CHEAR) to create an infrastructure to support the analysis of environmental exposures in NIH-funded studies focused on children's health. As of June 2019, almost 50 projects have drawn on the capabilities of this resource to provide expanded analyses of environmental exposures, enhancing the ability of these studies to

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[7] Kirkley KS, Popichak KA, Hammond SL, Davies C, Hunt L, Tjalkens RB. Genetic suppression of IKK2/NF-κB in astrocytes inhibits neuroinflammation and reduces neuronal loss in the MPTP-Probenecid model of Parkinson's disease. Neurobiol Dis. 2019 Jul;127:193-209. PMID: 30818064. https://www.ncbi.nlm.nih.gov/pubmed/30818064?dopt=Citation

[8] Ren Q, Ma M, et al. 2018. Soluble epoxide hydrolase plays a key role in the pathogenesis of Parkinson's disease. Proc Natl Acad Sci U S A 115(25):E5815–E5823. PMID: 29735655. https://www.ncbi.nlm.nih.gov/pubmed/29735655

[9] Wang, G. Association between maternal exposure to lead, maternal folate status, and intergenerational risk of childhood overweight and obesity. *JAMA Network Open.* 2019. doi:10.1001/jamanetworkopen.2019.12343. PMID: 31577354. https://www.ncbi.nlm.nih.gov/pubmed/31577354

[10] Malin AJ, Lesseur C, Busgang SA, Curtin P, Wright RO, Sanders AP. Fluoride exposure and kidney and liver function among adolescents in the United States: NHANES, 2013-2016. Environ Int. 2019 Nov;132:105012. doi:10.1016/j.envint.2019.105012. PMID: 31402058. https://www.ncbi.nlm.nih.gov/pubmed/31402058

draw meaningful conclusions about the role of the environment in their outcomes of interest. Funding increases have allowed NIEHS to expand this program into the Human Health Exposure Analysis Resource (HHEAR), to encompass studies of exposures at *all* life stages—from prenatal through adulthood into aging. NIEHS directed $9.5 million of its $12.0 million FY 2019 grant mechanism funding increase to this effort.

Expanding our understanding of what constitutes human-environment interactions, NIEHS was one of the first to support investigations into the interaction of environmental exposures with the microbiome—the communities of bacteria, viruses, and fungi that live symbiotically in and on human tissues such as the skin and gut. Studies are producing intriguing findings about the microbiome—now considered an organ in its own right—as both a target and a mediator of environmental effects. In a laboratory study looking at the effects of a widely used herbicide—2,4-dichlorophenoxyacetic acid (2,4-D)—on the microbiome, researchers found that low-dose, occupationally relevant exposure levels were toxic to certain beneficial gut microbes.[11] Yet other studies are showing how the maternal microbiome helps to protect the fetus by metabolizing methylmercury during pregnancy,[12] and providing evidence to support a dietary intervention for colon cancer.[13]

NIEHS is continually refining and innovating "tissue on a chip" materials, high-throughput testing methods, model organs and systems, and statistical methodologies to improve their application to environmental health research. NIEHS has invested in the use of new Collaborative Cross and Diversity Outbred rodent models, which were developed to simulate the genetic diversity found in human populations. These powerful tools for gene-environment studies are enabling researchers to identify new biomarkers for exposure assessment, improve extrapolation of rodent data to humans, and determine the genetic contributions for many common human environmental exposures.

What are we investing in for the future?

Just as NIEHS is innovating to confront the environmental side of the environmental health equation, it is expanding the use of new research tools that enable a new era of "Precision Health," including artificial intelligence methods. These tools are complementary to and integrated with the full spectrum of environmental health sciences, as researchers work to understand and take full advantage of the extraordinary amounts of new data generated by modern technologies. Building data tools is key for efforts such as improving precision medicine, which is based on taking into account all the available information about each patient—environment, lifestyle, family history and genetics—to enable customized health

[11] Tu P, Gao B, Chi L, Lai Y, Bian X, Ru H, Lu K. Subchronic low-dose 2,4-D exposure changed plasma acylcarnitine levels and induced gut microbiome perturbations in mice. Sci Rep. 2019 Mar 13;9(1):4363. doi:10.1038/s41598-019-40776-3. PMID: 30867497. https://www.ncbi.nlm.nih.gov/pubmed/30867497

[12] Rothenberg SE, Wagner CL, Hamidi B, Alekseyenko AV, Andrea Azcarate-Peril M. Longitudinal changes during pregnancy in gut microbiota and methylmercury biomarkers, and reversal of microbe-exposure correlations. Environ Res. 2019 May;172:700-712. doi: 10.1016/j.envres.2019.01.014. PMID: 30903970. https://www.ncbi.nlm.nih.gov/pubmed/30903970

[13] Kim E, Wright GA, Zoh RS, Patil BS, Jayaprakasha GK, Callaway ES, Ivanov I, Turner ND, Chapkin RS. Establishment of a multicomponent dietary bioactive human equivalent dose to delete damaged Lgr5+ stem cells using a mouse colon tumor initiation model. Eur J Cancer Prev. 2019 Sep;28(5):383-389. doi:10.1097/CEJ.0000000000000465. PMID: 30234553. https://www.ncbi.nlm.nih.gov/pubmed/30234553

recommendations for that individual. The current trans-NIH *All of Us* initiative emerged from the effort to take precision medicine to the next level by building a diverse database that can provide information for thousands of studies on a variety of health conditions; NIEHS is engaged with this initiative to help determine how best to incorporate environmental data. Existing and emerging data science tools will enable scientists to go beyond genetics, age, and sex to integrate factors such as stress, nutrition, and underlying immune status into methods for predicting an individual's unique risk of harm from environmental exposures or potential to respond to a given medicine or treatment. NIEHS-supported researchers are already demonstrating the potential value of these tools, including in a study in which machine learning was used to tease apart risk of cardiometabolic effects of prenatal exposure to a mixture of metals[14] and two projects using data integration and analysis to help individualize cancer treatments and improve outcomes.[15, 16] Similarly, at the National Toxicology Program (NTP)—which is headquartered at NIEHS—Health Effects Innovation is a new initiative designed to apply novel capabilities to enhance current toxicological approaches and to build a strategic assessment framework for understanding how environmental exposures contribute to global diseases of concern. The first areas of focus include assessments of chemicals for potential cardiovascular, cancer, and developmental neurotoxic effects.[17, 18, 19]

NIEHS will continue to prioritize investigations of major exposures of concern, building on both the established knowledge base and recent findings. Air pollution is one such concern, which the 2015 Global Burden of Disease report estimated as the fifth leading cause of death worldwide, responsible for more than four million deaths each year.[20] Emerging environmental exposures of interest already being explored include the increasing use of e-cigarettes and the ever-growing tide of microplastics in our oceans, our food, and our bodies. NIEHS will also continue to be at the forefront of research on "contaminants of emerging concern" such as per- and polyfluoroalkyl substances (PFAS). For example, new research has shown that exposure to

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[14] Kupsco A, Kioumourtzoglou MA, et al. Prenatal Metal Concentrations and Childhood Cardiometabolic Risk Using Bayesian Kernel Machine Regression to Assess Mixture and Interaction Effects. Epidemiology. 2019 Mar;30(2):263-273. doi:10.1097/EDE.0000000000000962. PMID: 30720588. https://www.ncbi.nlm.nih.gov/pubmed/30720588

[15] Chen, B. Integrating transcriptomic, proteomic, and pharmacogenomic data to inform individualized therapy in cancers. NIH Project Number 5K01Es028047-03. https://projectreporter.nih.gov/project_info_description.cfm?aid=9741127&icde=46917487&ddparam=&ddvalue=&ddsub=&cr=1&csb=default&cs=ASC&pball=

[16] Itakura H. Multi-scale data integration frameworks to improve cancer outcomes. NIH Project Number 5K01ES026832-04. https://projectreporter.nih.gov/project_info_description.cfm?aid=9613818&icde=46917357&ddparam=&ddvalue=&ddsub=&cr=1&csb=default&cs=ASC&pball=

[17] Berridge, B. Presentation to NTP Board of Scientific Counselors meeting. June 18, 2019. Accessed on October 10, 2019. ntp.niehs.nih.gov/ntp/about_ntp/bsc/2019/june/presentations/12berridge_bsc_508.pdf

[18] Casey, W. Presentation to NTP Board of Scientific Counselors meeting. June 18, 2019. Accessed on October 10, 2019.ntp.niehs.nih.gov/ntp/about_ntp/bsc/2019/june/presentations/15casey_bsc_508.pdf

[19] Sills, R and Behl, M. Presentation to NTP Board of Scientific Counselors meeting. June 18, 2019. Accessed on October 10, 2019. ntp.niehs.nih.gov/ntp/about_ntp/bsc/2019/june/presentations/14sills_bsc_508.pdf

[20] GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet.* 2016; 388:1659-1724. PMID: 27733284. https://www.ncbi.nlm.nih.gov/pubmed/27733284

perfluorinated chemicals can decrease effectiveness of vaccines against tuberculosis and diphtheria.[21]

In the future, the environmental health sciences will move beyond the concept of the "exposome" to that of the "envirome," which explores our natural, social, and personal environments in concert to determine how and why environmental conditions in each domain support health or cause disease.

Overall Budget Policy:
The FY 2021 President's Budget request is $730.1 million, a decrease of $72.5 million or 9.0 percent compared to the FY 2020 Enacted level. Reductions are distributed across all programmatic areas and basic, epidemiology, or clinical research.

Program Descriptions and Accomplishments

Fundamental Research: This program investigates the basic biological processes of how our bodies function, and of the pathways and systems that are susceptible to the effects of environmental stressors. This research addresses all levels of biological organization—molecular, biochemical pathway, cellular, tissue, organ, model organism, human, and population—and builds on the knowledge from new tools and techniques that allow us to ask more in-depth questions about the effects of our environment on biological systems.

Arsenic is a naturally occurring element found in water, air, food, and soil. Arsenic in groundwater is a widespread problem. Approximately seven percent of wells in the United States are thought to have arsenic levels above the current EPA standard of 10 parts per billion (ppb). Arsenic levels in the United States tend to be higher in rural communities in the Southwest, Midwest and the Northeast. Inorganic arsenic, which is found in the drinking water of millions of people worldwide, has been shown to be a human carcinogen.[22] The colon maintains a diverse microbial community—or microbiome—that is capable of metabolizing substances that are foreign to the human body, such as arsenic. The microbiomes of both humans and mice have been shown to metabolize arsenic. Research has indicated some arsenic metabolites are more toxic than others. To better understand the role of the microbiome in acute arsenic toxicity, NIEHS-funded scientists exposed mouse models to arsenic via drinking water. Experiments revealed loss of the microbiome increases arsenic toxicity and the presence of human intestinal microbiome offers protection against arsenic toxicity.[23] These studies may pave the way for development of probiotics optimized for mitigating arsenic toxicity.

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[21] Grandjean P, Heilmann C, Weihe P, Nielsen F, Mogensen UB, Timmermann A, Budtz-Jørgensen E. Estimated exposures to perfluorinated compounds in infancy predict attenuated vaccine antibody concentrations at age 5-years. *J Immunotoxicol*. 2017 Dec;14(1):188-195. doi: 10.1080/1547691X.2017.1360968. PMID: 28805477. https://www.ncbi.nlm.nih.gov/pubmed/28805477

[22] Naujokas MF, Anderson B, Ahsan H, Aposhian HV, Graziano JH, Thompson C, Suk WA. 2013. The broad scope of health effects from chronic arsenic exposure: update on a worldwide public health problem. Environ Health Perspect 121(3):295-302. PMID: 23458756. https://www.ncbi.nlm.nih.gov/pubmed/23458756

[23] Coryell M, McAlpine M, Pinkham NV, McDermott TR, and Walk ST. The gut microbiome is required for full protection against acute arsenic toxicity in mouse models. Nat Commun. 2018; 9: 5424. PMID: 30575732. https://www.ncbi.nlm.nih.gov/pubmed/30575732

Budget Policy: The FY 2021 President's Budget request is $188.7 million, a decrease of $18.3 million or 8.8 percent compared to the FY 2020 Enacted level.

Exposure Research: This program is focused on the study of environmental exposures, both internal and external; not only chemical environmental pollutants, but also exposures arising from other sources such as nutritional sources. The program goals are to develop improved methods to detect and measure environmental exposures in humans or other organisms, including biological markers, sensor and detector tools, better analytical methods, and informatics technologies.

Research has shown both genetic and environmental factors may play a role in autism spectrum disorder (ASD), a complex neurodevelopmental brain disorder that generally appears in the first two years of life and affects communication and behavior. Autism affects an estimated 1 in 59 children and it occurs in 4 times more boys than girls. Early life exposure to air pollution, heavy metals, pesticides, and other contaminants may be linked to ASD. Persistent organic pollutants (POPs) persist in the food chain resulting in continued exposure to animals and people despite a global ban on these chemicals in the 1970s. These chemicals can move across the placenta of a pregnant mother resulting in higher concentrations in cord blood than what is found in the mother's blood. A nationally representative sample of U.S. women revealed nearly all are exposed to POPs, suggesting prenatal exposure is possible for nearly all children.[24] NIEHS-funded scientists examined maternal serum for biomarkers of POPs in a national birth cohort of more than a million pregnancies in Finland and discovered maternal levels of a biomarker for the insecticide Dichlorodiphenyltrichloroethane (DDT) were significantly increased in women who gave birth to children who developed autism.[25] This groundbreaking research was the first to link DDT exposure with increased risk for autism using maternal biomarkers of exposure and underscores the importance of not only understanding the role of chemical exposure in autism, but also in recognizing the continued risk to human health posed by banned chemicals that have persisted in our environment for over 40 years.

Budget Policy: The FY 2021 President's Budget request is $103.2 million, a decrease of $10.9 million or 9.5 percent compared to the FY 2020 Enacted level.

Translational Research and Special Populations: This program includes a wide set of research activities encouraging integration of clinical, population, and community-based research to translate findings into improved public health practice and disease prevention strategies. These activities include research investments targeted toward understanding environmental risks to special populations (elderly people, children, and underserved populations) with an eye to developing interventions and solutions to real-world problems.

[24] Woodruff TJ, Zota AR, Schwartz JM. Environmental chemicals in pregnant women in the United States: NHANES 2003–2004. Environ Health Perspect. 2011;119:878–885. PMID: 21233055. https://www.ncbi.nlm.nih.gov/pubmed/21233055

[25] Brown AS, Cheslack-Postava K, et al. Association of maternal insecticide levels with autism in offspring from a national birth cohort. Am J Psychiatry. 2018 Nov 1: 175(11):1094-1101. PMID: 30111184. https://www.ncbi.nlm.nih.gov/pubmed/30111184

Personal care products are largely unregulated in the United States, and many are used by Americans without ever being reviewed for health safety. Some components of personal care products include chemicals that have been characterized as endocrine-disrupting chemicals. The endocrine system is a collection of specialized glands that secrete hormones into the blood and regulate metabolism, growth and development, reproduction, and many other biological processes. When the endocrine system is disrupted, a wide variety of adverse health outcomes can arise. Studies of a nationally representative sample of U.S. women revealed nearly all are exposed to endocrine-disrupting chemicals, suggesting prenatal exposure is possible for nearly all children.[26] Studies have shown girls are entering puberty—a developmental milestone controlled by the endocrine system—at progressively younger ages, raising concern for why this may be happening. NIEHS-funded scientists examined biomarkers of personal care product exposures during two critical windows of susceptibility (prenatal and peripubertal) and their potential effect on pubertal timing in predominantly Latino boys and girls of a U.S. farming community. This research found girls whose mothers had higher levels of exposure experienced puberty at younger ages.[27] Biomarkers of personal care product exposure were detected in over 90 percent of mothers and children studied, and as concentrations of exposure doubled in the mothers, pubertal timing hastened by approximately one month. Likewise, girls who had higher levels of exposure at age nine experienced puberty earlier. Prenatal exposure did not seem to impact pubertal timing in boys, and only one biomarker of exposure during the peripubertal window was associated with early pubertal onset. Early onset puberty has been associated with a variety of adverse health outcomes throughout the life course, including obesity and mental health disorders. This research with Latino children of low socioeconomic status suggests personal care product exposures may accelerate puberty in children and should be replicated in other communities to determine whether these findings are applicable to the U.S. population as a whole.

Budget Policy: The FY 2021 President's Budget request is $94.3 million, a decrease of $8.6 million or 8.3 percent compared to the FY 2020 Enacted level.

Program Portrait: Translating Environmental Science for Healthier Children

The NIEHS has a long history of developing and sustaining a strong base of Children's Environmental Health (CEH) research projects through both unsolicited grants programs and the jointly-funded NIEHS and EPA Children's Environmental Health and Disease Prevention Research Centers (CEHCs). The emphasis of the CEHCs on transdisciplinary research teams has demonstrated that this approach works. The research conducted through these Centers has helped to identify the role of environmental exposures in diseases that affect children such as asthma, obesity, autism and other neurodevelopmental disorders, and cancer, and continues to inform environmental health interventions to protect children at the local, regional, and national levels. However, the Nation's children are not as healthy as they should be: 1 in 5 are classified as obese, more than 10 million have been diagnosed with asthma at some point in their

[26] Woodruff TJ, Zota AR, Schwartz JM. Environmental chemicals in pregnant women in the United States: NHANES 2003–2004. Environ Health Perspect. 2011;119:878–885.
[27] Harley KG, Berger KP, et al. Association of phthalates, parabens and phenols found in personal care products with pubertal timing in girls and boys. Hum Reprod. 2019 Jan 1;34(1):109-117. doi: 10.1093/humrep/dey337. PMID: 30517665. https://www.ncbi.nlm.nih.gov/pubmed/30517665

lives, and the number of children with developmental delays has increased. In addition to human costs, environmentally related diseases in U.S. children cost an estimated $76 billion economically each year.[28] The persistence of these problems is, in part, due to a gap between scientific discoveries and their translation to solutions that can be readily integrated into mainstream medical and public health practice. To close this gap, NIEHS is developing new Children's Environmental Health (CEH) Research Translation Centers to pursue four goals: (1) increasing collaborations between research experts, including those in health communication; (2) promoting research translation into tangible tools and methods to protect children's health; (3) accelerating translation by raising awareness of the science among clinical and public health practitioners; and (4) supporting a network of CEH experts that will serve as a national resource to respond to emerging threats and an incubator for new research and translation ideas and pilot projects. The NIEHS plans to commit $5.0 million total in FY 2021 to these new centers.

Program Portrait: Science on the Scene—Disaster Research Response (DR2)

In recent years, disasters including hurricanes, wildfires, and oil spills, along with public health crises including the Zika, Ebola, and opioid epidemics, have created a keen awareness of the need for *time-critical research* in the aftermath of these events. Such research will enable us to answer questions about the risks to people of environmental exposures and injuries, potential short-term and long-term health impacts, populations that may be most vulnerable (e.g., pregnant women, elderly, children), the safety and effectiveness of health response efforts including medical treatments, the success of environmental cleanup efforts, and factors that may affect an individual or community's recovery and resilience to future events. The NIH Disaster Research Response (DR2) Program was created in 2013 by NIEHS and the National Library of Medicine (NLM) to support scientists, government agencies, first responders and other workers, and communities in conducting and participating in research designed to improve disaster response, reduce health impacts, and prevent future harm. The program has accelerated quickly, with lessons learned from one activity being almost immediately shared and applied in subsequent events. For example, a DR2-organized "tabletop" hurricane scenario exercise in Houston in 2015 brought together the broad range of local stakeholders, who were then better able to coordinate when Hurricane Harvey struck the city in 2017, launching research on exposures and impacts less than 14 days after landfall. Other priority outcomes of DR2 include: Rapid Acquisition of Pre/Post Incident Disaster Data (RAPIDD), a human subjects research protocol that is pre-reviewed by NIH to expedite the Institutional Review Board (IRB) processes that ensure ethical standards and human protections; an online, publicly accessible repository of more than 350 surveys, questionnaires, templates, mobile apps, and data collection tools and training curricula on how to conduct disaster research without impeding response.[29] The DR2 program has become a global model, with Japan and Canada adopting similar programs. NIEHS recently launched an initiative among its funded Centers at universities around the United States to engage grantees in the DR2 program and funding opportunities, thereby extending the Nation's investment in multidisciplinary environmental health sciences expertise by applying it to disaster scenarios. NIEHS has also funded a consortium of disaster-focused university research centers at Texas A&M, University of Texas Medical Branch at Galveston, Baylor, and University of Texas-Houston. DR2 is working to expand its reach through training workshops, including one in Seattle in 2021 to be focused on disaster research policy issues; outreach and training for IRBs to improve the timeliness of disaster research in the field; and increased coordination of Federal resources so they can be used more efficiently and effectively to protect the Nation's health and improve its resilience to disasters and other public health crises.

[28] Trasande L, Liu Y. Health Affairs 30, 5 (2011): 863–870 doi:10.1377/hlthaff.2010.1239. PMID: 21543421. https://www.ncbi.nlm.nih.gov/pubmed/21543421

[29] https://dr2.nlm.nih.gov/

Predictive Toxicology: A goal of the research investment by the interagency National Toxicology Program (NTP)—which is headquartered at NIEHS—is to evaluate environmental agents of public health concern and generate information that can be used by health regulatory agencies to make informed decisions that safeguard public health. NTP also works to develop new and improved test methods, including alternatives to animal testing and high-throughput methods, to generate useful public health information more rapidly. NTP research also helps to develop new and improved models of toxicity that can help to predict cancer and other adverse health outcomes that may result from fetal or early life exposures.

In 2019, there will be an estimated 1,762,450 new cancer cases and 606,880 cancer deaths in the U.S. alone.[30] The vast majority of cancer is not hereditary, suggesting environmental factors may play a role. Chemicals can be found in the food we eat, the air we breathe, the water we drink, and the products we use, and oftentimes little to no toxicity data are available for these chemicals. Traditional approaches to identify chemical carcinogens based on rodent studies and epidemiology are expensive, time-consuming, and not feasible for scaling to the large number of chemicals in commerce. NIEHS scientists, in collaboration with others, developed the Carcinogenome Project, a screening process to predict chemicals with cancer-causing potential.[31] The Carcinogenome Project harnessed a powerful combination of tools including gene expression profiling and artificial intelligence. Together, these technologies demonstrated an *in-vitro* approach to predict the carcinogenicity of chemicals with better accuracy, which paves the way for prioritizing the vast number of chemicals in our environment for targeted testing.

Budget Policy: The FY 2021 President's Budget request is $89.8 million, a decrease of $10.3 million or 10.3 percent compared to the FY 2020 Enacted level.

Program Portrait: Traffic-Related Air Pollution

Traffic-related air pollution (TRAP) refers to air pollution from emissions by motor vehicles due to the combustion of fossil fuels. TRAP includes carbon dioxide, carbon monoxide, particulate matter, and nitrogen oxides. In the United States, more than 45 million people live within 300 feet of a major roadway.[32] Proximity to major roadways is associated with greater exposure to TRAP which may negatively impact human health. Health outcomes include asthma, autism, cardiovascular disease, diabetes, and neurological outcomes. NIEHS has funded multiple projects examining the impact of TRAP on human health, as well as the costs associated with TRAP-related health outcomes. These studies have found long-term exposure to high levels of TRAP in childhood is associated with the development

[30] www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2017.html

[31] Li A, Lu X, Natoli T, Bittker J, Sipes NS, Subramanian A, Auerbach S, Sherr DH, and Monti S. The Carcinogenome Project: in vitro gene expression profiling of chemical perturbations to predict long-term carcinogenicity. 2019. Environ Health Perspect 127(4):47002. PMID: 30964323. https://www.ncbi.nlm.nih.gov/pubmed/30964323

[32] www.epa.gov/air-research/research-near-roadway-and-other-near-source-air-pollution

of asthma and decreased lung function.[33, 34] Researchers have also found an association with TRAP exposure during pregnancy and an increased risk of autism diagnosis later in life. Additionally, there is evidence that long-term exposure to TRAP may lead to dementia, Alzheimer's disease, and Parkinson's disease.[35, 36]

In 2019, the NTP released a draft monograph which evaluated the evidence that exposure to TRAP is associated with hypertensive disorders of pregnancy. Hypertensive disorders of pregnancy cause complications in over 10 percent of pregnancies worldwide and are a leading cause of maternal morbidity and mortality. In 2014, over 50,000 U.S. women suffered from severe maternal morbidity. While maternal mortality rates are decreasing worldwide, maternal mortality rates in the United States are rising.[37] Based on the results of its review, the NTP concluded that TRAP is presumed to be a hazard for pregnant women developing hypertensive disorders of pregnancy.[38]

NIEHS continues to promote the translation of data to knowledge to action, in part, through community engagement. In 2019, scientists from NIEHS joined others from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) in an online Question and Answer session, hosted by Reddit Ask Me Anything, to discuss air pollution, pregnancy, and child health and field questions from the virtual community.

Training and Education: This program's goal is to attract the brightest students and scientists into the environmental health sciences field to ensure a cadre of professionals to conduct the interdisciplinary research necessary to solve critical environmental health problems. The program includes efforts at the high school and undergraduate levels (opportunities for laboratory-based training), the graduate level (institutional training grants and individual fellowships), and the faculty level (grants for young investigators).

The Transition to Independent Environmental Health Research (TIEHR) Career Development Award (K22) provides three years of support for newly independent faculty who intend to pursue careers focused on environmental health sciences research, including pilot funding and salary support. At the conclusion of the award, the candidates are expected to demonstrate they can successfully compete for research funding in the environmental health sciences. Grantees in this program are making high impact research advances. For example, recent results from the Sperm Environmental Epigenetics and Development Study by a grantee supported with a K22 award

[33] Bowatte G, Lodge CJ, Knibbs LD, Erbas B, Perret JL, Jalaludin B, Morgan GG, Bui DS, Giles GG, Hamilton GS, Wood-Baker R, Thomas P, Thompson BR, Matheson MC, Abramson MJ, Walters EH, Dharmage SC. Traffic related air pollution and development and persistence of asthma and low lung function. 2018. Environ Int. 113:170-176. PMID: 29427878. https://www.ncbi.nlm.nih.gov/pubmed/29427878

[34] Urman R, McConnell R, Islam T, Avol EL, Lurmann FW, Vora H, Linn WS, Rappaport EB, Gilliland FD, Gauderman WJ. Associations of children's lung function with ambient air pollution: joint effects of regional and near-roadway pollutants. 2014. Thorax. 69(6):540-7. PMID: 24253832. https://www.ncbi.nlm.nih.gov/pubmed/24253832

[35] Kioumourtzoglou MA, Schwartz JD, Weisskopf MG, Melly SJ, Wang Y, Dominici F, Zanobetti A. Long-term PM2.5 Exposure and Neurological Hospital Admissions in the Northeastern United States. 2016. Environ Health Perspect. 124(1):23-9. PMID: 25978701. https://www.ncbi.nlm.nih.gov/pubmed/25978701

[36] Ritz B, Lee PC, Hansen J, Lassen CF, Ketzel M, Sørensen M, Raaschou-Nielsen O. Traffic-Related Air Pollution and Parkinson's Disease in Denmark: A Case-Control Study. 2016. Environ Health Perspect. 124(3):351-6. PMID: 26151951. https://www.ncbi.nlm.nih.gov/pubmed/26151951

[37] orwh.od.nih.gov/sites/orwh/files/docs/ORWH_MMM_Booklet_508C.pdf

[38] ntp.niehs.nih.gov/ntp/ohat/airpollchildhealth/trap_draft20190600_508.pdf

have shown promise in the development of a new clinical test for male infertility and potentially for *in vitro* fertilization (IVF) outcomes.[39]

Budget Policy: The FY 2021 President's Budget request is $17.9 million, a decrease of $1.9 million or 9.7 percent compared to the FY 2020 Enacted level.

Intramural Research: NIEHS intramural programs provide an in-house research arena focused on high-caliber science with high-impact breakthroughs. NIEHS intramural research studies are often long-term and comprise unique components, such as NIEHS's contribution to the NTP through its Division of the National Toxicology Program, epidemiological studies of environmentally associated diseases and exposures (including the study of individuals exposed by the 2010 Deepwater Horizon Oil Spill), and intervention and prevention studies to reduce the effects of exposures to hazardous environments. The NIEHS Clinical Research Unit provides opportunities for clinical and basic scientists in the intramural programs to collaborate and learn how environmental exposures influence human health and disease.

Epigenetic marks are heritable, reversible modifications of chromosomal structures that, in turn, regulate genome function in cells. Environmental exposures have the capacity to perturb epigenetic marks, which may result in aberrant regulation of DNA leading to adverse health outcomes. Addition of methyl groups to DNA, or DNA methylation, is one of the most common epigenetic marks. Scientists at NIEHS used a genetic mouse model to investigate DNA methylation in the mice and their offspring.[40] This approach revealed DNA methylation patterns were substantially linked to DNA sequence of the mouse genome, suggesting genetics influences DNA methylation patterns. Other observations were made, independent of DNA sequence, e.g. that female mice that had experienced pregnancy had DNA methylation patterns distinct from female mice that had never been pregnant. While the mechanism driving DNA methylation changes in mice that had experienced pregnancy is unknown, life events such as pregnancy may alter epigenetic marks. Further research is needed to determine whether epigenetic alterations occur and persist after other life events such as puberty or menopause and whether these changes serve a functional role in normal physiology.

Budget Policy: The FY 2021 President's Budget request is $207.3 million, a decrease of $21.0 million or 9.2 percent compared to the FY 2020 Enacted level.

Research Management and Support (RMS): The RMS program provides administrative, budgetary, logistical, and scientific support in the review, award, and monitoring of research grants and training awards. NIEHS oversaw approximately 880 off-site research grants and centers in FY 2019. Other RMS functions include on-site strategic planning, coordination, and evaluation of NIEHS programs; administration and facilities maintenance; regulatory

[39] Wu H, Huffman AM, Whitcomb BW, Josyula S, Labrie S, Tougias E, Rahil T, Sites CK, Pilsner JR. Sperm mitochondrial DNA measures and semen parameters among men undergoing fertility treatment. 2019. Reprod Biomed Online 38(1):66-75. PMID: 30502072. https://www.ncbi.nlm.nih.gov/pubmed/30502072

[40] Grimm SA, Shimbo T, Takaku M, Thomas JW, Auerback S, Bennett BD, Bucher JR, Burkholder AB, Day F, Du Y, Duncan CG, French JE, Foley JF, Li J, Merrick BA, Tice RR, Wang T, Xu X, NISC Comparative Sequencing Program, Buchel PR, Fargo DC, Mullikin JC, and Wade PA. DNA Methylation in mice is influenced by genetics as well as sex and life experience. 2019. Nat Commun 10(1):305. PMID: 30659182. https://www.ncbi.nlm.nih.gov/pubmed/30659182

compliance; ethics training and compliance; and liaison with other Federal agencies, Congress, stakeholders, and the general public.

Staff in the NIEHS Division of Extramural Research and Training published a report describing a new translational framework through which to analyze the impact of NIEHS research investments and interventions. The Translational Research Framework revamps the old "bench to bedside" model of therapeutic translation to embrace a broader definition of translational research, which can accommodate translation of environmental health research and prevention of environmentally-related disease. A description of the Framework can be found on the NIEHS website.[41]

Budget Policy: The FY 2021 President's Budget request is $28.9 million, a decrease of $1.5 million or 5.0 percent compared with the FY 2020 Enacted level.

[41] www.niehs.nih.gov/research/programs/translational/framework-details/index.cfm

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Budget Authority by Object Class[1]

(Dollars in Thousands)

		FY 2020 Enacted	FY 2021 President's Budget	FY 2021 +/- FY 2020
Total compensable workyears:				
	Full-time equivalent	662	662	0
	Full-time equivalent of overtime and holiday hours	1	1	0
	Average ES salary	$195	$198	$3
	Average GM/GS grade	12.0	12.0	0.0
	Average GM/GS salary	$102	$103	$2
	Average salary, grade established by act of July 1, 1944 (42 U.S.C. 207)	$117	$119	$2
	Average salary of ungraded positions	$162	$165	$2
	OBJECT CLASSES	**FY 2020 Enacted**	**FY 2021 President's Budget**	**FY 2021 +/- FY 2020**
	Personnel Compensation			
11.1	Full-Time Permanent	45,215	45,735	520
11.3	Other Than Full-Time Permanent	23,998	24,274	276
11.5	Other Personnel Compensation	1,454	1,471	17
11.7	Military Personnel	598	614	16
11.8	Special Personnel Services Payments	9,428	9,536	108
11.9	**Subtotal Personnel Compensation**	**$80,693**	**$81,630**	**$937**
12.1	Civilian Personnel Benefits	26,119	27,137	1,019
12.2	Military Personnel Benefits	364	374	10
13.0	Benefits to Former Personnel	0	0	0
	Subtotal Pay Costs	**$107,176**	**$109,141**	**$1,965**
21.0	Travel & Transportation of Persons	2,263	1,802	-461
22.0	Transportation of Things	422	336	-86
23.1	Rental Payments to GSA	3	2	-1
23.2	Rental Payments to Others	34	27	-7
23.3	Communications, Utilities & Misc. Charges	454	361	-93
24.0	Printing & Reproduction	6	5	-1
25.1	Consulting Services	455	362	-93
25.2	Other Services	50,972	42,100	-8,872
25.3	Purchase of goods and services from government accounts	111,387	102,249	-9,137
25.4	Operation & Maintenance of Facilities	6,830	5,328	-1,502
25.5	R&D Contracts	116,661	106,823	-9,838
25.6	Medical Care	725	588	-136
25.7	Operation & Maintenance of Equipment	7,216	5,744	-1,473
25.8	Subsistence & Support of Persons	0	0	0
25.0	**Subtotal Other Contractual Services**	**$294,246**	**$263,194**	**-$31,051**
26.0	Supplies & Materials	14,480	11,526	-2,954
31.0	Equipment	8,968	7,136	-1,832
32.0	Land and Structures	0	0	0
33.0	Investments & Loans	0	0	0
41.0	Grants, Subsidies & Contributions	374,545	336,615	-37,930
42.0	Insurance Claims & Indemnities	0	0	0
43.0	Interest & Dividends	3	2	-1
44.0	Refunds	0	0	0
	Subtotal Non-Pay Costs	**$695,422**	**$621,006**	**-$74,416**
	Total Budget Authority by Object Class	**$802,598**	**$730,147**	**-$72,451**

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

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Salaries and Expenses

(Dollars in Thousands)

OBJECT CLASSES	FY 2020 Enacted	FY 2021 President's Budget	FY 2021 +/- FY 2020
Personnel Compensation			
Full-Time Permanent (11.1)	$45,215	$45,735	$520
Other Than Full-Time Permanent (11.3)	23,998	24,274	276
Other Personnel Compensation (11.5)	1,454	1,471	17
Military Personnel (11.7)	598	614	16
Special Personnel Services Payments (11.8)	9,428	9,536	108
Subtotal Personnel Compensation (11.9)	**$80,693**	**$81,630**	**$937**
Civilian Personnel Benefits (12.1)	$26,119	$27,137	$1,019
Military Personnel Benefits (12.2)	364	374	10
Benefits to Former Personnel (13.0)	0	0	0
Subtotal Pay Costs	**$107,176**	**$109,141**	**$1,965**
Travel & Transportation of Persons (21.0)	$2,263	$1,802	-$461
Transportation of Things (22.0)	422	336	-86
Rental Payments to Others (23.2)	34	27	-7
Communications, Utilities & Misc. Charges (23.3)	454	361	-93
Printing & Reproduction (24.0)	6	5	-1
Other Contractual Services:			
Consultant Services (25.1)	455	362	-93
Other Services (25.2)	50,972	42,100	-8,872
Purchases from government accounts (25.3)	77,608	68,798	-8,810
Operation & Maintenance of Facilities (25.4)	6,830	5,328	-1,502
Operation & Maintenance of Equipment (25.7)	7,216	5,744	-1,473
Subsistence & Support of Persons (25.8)	0	0	0
Subtotal Other Contractual Services	**$143,082**	**$122,333**	**-$20,749**
Supplies & Materials (26.0)	$14,480	$11,526	-$2,954
Subtotal Non-Pay Costs	**$160,740**	**$136,389**	**-$24,351**
Total Administrative Costs	**$267,915**	**$245,530**	**-$22,385**

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Detail of Full-Time Equivalent Employment (FTE)

OFFICE/DIVISION	FY 2019 Final			FY 2020 Enacted			FY 2021 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Division of Extramural Research									
Direct:	70	-	70	76	-	76	76	-	76
Reimbursable:	2	-	2	2	-	2	2	-	2
Total:	72	-	72	78	-	78	78	-	78
Division of Intramural Research									
Direct:	301	1	302	326	2	328	326	2	328
Reimbursable:	2	-	2	2	-	2	2	-	2
Total:	303	1	304	328	2	330	328	2	330
Division of National Toxicology Program									
Direct:	100	1	101	108	1	109	108	1	109
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	100	1	101	108	1	109	108	1	109
Office of Management									
Direct:	67	2	69	73	2	75	73	2	75
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	67	2	69	73	2	75	73	2	75
Office of the Director									
Direct:	64	1	65	69	1	70	69	1	70
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	64	1	65	69	1	70	69	1	70
Total	606	5	611	656	6	662	656	6	662
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
2017	11.9
2018	12.0
2019	12.0
2020	12.0
2021	12.0

NATIONAL INSTITUTES OF HEALTH
National Institute of Environmental Health Sciences

Detail of Positions[1]

GRADE	FY 2019 Final	FY 2020 Enacted	FY 2021 President's Budget
Total, ES Positions	1	1	1
Total, ES Salary	190,285	194,700	197,679
GM/GS-15	35	36	36
GM/GS-14	63	65	65
GM/GS-13	117	125	125
GS-12	106	114	114
GS-11	82	88	88
GS-10	0	0	0
GS-9	28	35	35
GS-8	9	9	9
GS-7	21	27	27
GS-6	1	1	1
GS-5	0	0	0
GS-4	0	0	0
GS-3	0	0	0
GS-2	0	0	0
GS-1	0	0	0
Subtotal	462	500	500
Grades established by Act of July 1, 1944 (42 U.S.C. 207)			
Assistant Surgeon General	0	0	0
Director Grade	2	2	2
Senior Grade	3	4	4
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	5	6	6
Ungraded	172	186	186
Total permanent positions	466	505	505
Total positions, end of year	640	693	693
Total full-time equivalent (FTE) employment, end of year	611	662	662
Average ES salary	190,285	194,700	197,679
Average GM/GS grade	12.0	12.0	12.0
Average GM/GS salary	99,384	101,690	103,246

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