

# NIH Nutrition Research Report

## 2015 & 2016



### **About the *NIH Nutrition Research Report***

The *NIH Nutrition Research Report, 2015 & 2016* was prepared by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Office of Nutrition Research. This Report summarizes 2015 and 2016 nutrition research and research training activities supported by the NIH during this two-year period. This Report also shares the research directions of the 23 NIH institutes and centers supporting these activities.

### **About the NIDDK Office of Nutrition Research**

The NIDDK Office of Nutrition Research (ONR) was established in August of 2015 and is responsible for leadership of nutrition research in NIDDK and collaboratively, across the National Institutes of Health (NIH). The office participates in strategic planning, portfolio analysis, budget and resource allocation, and assessment of research needs and opportunities that fall within the mission of NIDDK and the NIH. Strategic planning includes developing new NIH nutrition research initiatives.

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### **Cover Image**

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# NIH NUTRITION RESEARCH REPORT, 2015 & 2016

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## I. EXECUTIVE SUMMARY

Each year, the National Institutes of Health (NIH) funds a broad array of basic and applied research studies to further our understanding of nutrition as it relates to human health and disease. This includes research related to how nutrients and food components are ingested, digested, absorbed, metabolized, transported, stored, and excreted and the overall impact on the body as well as the study of the environment, psychology, and behavior associated with eating and how these factors play a role in nutritional status and in which foods people choose to consume.

This Report summarizes NIH nutrition research activities in Fiscal Year (FY) 2015 and FY 2016 and builds on an earlier publication summarizing nutrition research activities in FY 2013 and FY 2014. The Report was compiled by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Office of Nutrition Research (ONR), located within the NIDDK Director's Office. The ONR serves as a point of contact for nutrition research coordination by helping to lead NIH-wide strategic planning and the development of nutrition research initiatives.

The NIH leads all federal agencies in funding nutrition research and training. The total NIH investment in nutrition-related research was approximately \$1.5 billion in FY 2015 and \$1.6 billion in FY 2016. The NIDDK; National Heart, Lung, and Blood Institute (NHLBI); and National Cancer Institute (NCI) lead the NIH Institutes and Centers (ICs) in nutrition research funding. In FY 2016, their nutrition-related funding was \$559 million, \$224 million, and \$165 million respectively. Approximately half of the nutrition-related projects in FYs 2015-2016 were related to prevention and/or obesity research.

NIH-supported nutrition research has led to important discoveries. Many of these findings are announced in [NIH News Releases](#) or are published in [NIH Research Matters](#), a biweekly update of NIH research highlights from the NIH Office of Communications and Public Liaison. Highlights from 2015-2016 include:

- Periodic cycles of a low-calorie diet that mimicked fasting improved metabolic, immune, and other functions in mice.
- Children of obese mothers who had low levels of folate during pregnancy had a higher risk of obesity.
- A study in mice provided insights into how food additives called emulsifiers might alter gut microbes and increase the risk of developing colorectal cancer.

During 2015 and 2016, the NIH sponsored more than 15 nutrition-related scientific meetings, workshops, and symposiums. These events play a key role in the advancement of nutrition science by

providing an opportunity to identify critical research gaps and disseminate research findings to the scientific community and to the public.

Trans-NIH, government-wide, and public-private partnership collaborations were critical to the development of numerous nutrition research, strategic planning, and technology transfer initiatives during 2015–2016. These collaborations are critical to effectively utilize resources and harmonize the federal nutrition research agenda. Examples include the Interagency Committee on Human Nutrition Research (ICHNR), the National Collaborative on Childhood Obesity Research (NCCOR), and the NIH Nutrition Research Coordinating Committee.

One of the most notable collaborations during this reporting period was the establishment of the NIH Nutrition Research Task Force. The NIH Director, Dr. Francis Collins, established the Task Force in the fall of 2016 to coordinate and accelerate progress in nutrition research across the NIH and to guide the development of the first NIH-wide strategic plan for nutrition research for the next 10 years. A final draft of the NIH Nutrition Research Strategic Plan is expected in 2018. The plan will complement and enhance ongoing research efforts across NIH on diseases and conditions affected by nutrition; it will emphasize cross-cutting, innovative opportunities to accelerate nutrition research across a wide range of areas, from basic science to clinical practice.

The NIH is committed to fostering innovative research and training to advance the field of nutritional science with the goal of protecting and improving health. Each NIH IC plays an integral role in accomplishing this mission, and they have shared their research directions as they pertain to nutrition. The ONR hopes this comprehensive report is not only informative but also serves to stimulate new ideas and discoveries.

## II. INTRODUCTION

The National Institutes of Health (NIH), part of the U.S. Department of Health and Human Services (HHS), is the nation's medical research agency. The NIH is made up of 27 institutes and centers (ICs), each with a specific research agenda that often focuses on diseases or body systems. The NIH supports biomedical research and training in nutrition as it relates to human development, health maintenance, disease prevention, and disease treatment.

Nutrition is a factor in many diseases and is an integral part of overall health, development, and wellbeing. As a result, research interests in the nutritional sciences extend far beyond those of a single institute. Biomedical nutrition research and training in 2015 and 2016 was supported by 24 NIH ICs and the NIH Office of the Director (OD).

The NIH nutrition research program includes extramural and intramural research as well as research training. The major component of the program is extramural research, carried out at hundreds of institutions across the globe. Many of the research projects funded by the NIH are based on ideas developed and submitted by individual investigators, principally from graduate science departments of nutrition, medicine, public health, and dentistry. Most of the intramural research is carried out in laboratories on the NIH campus in Bethesda, Maryland, and at the Warren Grant Magnuson Clinical Center, although several ICs also have off-campus programs located throughout the country.

### III. OFFICE OF NUTRITION RESEARCH

On August 1, 2015 the NIH's National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) established the [Office of Nutrition Research \(ONR\)](#) within the NIDDK Office of the Director. The office replaced the NIH Division of Nutrition Research Coordination (DNRC). One of the initial responsibilities of the ONR is to lead the development of an NIH-wide strategic plan for nutrition research and will work with the NIH Nutrition Research Task Force to accomplish this goal. The NIH supports a broad range of nutrition research, including studies on the effects of nutrient and dietary intake on human growth and disease, genetic influences on human nutrition and metabolism and other scientific areas. The strategic plan will emphasize cross-cutting, innovative opportunities to accelerate nutrition research across a wide range of areas, from basic science to experimental design to training. These opportunities will complement and enhance ongoing research efforts across the NIH on diseases and conditions affected by nutrition. A final draft of the strategic plan is expected in the fall of 2018.

[Christopher J. Lynch, Ph.D.](#) was named the director of the Office of Nutrition Research (ONR) and officially assumed his role on Feb. 21, 2016. Dr. Lynch was tasked with facilitating nutrition research within NIDDK and across the NIH. He is the executive secretary for the [National Institutes of Health Nutrition Research Task Force \(NRTF\)](#) which was established in October 2016 to support the development of the first NIH-wide strategic plan for nutrition research, and also acts on behalf of the NIH as the interagency point of contact for nutrition research.

## IV. NIH NUTRITION RESEARCH AND FUNDING

### Overview

The NIH is the leader in federally supported nutrition research and training. In FY 2015 and FY 2016, the NIH provided \$1.574 and \$1.615 billion respectively in financial support for nutrition research and training. This represents the combined individual contributions of 24 NIH ICs and the NIH OD. In FY 2015-2016, the NIH funded projects in 50 states, 3 territories, and 19 foreign countries. The NIH supported 344 clinical trials, which were either active or recruiting.

### Human Nutrition Research Reporting

The FY 2015-2016 nutrition research and training information in this Report, including grants, contracts and, other funding mechanisms, was obtained using the NIH Research Portfolio Online Reporting Tools (RePORT) Expenditures and Results (RePORTER) System.

#### About RePORTER

[RePORTER](#) is an electronic tool that allows users to search a repository of both intramural and extramural NIH-funded research projects from the past 25 years and access publications (since 1985) and patents resulting from NIH funding. Although not included in this Report, in addition to NIH-funded research, RePORTER provides access to research supported by the Centers for Disease Control and Prevention, the Agency for Healthcare Research and Quality, the Health Resources and Services Administration, the Substance Abuse and Mental Health Services Administration, and the U.S. Department of Veterans Affairs. The new [Federal RePORTER](#) system, launched in September 2014, was developed based on the NIH RePORTER.

As described in the [2006 NIH Reform Act](#), Congress requires the NIH to report annual spending for over 200 research, condition, and disease categories, including nutrition. Historically, projects related to nutrition were identified by staff in each of the NIH ICs. However, at the request of Congress, the NIH embarked on a process to provide better consistency and transparency in the reporting of its funded research. Beginning with FY 2008, the NIH began using the [Research, Condition, and Disease Categorization](#) (RCDC) system to define the more than 200 categories, including nutrition, which the NIH reports annually to Congress and the public. RCDC uses sophisticated text data mining in conjunction with NIH-wide definitions used to match projects to research spending categories.

The definitions (fingerprints) are a list of terms and concepts selected by NIH scientific experts to define a research category. The NIH Nutrition Fingerprint is based on the Interagency Committee on Human Nutrition Research (ICHNR) definition of human nutrition research, *the pursuit of new knowledge to improve the understanding of nutrition as it relates to human health and disease and, as here defined, encompasses studies in five major areas: biomedical and behavioral sciences; food sciences; nutrition monitoring and surveillance; nutrition education; and impact on nutrition and intervention programs and socioeconomic factors*, and was created by NIH staff working in conjunction with nutrition science experts representing many NIH ICs. The Fingerprint is compared to each NIH funded research project by searching titles, abstracts, and specific aims to generate a list of research projects

which are nutrition-related. As there is no reasonable way to assign a percent nutrition using the Nutrition Fingerprint, the dollars for all identified nutrition-related projects are counted as 100% nutrition. Research projects may meet the criteria of multiple fingerprints, and most nutrition projects are categorized under other spending categories as well. In other words, a project may be counted as nutrition, obesity, and prevention, and it would be counted once in each category, so adding the number of projects, or dollars, in each category would far exceed the total number of projects.

## Nutrition Research and Training Expenditures

### Trends: FY 2012-2016

As a percentage of total NIH spending, nutrition research funding has been stable at approximately 5%. Table 1 shows total NIH biomedical nutrition research and training support in current, as well as constant dollars. Actual obligations for nutrition research and training by NIH ICs during FY 2012-2016 are shown in Table 2. Across this 5-year interval, NIDDK, NHLBI and NCI led NIH spending in nutrition-related research. Cumulatively, nutrition spending by these three ICs accounted for approximately 60% of all NIH nutrition related expenditures in each year of this interval.<sup>1</sup>

Compared to FY 2015, nutrition research funding increased by \$41 million in FY 2016. Although there was a large increase in nutrition funding overall across the NIH, that was not a uniform trend across individual ICs. NIDDK, NHLBI and NCI are consistently the top three ICs funding nutrition research, but their nutrition funding trends are quite different. NIDDK and NHLBI increased nutrition funding (by 4% and 5% respectively) between FY 2015 and FY 2016, while NCI reduced nutrition research funding by 5%. Over the 5-year period, NCI has steadily reduced funding for nutrition research, so that FY 2016 nutrition funding was 42% less than the funding level in FY 2012. NHLBI nutrition research funding is still down 5% across the same period, but after dropping each year FY 2012 – FY 2014, funding began increasing again in FYs 2015 - 2016. Most of the \$41 million overall funding increase between FY 2015-2016 came from NIDDK (+ \$20 million) and NHLBI (+\$10 million), but several other institutes also significantly increased their nutrition research portfolios, including National Institute of General Medical Sciences (NIGMS) (13%), the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (24%), the National Institute of Allergy and Infectious Diseases (NIAID) (13%), and the National Institute of Nursing Research (NINR) (30%).

The most recent nutrition research and training expenditures for NIH ICs are shown in Table 3 as amounts and as percentages of their total obligation. Numbers of projects for each IC supporting nutrition research are also included. In FY 2016, NIDDK, NHLBI and NCI, collectively accounted for nearly 60 percent of the total NIH nutrition related spending, but in terms of the proportion of total IC budget dedicated to nutrition, the three leading NIH components were the NIDDK, the National Center for

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<sup>1</sup> For more information on FY 2012-2014 nutrition spending, see the NIH Nutrition Research Reports for 2011-2012 and 2013-2014 ([http://dnrc.nih.gov/pdf/nutrition\\_research\\_report\\_2011\\_2012.pdf](http://dnrc.nih.gov/pdf/nutrition_research_report_2011_2012.pdf) and [https://www.niddk.nih.gov/about-niddk/strategic-plans-reports/Documents/NIH\\_Nutrition\\_Research\\_Report\\_2013\\_2014.pdf](https://www.niddk.nih.gov/about-niddk/strategic-plans-reports/Documents/NIH_Nutrition_Research_Report_2013_2014.pdf) )

Complementary and Integrative Health (NCCIH)<sup>2</sup> and NINR with 28 percent, 26 percent, and 10 percent, respectively.

**Table 1. Actual Obligations, NIH Biomedical Nutrition Research and Training in Current and Constant Dollars and as a Percentage of Total NIH Obligations FY 2012-2016 (in thousands of dollars)**

Fiscal Year	Nutrition Research and Training, Current Dollars <sup>a</sup>	Nutrition Research and Training, Constant Dollars <sup>b</sup>	Total NIH Obligations <sup>c</sup>	Current Nutrition Dollars as a Percentage of Total NIH Obligations
2012	\$1,692,018	\$1,692,018	\$30,362,977	5.6%
2013	\$1,524,259	\$1,498,347	\$28,705,521	5.3%
2014	\$1,554,963	\$1,502,094	\$29,930,150	5.2%
2015	\$1,574,386	\$1,503,539	\$29,883,352	5.3%
2016	\$1,615,382	\$1,523,305	\$31,883,088	5.1%

a Expenditures. Source: NIH RePORT.

b Based on biomedical R&D price index, FY 2012 = 100 percent.

c Total excludes obligations for National Library of Medicine and Buildings and Facilities.

<sup>2</sup> Until December 2014, the NCCIH was named the National Center for Complementary and Alternative Medicine (NCCAM): <https://nccih.nih.gov/news/press/12172014>

**Table 2. Funding for Nutrition Research and Training by NIH Component  
FY 2012-2016 (ordered by FY 2012, largest to least, in thousands of dollars)**

Institute/ Center	2012	2013	2014	2015	2016
<b>Total</b>	<b>1,692,018</b>	<b>1,524,259</b>	<b>1,554,963</b>	<b>1,574,386</b>	<b>1,615,382</b>
<b>NIDDK</b>	517,288	527,470	507,564	539,558	558,635
<b>NCI</b>	286,701	200,252	194,457	172,735	165,117
<b>NHLBI</b>	236,207	220,402	205,936	213,626	223,796
<b>NICHD</b>	115,181	88,520	97,770	117,777	100,685
<b>NIA</b>	92,876	85,578	87,959	90,131	85,857
<b>NIEHS</b>	73,018	57,072	55,250	51,715	53,955
<b>OD<sup>a</sup></b>	50,495	49,150	82,243	68,480	65,711
<b>NIGMS</b>	45,899	44,427	59,388	55,394	62,587
<b>NCCIH</b>	31,757	25,248	26,531	30,510	33,242
<b>NIMH</b>	31,665	29,414	30,706	31,677	33,607
<b>NIAID</b>	31,234	33,260	40,660	40,560	45,956
<b>NIAAA</b>	25,647	23,727	29,461	26,627	32,892
<b>NIMHD</b>	25,040	16,588	18,720	19,578	24,233
<b>NINDS</b>	25,008	22,390	20,105	18,973	18,810
<b>NIDCD</b>	22,968	17,448	17,421	19,837	19,862
<b>NIDA</b>	19,285	21,881	20,933	13,101	16,129
<b>NIAMS</b>	17,788	14,277	12,586	12,110	12,468
<b>NEI</b>	11,282	13,105	10,900	14,270	14,632
<b>NIDCR</b>	10,516	7,370	9,273	14,285	14,429
<b>NHGRI</b>	9,621	9,729	7,941	5,964	8,476
<b>NINR</b>	8,717	12,206	13,585	10,993	14,239
<b>NCATS</b>	1,868	1,315	1,839	2,444	4,871
<b>FIC</b>	1,163	1,215	1,247	1,744	1,996
<b>NIBIB</b>	792	2,215	2,450	2,226	2,949
<b>NLM</b>	-	-	35	74	249

a Office of the Director (OD) includes Office of Disease Prevention, Office of Dietary Supplements, Office of Behavioral and Social Sciences Research, Office of Research on Women's Health, Office of Extramural Research, Office of Research Infrastructure Programs and NIH Roadmap/Common Fund.

**Table 3. NIH Nutrition Research Funding as a Percentage of Total IC Obligations, and Number of Projects by NIH Component, FY 2016 (dollars in thousands)**

Institute/ Center (IC)	Number of Projects	Nutrition Research and Training	Total IC Obligations	Nutrition as Percentage of Total IC Obligations
FIC	13	\$1,996,354	\$69,996,000	2.9%
NCATS	16	\$4,871,391	\$684,366,000	0.7%
NCCIH	107	\$33,241,886	\$129,760,000	25.6%
NCI	465	\$165,117,286	\$5,206,169,000	3.2%
NEI	52	\$14,631,649	\$707,002,000	2.1%
NHGRI	6	\$8,476,134	\$512,486,000	1.7%
NHLBI	525	\$223,796,108	\$3,109,062,000	7.2%
NIA	237	\$85,856,561	\$1,596,005,000	5.4%
NIAAA	86	\$32,892,412	\$466,713,000	7.0%
NIAID	135	\$45,956,184	\$4,749,884,000	1.0%
NIAMS	43	\$12,467,981	\$540,874,000	2.3%
NIBIB	13	\$2,949,295	\$342,997,000	0.9%
NICHD	289	\$100,684,717	\$1,338,280,000	7.5%
NIDA	33	\$16,129,137	\$1,048,971,000	1.5%
NIDCD	73	\$19,861,660	\$422,311,000	4.7%
NIDCR	39	\$14,428,946	\$412,788,000	3.5%
NIDDK	1461	\$558,634,836	\$1,963,738,000	28.4%
NIEHS	158	\$53,955,459	\$769,730,000	7.0%
NIGMS	211	\$62,586,706	\$2,508,868,000	2.5%
NIMH	85	\$33,607,009	\$1,516,325,000	2.2%
NIMHD	74	\$24,232,698	\$280,264,000	8.6%
NINDS	65	\$18,809,766	\$1,692,830,000	1.1%
NINR	39	\$14,238,558	\$145,701,000	9.8%
NLM	2	\$248,979	\$393,074,000	0.1%
OD <sup>c</sup>	200	\$65,710,690	\$1,274,891,000	5.2%
<b>TOTAL</b>	<b>4427</b>	<b>\$1,615,382,402</b>	<b>31,883,088,000</b>	<b>5.1%</b>

a Source: NIH RePORTER.

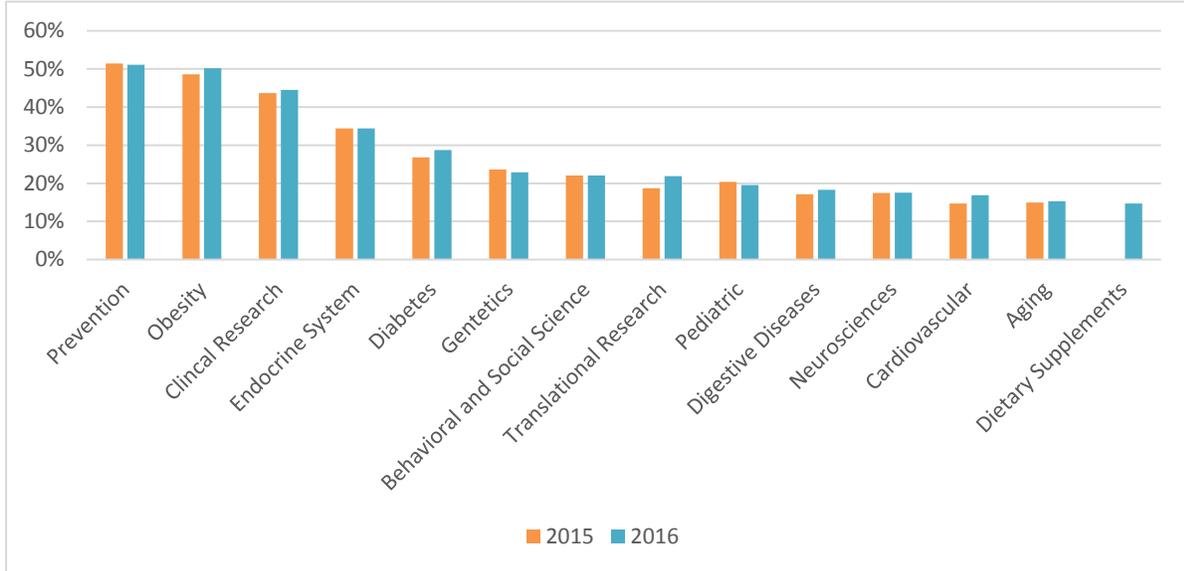
b Source: NIH Office of Program Planning and Evaluation.

c Office of the Director (OD) includes Office of Disease Prevention, Office of Dietary Supplements, Office of Behavioral and Social Sciences Research, Office of Research on Women's Health, Office of Extramural Research, Office of Research Infrastructure Programs, SEPA and NIH Roadmap/Common Fund.

### **Spending Categories**

NIH research projects may meet the criteria of multiple Fingerprints, and most Nutrition projects are categorized under other spending categories as well as Nutrition. Figure 1 shows the spending categories which appear most frequently in projects categorized as Nutrition. Approximately half of the Nutrition projects funded in FYs 2015–2016 were also categorized as Prevention or Obesity and nearly half were categorized as Clinical Research. Dietary Supplements was a new spending category in FY 2016.

**Figure 1. NIH Nutrition Top Overlapping RCDC Spending Categories as a Percent of Total Projects**

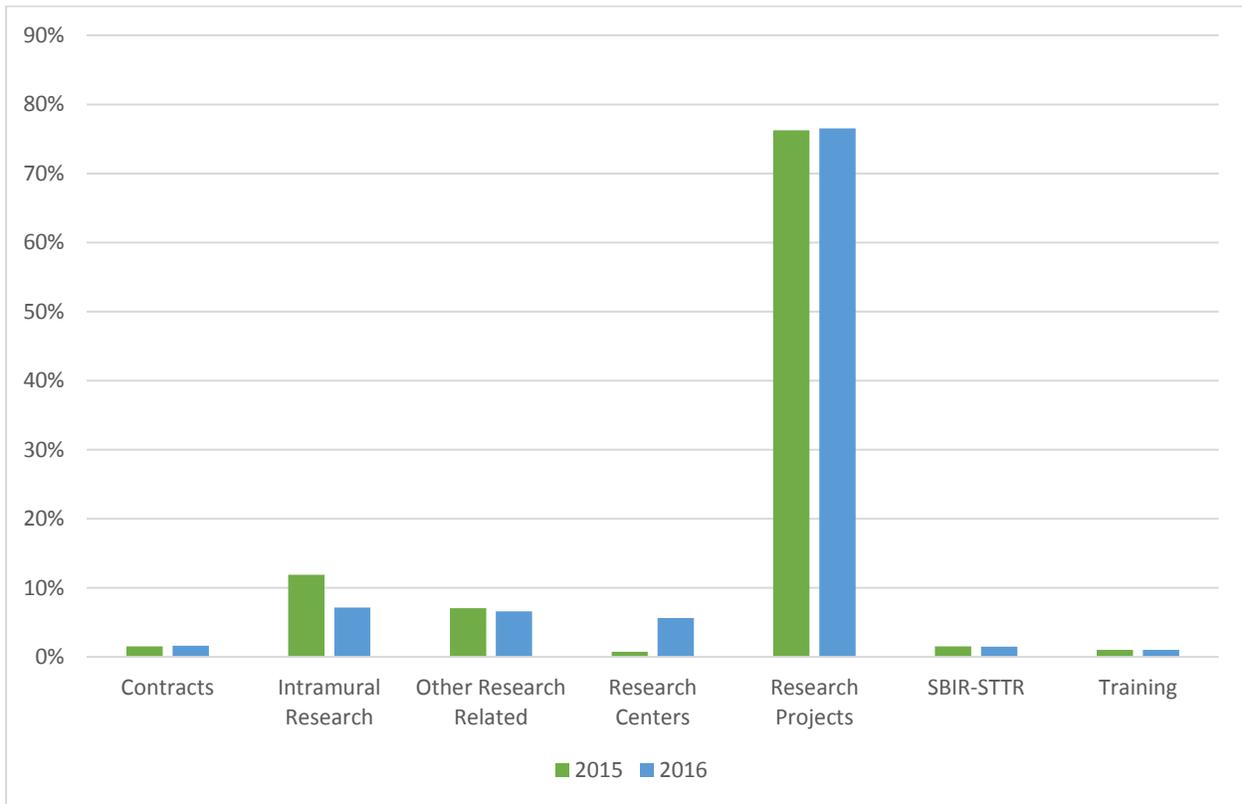


**Funding Mechanism**

Figure 2 shows the percent of FY 2015-2016 nutrition funding by research mechanisms. Extramural projects comprised 93% of the NIH nutrition research portfolio in FY 2016. Within the extramural category, Research Project Grants (RPGs) comprised the largest category of support, and Other Research Related, which includes conferences and cooperative agreements, comprised the second largest category of support.

The NIH supports training in biomedical and behavioral nutrition research primarily through two extramural mechanisms: institutional awards and individual awards. The institutional awards, commonly called “training grants,” are designed to enable institutions to make training awards to individuals selected by them for predoctoral and postdoctoral research training. The predoctoral and postdoctoral individual awards are offered as either Fellowships or Career Awards to provide research training to individuals to broaden their scientific background and extend their potential for research.

**Figure 2. Nutrition Funding Percent by NIH Research Mechanism, FY 2015-2016**



Projects funded in FY 2015-2016 were received in response to over 500 different Funding Opportunity Announcements (FOAs), but most funded nutrition projects came in under the Research Project Grant (Parent R01) or NIH Exploratory/Developmental Research Grant Program (Parent R21) FOAs<sup>3</sup>.

<sup>3</sup> All applications must be submitted in response to a [Funding Opportunity Announcement](http://grants.nih.gov/grants/guide/parent_announcements.htm) (FOA). NIH and other HHS Agencies have developed omnibus Parent announcements for use by applicants who wish to submit what were formerly termed “unsolicited” applications. To learn more visit: [http://grants.nih.gov/grants/guide/parent\\_announcements.htm](http://grants.nih.gov/grants/guide/parent_announcements.htm)

## Research Solicitation

The NIH considers applications for the support of basic or clinical biomedical, behavioral, and bioengineering research. New extramural grant programs are made publicly available through FOAs, otherwise known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the agency and type of program.

The *NIH Guide for Grants and Contracts*, which serves in lieu of the *Federal Register*, is the official publication for NIH medical and behavioral research grant policies, guidelines, and funding opportunities. NIH Contracting Offices and other HHS agencies also use the NIH Guide to announce their funding opportunities. For information on how to search the NIH Guide, see “[About the NIH Guide for Grants and Contracts](#).”

## V. NIH NUTRITION RESEARCH NEWS

NIH-supported nutrition research led to important discoveries in 2015 and 2016. Many of these discoveries were announced in an [NIH News Release](#) or published in *NIH Research Matters*. The list below illustrates a sample of research highlights, and a more comprehensive list of NIH nutrition-related press releases and *Nutrition Research Matters* articles can be found in Table 4.

### Highlights from NIH News Releases and *NIH Research Matters*

#### Cancer

- A study in mice gives insights into how food additives called emulsifiers might alter gut microbes and increase the risk of developing colorectal cancer.

#### Cardiovascular Disease

- Researchers found that blood levels of seafood- and plant-based omega-3 fatty acids were associated with a lower risk of dying from heart attacks.
- New findings suggest that levels of HDL cholesterol may not be as important as how well it functions to remove cholesterol from the body.

#### Diabetes

- Women who have had gestational diabetes may indeed benefit from a diet rich in fruits, vegetables, and whole grains.
- Mice with immune cells unable to use vitamin D developed precursors of heart disease and type 2 diabetes. The mechanisms uncovered may lead to novel therapies.

#### Dietary Patterns

- Periodic cycles of a low-calorie diet that mimicked fasting improved metabolic, immune, and other functions in mice. A pilot study suggested health benefits to people.

#### Food Allergies

- NIH-funded study suggests early peanut consumption will offer lasting protection.

#### Overweight and Obesity

- Female mice fed a diet high in fat and sugar produced 3 generations of female offspring with metabolic problems. The findings suggest how a mother's obesity can affect her descendants.
- Children of obese mothers who had low levels of folate during pregnancy have a higher risk of obesity.
- Non-invasive brain stimulation decreased calorie consumption and increased weight loss in adults who were obese.

<b>Table 4: Selected Nutrition-Related NIH News in 2015 and 2016 in Reverse Chronological Order</b>	
<b>DATE</b>	<b>TITLE</b>
November 22, 2016	<a href="#">Food additives promote inflammation, colon cancer in mice</a>
October 14, 2016	<a href="#">Weight loss leads to strong increase in appetite</a>
July 12, 2016	<a href="#">Omega-3s linked with lower risk of fatal heart attacks</a>
June 28, 2016	<a href="#">Poor maternal diet affects future generations of mice</a>
June 28, 2016	<a href="#">Low folate during pregnancy associated with childhood obesity risk</a>
May 10, 2016	<a href="#">Strategies successfully reduce weight gain in young adults</a>
April 18, 2016	<a href="#">Healthy diet may reduce high blood pressure risk after gestational diabetes, NIH study suggests</a>
March 24, 2016	<a href="#">Couples' pre-pregnancy caffeine consumption linked to miscarriage risk</a>
March 22, 2016	<a href="#">When HDL cholesterol doesn't protect against heart disease</a>
March 4, 2016	<a href="#">Benefits of peanut allergy prevention strategy persist after one-year peanut avoidance</a>
December 7, 2015	<a href="#">How taste is perceived in the brain</a>
November 23, 2015	<a href="#">Male and female drinking patterns becoming more alike in the US</a>
November 4, 2015	<a href="#">Brain stimulation limits calories consumed in adults with obesity</a>
October 1, 2015	<a href="#">Low Maternal Cholesterol Tied to Premature Birth</a>
September 28, 2015	<a href="#">Genetic Adaptations to Diet and Climate</a>
September 16, 2015	<a href="#">Diet, exercise, smoking habits, and genes interact to affect AMD risk</a>
September 1, 2015	<a href="#">NIH study finds calorie restriction lowers some risk factors for age-related diseases</a>
August 26, 2015	<a href="#">Low-level arsenic exposure before birth associated with early puberty and obesity in female mice</a>

August 25, 2015	<a href="#">NIH study shows no benefit of omega-3 or other nutritional supplements for cognitive decline</a>
August 13, 2015	<a href="#">NIH study finds cutting dietary fat reduces body fat more than cutting carbs</a>
August 13, 2015	<a href="#">Research reveals unintended consequences of inappropriate medical food use in managing patients with a type of metabolic disorders</a>
July 20, 2015	<a href="#">NIH Body Weight Planner added to USDA SuperTracker food and activity tool</a>
July 13, 2015	<a href="#">Health Effects of a Diet that Mimics Fasting</a>
May 11, 2015	<a href="#">Ease of weight loss influenced by individual biology</a>
March 31, 2015	<a href="#">How Vitamin D May Affect Heart Disease, Diabetes</a>
March 16, 2015	<a href="#">Food Additives Alter Gut Microbes, Cause Diseases in Mice</a>
January 12, 2015	<a href="#">Pathways Underlying the Benefits of Calorie Restriction</a>

## VI. NIH-SPONSORED NUTRITION CONFERENCES, SCIENTIFIC MEETINGS, & VIDEOCASTS

NIH conferences, workshops, and symposia play a key role in the advancement of nutrition science. Such forums provide an opportunity to share information, identify research gaps, and to stimulate new areas of research. A select list of nutrition-related events that were sponsored or co-sponsored by NIH institutes and centers in 2015 and 2016 are listed below Table 5. Some of these events have been archived on the NIH VideoCast website or the sponsoring organization’s website for future viewing.

<b>Table 5: NIH-Sponsored Nutrition Conferences, Seminars &amp; VideoCasts, In Reverse Chronological Order</b>				
<b>Title</b>	<b>Event Type</b>	<b>Date</b>	<b>NIH Sponsor(s)</b>	<b>Event Speaker(s)</b>
<a href="#">Nutritional Metabolomics to Identify Biomarkers of Dietary Patterns and Specific Diet Exposures</a>	<a href="#">Webinar Series</a>	December 6, 2016	NIH Metabolomics Interest Group	Mary Playdon, PhD, MPH, Post-Doctoral Fellow, NCI's Division of Cancer Epidemiology and Genetics
<a href="#">Nutrient Sensing by the mTOR Pathway</a>	<a href="#">Stars in Nutrition and Cancer Lecture Series</a>	December 5, 2016	NCI	David M. Sabatini, MD, PhD, Professor of Biology, Massachusetts Institute of Technology
<a href="#">When a Calorie is not a Calorie: Unraveling the Signals Driving Sugar Reward</a>	Seminar	November 9, 2016	NIDDK	Dana Small, PhD, Professor, Yale University
<a href="#">Iron Screening and Supplementation of Iron-replete Pregnant Women and Young Children</a>	Workshop	September 28-29, 2016	ODS	Multiple Speakers ( <a href="#">see agenda</a> )

<a href="#">New Mobile-Friendly Dietary Assessment Tool</a>	Transferring Epidemiology through Advanced Methods (TEAM) Webinar Series	July 19, 2016	NCI	Amy F. Subar, PhD, MPH, RD, Program Director and Nutritionist, NCI; Amy Miller, MPH, Study Manager, Westat Inc.; Thea Zimmerman, MS, RD, Nutritionist, Westat Inc.; Deirdre Douglass, MS, RD, Nutritionist, Westat Inc.
<a href="#">Research Strategies for Nutritional and Physical Activity Epidemiology and Cancer Prevention</a>	Workshop	June 28, 2016	NCI	Multiple Speakers
<a href="#">Nutrition, Fasting, Longevity and Diseases</a>	<a href="#">GeroScience Interest Group (GSIG) Seminars</a>	May 12, 2016	NIA	Valter Longo, PhD, Edna Jones Professor in Gerontology, Biol Sci, Director of USC Longevity Inst, University of Southern California Longevity Institute
<a href="#">Addressing Challenges in the Assessment of Botanical Dietary Supplement Safety</a>	Workshop	April 26-27, 2016	NIEHS and ODS	Multiple Speakers
<a href="#">Food-Based Cancer Prevention Strategies: Is There a Future for Human Studies?</a>	<a href="#">Stars in Nutrition and Cancer Lecture Series</a>	March 15, 2016	NCI	Steven K. Clinton, MD, PhD, Professor and Chair in Cancer Research, The Ohio State University
<a href="#">Why mammals suck: the food, medicine, and signal of mother's milk</a>	<a href="#">NIH Director's Wednesday Afternoon Lecture Series</a>	February 17, 2016	OD	Katie Hinde, PhD, Arizona State University

Selecting Instruments for Diet and Physical Activity Assessment	Transferring Epidemiology through Advanced Methods (TEAM) Webinar Series	December 9, 2015	NCI	Susan Krebs-Smith, PhD, MPH, Chief, Risk Factor Assessment Branch, Epidemiology and Genomics Research Program, NCI; Jill Reedy, PhD, MPH, RD, Program Director, Risk Factor Assessment Branch, Epidemiology and Genomics Research Program, NCI
Public Meeting on Assessing Safe Use of Folic Acid	National Toxicology Program Expert Panel	May 11-12, 2015	NIEHS and ODS	Multiple Speakers
Liver Injury from Herbal and Dietary Supplements	Workshop	May 4-5, 2015	NIDDK & ODS	Multiple Speakers
Alcohol: How Does It Do the Things It Does?	Demystifying Medicine Lecture	March 17, 2015	OD	George Koob, PhD, (NIAAA), and Bin Gao, MD, PhD, (NIAAA)
Options for Consideration of Chronic Disease Endpoints for Dietary Reference Intakes (DRIs)	Two-day workshop held by the DRI Committees of the U.S. and Canadian governments	March 10-11, 2015	The DRI Committees of the U.S. and Canadian governments	Multiple Speakers
Lifestyle and Breast Cancer	Stars in Nutrition and Cancer Lecture Series	March 3, 2015	NCI	Pamela Goodwin, MD, Professor of Medicine, University of Toronto
The John Milner Nutrition and Cancer Prevention Research Practicum	Practicum	March 2—6, 2015	NCI	Multiple

<a href="#">Make the DASH to Heart Health</a>	Focus on You Lecture Series	February 18, 2015	ORS	Kathryn McMurry, MS, NHLBI, NIH
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## VII. NUTRITION RELATED TRANS-NIH COMMITTEES

Several groups are engaged in collaborative activities at the NIH. The activities facilitate the sharing of resources and expertise, and they foster communication and opportunities for collaboration within the NIH nutrition scientific community. Key groups with representation from across the NIH are listed and described below.

### **Behavioral and Social Sciences Research Coordinating Committee**

The NIH [Behavioral and Social Sciences Research Coordinating Committee \(BSSR CC\)](#) was established to enhance information exchange, communication, integration, and coordination of behavioral and social sciences research/training activities at the NIH. The BSSR CC serves as an advisory body to the Director of the NIH Office of Behavioral and Social Sciences Research (OBSSR), which includes making recommendations regarding scientific, programmatic, and policy issues and activities and assisting OBSSR in the coordination of and collaboration among the NIH Institute/Center Directors (ICDs) in programmatic and scientific activities in the behavioral and social sciences at the NIH. In addition, the BSSR CC serves as a point of coordination among the ICDs, OBSSR, NIH staff, and the external scientific community. For information about upcoming events, see the [BSSR CC calendar](#).

### **Nutrition Research Coordinating Committee (NRCC)**

The NIH [Nutrition Research Coordinating Committee \(NRCC\)](#) was originally established in 1975 for the primary purpose of reviewing, discussing, and stimulating support for nutrition research and training within the NIH. Today, the NRCC is a vibrant group whose membership includes representatives and interested staff from NIH institutes, centers, offices, and other federal agencies. The NRCC is chaired by the director of the NIDDK Office of Nutrition Research. NRCC meetings occur monthly and typically include scientific seminars, nutrition research program and policy updates, information about research interests and collaborative project activities. In addition, a subcommittee of the Nutrition Research Coordinating Committee, the NIH Nutrition Education Subcommittee (NES), reviews federal nutrition education materials that contain dietary guidance for the general population.

### **Nutrition Research Task Force**

The [National Institutes of Health Nutrition Research Task Force \(NRTF\)](#) was established in 2016 to coordinate and accelerate progress in nutrition research across the NIH and guide the development of the first NIH-wide strategic plan for nutrition research for the next 10 years. The NRTF draws from experts across multiple fields, as nutrition affects both a wide range of diseases — including diabetes, cancer, obesity, and heart disease — as well as overall health and normal development.

The Task Force was charged with the following:

- Develop a strategic plan for the next decade to help guide NIH-supported nutrition research. The plan will identify promising scientific opportunities and key research gaps and promote interdisciplinary work to achieve common goals in nutrition.

- Solicit feedback in the development of the plan and related efforts, including from the public, other federal agencies, scientific and professional associations and other organizations, and the scientific community.
- Appoint a senior leadership group to guide implementation of the plan.

The strategic plan will emphasize cross-cutting, innovative opportunities to accelerate nutrition research across a wide range of areas, from basic science to experimental design to training. These opportunities will complement and enhance ongoing research efforts across the NIH on diseases and conditions affected by nutrition. The final strategic plan is expected in the fall of 2018.

The Task Force is chaired by Dr. Griffin P. Rodgers, director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Co-chairs are Dr. Gary Gibbons, director of the National Heart, Lung, and Blood Institute; Dr. Douglas R. Lowy, acting director of the National Cancer Institute; and Dr. Diana W. Bianchi, director of the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Participants on the Task Force will represent these and other institutes within the NIH, as well as other stakeholders. Dr. Christopher Lynch, director of NIDDK's [Office of Nutrition Research](#), is the executive secretary.

#### **Obesity Research Task Force**

The NIH [Obesity Research Task Force](#) was formed to provide the NIH research community with a means of exchanging information on a broad spectrum of NIH obesity-related research including molecular, genetic, behavioral, environmental, clinical, and epidemiologic studies. The Task Force is co-chaired by the Directors of the NIDDK, NHLBI, and NICHD. The members of the Task Force include representatives from these and many other NIH ICs. In 2011, the Task Force published an updated [Strategic Plan for NIH Obesity Research](#) to reflect recent obesity research activities and encourage innovative scientific research investigations to combat the obesity epidemic. The Plan reflects exciting opportunities and discoveries that have emerged since the first strategic plan was published in 2004.

#### **Prevention Research Coordinating Committee (PRCC)**

The [PRCC](#) is a trans-NIH committee that provides a forum for NIH Institutes and Centers, and other federal partners to exchange programmatic and scientific information on prevention research activities that are sponsored by federal agencies and other organizations. The NIH Office of Disease Prevention (ODP) coordinates the Committee's activities. The PRCC advises the ODP Director and provides recommendations regarding scientific, programmatic, and policy issues related to health promotion and disease prevention.

## VIII. KEY FEDERAL COLLABORATIONS

Interagency collaboration enhances the field of nutrition. Highlighted below are some of the key collaborative efforts that took place during 2015 and 2016.

### **Dietary Guidance Development Project for Pregnancy and Infants and Toddlers from Birth to 24 Months (P/B-24)**

The *Dietary Guidelines for Americans* have traditionally focused on Americans ages 2 years and older. However, both external and internal stakeholders have recommended that similar dietary guidance recommendations be developed for children from birth to 24 months. The U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) initiated [the Dietary Guidance Development Pregnancy and Birth to 24 Months \(P/B-24\) Project](#) in 2012 to develop a process to determine the breadth and scope of evidence available to inform development of dietary guidance for this population.

The current work of the P/B-24 project includes identifying topics of public health importance for women who are pregnant and infants and toddlers up to age 24 months. HHS and USDA decided on a small number of diet and health-related questions, [drawn from a previous phase of the project](#), for the P/B-24 project to answer through systematic reviews. USDA's Nutrition Evidence Library (NEL), in conjunction with HHS, is currently collaborating with nutrition experts to conduct systematic reviews for the questions. USDA and HHS expect to complete these systematic reviews and make the results available to the public in 2018. [Click here to see the full list of questions under review.](#)

### **Dietary Guidelines for Americans**

The *Dietary Guidelines for Americans* are the foundation of federal food and nutrition programs, policies, and education initiatives. The Dietary Guidelines are jointly issued and updated by USDA and HHS every five years, as required by law. The Dietary Guidelines are informed by a scientific report prepared by a federal advisory committee and comments received from federal agencies, industry, organizations, and consumers. The most current version, the [2015-2020 Dietary Guidelines for Americans](#) reflect [the Scientific Report of the 2015 Dietary Guidelines Advisory Committee](#). Numerous dietary guidance messages and education resources found on the [ChooseMyPlate.gov](#) and [Health.gov](#) websites have been developed to disseminate the Dietary Guidelines recommendations to the consumers.

### **Dietary Reference Intakes (DRI)**

[Dietary Reference Intakes](#) (DRIs) are nutrient reference values developed by the National Academies of Sciences, Engineering, and Medicine.<sup>4</sup> The DRIs are intended to serve as a guide for nutritional intake and provide the scientific basis for the development of food guidelines in both the United States and Canada. These nutrient reference values are specified based on age, gender and life stage and cover more than 40 nutrient substances.

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<sup>4</sup> As of March 2016, the Health and Medicine Division of the National Academies of Sciences, Engineering continues the consensus studies and convening activities previously undertaken by the Institute of Medicine (IOM).

Government coordination of DRI-related activities is a joint effort between representatives of the U.S. and Canadian governments. The U.S.-Canada Joint DRI Working Group and the Interagency Committee on Human Nutrition Research (ICHNR) Subcommittee on Dietary Reference Intakes work together to develop an efficient process that ensures DRI values continue to be scientifically sound, current, and useful for public health purposes. This includes identifying DRI needs and prioritizing nutrient reviews, advancing work to resolve methodology issues, and coordinating funding for new DRI reviews.

In 2013, the U.S.-Canada Joint DRI Working Group called for nominations for nutrients to be considered for future DRI reviews. Many of the nominated nutrients cited new data on chronic disease relationships as the justification for new DRI reviews, including three of the four nutrients (omega-3 fatty acids, sodium, magnesium, and vitamin E) selected by the DRI Working Group for further consideration based on the availability of sufficient new and relevant evidence. This highlighted a need for an evaluation of the challenges involved in incorporating chronic disease endpoints into DRI processes. Government agencies decided that a workshop on the potential use of chronic disease endpoints in setting DRI values was needed before the next nutrient review would be undertaken. On March 10-11, 2015, a workshop, [Options for Consideration of Chronic Disease Endpoints for Dietary Reference Intakes \(DRIs\)](#), was held at the NIH to address whether, and how, chronic disease outcomes can be incorporated into the process of setting DRI.

This workshop and extensive follow-up discussions informed the development of the report, [Options for basing Dietary Reference Intakes \(DRIs\) on chronic disease endpoints: Report from a joint U.S./Canadian-Sponsored working group](#). Based on this report, the Joint U.S.-Canadian DRI Working Group collaborated with the National Academies of Sciences, Engineering, and Medicine to develop [guiding principles for inclusion of chronic disease endpoints](#) to be used by committees setting future DRIs.

Sodium and potassium were selected to undergo a DRI review. In anticipation of this [process](#), a systematic evidence review of the [Effects of Dietary Sodium and Potassium Intake on Chronic Disease Outcomes and Related Risk Factors](#) began in late summer 2016.

### **Dietary Supplement Ingredients Database (DSID)**

The [Dietary Supplements Ingredients Database \(DSID\)](#) contains analytical data on dietary supplement product ingredients. The DSID was developed by the [Nutrient Data Laboratory](#), US Department of Agriculture, in collaboration with the [Office of Dietary Supplements](#) at the National Institutes of Health (NIH) and other federal agencies. The goals of the DSID project are to establish reliable analytically predicted estimates of ingredient content in dietary supplement products; compare analyzed levels of ingredients to labeled values provided by manufacturers, if available; and improve dietary intake assessments by providing data files and online calculators that adjust label values into analytically predicted amounts. The first data release, DSID-1, provided analytically derived estimates of nutrients found in a nationally representative set of adult multivitamin/mineral (MVM) products used in the U.S.. The release of DSID-2 in 2012, provided updated analytical data on adult multivitamin/mineral products and children's MVM products. In March 2015, results for the analytically derived estimates of ingredient content for non-prescription prenatal MVMs and omega-3 fatty acid supplements were released for the

first time (DSID-3). A brief description of each data file can be found [here](#), along with individual links to the data files.

### **Dietary Supplement Label Database (DSLDD)**

The [Dietary Supplement Label Database \(DSLDD\)](#) is a joint effort between the NIH National Library of Medicine and Office of Dietary Supplements, with input from many federal stakeholders. The DSLDD project was launched in June 2013. The database contains the full label contents from a sample of dietary supplement products marketed in the U.S. The DSLDD is expected to continue expanding with the goal of capturing labels for most of the 55,000 different dietary supplements sold in the U.S.

### **Healthy People**

Healthy People is a national health promotion and disease prevention agenda that provides a framework to achieve ten-year goals and objectives to improve the nation's health. The Healthy People initiative, which began more than thirty years ago, is grounded in the principle that setting national objectives and monitoring progress toward achieving them can motivate action.

Healthy People objectives are organized within distinct topic areas, for which multiple agencies provide leadership. The National Institutes of Health co-leads the Nutrition and Weight Status, Chronic Kidney Disease, Diabetes, Cancer, and Heart Disease and Stroke topic areas. For more information about objectives that monitor access to healthier foods, weight reduction and nutritional counseling in health care and worksite settings, weight status, food insecurity, food and nutrient consumption, and iron deficiency, view the [Healthy People 2020 Midcourse Review for the Nutrition and Weight Status](#).

Planning is now underway for *Healthy People 2030*. Every decade, the Healthy People initiative develops a new set of science-based, 10-year national objectives with the goal of improving the health of all Americans. The development of Healthy People 2030 includes establishing a framework for the initiative (including the vision, mission, foundational principles, plan of action, and overarching goals) and identifying new objectives. To provide advice and assistance to the Secretary and the Department of Health and Human Services (HHS) in the development of health promotion and disease prevention objectives to improve the health of Americans by 2030, an advisory committee composed of non-federal, independent subject matter experts are selected to provide recommendations. The [Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2030](#) (Committee) held their inaugural meeting in December 2016.

For more information on Healthy People Topic Areas, please view <http://www.healthypeople.gov/2020/topicsobjectives2020/default.aspx>.

### **Interagency Committee on Human Nutrition Research (ICHNR)**

The [Interagency Committee on Human Nutrition Research \(ICHNR\)](#) aims to increase the overall effectiveness and productivity of federally supported or conducted human nutrition research. Created in 1983 and reassembled in 2013, the ICHNR was charged with improving the planning, coordination, and communication among federal agencies engaged in nutrition research and with facilitating the development and updating of plans for federal research programs to meet current and future domestic and international needs for nutrition. The ICHNR includes representatives from the departments of

Agriculture (USDA), Health and Human Services (HHS), Defense (DoD) and Commerce; the Federal Trade Commission (FTC), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), the Agency for International Development (USAID), the Environmental Protection Agency (EPA), the Veterans Health Administration (VHA), and the White House Office of Science and Technology Policy (OSTP). In addition to its interagency coordination and communication roles, the ICHNR strives to increase the effectiveness and productivity of federal agencies that are engaged in nutrition research by supporting activities to inform researchers and policy staff on ongoing federally supported or conducted human nutrition research, nutrition monitoring, and nutrition program activities.

The ICHNR developed the [National Nutrition Research Roadmap 2016-2021: Advancing Nutrition Research to Improve and Sustain Health](#) as a means of identifying research priorities for human nutrition and to describe the role of the ICHNR departments and agencies in addressing those priorities over the next five to ten years. It suggests 120 short-term and long-term initiatives across 11 topical areas.

### **National Collaborative on Childhood Obesity Research (NCCOR)**

[NCCOR](#) is a public-private partnership undertaken by the Centers for Disease Control and Prevention (CDC), the NIH (NCI, NICHD, NIDDK, NHLBI, and OBSSR), the Robert Wood Johnson Foundation (RWJF), and the USDA. The initiative was formally launched in 2009 with a primary mission of improving the efficiency, effectiveness, and application of childhood obesity research and halting and reversing the childhood obesity epidemic through enhanced coordination and collaboration. The NCCOR partnership has focused its efforts on identifying, designing, and implementing innovative, practical, and sustainable interventions in diverse settings; increasing national, state, and local obesity surveillance activities; supporting childhood obesity research and program evaluation activities; and identifying ways to optimize research outcomes, build capacity for new research and surveillance, and create and support the mechanisms and infrastructure needed for research translation and dissemination. These efforts have proven enormously successful. NCCOR partners have formed strategic alliances with diverse groups, produced education and training resources for researchers and stakeholders, and informed the broader research community and policymakers of progress in child obesity prevention.

The [2015 NCCOR Annual Report](#) and the [2016 NCCOR Annual Report](#) are both available on the NCCOR website. Project highlights from 2015 and 2016 include the publication of Site Summary Reports from the [Childhood Obesity Declines Project](#); the development of [Measures Registry User Guides](#), and a series of [Connect & Explore Webinars](#) on topics such as evaluating health care community collaborations and the SNAP-Ed Evaluation Framework.

### **National Food and Nutrient Analysis Program (NFNAP)**

Federal food and dietary supplement product database activities have been coordinated through the [National Food and Nutrient Analysis Program \(NFNAP\)](#) initiative since 1997. NFNAP is directed by the USDA/ARS Nutrient Data Laboratory (NDL) in collaboration with NCI and other supporting NIH offices and institutes (NEI, NHLBI, NIA, NICHD, NIDCR, NIDDK, ODP, ODS, ORWH) and federal agencies (CDC, FDA, and HHS).

The five Specific Aims of NFNAP are to: 1) establish a monitoring program for Key Foods and critical nutrients. Key Foods are frequently consumed foods and ingredients, which contributed, collectively, more than 75% of the intake of any specific nutrient for the U.S. population; 2) conduct comprehensive analyses of selected Key Foods; 3) develop databases for high priority foods consumed by U.S. ethnic subpopulations; 4) develop databases for new bioactive components; and 5) develop a validated database for ingredients in dietary supplements. For each Specific Aim, the process includes the identification of foods for analysis, the development of unique statistically based sampling plans, and the application of validated analytical chemistry. The primary outcome of the Program is to develop comprehensive nutrient composition databases having unprecedented analytical quality.

Several recent accomplishments in food composition analysis and database development can be traced to the NFNAP initiative. The NFNAP initiative has also supported dietary supplements research and database development, including the DSID, which stemmed from the NFNAP initiative, and the DSLD. Both are described above.

### **Vitamin D Standardization Program**

The NIH Office of Dietary Supplements leads the [Vitamin D Standardization Program \(VDSP\)](#). Part of the [ODS Vitamin D Initiative](#), VDSP is an international collaborative effort to standardize the laboratory measurement of vitamin D status.

## **IX. NIH INSTITUTE AND CENTER RESEARCH DIRECTIONS**

The NIH supports extensive research on the relationship between nutrition and health. Through approaches that focus on both basic and translational research as well as training investigators, the NIH nutrition portfolio covers a vast array of programs. Details about each IC's specific research directions and priority nutrition areas are below.

*Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD)

Fogarty International Center (FIC)

National Cancer Institute (NCI)

National Center for Complementary and Integrative Health (NCCIH)

National Eye Institute (NEI)

National Heart, Lung, and Blood Institute (NHLBI)

National Human Genome Research Institute (NHGRI)

National Institute on Aging (NIA)

National Institute on Alcohol Abuse and Alcoholism (NIAAA)

National Institute of Allergy and Infectious Diseases (NIAID)

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

National Institute on Deafness and Other Communication Disorders (NIDCD)

National Institute of Dental and Craniofacial Research (NIDCR)

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

National Institute of Drug Abuse (NIDA)

National Institute of Environmental Health Sciences (NIEHS)

National Institute of General Medical Sciences (NIGMS)

National Institute of Mental Health (NIMH)

National Institute on Minority Health Disparities (NIMHD)

National Institute of Neurological Disorders and Stroke (NINDS)

National Institute of Nursing Research (NINR)

Office of the Director (ODS)

Warren Grant Magnuson Clinical Center (CC)

**Eunice Kennedy Shriver National Institute of Child Health and Human  
Development (NICHD)**

<http://www.nichd.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$100,684,717
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	7.5%

**OVERVIEW**

Consistent with the NICHD mission, the nutrition research program is focused on the continuum of human development, from conception through infancy, childhood, and adolescence. The nutrition research program emphasizes the evidence base needed to support domestic and global programs in health promotion and disease preventive through expanded understanding of the role of diet and nutrition in normal development as well as the myriad of conditions and stresses that can impact health.

Coordinated through the Pediatric Growth and Nutrition Branch, NICHD's extramural nutrition portfolio is multidisciplinary in nature, involving research to understand the genetic, biochemical, developmental (physical and neurological), behavioral, and cultural role of diet and nutrition in health promotion, disease prevention and treatment. The historical focus of the NICHD nutrition extramural portfolio has been on several core areas:

- Nutrient requirements and best feeding practices for newborn infants including full term, premature, and low birth weight infants
- Lactation:
  - Mammary gland development and physiology
  - Ontogeny of breast milk
  - Human milk composition
  - Factors affecting prevalence of breastfeeding
  - Lactation performance and initiation and duration of breastfeeding
  - Social/behavioral factors influencing infant feeding choices
- Intake regulation
  - Social/cultural/behavioral aspects
  - Sensory response (i.e., development of hedonic response to food/dietary constituents)
- Growth and development
  - Physical (e.g., bone health, body composition)
  - Neurological including effects on cognitive/behavioral outcomes
- Evaluation of the role of nutrition in ontogeny, prevention, and care of disease both acute and long-term

- Prematurity
- Infection, HIV, tuberculosis, malaria, diarrheal diseases
- Non-communicable diseases (NCDs) including obesity, diabetes, bone disease, cardiovascular disease risk, and cancer

Within this broad agenda, NICHD supports programs that address related issues such as:

- Impact of nutrition on reproduction
- Nutritional therapy of inborn errors of metabolism
- Assessment of nutritional status including discovery, development, and deployment of sensitive and specific biomarkers of nutrient status
- Understanding nutrition as a biological variable including:
  - Role of nutrients within biological systems (e.g., neurological, immunological or organs such as the placenta)
  - Intersection of nutrition (including infant feeding practices) and the microbiome particularly as pertains to development of gut immunology, health promotion and disease prevention of infants
  - Role of nutrition as both a predictor and an outcome of infectious (e.g., HIV, malaria, TB, diarrheal disease) and non-communicable diseases (e.g., diabetes, cardiovascular disease, cancer) and their treatment

NICHD's interest in the above areas continues to expand. An area of high public health priority is best practices for feeding infants >6 months, including the nutrient requirements for healthy growth and development and the modes for delivery of those nutrients to infants beyond the period of exclusive breastfeeding (> 6 months of age). Interest centers on metabolic processes in neonatal adaptation and on the role played by essential nutrients and other components of human milk. For example, NICHD has supported seminal work elucidating the effects of specific bioactive components of human milk, e.g., oligosaccharides, and lactoferrin on development of the gut microbiome, immune function, and nutrient delivery.

NICHD continues to encourage research on cultural and behavioral determinants of dietary patterns including studies of factors affecting the development of eating habits, taste, and olfaction; food avoidances; and behavior modification of dietary intake. An additional area of emphasis is understanding social/behavioral/cultural factors that influence maternal/caregiver infant feeding choices, as well as biological influences on successful implementation and sustainability of breastfeeding.

NICHD plays a leadership role in efforts to understand the role of the fetal environment in subsequent health outcomes including development of adult diseases. In a similar vein, the portfolio is actively growing in studies of the origins of childhood obesity and other components of metabolic syndrome later in life. A focus of these efforts has been on those factors that contribute to documented health disparities in the US.

In the area of international nutrition research, NICHD has played a leadership role within the NIH community through the development of the trans-NIH Subcommittee on International Nutrition Research, a subcommittee of the NIH Office of Nutrition Research's Nutrition Research Coordinating Committee (formerly, Nutrition Coordinating Committee). The current NICHD international nutrition research portfolio is coalesced around areas of traditional interest, e.g., the role and impact of specific micronutrients (e.g., vitamin A, and iron) in maternal and child health, as well as emerging programs in the role of nutrition in health promotion and disease prevention. Among the current priorities are the safety and effectiveness of common nutritional interventions in the context of prevention, care, and treatment of infectious (e.g., HIV, malaria, TB) and non-communicable diseases in resource constrained settings. Through partnerships with other funding agencies (e.g., the Bill and Melinda Gates Foundation) and the global health community (as technical consultant to the World Health Organization), NICHD has played an important role in addressing a range of issues affecting global health programs and policies.

The ability to identify, develop, and implement biomarkers to assess nutrient status continues to be a high priority for NICHD. For example, the “[Biomarkers of Nutrition for Development: BOND](#)” program is intended to harmonize the process for discovery, development, and use of nutrient biomarkers across a range of applications and to develop the necessary evidence through new research to support the implementation of new biomarkers utilizing state-of-the-art technologies.

Nutrition research is also conducted in NICHD's intramural divisions. For example, the Pregnancy Eating Attributes Study (PEAS), supported by NICHD's Division of Intramural Population Research, is an observational cohort study to examine the role of food reward eating behavior in maternal diet to weight changes during pregnancy and postpartum. This study also includes other factors related to eating behavior, such as physical activity, stress, sleep, and depression. The study measures weight-related biomedical, psychosocial, and genetic factors. Within NICHD's Division of Intramural Research, scientists have examined polymorphisms in genes involved in the leptin signaling pathway to identify gene variants impacting on body composition. They are currently studying a genetic variant (MC3R) that is associated with adiposity in children, and focused on the relationship between the BDNF-TrkB pathway and body mass in children. They have found several changes in or near the BDNF gene that impact adiposity in children and adults. Additional translational trials are planned or have begun related to modulation of the leptin signaling pathway, and these researchers are also investigating whether colchicine can decrease inflammation and improve obesity-related metabolic dysregulation (ZIAHD000641).

## **RESEARCH DIRECTIONS**

The following additional examples of current nutrition research supported by NICHD show the range and depth of the NICHD nutrition portfolio.

- Longitudinal Cohort studies including:
  - Leveraging data from a unique cohort of children in Guatemala who received supplemental nutrition in early childhood, researchers are conducting a long-term follow up study to assess the relationship between early nutrition and cardiometabolomic risk (R01HD075784).

- Title: Transgenerational Effects of Undernutrition on Children: PI: Galler, Janina R. (R01HD060986).
- Researchers are investigating how restricted fetal growth may change how the vascular system matures early in life, and how these changes may lead to increased cardiovascular risks (R01HD078639).
- Infancy is an important target period for obesity prevention because obesity in infancy is associated with obesity later in life. Obesity can start in infants when they are fed beyond the point of satisfaction. Researchers are testing a novel approach involving teaching mothers American Sign Language (ASL) signs indicative of hunger, thirst, and satiety, which they will in turn teach their pre-verbal infant. This training in ASL will be augmented with information for mothers about expected development of infants' eating behaviors and nutritional requirements to support healthy growth. The scientists will evaluate the initial impact of the intervention on observed feeding interactions, reported infant feeding behaviors and maternal feeding behaviors/beliefs, and infant nutritional intake and growth (R21HD082707).
- Inadequate nutrition of infants in resource-limited countries continues to be a major public health concern, yet there is limited scientific knowledge about the relationships among maternal nutrition, volume and quality of breast milk, and early growth failure for infants. Researchers are conducting a study in rural India to assess maternal nutrition and the volume and composition of breast milk, including micronutrient density and pro-inflammatory cytokines. This research is designed to inform maternal-focused nutrition strategies (R21HD080107).
- Scientists are conducting a randomized controlled trial in formula-fed infants to determine how the type of formula may affect energy balance, growth, and hunger. One group of infants will receive cow milk formula, and another will receive an alternative formula developed with extensively hydrolyzed protein. Over a period of two years, researchers will assess infants' energy expenditure, energy intake and loss, biomarkers of satiation, and food acceptance. The researchers hope that this study will help inform methods to reduce obesity risk among formula-fed infants (R01HD072307).
- Human breast milk not only provides nutrition to infants, but also gives infants many benefits including stimulation of the immune system. Important functional ingredients of human breast milk are human milk oligosaccharides. However, the relationships between the structures and functions of oligosaccharides are still not well understood, in part due to the limited availability of HMOs on which to conduct research. Under a small business grant, scientists are preparing a library of oligosaccharides for future research and long-term commercial applications. (R44HD083975)
- Researchers are evaluating the longitudinal test performance of an array of metabolomic biomarkers, as well as conventional biomarkers of glycemia, for identifying progression of glucose tolerance (normal to prediabetes or prediabetes to diabetes) in overweight and obese children. In addition, the researchers plan to conduct a feeding study to examine variability in

metabolomic biomarkers associated with abnormal glucose tolerance in response to diet (R01HD074559).

- Two studies are examining the role of stress in diet and obesity in minority or disadvantaged populations. One group of researchers is extending a previous cohort study, linking data collected for girls age 10-20 with new data from the same women at age 36 and their children, providing a unique look at intergenerational patterns of overweight and obesity. The scientists will model relationships between life stress, eating patterns, and obesity in both generations (R01HD073568). Another study focuses on children during the transition to adolescence (ages 8-12), testing the hypothesis that household food insecurity increases children's psychological stress, which shapes their eating behaviors and food choice and predicts subsequent weight gain (K99HD084758).
- NICHD is supporting efforts to develop a partnership to promote community-based participatory research to address childhood obesity on the Flathead Reservation (R13HD080904).

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## Fogarty International Center (FIC)

<http://www.fic.nih.gov/Pages/Default.aspx>

<b>Nutrition Research Spending (FY 2016):</b>	\$1,996,354
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	2.9%

### OVERVIEW

The Fogarty International Center (FIC) is dedicated to advancing the mission of the NIH by supporting and facilitating global health research conducted by U.S. and international investigators, building partnerships between health research institutions in the U.S. and abroad, and training future generations of scientists to address global health needs. FIC currently funds more than 400 research and training projects involving more than 100 U.S. universities and investigators in numerous foreign countries, most of which are in low- and middle-income countries (LMIC). FIC staff engage with scientists around the world to address critical global health research problems such as emerging infectious diseases, and the need to strengthen research capacity in LMICs.

FIC has a strong interest in nutrition as it relates to overall global health. Recent nutrition-related projects funded by FIC aim to do the following:

- Understand and improve nutritional and metabolic health in Namibia, a country with a high prevalence of HIV, by recruiting and training new LMIC investigators in HIV nutrition and metabolism to conduct independent research and translate the results of the results of nutrition and metabolism research to program development
- Develop long-term follow-up studies on nutritionally- and metabolically related complications and comorbidities of HIV based on an analysis of data repositories from recently completed large-scale HIV-nutrition clinical trial in Zambia
- Identify immunologic, metabolic, and nutritional risk factors associated with neurodevelopmental impairment in children with severe malaria who are treated with artesunate in Uganda
- Develop a research training program to strengthen and sustain the capability in Bangladesh to conduct and translate research on maternal and child health and nutritional issues related to infectious diseases
- Conduct a series of studies that will derive, validate, and assess the reliability of a new clinical prediction rule for severe dehydration and malnutrition in children with diarrhea in LMICs
- Develop, implement, and evaluate a smartphone-/ tablet -based network of layperson mHealth workers who use simple-to-operate software to report presumptive and medically diagnosed cases of Nodding Syndrome including head nodding triggered by eating and other sensory stimuli

- Strengthen the capacity of Latin American countries to address the non- communicable diseases (NCD) epidemic through a comprehensive training program that integrates multilevel and life course approaches and emphasizes the importance of reducing social inequalities in NCD

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## National Cancer Institute (NCI)

<http://www.cancer.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$165,117,286
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	3.2%

### OVERVIEW

Cancer is the second leading cause of death in the United States. During 2016, the number of new cancer cases is estimated to approach 1,685,210 and about 595,690 could die because of cancer-associated complications. Since the NCI was established in 1937, scientists have identified various cancer-related factors such as genetics and environmental exposures. Foods and their associated constituents are thought to be environmental factors that can significantly influence cancer risk and tumor behavior. The complexity of this area is expanded by the thousands of dietary components that are consumed.

Cancer research and training are performed and/or supported by both intramural and extramural programs at NCI. NCI makes awards to investigators residing in the United States and at international sites. NCI's goal is to support research that ultimately leads to important clinical outcomes: improvements in prevention, diagnosis, and treatment that can reduce the incidence, morbidity, and mortality of all types of cancer. NCI requires a wide range of research disciplines that span the continuum from basic science to clinical research to research on implementation and cancer care delivery. Areas of research that NCI supports includes basic sciences, such as genetics, genomics, cell biology, immunology, and nanotechnology; translational and clinical sciences, such as drug development and testing, diagnostics, and the discovery and development of molecular markers, advanced imaging technologies, and new radiotherapy techniques; population sciences, such as population genetics, epidemiology, and environmental sciences; and behavioral sciences. NCI supports various interdisciplinary training programs in basic, clinical and population sciences to foster the development of future national and international scientific leaders who will use modern approaches and technologies to address critical issues in cancer.

NCI nutrition research incorporates a variety of approaches to determine the influence of diet and dietary components on the cancer process, including epidemiologic studies (i.e., cross-sectional, case-control and cohort studies), clinical intervention studies, compositional studies involving food content and components, preclinical (animal models and cell cultures) and clinical biochemical/physiologic assessments of nutrient metabolism and absorption patterns. In addition, NCI provides summaries of ongoing research related to nutrition and cancer through Web sites and other programs within the Office of Communications and Public Liaison.

### RESEARCH DIRECTIONS

NCI supports extensive research on the relationship between nutrition and cancer in a wide variety of areas spanning the prevention and therapy domains including studies that focus on basic molecular and

cellular mechanisms of action of bioactive food components, dietary assessment methods, etiology, risk factor monitoring, and development of evidence-based interventions. Among the many research approaches being pursued and/or encouraged, the following are of particular note:

#### Dietary Assessment Methods

- Innovative approaches and technologies for assessing diet, weight control, and physical activity behaviors, such as electronic handheld monitoring devices and internet surveys, in collaboration with other NIH institutes
- Identification and validation of biomarkers of dietary intake to assess the accuracy of dietary assessment methods commonly used in epidemiology, intervention, and surveillance research
- Improved diet and physical activity assessment methodology across culturally diverse populations
- Studies to examine patterns of multidimensionality and dynamism of diet, including diurnal patterns and patterns over the life-course

#### Define Molecular Targets for Bioactive Food Components

- Preclinical and clinical studies using genomic, epigenomic, proteomic and metabolomic approaches to identify critical bioactive food components and their sites of action in the cancer process
- Preclinical and clinical studies to understand the interplay between nutrition, the microbiome, immune function, and cancer prevention
- Clinical studies to examine biological effects of microbial-generated metabolites from food components and their role in cancer prevention, etiology, and cancer health disparities
- Clinical and mechanistic studies on the effects of prebiotics and probiotics found in food or food components, their interaction with members of the gut, mouth, and skin microbiota, and their role in carcinogenesis and metabolism
- Essential and non-essential food components as modifiers of carcinogen metabolism, DNA repair, cell proliferation, differentiation, immunocompetence, hormonal homeostasis, and apoptosis
- New technologies for evaluating metabolic profiles, genetic susceptibilities and predispositions to cancer as influenced by diet
- Trans-disciplinary research centers to discover and characterize mechanisms by which diet, weight, and physical activity interacts with genetic and other factors in cancer development and progression
- Food preparation and processing methods, as well as variation in food and alcohol, fat, and fiber intake as modifiers of biomarkers or tumor incidence
- Interdependence of obesity, exercise, and inflammatory responses in establishing cancer risk and tumor behavior through various epidemiologic, clinical, and preclinical investigations

- Physiological responses to phytochemicals occurring in fruits and vegetables, zoochemical occurring in animal products, fungochemicals occurring in mushrooms, and bacterochemicals arising from gastrointestinal microorganisms to determine their role in cancer incidence and tumor behavior
- Investigating the mechanisms for which diet and nutritional interventions affect the response to cancer treatment
- Nutritional requirements of the cancer patient and neoplastic tissues with emphasis on nutrient uptake, utilization, and cellular control mechanisms in both normal and neoplastic tissues, and on host-tumor interactions and competition for nutrients

#### Population Surveillance, Economics, and Policy

- Population-level monitoring of diet and other risk factors for the refinement of nationwide surveys such as the National Health Interview Survey, California Health Interview Survey, and National Health and Nutrition Examination Survey
- Cohort Consortium to collect enhanced self-report and objective measures on diet and bioactive food components
- Collaboration with the National Center for Health Statistics (NCHS), nationwide surveys to enhance self-report, biologic, and genetic measures for monitoring and examining the impact of behaviors related to energy balance and cancer
- Public comprehension of health recommendations on nutrition and physical activity through the NCI Health Information National Trends Survey (HINTS)
- Trans-NIH initiative to support innovative economic research on diet, physical activity, and energy balance to examine societal, market and economic forces that may influence nutrition and related practice, particularly in at risk populations
- Private-public initiatives to develop research resources to track legislation and policies related to diet, weight control, and physical activity to assist in the understanding of factors influencing decisions at the population level and within clinical practice

#### Development of Evidence-Based Interventions

- Trans-disciplinary research centers to develop effective innovative approaches with broad population impact at the social, environmental, and policy levels for prevention of obesity
- Clinical dietary intervention trials with specific diets, foods and food components, cancer incidence, and tumor behavior
- Genomic technologies to identify those who respond maximally to dietary intervention and those who might be placed at risk because of dietary change
- Cost-effective approaches using food components for prevention and therapeutic strategies within clinical interventions
- Clinical trials to evaluate the effectiveness of nutritional support in the rehabilitation of the cancer patient, nutrition requirements during remission, and nutrient and dietary factors needed to maximize patient survival

- Behavioral research to identify evidence-based behavioral approaches for improving diet, physical activity, and weight control practices
- Research methodologies for improved empirical study of cancer-relevant behaviors (e.g., diet, physical activity, energy balance, and environmental exposures) and the psychosocial and built environment correlates of these. Examples include measures of psychosocial correlates of eating patterns and physical activity and of the obesogenic environment along with food consumption and dietary related biomarkers and the interaction between the environment and psychosocial factors associated with cancer preventive health behaviors

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## National Center for Complementary and Integrative Health (NCCIH)

<https://nccih.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$33,241,886
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	25.6%

### OVERVIEW

The National Center for Complementary and Integrative Health (NCCIH)<sup>5</sup> is the Federal Government's lead agency for scientific research on complementary and integrative health. The Center's mission is to define, through rigorous scientific investigation, the usefulness, safety and underlying mechanisms of complementary and integrative approaches and their roles in improving health and health care. There are many definitions of complementary and integrative health. NCCIH simply defines these as a group of diverse medical and health care interventions, practices, products, or disciplines that are not generally considered part of conventional medicine, such as natural products and mind and body approaches. According to the 2012 National Health Interview Survey, adults' use of fish oil, probiotics or prebiotics, and melatonin increased significantly between 2007 and 2012, while use of glucosamine/chondroitin, echinacea, and garlic decreased during that same time period. Fish oil was the most commonly used natural product among children.

### CAM NATURAL PRODUCTS RESEARCH

Establishing priorities across the entire field of complementary and integrative health research is enormously challenging. Of interest to the field of nutrition is NCCIH's robust natural products research portfolio that includes dietary supplements, herbal and botanical products, probiotics, and food-based phytochemicals. The Center's research on natural products relies heavily on the methods and tools of pharmacology and pharmacognosy. NCCIH has established rigorous standards and policies for quality and integrity of products used in NCCIH-supported research. Read more at: <http://nccih.nih.gov/research/policies/naturalproduct.htm>.

### RESEARCH DIRECTIONS

Historically, NCCIH has supported the vast majority of basic and translational research and development activities relevant to complementary approaches in natural products research through investigator-initiated research grants. This broad-based approach has yielded a large body of information and promising leads for future research. Support of complementary and integrative health research in the future remains essential. Going forward, a portion of NCCIH's natural product efforts will be targeted to more selected areas of basic, mechanistic, translational, and clinical research needed to expedite the development of the evidence base regarding specific, high-priority NCCIH research areas.

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<sup>5</sup> NCCIH was formerly called the National Center for Complementary and Alternative Medicine (NCCAM) until December 17, 2014: <https://nccih.nih.gov/news/press/12172014>

NCCIH's three strategies to advance its current portfolio of complementary and integrative health research are:

- Harness state-of-the-art "omics" and other high-throughput technologies and systems biology approaches of the sciences of pharmacology and pharmacognosy
- Support translational research to build a solid biological foundation for research on complementary and integrative health topics
- Support targeted clinical evaluation approaches and safety/efficacy studies

In addition, NCCIH has closely aligned its probiotics/prebiotics research with the trans-NIH Microbiome Project exploring the complex microbial ecology of host-microbial relationships. NCCIH is also directing efforts to promote greater trans-agency and inter-agency collaborations to share resources and expertise with the U.S. Food and Drug Administration, the U.S. Department of Agriculture, the Department of Defense, and Veteran's Administration, as well as other Federal agencies and stakeholders to facilitate progress in complementary and integrative health research and regulatory policy. Finally, NCCIH continues to co-sponsor a Botanical Dietary Supplements Centers Program with the NIH Office of Dietary Supplements.

Research solicitations across the broad spectrum of NCCIH's research may be found at <https://nccih.nih.gov/grants/funding>.

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## National Eye Institute (NEI)

<http://www.nei.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$14,631,649
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	2.1%

### OVERVIEW

NEI's mission is to reduce the prevalence of blindness, visual impairment, and eye disease in the United States and throughout the world. According to the [World Health Organization](#), three quarters of the 45 million cases of blindness worldwide are considered curable or preventable. Xerophthalmia, a blinding disease caused by vitamin A deficiency, is the leading cause of nutrition-related blindness and visual impairment among the world's children. It accounts for 70 percent of the estimated 1.5 million blind children in the world. Mild vitamin A deficiency, with consequences for child health and survival, affects another 20 to 40 million children worldwide.

Age-related cataract and macular degeneration are the major causes of visual impairment and blindness in the aging U.S. population. NEI supports research on the role of nutrition and of micronutrients, such as vitamins and trace minerals with antioxidant capabilities, in the development and worsening of these two eye disorders. NEI-supported scientists also are evaluating the effect of nutritional factors on other visual disorders, such as retinopathy of prematurity, glaucoma, retinitis pigmentosa, and diabetic retinopathy.

### RESEARCH DIRECTIONS

The following projects represent some of the many nutrition-related research areas supported by NEI:

- The major epidemiological and randomized placebo-controlled clinical trial “[Age-Related Eye Disease Study](#)” (AREDS) showed that high levels of antioxidants (vitamin C, vitamin E, and beta carotene) and zinc reduced the risk of progression to advanced age-related macular degeneration (AMD) by 25 percent for those at high risk.
- A follow up study, [AREDS2](#) tested a new formulation, adding omega-3 fatty acids as well as substituting antioxidants lutein and zeaxanthin for beta-carotene, which has been implicated as a risk factor for lung cancer in smokers and former smokers. While the omega-3 fatty acids had no effect on the formulation, the combination of lutein and zeaxanthin was a successful substitution, and this new formulation provides a safe and effective treatment for people at risk of advanced AMD.
- As ancillary studies to the VITamin D and OmegaA-3 Trial (VITAL) randomized trial, investigators will examine effects and synergism of DHA and EPA supplements from fish oil and vitamin D in reducing incidence or progression of AMD and dry eye disease.
- Premature, low birth weight infants are at high risk for retinopathy of prematurity (ROP), the leading cause of blindness in children. In animal studies, long-chain fatty acids suppress ROP. An NEI study suggested that adding dietary fatty acids increase levels of adiponectin,

communicating signals to the retina to regulate the creation of disease causing blood vessels (neovascularization) in the eye. Adiponectin deficiency blocked the dietary fatty acid suppression of neovascularization.

- Epidemiology studies are elucidating the interacting roles of environmental and genetic risk factors for complex eye diseases by examining diet and lifestyles in different populations. Using blood tests or nutritional surveys, the importance of fish oils, carotenoids, and vitamins for eye disease are being studied.
- Carotenoid levels, measured easily, safely and at low cost, are known to vary by individual, influenced by factors such as dietary sources, total nutrient intake, vitamin supplementation, genetics, and metabolism. NEI research is conducting long-term follow up on a cohort of participants from a clinical trial on carotenoids in eye disease to understand better the factors characterizing individual variation in carotenoids within population subgroups and to determine whether clinically significant relationships exist between carotenoid levels and incidence or progression of signs of age-related eye disease, specifically age-related macular degeneration. Pending a clinically meaningful relationship between carotenoids and eye disease, this research may inform future strategies to arrive at optimal dietary or vitamin supplementation over the life span.
- Macular pigment (MP) is comprised of the dietary carotenoids lutein, zeaxanthin and meso-zeaxanthin and declines with age. NEI scientists are testing the hypothesis that MP is a modifiable risk marker for AMD, and that preserving MP might help reduce risk for developing eye diseases and vision loss. Another study showed type 2 diabetes was associated with lower density of MP.
- Basic research on the metabolism of nutritional compounds, such as carotenoids using animal models, complements epidemiological studies of the eye. Animal models also are useful for testing nutritional/pharmacological therapies to prevent proliferative diabetic retinopathy (PDR), for example. Diets rich in omega-3 fatty acids counter the effects of diabetic retinopathy; scientists are testing the ability of these fatty acids along with COX-2 inhibitors, such as aspirin, to target inflammatory and angiogenic factors in PDR.
- NEI grantees are investigating the role of oxidative stress in age- and diabetes-related eye diseases, such as AMD, cataract formation, and glaucoma. Scientists are testing if dietary interventions can modify these biochemical markers of oxidative stress in AMD patients with different backgrounds. Eicosapentaenoic acid (EPA) added to cultured retina neurons blocked cell death in response to oxidative stress, whereas related fatty acids had no effect. Other teams are examining the mechanisms by which caloric restriction protects retinal cell death in glaucoma and whether these mechanisms can be reversed through dietary supplements such as resveratrol, a natural compound found in red wine.
- Vitamin A is the precursor for 11-cis-retinal, a molecule essential for vision. Investigations into vitamin A, its derivatives, and the proteins that bind and transport it to cells are a major focus of NEI-supported research. Scientists are exploring the role these substances play in the normal metabolism of ocular tissues and in the visual cycle. Alterations of ocular tissue integrity and

metabolism brought about by chronic deficiency of vitamin A also are being studied. These investigations include studying the role of vitamin A in maintaining the immune competence of the eye and the ability of ocular tissues to respond to infections and trauma.

- During eye development, precisely controlled programmed cell death is needed to separate the lens from the precursor to the cornea. Vitamin A deficiency can disrupt this process causing congenital blindness known as Peters' anomaly. NEI research is investigating the signaling mechanisms of vitamin A metabolite retinoic acid and its role in programmed cell death in the early stage of ocular lens and anterior eye development.
- Vitamin D, predominantly produced in the skin in response to UV sunlight, may also be produced in the cornea. It may also have a role in intraocular pressure control and AMD. NEI research is focusing on Vitamin D metabolism in the cornea, in tear fluid and its role in ocular wound healing. Vitamin D deficiency may affect over 50 percent of the United States population.
- Corneal scarring can develop as result of physical trauma, chemical burns, or infection, is a leading cause of blindness worldwide. Caloric restriction has been shown to extend lifespan and increase resistance to acute stress, and is correlated with improved outcomes following liver surgery. An exploratory study is testing if pre-surgical dietary restriction can modulate corneal wound healing.
- Cystoid macular edema (CME), swelling of the retina, is a complication occurring in 25 percent of patients with retinitis pigmentosa, but may be reduced by iodine supplements. Researchers are studying the role of dietary iodine, as well as linolenic acid, in reducing the risk of CME.

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## National Heart, Lung, and Blood Institute (NHLBI)

<http://www.nhlbi.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$223,796,108
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	7.2%

### OVERVIEW

The diseases within the purview of the NHLBI impose a heavy burden on the health and economy of the American people. Cardiovascular, lung, and blood diseases accounted for 40 percent of all deaths in the United States in 2015. Cardiovascular, lower respiratory, and cerebrovascular diseases accounted for 3 of the 5 leading causes of death in adults and 4 of the 10 leading causes of death in infants. The number of deaths attributable to cardiovascular disease (CVD) declined from 1999 until 2011, but increased each year from 2012 to 2015. CVD still accounts for almost one third of all deaths. The estimated economic cost of heart, lung, and blood diseases was \$455 billion, 22 percent of the total economic costs of illness, injuries, and death, in 2013-2014.

An important overall goal of the NHLBI nutrition research program is to prevent and treat cardiovascular diseases, such as heart attack, stroke, arrhythmias, peripheral arterial disease, and heart failure, and their risk factors. With heart disease as the nation's number one killer, an important focus of the research is to reduce risk by examining the influence of nutrition and physical activity on well-characterized risk factors such as high blood cholesterol levels, high blood pressure, obesity, and poor levels of cardiovascular and physical fitness. Emerging cardiovascular risk factors such as elevated inflammatory response markers also may be influenced by nutrition, and it is hoped that a better understanding of these relationships will ultimately provide new approaches to prevention. Some cases of congenital heart defect also appear to have a nutritional basis and thus may be prevented by improving maternal diets or nutritional status.

Other critical goals of the NHLBI nutrition research program include to prevention and treatment of lung diseases such as asthma and chronic obstructive pulmonary disease, and blood diseases such as clotting disorders and sickle cell disease. Another area of nutrition research interest is in sleep deficiency and sleep disorders, which are associated with obesity, are risk factors for cardiovascular disease, and mediate behavioral, physiological, and molecular processes involved in nutrient intake and metabolism.

The scope of the NHLBI nutrition research program encompasses the full research spectrum including basic investigations, epidemiologic and observational studies, clinical and community intervention studies, and demonstration and dissemination studies. NHLBI also fosters collaboration to apply research results and leverage resources to address public health needs, nationally and internationally. In addition, NHLBI supports academic and professional training in nutrition research as well as the development of innovative nutrition education programs for medical students, residents, attending physicians, and other health-care professionals.

## RESEARCH DIRECTIONS

Some of the main points of emphasis in the NHLBI nutrition research program include:

### Heart and Vascular Diseases

#### *Mechanisms and Risk Factors*

- Identify dietary patterns, foods, nutrients, and other dietary components that are effective in improving blood pressure, lipids, glucose, and overall cardiovascular health, and determine the mechanisms by which these effects are achieved.
- Evaluate the relationship between physiologic- and pharmacologic-level intake of nutrients and other dietary components with the pathophysiology of atherosclerosis and other cardiovascular disease mechanisms.
- Investigate the interaction of nutrients or dietary factors with pharmacologic agents to reduce cardiovascular disease risk.
- Investigate the interaction of nutrients or dietary factors with the gut microbiome as a mediator of cardiovascular risk associated inflammation.
- Develop animal models to study hypertension, dyslipidemias, obesity, and other nutrition-related cardiovascular risk factors.
- Investigate the interactions between genetic factors and diet as they influence cardiovascular disease risk.
- Develop new biomarkers of nutrient metabolism for use in studies of the causation, prevention, or treatment of cardiovascular diseases.
- Investigate racial, ethnic, and gender differences in nutrition-related cardiovascular disease risk, nutrient metabolism, dietary habits, and responsiveness to dietary intervention.
- Identify behavioral, social, and environmental determinants of nutrient intake, dietary patterns, and health that relate to or affect cardiovascular risk.
- Elucidate the role of body weight and fat distribution as related to the development of cardiovascular disease and its risk factors.
- Determine the relative roles of physical activity and diet in achieving energy balance, healthy body weight, fat loss, changes in body fat distribution, and long-term maintenance of weight loss.
- Investigate mechanisms and implications of unintended weight loss in low to moderate risk populations and on heart failure.

#### *Intervention and Translation Research*

- Investigate the effects of macro- and micro-nutrients, functional foods, dietary supplements and complementary and alternative therapies in the prevention and treatment of cardiovascular disease.

- Determine the optimal amount, type, and intensity of physical activity or fitness level needed for weight control and cardiovascular health, and the contribution of sedentary behaviors to cardiovascular risk.
- Identify influences of the built, home, psychosocial, and sociocultural environments on dietary behavior, and develop and test interventions targeting these influences.
- Develop and test intervention strategies that focus on the interactions among individual dietary behaviors, genetics, and the environment (e.g., home, community, and built environment) to reduce cardiovascular risks, particularly those targeting different literacy levels, socioeconomic levels, and race/ethnic groups.
- Characterize behavioral determinants of adherence to dietary and physical activity recommendations and develop effective interventions to improve adherence.
- Develop effective strategies and materials for the dissemination of nutrition and disease prevention information aimed at health professionals and the public of different ages, literacy levels, and ethnic backgrounds.
- Develop effective methods for increasing and sustaining regular moderate-intensity physical activity and for reducing sedentary behaviors.
- Develop and test lifestyle interventions to prevent obesity and excessive weight gain across the lifespan, and for long-term maintenance of weight loss, particularly interventions that are practical, cost-effective, sustainable, and have high potential for broad-scale dissemination.

#### *Assessment*

- Monitor secular trends in dietary constituents related to cardiovascular disease and its risk factors.
- Continue surveillance of public knowledge and physician practices that pertain to diet, obesity, and cardiovascular disease.
- Advance the state of the art in dietary intake methodology, including dietary assessment tools, statistical techniques, and food composition analysis, methods, standard reference materials, databases, and software.
- Advance the state of the art in physical activity assessment methodology, including new instruments and techniques to assess sustained vigorous activity, moderate and light intensity activity, sedentary activity, and activity to maintain strength, balance, and flexibility.
- Develop improved technologies for assessing energy balance, intake, and expenditure under research conditions and in real-world settings.

#### **Lung Diseases and Sleep Disorders**

- Investigate the role of nutrition in the development of normal pulmonary immune defense systems, especially during lung development.
- Explore the role of nutrition in preventing respiratory muscle dysfunction in acute and chronic pulmonary disease.

- Investigate the relationship between sleep apnea (sleep-disordered breathing) and obesity, as well as the effect of dietary factors on the control of breathing and airway function.
- Determine the health-related consequences of sleep deficiency (i.e. insufficient sleep duration, circadian misalignment, poor sleep quality) on increased disease risk for nutrition-related conditions such as obesity, cardiopulmonary diseases, and diabetes.
- Elucidate circadian-dependent mechanisms coupled to behavioral, physiological, and cellular mediators of nutrient metabolism and related cardiometabolic pathophysiology.
- Identify biomarkers and molecular signatures of sleep deficiency that predict increased risk or point to novel therapeutic targets for nutrient-related cardiopulmonary and metabolic disease.
- Investigate the role of specific nutrients in adult and infant respiratory distress syndromes.
- Evaluate the relationship between diet and genetic factors in determining an individual's susceptibility to diseases of the lung.
- Examine undernutrition as a risk for tuberculosis and other lung infections.
- Evaluate the effect of maternal diet during pregnancy on the development of allergies and asthma in the offspring.

#### **Blood Diseases**

- Investigate the role of food insecurity and food deserts in obesity and overweight in hemoglobinopathy patients.
- Identify mechanism(s) by which nutrients and other dietary factors influence the synthesis and expression of functional activity of platelets and of proteins involved in the coagulation of blood.
- Elucidate the role of nutrients and other dietary factors in the genesis, treatment, and prevention of blood vessel obstruction.
- Investigate energy balance and nutrient requirements among children with sickle cell disease, especially children who fail to thrive, and adolescents who are in a rapid growth phase.
- Conduct studies on the benefits of appropriate dietary intervention and nutritional supplementation in hemoglobin disorders.
- Improve understanding of nutritional factors in the management and clinical variability of hemoglobin disorders.
- Characterize the relationship between nutritional deficiencies and immune dysfunction in sickle cell disease.

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## National Human Genome Research Institute (NHGRI)

<http://www.genome.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$8,476,134
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	1.7%

### OVERVIEW

Since the completion of the Human Genome Project in 2003, NHGRI-supported research has focused on advancing genomic science and medicine through a deeper understanding of genome structure and function, the relationships between genes, environment and human health, and attitudes and behaviors related to genomic information.

As part of its mission to advance genomic science and medicine, NHGRI funds research on the complex relationships between genomics and nutrition-relevant variables. Genomics plays an essential role in individual variation in metabolism and predisposition for genetically complex diseases including obesity, diabetes, heart disease, and cancer. NHGRI supports studies to investigate the interplay between genetic and environmental risk factors for these complex diseases in multi-ethnic cohorts. In addition, NHGRI funds research on how people understand and use genomic information to shape food and nutrition choices.

### RESEARCH DIRECTIONS

NHGRI supports research on genomic and environmental interactions (GxE), including the interactions of genes and diet and nutrition.

Folate and vitamin B12 are essential nutrients for cell growth and neurological development, and deficiencies increase the risk of tumors, miscarriage, birth defects including spina bifida, and cognitive problems in older people. NHGRI intramural investigators are studying genes that affect folate and vitamin B12 metabolism and contribute to disease. These studies include clinical based research on patients with rare inborn errors of metabolism and epidemiologic studies of common complex disease. Detailed knowledge of the function of the genes in the folate/vitamin B12 metabolic pathways will add to our understanding of neural tube defects and potentially help guide public health policy in the area of nutritional supplementation.

Obesity is a heritable health condition underpinned by a combination of genetic and environmental influences. Increased understanding and awareness of the heritability of obesity can help parents of children with a high risk for obesity make informed food choices and form healthy habits early on. In the Mothers' TAKE study, NHGRI researchers have investigated how mothers' food choices for their children are affected by information about family history and obesity risk. The researchers are also looking at how genetic risk information influences mothers' feelings of guilt, factors associated with food choices for boy or girl children, and how mothers' weight trajectories influenced their own health beliefs and

attitudes. Results could suggest possible risks and benefits of integrating genetic risk messages into behavior change intervention approaches to promote optimal body weight in childhood.

NHGRI researchers are also studying the benefits, risks, and effects of providing genomics information about obesity into clinical weight-management encounters, with a focus on including stigmatized and underserved populations. The study is using simulations where overweight participants interact with a virtual reality physician, and researchers assess how this influences their attitudes, behaviors, and perceptions of stigmatization. The results could help inform ways that physicians can introduce genomic information into clinical care to encourage healthy behaviors.

NHGRI investigators conducted a research study about diet, weight, food preferences, and beliefs about the role of heredity in eating habits and weight. Healthy adult volunteers answered survey questions about their behavior, experiences, preferences, and beliefs related to eating, weight, and nutrition. The researchers are analyzing data from this study and plan to evaluate the feasibility of characterizing robust clusters of eating behavior phenotypes that show variation across individuals and that are associated with weight outcomes.

Moreover, NHGRI-funded projects are studying the relationship between genetic variation and metabolism in humans, especially in a variety of diverse populations that are underrepresented in genomics research. A more robust understanding of how genetic variation affects the risk of obesity and metabolic disorders in diverse populations can lead to better methods of disease prevention and approaches to reducing health disparities. One group of scientists is analyzing whole genome sequences to find genetic variants that contribute to obesity and metabolic disorders in Hispanic people, with a special focus on discovering the contributions of rare variants. Another study is using samples from a large multiethnic cohort to study genetic and environmental contributions to obesity, type 2 diabetes, and other traits to create disease risk prediction models for ancestrally diverse populations.

Finally, NHGRI investigators and NHGRI-funded investigators are also exploring how genetic and environmental factors contribute to complex diseases in Africans and African Americans. Led by NHGRI, NIH's Common Fund program, Human Heredity and Health in Africa (H3Africa), has projects aimed at 1) building infrastructure and capacity to understand how genetic and environmental factors contribute to obesity and cardiometabolic disease in sub-Saharan Africa and 2) carrying out studies to identify these genetic factors. NHGRI investigators are participating in the development and implementation of protocols for H3Africa projects and have helped design a custom chip array for genotyping in African populations. These intramural researchers are also conducting studies outside of the H3Africa program to understand the genetic basis of diabetes, obesity, and heart disease in African Diaspora populations as well as other projects that seek to understand metabolic disorders and dyslipidemia in populations of African ancestry.

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## National Institute on Aging (NIA)

<http://www.nia.nih.gov>

<b>Nutrition Research Spending (FY 2016):</b>	\$85,856,561
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	5.4%

### OVERVIEW

Today, approximately 13.4% of Americans are 65 or over. By the year 2025, this number is expected to grow to over 20 percent as life span extends well into the eighth decade. The mission of the NIA is to foster research that finds methods to extend years of productive life through improved health, lifestyle, and psychosocial status. NIA contributes to this goal by supporting basic, animal model, clinical, and population-based studies to determine the ways in which nutrition influences the onset and progression of aging.

Nutrition and aging research poses several unique challenges. The variation of physiological and behavioral measures increases with age. Because the rate of change in functional capacity and aging processes differs among individuals, those who reach old age are the most biologically heterogeneous of all age groups. The diversity observed in aging individuals results from a lifetime of environmental experiences superimposed on individual differences in genetic predisposition. Investigators in nutrition and aging must consider additional factors such as genetic variation, race, smoking status, physical activity, social factors, health and medication history.

A most difficult problem is to separate those changes observed in old age that are due to inevitable aging processes from those that are manifestations of pathology. In some cases, such as those related to the progressive loss of skeletal tissue, an aging process becomes pathological when bone density is reduced to a level where low-trauma fractures can occur. Researchers also must determine if the magnitude of change in age-related parameters is clinically significant and which aging processes are detrimental to the health of older individuals.

### RESEARCH DIRECTIONS

The National Institute on Aging continues its efforts in nutrition research to promote and maintain healthy aging. The NIA solicits input from the scientific community to aid in identifying the most important topic areas and directions for nutrition and aging research.

Nutrition research is supported in the four Extramural Divisions—Division of Aging Biology (DAB), Division of Behavioral and Social Research (DBSR), Division of Geriatrics and Clinical Gerontology (DGCG), and Division of Neuroscience (DN) as well as in the NIA Intramural Programs—Laboratories of Epidemiology, Demography, and Biometry, Clinical Investigation, Cardiovascular Science, Molecular Biology and Immunology, and Experimental Gerontology, Genetics, Molecular Gerontology, Neurogenetics, Neuroscience, and Behavioral Neuroscience. In 1991, the NIA created a Nutrition

Office to facilitate interaction and planning activities among the NIA programs to give nutrition and aging research greater visibility.

Present research directions and areas of priority in nutrition and aging are based on NIA staff evaluation of current research, advice from scientific advisors, and the results and recommendations from nutrition and aging conferences. These include the following and the Divisions most likely to be interested in these areas of research:

- Bionutrition studies utilizing cellular and molecular techniques to identify the mechanisms of age-related changes in metabolism, homeostasis, and differential cell function (DAB)
- Nutrient requirements and their age-dependent changes in older persons and animal models (DAB and DGCG)
- Effects of age on physiological processes through which nutrients, drugs, and other non-nutrient substances are absorbed, metabolized, and excreted in humans and in analogous animal models (DAB and DGCG)
- Nutritional status of older Americans and special subpopulations of older people at special nutritional risk such as those with multiple chronic conditions (DGCG)
- Effects of calorie reduction on age-related pathologies and/or longevity (DAB and DGCG)
- Nutritional factors associated with physiologic and psychological changes such as immunocompetence, cardiovascular function, neurological function, body composition, physical function, sensory perception, control of appetite, macronutrient utilization, endocrine control, genetics, cognitive health and emotional regulation (all Divisions)
- The role of nutritional factors, including dietary supplements, in prevention and treatment of age-related degenerative diseases including diabetes, osteoporosis, neurological disorders, immune deficits, heart disease, cancer, gastrointestinal diseases, and other comorbidities (all Divisions) Effect of neurological changes, such as dementia, and declines in sensory reception and perception on nutrient intake (DN)
- Neural mechanisms underlying the control of eating, drinking, and satiety that affect Nutrient intake (DN)
- Effect of diet, food extracts, and dietary supplements on cognition, sensory systems, and motor function (DN)
- General epidemiological studies and analysis of nutritional status, body composition, and their correlates with functional measures (DGCG and DBSR)
- Psychosocial aspects of nutrition, including studies of diet as a major factor contributing to quality of life and how diet interacts with social, environmental and lifestyle variables including food insecurity, food environment/availability, exercise, smoking, and consumption of alcoholic beverages (DBSR)
- Behavioral aspects of dietary change, including behavioral economics and mechanistic studies of behavior change related to diet and other health behaviors (DBSR)

A rapidly aging population makes it critical to find ways to maximize the span of good health and thereby improve the quality of life of older people. For this reason, the NIA supports research to study nutrition-aging interactions.

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## National Institute on Alcohol Abuse and Alcoholism (NIAAA)

<http://www.niaaa.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$32,892,412
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	7.0%

### OVERVIEW

The NIAAA supports nutrition research through programs in basic and clinical sciences and seeks to identify the complex relationships between alcohol consumption, nutritional status, and health.

### RESEARCH DIRECTIONS

Examples of the nutrition research encouraged and supported by the NIAAA are:

- Studies on alcohol metabolism and its effect on autonomic signals involved in alcohol and food intake
- Studies on alcohol effects on the absorption, utilization, and excretion of minerals (iron, magnesium, zinc, selenium, and calcium) to clarify the role that alcohol-induced changes in these minerals may play in inducing pathological consequences of chronic alcohol consumption, such as liver fibrosis and hypertension
- Studies on ethanol alteration of the distribution of essential fatty acids and prostanoid production and the role of eicosanoids in alcohol-induced physiological changes
- The role of alcohol-induced malnutrition in the pathogenesis of fetal alcohol syndrome (FAS), including impaired placental transport of nutrients
- Studies of alcohol-nutrient interactions related to possible health risks or benefits of moderate ethanol intake
- Studies on the contribution of alcohol in modulation of the endocannabinoid system and appetite regulating peptides such as ghrelin and leptin
- Studies of the roles of thiamin deficiency, alcohol intake, and genetic predisposition in the etiology of cellular degeneration and Wernicke-Korsakoff syndrome
- Evaluation of the role of alcohol-associated increased iron accumulation in the development of alcoholic liver disease and pancreatitis
- Evaluation of the role of alcohol-associated depletion of folate, S-adenosylmethionine, and glutathione in the development of alcoholic liver disease, pancreatitis, cardiomyopathy, and lung injury
- Understanding the role of magnesium in alcohol-associated strokes
- Understanding the role of alcohol on fat metabolism (oxidation, synthesis, and transport of fatty acids) and its connection with the development of alcoholic liver disease and muscle wasting
- Studies on the possible role of fat and protein composition of the diet in management and prevention of fatty liver, alcoholic hepatitis, or liver fibrosis and cirrhosis

- Investigation of the effects of alcohol on vitamin A metabolism and associated tissue injury
- Examination of the role of choline, betaine, retinoids and phosphatidylcholine in the attenuation of alcoholic liver disease
- Understanding the contribution of prenatal and postnatal nutritional factors that may modify risk for FASD in children with prenatal alcohol exposure.
- Nutritional deficits from alcohol induced intestinal dysbiosis

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## National Institute of Allergy and Infectious Diseases (NIAID)

<http://www.niaid.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$45,956,184
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	1.0%

### OVERVIEW

Although NIAID was established in 1948, it traces its roots back to the Laboratory of Hygiene, a bacteriological laboratory that was founded in 1887 and was the forerunner of NIH and NIAID. NIAID supports basic and clinical research in microbiology, infectious diseases, immunology, and allergy. A major component of NIAID's basic research is concerned with fundamental life processes as exemplified in microorganisms and in animal cells in vitro. Techniques and basic biologic principles, developed because of this fundamental research in microbiology and immunology, have been applied to other areas of biology and medicine, including nutrition.

The complex interrelationships among nutrition, microbial infections, and immunology have important health implications. In the developing world, more than 1.7 billion cases of infectious diarrheal disease occur annually in children under the age of 5 years. Malnutrition both predisposes to diarrhea and occurs as a result of diarrhea. Immunodeficiency states, such as HIV/AIDS, cause malnutrition and set the stage for co-infections and co-morbidities that accelerate the cycle of malnutrition and infection. Asthma and allergic diseases affect over 60 million Americans. Surgery and trauma lay the groundwork for infection and subsequent malnutrition. Many of these infections and conditions, or their complications, can be mitigated, at least in part, by appropriate nutrition.

NIAID studies on nutrition are an integral part of the institute's research to lessen the adverse health consequences of immunologic and infectious diseases. Of particular significance are the consequences of wasting on the underlying HIV/AIDS disease process, including its infectious and immunological complications, and the role of nutrition in the development of safe and effective vaccines against infectious diseases. Continuing concerns are the prevalence of infections among the malnourished, the effect of infections on nutritional status, host-microbiome interactions, and its relationship to nutrition in health and disease, the prevalence and control of acute respiratory infections and food-borne microbial illness, and the effect of malnutrition on resistance to infection, especially to infectious diarrhea and respiratory infections in young children.

### RESEARCH DIRECTIONS

NIAID's interest in nutrition aims at a better understanding of the complex inter-relationships of nutrition, immunity, and infection. The institute's research directions are correspondingly varied. They include the following:

- All aspects of nutrition and the development, consequences, and treatment of HIV/AIDS; the relationship of nutrition to the development and treatment of co-morbidities (such as

osteopenia) associated with HIV disease and treatment; the relationship of nutrition to the pathogenesis and treatment of pediatric HIV disease, such as growth and development, including the impact of infant feeding choices; and the impact of undernutrition on absorption and pharmacodynamics of antiretroviral agents

- The negative effect of malnutrition on resistance to tropical infections, especially infectious diarrheas and tuberculosis, and the role of breast milk as a defense against enteric infections
- The role of host-microbiome interactions in disease and its relationship to nutrition
- The significant morbidity and mortality of rotavirus-induced infectious diarrhea among infants in developing countries and a major effort to develop a safe, effective, and practical rotavirus vaccine for newborns
- The impact of micronutrient deficiencies on the outcome of acute respiratory infections and on viral evolution, and the role of vitamin D and other micronutrients on tuberculosis and other infectious diseases
- The role of nutritional factors in the immune response to animal parasites that cause significant human disease, e.g., schistosomiasis, giardiasis, and cryptosporidiosis
- Infections in American hospitals, including the effect of surgery on immune function, hypercatabolism, and resistance to infection
- The modulating effects of specific nutrients (e.g., vitamins, trace elements, fatty acids, fiber, and amino acids) on basic immune function
- Immune responses, tolerance, and allergic reactions to specific foods such as milk, egg, and peanut

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## National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

<http://www.niams.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$12,467,981
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	2.3%

### OVERVIEW

NIAMS conducts and supports basic and clinical research on many of the most debilitating diseases affecting the U.S. population. These include the many forms of arthritis and numerous diseases of the musculoskeletal system and skin, as well as research on the normal structure and function of joints, muscles, bones, and skin. NIAMS is the lead institute at NIH for research on osteoporosis and related bone diseases. Basic research involves a wide variety of scientific disciplines including immunology, genetics, molecular biology, biochemistry, physiology, virology, and pharmacology. Clinical research addresses the fields of rheumatology, orthopedics, bone endocrinology, sports medicine, and dermatology.

### RESEARCH DIRECTIONS

NIAMS supports programs of research and research training in the fields of arthritis, musculoskeletal diseases, bone biology and bone diseases, muscle biology, and skin diseases. Examples of ongoing nutrition research supported by NIAMS are as follows:

- Studies on the function of diets and nutrients in osteoarthritis, autoimmune diseases such as rheumatic arthritis and lupus, inflammation, and joint pain
- Research on nutritional regulation of muscle growth and repair
- Investigation of dietary risk factors for bone loss and dietary intervention to prevent bone fractures

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## National Institute of Dental and Craniofacial Research (NIDCR)

<http://www.nidcr.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$14,428,946
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	3.5%

### OVERVIEW

The mission of the National Institute of Dental and Craniofacial Research (NIDCR) is to improve dental, oral, and craniofacial health through research, research training, and the dissemination of health information. NIDCR has a diverse portfolio of research related to taste, smell, diet, nutrition, diabetes, obesity, and oral health, including specific research on oral cancer, orofacial clefting, dental caries (cavities), and periodontal disease.

NIDCR supports research on the three underlying components of caries: oral bacteria, the biology of teeth, and the important role of diet and nutrition. Both the types of food consumed and the eating behaviors themselves are key factors in the development of caries. A better understanding of the complexity of influences on oral health, including the role of behavior, diet, and nutrition, will be essential to designing effective strategies and interventions to improve oral health.

### RESEARCH DIRECTIONS

#### Nutrition and oral health

- Influence of fluoride, exposure to sugared beverages, and other dietary factors on caries in adolescents
- Role of genetics, diet during infancy and early childhood, and other factors in the development of early childhood caries in high risk populations
- Impact of dietary and behavioral change interventions to reduce sugar-sweetened beverage consumption on prevalence of severe early childhood caries
- Impact of circulating maternal vitamin D on children's primary tooth development and dental caries experience
- Development of novel probiotics for the treatment of Sjögren's syndrome and for the control and prevention of dental caries and periodontal disease
- Roles of dietary components and/or plant extracts in regulating the inflammatory processes of periodontitis and rheumatoid arthritis
- Characterization of novel innate immunity factors in human milk and their role in reducing oral HIV transmission via breastfeeding
- Identification of nutritional biomarkers during pregnancy and genetic variants associated with risk of oral clefts
- Impact of Vitamin A in the maternal diet on facial development and risk of oral clefts

- Mechanisms by which taste and smell are integrated to impact the sensory experience of flavor and guide behavior

#### Microbiology

- Mechanisms by which the oral bacteria that cause caries coordinate the uptake and metabolism of sugars to maximize their growth and acid production
- Identification of dietary compounds that may prevent the development of caries by inhibiting harmful biofilm formation while leaving beneficial microbes intact
- Characterization of the relationship between oral bacteria and obesity
- Association of factors such as an altered gut microbiome and nutritional deficiencies with adverse outcomes in HIV-exposed infants
- Effect of diet and the oral microbiome on oral pediatric HIV vaccine efficacy

#### Diabetes and metabolic syndrome

- Impact of glycemic control on the integration and survival of dental implants in diabetic patients
- Association between diabetes and periodontal disease
- Molecular mechanisms underlying diabetic osteopenia

#### Oral cancer

- Use of vitamin D3 as a dietary supplement to improve the efficacy of an oral cancer treatment
- Use of plant extracts to prevent and treat oral cancer
- Development of a mouthwash formulation containing natural antioxidants to prevent oral mucositis, a common side effect of chemo-radiation treatment for head and neck cancer

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## National Institute on Deafness and Other Communication Disorders (NIDCD)

<http://www.nidcd.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$19,861,660
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	4.7%

### OVERVIEW

NIDCD conducts and supports research and research training on normal mechanisms, as well as on diseases and disorders of hearing, balance, taste, smell, voice, speech, and language.

#### Chemical Senses—Taste and Smell

The chemical senses—more commonly known as taste, smell, and chemesthesis (chemically provoked irritation)—enable us to use chemical signals to communicate with the environment and each other. For people, memories of taste and smell experiences are vivid and long lasting, and play an important role in our enjoyment of life.

The chemical senses are important for regulating food preferences and intake. They evolved to help humans and other animals survive in environments in which required nutrients were scarce and many plants contained poisonous, bitter compounds. Consequently, we seek out sweet, fatty foods and tend to reject the bitterness that characterizes many nutritious vegetables. Although this behavior made sense as humans were evolving, an almost limitless availability of high-calorie foods today can cause the normal function of taste and smell to lead to overconsumption and obesity. More than 2 of every 3 adults are considered to be overweight or obese, and more than 1 of every 3 adults is considered to be obese. Individuals who are overweight or obese are at risk of numerous serious conditions (e.g., Type 2 diabetes, heart disease, and sleep apnea).

People with smell disorders often have problems appreciating the smell of foods and claim that food is less enjoyable. They may change their eating habits, which may have a long-term impact on overall health. Loss of the sense of smell may also cause a person to add too much sugar or salt to make food taste better. This can be a problem for people with certain medical conditions such as diabetes or high blood pressure. In addition, cancer treatments such as radiation and chemotherapy may result in taste and smell loss and an associated decrease in appetite, complicating treatment.

Humans seek out their preferred flavors in foods. Flavor involves interactions between the sensors that signal taste, temperature, touch, smell, and chemesthetic sensations associated with our foods and the parts of the brain that interpret, remember, or think about them. Flavor plays an important role in determining whether someone accepts a particular food and how much of it they choose to eat. Scientists studying the chemical senses are interested in learning more about the molecular and developmental bases for how flavors influence food intake and overall health.

Scientists are interested in learning more about how the body detects and responds to salt, fats, and other food characteristics that humans seek out. Data gained from these studies can help us determine new strategies to control overconsumption and improve health without reducing our enjoyment of food. Ongoing research is studying the structure and function of discrete taste, smell, and chemesthetic receptors, as well as their targets within the brain.

## RESEARCH DIRECTIONS

### NIDCD's Priority Areas in Taste and Smell Research

With the help of experts in the field of Chemical Senses, NIDCD has identified the following areas of research opportunity and areas where gaps in knowledge are hampering our understanding. For more detail, please refer to [NIDCD's Strategic Plan for Research 2017-2021](#).

#### Priority Area 1: Understanding Normal Function

- **Fundamental Biology of Chemosensory Function:** Continue to develop and apply new tools and approaches to delineate the organization of molecules, cells, and neural circuits underlying the function of the chemesthetic (trigeminal), gustatory and olfactory systems, including development, cell turnover, regeneration, and plasticity.
- **Peripheral and Central Bases of Flavor:** Understand the complex interactions between peripheral and central aspects of flavor perception, including retronasal or orthonasal olfaction, oral chemesthesis (chemical irritation), taste, oral somesthesia (temperature, texture), memory, and motivational state (such as hunger).
- **Sentinel/Sensory Functions:** Describe how chemical senses help us avoid dangers such as spoiled or contaminated foods, how they detect potentially toxic chemicals in the environment and in our bodies, and how these protective functions can be damaged and regenerated.
- **Genetic Aspects of Chemosensory Sensitivity:**
  - **Genomics:** Identify genes involved in the development and normal function of the taste and smell systems, including the use of single-cell profiling approaches.
  - **Variation:** Describe the normal variation in taste and smell sensitivity. Identify the genes involved in order to understand what is outside the range of normal function. Describe how such variation may relate to susceptibility for human communication disorders.
  - **Experience:** Identify genes involved with storing memories of taste and smell. Determine how experience influences future diet.
  - **Epigenetics:** Describe how external factors (e.g., sensory experience, diet, stress) activate and deactivate genes.
- **Central Control of Taste and Smell:** Characterize top-down control within the central nervous system that modulates sensory input, sensory processing, and perception, and determine how such activity may change depending on internal state, motivational or cognitive factors.

- **Developing Tools to Measure Taste and Smell Function:** Refine, develop, and apply appropriate psychophysical and behavioral methods for assessing taste and smell functions in animal models and humans. Provide practicing physicians with standardized tools to test taste and smell during physical exams or routine office visits. Develop criteria and metrics for the range of “normal” taste and smell by analogy to hearing and vision.
- **Develop Novel Approaches to Alter Taste Function:** Alter the levels of salt, sugar, and fat intake using innovative methods such as using artificial substitutes or changing learned flavor preferences.

#### Priority Area 2: Understanding Diseases and Disorders

- **Genetic Disorders:** Clarify and classify taste and smell disorders caused mainly by significant genetic alterations (e.g., ciliopathies and channelopathies). Determine the normal range of variation of function in the chemical senses as related to genetic polymorphisms.
- **Environmental Insults on Taste and Smell:** Identify the mechanisms that contribute to taste and smell loss and/or dysfunction resulting from radiation, chemotherapy, head trauma, and toxins.
- **Sinusitis/Rhinitis:** Identify the molecular and cellular bases for loss of olfaction following nasal cavity or sinus infection, the most common cause of temporary and permanent olfactory loss.
- **Understanding How the Activity of the Chemical Senses Can Lead to Excessive Consumption or Malnutrition:** Determine whether calorie intake is affected by normal variation or altered function of taste and smell activity.
- **Epidemiology:** Describe the incidence and prevalence of taste and smell loss and dysfunction. For example, as the population ages, determine how many more people report taste and smell problems that affect quality of life. Enable practical approaches for wider integration of standardized chemosensory measurements into large-scale epidemiological and clinical studies.

#### Priority Area 3: Improving Diagnosis, Treatment, and Prevention

- **Improved Diagnostic Tools and Pharmacological Treatments:** Develop and validate tests to evaluate taste and smell function that are practical and affordable for use in the office setting. Develop drugs to treat taste and smell dysfunction, especially drugs which slow apoptosis (cell death) and promote regeneration.
- **Regenerative Medicine/Tissue Engineering:** Increase understanding of the properties that enable stem cells in the peripheral taste and smell pathways to proliferate and differentiate, providing insights not only for the treatment of taste and smell loss but also for the treatment of other neurological diseases.

**Enhancing the Clinical Enterprise:** Promote clinical training in the chemical senses to encourage development of animal models of relevant disorders and promote clinical and translational research, involving interdisciplinary teams of clinicians and basic scientists.

#### Priority Area 4: Improving Outcomes for Human Communication

- **Translational Research:** Translational research in the chemical senses is in its infancy, due in part to the modest amount of clinical research that has been conducted. Currently, no evidence-based preventive measures, interventions, or treatments are applied to taste and smell dysfunction. Comparative effectiveness research is premature because of the lack of intervention and treatment strategies and decisions. Because taste and smell loss become increasingly common in a population with a growing proportion of older adults, the NIDCD has identified translational research in the chemical senses as a critical gap area.

## **OUTLOOK**

Nutrition is often a significant factor in studies of taste and smell, and NIDCD will continue to support chemosensory/nutrition research through the Taste and Smell Program. Because this research is often of trans-NIH relevance, NIDCD will continue to collaborate with other components of the NIH.

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## National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

<http://www2.niddk.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$558,634,836
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	28.4%

### OVERVIEW

Since its creation in 1950, NIDDK's research responsibilities have involved nutrition-related research to prevent and treat multiple diseases and disorders, including liver and biliary diseases; pancreatic diseases; gastrointestinal, digestion, and absorption disorders; diabetes; obesity; a variety of endocrine disorders; kidney and urological diseases; metabolic diseases, including cystic fibrosis; and eating disorders. This research is supported by three divisions: the Division of Diabetes, Endocrinology, and Metabolic Diseases (DEM); the Division of Digestive Diseases and Nutrition (DDN); and the Division of Kidney, Urologic, and Hematologic Diseases (KUH). Specific programs funding nutrition-related research are listed below:

- [Clinical and Epidemiological Nutrition Research](#)
- [Clinical, Behavioral, and Epidemiological Obesity Research](#)
- [Endocrinology and Hormone Signaling](#)
- [Gastrointestinal, Nutrition, and Liver Research in HIV/AIDS](#)
- [Metabolic Pathways](#)
- [Metabolism, Energy Balance, and Obesity](#)
- [Nutrient Metabolism, Status, and Assessment](#)
- [Nutrition and Obesity Genetics and Genomics](#)
- [Nutrition Obesity Research Centers](#)
- [Obesity Treatment and Prevention](#)
- [Obesity, Pregnancy, and the Intrauterine Environment](#)

### RESEARCH DIRECTIONS

NIDDK fosters and supports other nutrition research and training in several areas of basic and clinical nutrition, including:

- Research to enhance the quality of measurements of dietary intake and physical activity
- Research on the social, cultural, psychological, economic, environmental, and other determinants that influence eating patterns and dietary intake
- Promote the application of nutrigenetics and/or nutrigenomics approaches to nutrition research through collaborative interaction among nutrition researchers and experts in omics technologies
- Studies elucidating the absorption, transport, and metabolism of nutrients and the biological control of such processes
- The identification of unrecognized roles of nutrients or their metabolites in health and disease

- The role of the gut microbiome in health and disease
- Research on dietary fiber to determine its chemical characteristics and its effects on intestinal microflora and food transit time; its interaction with nutrients, bile acids, and other substances in the gut; its effects on digestive enzymes and absorption; and the development of improved routine methods for analyzing its components
- Assessment of the requirement levels and metabolic roles of trace elements, with the help of reliable, newly developed analytical methods
- Investigation into the contribution of genetic and metabolic factors to obesity causation, including the molecular and genetic basis of energy metabolism and the nature of genetic factors associated with human obesity research to improve nutritional support to hospitalized patients, to improve nutritional status assessment methodology, and to acquire more information about the effects of disease states on the nutritional needs of patients
- Studies of the causes of wasting malnutrition and other nutritional disorders that occur in renal failure
- Research on the interplay of dietary factors (such as calcium, vitamin D, phosphate, protein, and oxalate) in the etiology of renal stones
- Investigation of the mechanisms by which nutrients might affect renal function
- Studies to elucidate the endocrine and metabolic basis of wasting in HIV infection and other chronic diseases
- Studies on the role of calorie intake and physical activity, and subsequent weight control, in the prevention of type 2 diabetes
- Investigation of the metabolic mechanisms of intestinal and hepatic processing of dietary carbohydrate, and the effects of other nutrients and of fiber on carbohydrate metabolism
- Investigation of the effects of nutrient antioxidants in normal and abnormal cellular function and metabolism.
- Clinical research into nutrition-related areas such as cholesterol and pigment gallstones; inborn errors in bile acid metabolism; chronic hepatitis that evolves from autoimmune, viral, or alcoholic disease; and various liver diseases, such as Wilson's disease and portal hypertension
- Investigations into the control of appetite and satiety in animals and humans
- Studies on the impact of bariatric surgery on health and on the mechanisms by which bariatric surgery may impact food intake, body weight, and obesity-related co-morbid conditions

## RESOURCES FOR NUTRITION RESEARCHERS

- **Conference support to advance nutrition research agenda:** NIDDK supports high quality conferences that are relevant to the public health and to the scientific mission of NIDDK. For more information, visit: <https://www.niddk.nih.gov/research-funding/current-opportunities/pa-16-294>

- **Digestive Diseases Research Core Centers:** Digestive Diseases Research Core Centers generate investigative resources that can be made available to the broader research community. Centers also often support pilot and feasibility programs that fund small grants to generate preliminary data to include in larger grant applications and offer enrichment activities. Further information about the Centers can be found on the overall [Digestive Diseases Research Core Centers](#) website as well as on the individual centers' websites.
- **Mouse Metabolic Phenotyping Centers:** The MMPC is a National Institutes of Health-sponsored resource that provides experimental testing services to scientists studying diabetes, obesity, diabetic complications, and other metabolic diseases in mice. For more information, visit: <http://www.mmpc.org/>
- **NIDDK Diabetes Centers:** NIDDK Diabetes Centers generate investigative resources that are available to the broader research community. Centers also provide short-term enrichment activities, as well as pilot and feasibility programs that fund small research grants designed to generate preliminary data for larger grant applications. For more information about each Diabetes Center's aims, shared resources, pilot and feasibility programs, enrichment programs, and activities, please visit their websites. More information is available at: <https://diabetescenters.org/>
- **Nutrition Obesity Research Centers:** The NORC program supports 11 Centers providing research infrastructure, including research services, enrichment programs, and collaborative activities, at academic/medical institutions throughout the U.S. The goal of the program is to foster interdisciplinary basic, clinical, and public health research. The NORC program strengthens and provides cost-effective research resources to multidisciplinary groups at institutions with an established, comprehensive research base in nutritional sciences and/or obesity and related research topics. Visit the centralized [NORC](#) website for detailed information about the NORCs, including research resources, and services available to the broader research community.
- **Training:** Nutrition research training in the areas of nutrient metabolism, obesity, and energy regulation has been encouraged. NIDDK training and career development (F, T, and K funding mechanisms) are described in more detail at the following website: <http://www2.niddk.nih.gov/Funding/TrainingCareerDev/>.

## RESEARCH DISSEMINATION

NIDDK disseminates science-based information on diabetes and other endocrine and metabolic diseases; digestive diseases, nutritional disorders, and obesity; and kidney, urologic, and hematologic diseases. NIDDK health communication programs ensure that this information is imparted to health care providers and the public for the direct benefit of patients and their families. To learn more about each of these programs and the nutrition resources they provide, visit the links below.

- [National Diabetes Education Program](#)—The National Diabetes and Education Program (NDEP) works collaboratively with its partners at the federal, state, and local levels to improve the treatment and outcomes for people with diabetes, promote early diagnosis, and prevent or

delay the onset of type 2 diabetes. NDEP is jointly sponsored by the NIH and the Centers for Disease Control and Prevention (CDC).

- [National Kidney Disease Education Program](#)—Diet plays an important role in helping chronic kidney disease (CKD) patients maintain good nutritional status, slow progression, and treat complications. NKDEP has developed a series of resources for health professionals, such as the CKD Nutrition Management Training Program, as well for patients.
- [Weight-control Information Network](#)—The Weight-control Information Network provides the general public, health professionals, and the media with science-based, up-to-date, culturally relevant materials, and weight management tips.

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## National Institute on Drug Abuse (NIDA)

<http://www.drugabuse.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$16,129,137
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	1.5%

### OVERVIEW

NIDA's mission is to lead the Nation in bringing the power of science to bear on drug abuse and addiction. NIDA supports research programs in basic, clinical, and translational sciences in the areas of neuroscience, genetics, medication and behavioral therapies, epidemiology, prevention, and health services, including implementation science and comparative effectiveness research.

### RESEARCH DIRECTIONS

NIDA encourages and supports a variety of nutrition-related research in human and animal subjects. Examples of NIDA-funded research and areas of interest include:

- Identifying whether, and through what mechanisms, developmental exposure, including prenatal exposure, to specific nutrients modifies subsequent vulnerability for substance use disorders
- Determining whether, and through what mechanisms, nutritional conditions affecting homeostatic regulation, food restriction, or specific nutrients alter drug taking and relapse to drug taking
- Understanding the influence of environmental exposures, including drugs of abuse and dietary components, on brain energy utilization in key systems for substance abuse and addiction
- Studies of nutritional and metabolic disorders in HIV-positive individuals with substance use disorders
- Studies of the addiction-like effects of highly palatable foods, and conversely, the role of appetite-regulating peptides such as orexin/hypocretin, leptin, ghrelin, insulin and GLP-1 as potential targets for treating substance use disorders
- Examining bi-directional interactions between the effects of drugs of abuse on the gut microbiome and microbial effects in the gut-brain axis on motivational and cognitive processes influencing substance use disorders
- Assessing the biological basis for co-morbidity of eating disorders and substance use disorders, including the role of stress hormones and specific neurotransmitter systems
- Behavioral and neurobiological studies of reward processing and compulsive seeking of food and drug rewards to characterize processes of dysregulated appetitive behaviors
- Identifying biobehavioral mechanisms underlying appetite changes associated with smoking cessation, including the role of genetic factors and gender differences

- Determining the prevalence of malnutrition and nutritional risk factors in patients undergoing treatment for substance use disorders

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## National Institute of Environmental Health Sciences (NIEHS)

<http://www.niehs.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$53,955,459
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	7.0%

### OVERVIEW

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. As an institute, NIEHS is uniquely positioned to investigate the interplay between environmental exposures, human biology, genetics, and common diseases that limit longevity and quality of life.

Research conducted over the past several decades indicates that disease risk is multifactorial, influenced by diverse elements that include exposure to environmental agents – including nutritional sources - and genetic susceptibility. From a pathophysiological standpoint, many environmental exposures affect common biological pathways that are linked to disease, such as oxidative stress and inflammation; these same pathways are likely to be influenced by diet and nutritional status. Thus, variability in disease risk in response to environmental exposures within populations may be at least partially attributable to unmeasured variation in nutritional status and/or other components of the diet. The NIEHS nutrition research portfolio includes projects aimed at: 1) more clearly identifying those dietary components that influence the onset or trajectory of environmentally-linked disease, and 2) increasing our understanding of the mechanisms underlying the interplay between diet/nutrition and exposure to environmental agents and disease risk. Elucidating those mechanisms underlying these complex interactions will enable the development of effective prevention and intervention strategies to mitigate environmentally-induced diseases.

### RESEARCH DIRECTIONS

#### Applied Research

- Expand existing studies to look at the interplay between diet and health outcomes, including secondary data analysis in on-going studies
- Encourage studies to test or develop novel tools or methods of exposure assessment for future studies that will look at diet and environment
- Refine and validate dietary assessments for exposure characterized subpopulations
- Add new environmental measures or assays to existing dietary studies
- Develop new analytical methods or models to incorporate multiple layers of data (diet and environment)
- Assess the joint action of multiple environmental insults, including chemicals, nonchemical stressors, and nutritional components, on toxicity and disease, and identify interactions resulting from combined exposures.

## Basic Research

- Identify pathways during critical life stages where the effects of dietary parameters will have the most pronounced effects on health outcomes
- Use well established animal models of environmentally-induced disease to study the interaction of diet with environmental toxicants
- Identify key molecular targets in relevant biologic pathways that could be useful in prevention/intervention studies

## Examples of Nutrition Research Supported by NIEHS

- The impact of dietary fat on arsenic-induced hepatotoxicity
- Silica-accelerated autoimmunity and the role of dietary lipids
- The epigenetic effects of dietary polyphenols and zeronal
- Diet, physical activity, and the relationship between air pollution and CVD
- Health disparities that can lead to both poor nutrition and increased environmental exposures in vulnerable populations
- The combined effects of high fat diet and air pollutants on inflammation and insulin resistance
- Increased neurotoxicity of manganese in individuals with iron deficiency
- Combined exposures to poor nutrition and chlorinated organics that lead to obesity, CVD, and cancer
- Nutrients that modify the toxicity of methylmercury in a fish-eating population
- Ameliorating environmental risk factors for autism with folate supplements
- The protective effects of fatty acids against phthalate-induced inflammation
- The protective effects of selenium against neurological damage
- The impact of serum vitamin D levels on susceptibility to inhaled pollutants in urban children with asthma
- The impact of prenatal diet on how air pollutants affect neurodevelopment
- Health effects or toxicity of various dietary supplements such as Ginkgo biloba
- The endocrine disrupting effects of genistein in soy formula
- The efficacy of chemoprevention interventions with broccoli sprouts in populations exposed to high levels of food (aflatoxins) and air-borne toxicants (alkylanilines and polycyclic aromatic hydrocarbons)
- Prevention of UV-induced carcinogenesis by cyanidin-3-glucoside

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## National Institute of General Medical Sciences (NIGMS)

<http://www.nigms.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$62,586,706
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	2.5%

### OVERVIEW

The principal mission of NIGMS is to support fundamental research that undergirds all biomedical investigations. The major focus of the institute is on research concerned with expanding knowledge of fundamental biological structure and function at the cellular and molecular levels. Extramural studies supported by the institute include investigations in the biophysical sciences and the physiological sciences, in particular the response of the whole body to trauma; the structure and function of the cell; the basic mechanisms of heredity; and the molecular aspects of the interactions between therapeutic drugs and agents and their target cells, tissues, or organs.

The majority of the nutrition-related research supported by NIGMS is in its trauma and burn injury program area, which focuses on the mechanisms involved in the body's systemic responses to trauma. Thus, research on the role of nutrition in decreasing morbidity rates and morbidity for patients who suffer serious trauma or burn injury is of significant interest to the institute. NIGMS-supported scientists are exploring nutritional requirements following severe trauma and sepsis, new concepts in parenteral therapy, branched chain amino acid feeding during injury, and cellular function during septic and hemorrhagic shock. In addition, studies are being supported that are investigating the cellular changes and mechanisms responsible for the protein wasting associated with nutritional deprivation.

### RESEARCH DIRECTIONS

The following areas of basic research on diseases and traumatic injury are being investigated:

- The role of diet in organ and cellular responses to cytokines
- Changes in metabolic patterns and nutritional requirements following severe injury
- Hormonal imbalance following injury and its effects on metabolism
- Mechanisms involved in producing a protein catabolic state after injury
- Adaptive regulation of nutrient transport by the gut; transport appears to be governed by nutrient-receptor proteins on specific cell surfaces
- Mechanism of suppression of lipoprotein lipase activity by tumor necrosis factor (TNF)
- Determining components of the host defense system (neutrophils, immunomodulators, etc.) that are important in preventing bacterial translocation
- Identifying receptors that recognize serum proteins carrying galactosyl sugar residues, including hormones that regulate the rate and extent of nutrient uptake and processing in the liver
- The importance of enteral versus parenteral feeding

- The inclusion of glutamine and human growth hormone in nutritional regimes
- Interactions between and regulation of arginine, citrulline, ornithine, and urea metabolism following trauma or sepsis

Research supported by NIGMS serves to establish the foundation of new knowledge needed to make advances in the understanding of biological processes and many diseases. Those investigations that are nutrition-related will help to provide the concepts and relevant information necessary to develop new treatments, particularly in the area of traumatic injury, and hence, serve to decrease morbidity and mortality.

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## National Institute of Mental Health (NIMH)

<http://www.nimh.nih.gov/index.shtml>

<b>Nutrition Research Spending (FY 2016):</b>	\$33,607,009
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	2.2%

### OVERVIEW

The mission of NIMH is to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery, and cure.

### RESEARCH DIRECTIONS

#### The Eating Disorders Research Program

This program supports research on the etiology, core features, longitudinal course, and assessment of eating disorders. It also supports studies focusing on the elucidation of risk factors for the onset or recurrence of psychopathology. Intervention development studies grounded in findings from psychopathology are supported as the next step in the translation of basic research to effective treatments.

#### Areas of Emphasis

- Identifying phenotypes and endophenotypes as new targets for assessment and therapeutics that are emerging from integrative genetics, pathophysiology, and psychopathology research
- Conducting translational research on cognition, emotion and affect dysregulation to find new strategies for treating eating disorders
- Identifying ways in which genetic and environmental factors interact to raise or lower risk for eating disorders
- Developing new preventive and treatment interventions targeted to specific cognitive, emotional, or interpersonal components of the psychopathology of eating disorders
- Using modern psychometric and statistical theories to advance fundamental conceptualizations of nosology and consequent approaches toward more focused assessment and treatment of the many dimensions and subtypes that constitute eating disorders

#### Anxiety and Related Disorders of Behavioral Dysregulation Program

This program supports research on the neural mechanisms and trajectories of anxiety disorders and associated disorders of behavioral dysregulation during development. The program supports research on a range of clinical symptoms and phenotypes including anxiety disorders (e.g., generalized anxiety disorder, social anxiety disorder, specific phobias, panic disorder, agoraphobia, separation anxiety

disorder, selective mutism), obsessive-compulsive disorder, eating disorders (e.g. anorexia nervosa, bulimia nervosa, binge eating disorder), and related phenotypes and prodromes.

#### Areas of Emphasis

- Examining the etiology, neurodevelopmental mechanisms, developmental course, periods of vulnerability or sensitivity, or risk processes related to the onset, progression, recurrence, and remission of these disorders and their relevant components
- Characterizing the developmental trajectories of brain maturation and dimensions of behavior to understand the roots of mental illness
- Identifying sensitive periods for typical and atypical trajectories
- Elucidating biomarkers and mechanisms of disease progression
- Delineating mechanisms of sex/gender differences in the development of behavioral dysregulation
- Testing integrative models that incorporate multiple levels of analysis and Research Domain Criteria (RDoC) approaches

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## National Institute on Minority Health and Health Disparities (NIMHD)

<http://www.nimhd.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$24,232,698
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	8.6%

### OVERVIEW

NIMHD’s mission is to lead scientific research to improve minority health and reduce health disparities. NIMHD works independently and in partnership with other NIH Institutes, Centers, other federal agencies, and community organizations:

- Plan, coordinate, review, and evaluate NIH minority health and health disparities research and activities
- Conduct and support research in minority health and health disparities
- Promote and support the training of a diverse research workforce
- Translate and disseminate research information
- Foster innovative collaborations and partnerships

Over the last two decades the overall health of the Nation has improved significantly. However, racial and ethnic minority, rural, low socioeconomic status (SES), sexual and gender minority (SGM), and other underserved populations continue to experience a disproportionate burden of illness, disability, and premature death. Poor nutrition can impact people for a lifetime and may contribute to health disparities across many populations. Health disparities in cardiovascular disease, cancer, infant mortality, obesity, asthma, diabetes, and stroke may all be impacted by nutrition.

The higher prevalence of morbidity, poor outcomes, and chronic diseases, including diabetes, hypertension, cardiovascular disease, and certain cancers experienced by African Americans, American Indians, and Latinos are substantially greater compared to Whites. Pacific Islanders also have a higher prevalence of diabetes in comparison to Whites. These are conditions that are influenced by nutrition and diet-related behaviors. Limited research has been conducted on the biological and genetic bases for these disparities, which may provide further understanding about the causes of these disparities among racial and ethnic populations. Neighborhood and other social factors, that sustain the existence of “food deserts” in low income communities reduce access to food sources that can promote healthier eating. The biological, genetic, socioeconomic, environmental, cultural, and structural differences that exist between racial and ethnic minorities and Whites perpetuate these nutrition-related health disparities. Conducting further research in understanding the health determinants associated with these disparities can advance our understanding and development of culturally appropriate solutions for these nutrition-related health disparities.

## **RESEARCH DIRECTIONS**

NIMHD supports nutrition research that examines the causes, treatment, and prevention of diseases disproportionately impacting health disparity populations. The following are selected examples of NIMHD's nutrition-related projects:

### **Mechanisms and Risk Factors**

- Analyzing fatty acids-mediated inflammation and ethnic disparity in pregnancy outcomes in African Americans
- Understanding the relationship between obesity on stress in south and southeast Asians
- Building multi-level models to examine the relationship between obesity and prostate cancer in African Americans
- Examining obesity and adverse dietary patterns as susceptibility factors to pollutant exposure in chronic obstructive pulmonary disease among low-income communities
- Determining the effect of food marketing and attentional biases on eating behaviors in African American adolescent girls
- Investigating the associations between obesity, built environment, biological, behavioral, and psychosocial determinants leading to cardiovascular disease mortality in African Americans

### **Intervention and Translation Research**

- Conducting health promotion interventions to induce positive changes in behaviors related to increased risk of chronic diseases among HIV positive African American men
- Developing comparative and cost-effectiveness of population strategies to improve diet and reduce cancer in low-income populations
- Examining wireless technology assisted weight management in African American pre-diabetic adolescents and young adults
- Implementing a nutrigenetic intervention to reduce liver fat in Latinos
- Restoring the eating environment by advancing sustainable community-based participatory research interventions to improve the diet of rural Appalachian children
- Tailoring behavioral intervention for overweight African American and Latino men

### **Prevention**

- Developing a culturally adapted diabetes prevention program for Latinos
- Supporting health resilience among American Indians in Arizona
- Preventing and reducing obesity health disparities among Latino youth

**Nutrition Education/Outreach**

- Improving clinical encounter communications to enhance diabetes care in low-income African Americans
- Promoting healthy lifestyle behaviors to address obesity related complications of African Americans with severe mental illness using peer navigators

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## National Institute of Neurological Disorders and Stroke (NINDS)

<http://www.ninds.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$18,809,766
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	1.1%

### OVERVIEW

Created in 1950, the mission of the National Institute of Neurological Disorders and Stroke (NINDS) is to seek fundamental knowledge about the brain and nervous system and to develop better prevention, diagnostic, and treatment strategies to reduce the burden of neurological disease. NINDS conducts, fosters, coordinates, and guides basic neuroscience research, and supports translational and clinical research on the causes, prevention, diagnosis, and treatment of neurological disorders and stroke. NINDS also funds training and career development programs to nurture a talented and diverse neuroscience research workforce, and communicates scientific discoveries and their implications for neurological health to the public, health professionals, researchers, and policy-makers.

### RESEARCH DIRECTIONS

Rapid and recent progress in brain research has yielded new understanding of the interaction between nutrition and the nervous system. NINDS nutrition research supports studies examining the role of specific nutrients in a number of neurological disorders and in neuronal injury. Most studies focus on understanding the molecular and cellular mechanisms by which nutrient deficiency or metabolic conditions lead or contribute to changes in neural function, and testing the effects of nutritional supplements or modified metabolic pathways in animal models of neurological diseases. Major areas of nutrition research currently funded by NINDS include:

- Investigating the role of nutrients in brain health and development, and studying how nutrient deficiency or metabolic conditions (e.g., vitamin deficiency, type II diabetes, hyperhomocysteinemia, obesity etc.) can contribute to impaired neural function and neurological diseases
- Investigating the relationship between neural function and metabolism to better understand the mechanisms by which disrupted metabolism can result from neurological conditions
- Understanding how cellular energy metabolism affects brain function, and developing better imaging tools to visualize metabolism in the brain
- Discovering metabolic risk factors or biomarkers related to nutrition/metabolism that can predict, diagnose, or track disease progression of neurological diseases
- Investigating neurological mechanisms underlying dietary interventions, and identifying novel drug targets involved in metabolic pathways

- Testing new treatment strategies that target metabolic pathways or use nutritional supplements in neurological diseases, including traumatic brain injury, stroke, cerebrovascular disease, Alzheimer’s disease, Parkinson’s disease, multiple sclerosis, and epilepsy

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## National Institute of Nursing Research (NINR)

<http://www.ninr.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$14,238,558
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	9.8%

### OVERVIEW

The mission of NINR is to promote and improve the health of individuals, families, communities, and populations. NINR supports clinical and basic research, and research training, to build the scientific foundation for clinical practice, prevent disease and disability, manage and eliminate symptoms caused by illness, and enhance end-of-life and palliative care. The research focus encompasses health promotion and disease prevention, quality of life, health disparities, and end-of-life/palliative care. NINR seeks to extend nursing science by integrating the biological and behavioral sciences, employing new technologies to research questions, improving research methods, and developing the scientists of the future. The research mission of NINR is available at:

[www.ninr.nih.gov/AboutNINR/NINRMissionandStrategicPlan/](http://www.ninr.nih.gov/AboutNINR/NINRMissionandStrategicPlan/)

### RESEARCH DIRECTIONS

NINR views nutrition as an essential component of health promotion, disease prevention, and self and symptom management; and, as such, supports a broad range of research in the science of nutrition. The nutrition research portfolio at NINR crosses the spectrums of disease, populations, and the lifespan. Recent examples of research areas include studies elucidating the effects of nutrition in gestation, including conditions such as pre-eclampsia; examining breastfeeding outcomes and feeding difficulties in pre-term infants and their growth and long-term health outcomes; designing and testing tailored, nutritional interventions for low income and diverse populations; exploring nutritional connections and molecular mechanisms in abdominal and gastrointestinal pain for children and adults; implementing nutrition interventions in diabetes and kidney disease management; and, developing and testing a variety of interventions for prevention and treatment of obesity and cardiovascular disease. NINR has co-sponsored several nutrition-related funding announcements and recently sponsored an announcement (PA-16-428: Health Promotion Among Racial and Ethnic Minority Males) to promote research into the development and testing of innovative interventions to reduce risk factors associated with the leading causes of morbidity and mortality (e.g., smoking, poor nutrition, and alcohol use) among racial and ethnic minority men in rural, urban, and nontraditional settings. NINR also sponsored PA-15-100 Maternal Nutrition and Pre-pregnancy Obesity: Effects on Mothers, Infants and Children, which encourages R01 applications to improve health outcomes for women, infants and children, by stimulating interdisciplinary research focused on maternal nutrition and pre-pregnancy obesity; and PA-14-177 Healthy Habits: Timing for Developing Sustainable Healthy Behaviors in Children and Adolescents which seeks to encourage applications that employ innovative research to identify mechanisms of influence and/or promote positive sustainable health behavior(s) in children and youth (birth to age 21).

These studies highlight NINR's long-term commitment to health promotion, patient empowerment in the management of illness and recovery, and the reduction of disease and disability. Findings from these studies will add to the growing body of literature related to nutrition.

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## Office of Dietary Supplements (ODS)

<http://ods.od.nih.gov/>

<b>Nutrition Research Spending (FY 2016):</b>	\$36,849,745
<b>Nutrition as Percentage of Total IC Obligations (FY 2016):</b>	NA

### OVERVIEW

The mission of the ODS at the National Institutes of Health (NIH) is to strengthen knowledge and understanding of dietary supplements by evaluating scientific information, stimulating, and supporting research; disseminating research results; and educating the public to foster an enhanced quality of life and health for the U.S. population.

Dietary supplements are widely used in the United States by people who want to maintain or improve their health or reduce their risk of illness. Americans spend over \$41 billion per year on more than 75,000 products containing vitamins and minerals, herbs and botanicals, and other ingredients such as glucosamine, fish oils, and probiotics.

The Dietary Supplement Health and Education Act (DSHEA) of 1994 defined dietary supplements as products intended to supplement the diet. DSHEA also established ODS at NIH in the U.S. Department of Health and Human Services (HHS), which began operations in November 1995. Its director is Paul M. Coates, Ph.D.

Scientists are studying dietary supplements to determine their value in maintaining good health. ODS supports this research to assess the benefits and risks of dietary supplements and communicates the results of this research to scientists, health professionals, and consumers.

### RESEARCH DIRECTIONS

Examples of ODS Activities:

#### Research Support

The majority of the ODS budget supports research on dietary supplements in collaboration with many NIH Institutes and Centers. For FY2016 ODS provided \$11.2 million in co-funding 87 grants across 15 NIH institutes and centers. Since its inception, ODS has funded hundreds of conferences, workshops, and meetings on dietary supplements that help inform and direct research efforts for ODS and NIH.

<http://ods.od.nih.gov/Research/funding.sec.aspx>

#### Centers for Advancing Research on Botanical and Other Natural Products (CARBON) Program

Since 1999, in partnership with the National Center for Complementary and Integrative Health, ODS has funded multidisciplinary centers to study the health effects of botanicals at academic research institutions across the United States. These centers identify and characterize botanical ingredients, assess their biological activity and bioavailability; evaluate their effects in cells, animals, and people;

help select botanicals to test in clinical trials; and provide a rich environment for training and career development. [http://ods.od.nih.gov/Research/Dietary\\_Supplement\\_Research\\_Centers.aspx](http://ods.od.nih.gov/Research/Dietary_Supplement_Research_Centers.aspx)

### **Analytical Methods and Reference Materials**

More than 75,000 dietary supplements are estimated to be available in the U.S. marketplace, but in many cases, reliable analytical methods are not available to assess the quality of their ingredients. This ODS initiative enhances collaborative efforts to develop and validate analytical methods and develop reference materials for commonly used dietary supplements.

<http://ods.od.nih.gov/Research/AMRMPProgramWebsite.aspx>

### **Evidence-Based Reviews**

ODS sponsors systematic reviews of the efficacy and safety of dietary supplements and the identification of research needs. Reviewed topics have included ephedra, omega-3 fatty acids, vitamin D, soy, berries and B vitamins, and multivitamin/mineral supplements. [http://ods.od.nih.gov/Research/Evidence-Based\\_Review\\_Program.aspx](http://ods.od.nih.gov/Research/Evidence-Based_Review_Program.aspx)

### **Training and Career Development**

ODS provides support for postdoctoral students and scientists at universities across the United States, as well as in government agencies. This program's goal is to expand the number of well-qualified researchers who investigate dietary supplements, with an emphasis on training young investigators, minorities, and women. Program components include:

- ODS Research Scholars Program: <http://ods.od.nih.gov/Research/Training.aspx>
- Mary Frances Picciano Dietary Supplements Research Practicum: <https://ods.od.nih.gov/Research/dsrp.aspx>
- John A. Milner Fellowship Program – A joint activity with the USDA Beltsville Human Nutrition Research Center: [https://www.ars.usda.gov/ARSUserFiles/80400500/pdf/MilnerFellowshipfinal20060914\(f\).pdf](https://www.ars.usda.gov/ARSUserFiles/80400500/pdf/MilnerFellowshipfinal20060914(f).pdf)

### **Population Studies**

This program evaluates dietary supplement use, including the assessment of biological measures of supplement exposure and associated health effects in representative populations. This effort will build the capacity of ODS to analyze population data, such as those from the National Health and Nutrition Examination Survey (NHANES). Initial work has focused on vitamin D through collaborative research projects with several universities and government agencies.

### **Vitamin D Initiative**

ODS leads efforts to advance knowledge of vitamin D's importance to health, and to accurately measure vitamin D levels in foods and vitamin D status in the U.S. population. ODS has funded the development of standard reference materials to assess this nutrient, and has sponsored evidence-based reviews to inform updated recommended dietary allowances and safe levels of intake for vitamin D. ODS also

sponsors conferences and workshops on vitamin D and leads a federal working group to identify and meet research needs. <https://ods.od.nih.gov/Research/VitaminD.aspx>

### **Dietary Supplement Ingredient and Label Databases**

The Dietary Supplement Ingredient Database (DSID), developed by the USDA Nutrient Data Laboratory in collaboration with ODS and other federal agencies, provides estimated levels of ingredients in dietary supplement products sold in the United States. The DSID is intended primarily for research applications. <https://dietarysupplementdatabase.usda.nih.gov/>

The Dietary Supplement Label Database (DSLDB), a collaborative project of ODS and the National Library of Medicine, contains information taken from the labels of approximately 60,000 dietary supplement products available in the U.S. marketplace. Each month approximately 1,000 labels are added to the DSLDB. [https://ods.od.nih.gov/Research/Dietary\\_Supplement\\_Label\\_Database.aspx](https://ods.od.nih.gov/Research/Dietary_Supplement_Label_Database.aspx)

### **Communications**

ODS develops and disseminates information about the latest science on dietary supplements for a wide range of audiences including researchers, healthcare providers, industry, and consumers. This information is provided through the ODS website, fact sheets, e-newsletters, and staff presentations at professional and consumer-focused meetings.

- Supplement fact sheets: <https://ods.od.nih.gov/HealthInformation/makingdecisions.sec.aspx>
- To sign up for the listserv: [https://ods.od.nih.gov/News/ODS\\_ListServ.aspx](https://ods.od.nih.gov/News/ODS_ListServ.aspx)

### **Information Resources on Dietary Supplements**

ODS makes accurate and up-to-date scientific information about dietary supplements available to researchers, health care providers, and the public, through the following resources:

- **Dietary Supplement Fact Sheets:** These overviews of dietary supplement ingredients (including vitamin D, omega-3 fatty acids, and weight-loss supplements) are written for varied audiences, including researchers, health care providers, and consumers. Consumer fact sheets are also available in Spanish.
- **PubMed Dietary Supplement Subset:** The subset is designed to limit search results to citations from a broad spectrum of dietary supplement literature including vitamin, mineral, phytochemical, ergogenic, botanical, and herbal supplements in human nutrition and animal models.
- **Computer Access to Research on Dietary Supplements (CARDS):** This searchable database provides information on federally funded research projects pertaining to dietary supplements.
- **Dietary Supplement Ingredient Database (DSID):** This database provides the amount of nutrients in some dietary supplements based on chemical analysis.

- [Dietary Supplement Label Database \(DSLDB\)](#): This database contains information taken from the labels of the dietary supplement products available in the U.S. marketplace.

### **ODS Newsletters**

ODS distributes three [electronic publications](#) through the ODS listserv:

- *ODS Update*, sent out periodically, includes news about ODS programs, staff publications and presentations, dietary supplement fact sheets, databases, meetings, and exhibits.
- *The Scoop*, a consumer-focused e-newsletter, is sent out several times a year. Each issue has a slightly different theme such as multivitamins or dietary supplements and aging.
- ODS informs the listserv about timely announcements through the *Special Supplement*.

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## Warren Grant Magnuson Clinical Center (CC)

<http://clinicalcenter.nih.gov/>

### OVERVIEW

The Clinical Center at the National Institutes of Health (NIH) in Bethesda, Maryland, is part of the NIH's intramural science research program and is the nation's largest hospital devoted entirely to clinical research. It is a national resource that makes it possible to rapidly translate scientific observations and laboratory discoveries into new approaches for diagnosing, treating, and preventing disease. Currently, there are about 1,600 clinical research studies in progress at the NIH Clinical Center. The clinical trials at the NIH Clinical Center are predominantly Phase I and Phase II, often first-in-human to test safety and efficacy.

More than 500,000 patients, from all 50 states and throughout the world, have participated in clinical research at the Clinical Center since it opened in 1953.

The Clinical Center promotes translational research—that is, the transference of scientific laboratory research into applications that benefit patient health and medical care. The "bench-to bedside" approach adopted in 1953 locates patient care units in close proximity to cutting-edge laboratories conducting related research. This facilitates interaction and collaboration among clinicians and researchers. Most importantly, patients and families in the Clinical Center benefit from the cutting-edge technologies and research, and the compassionate care that are the signature of the NIH.

The Mark O. Hatfield Clinical Research Center was opened in 2005. The facility houses inpatient units, day hospitals, and research labs and connects to the original Warren Grant Magnuson Clinical Center. Together, the Magnuson and Hatfield buildings form the NIH Clinical Center. They serve the dual role of providing humane and healing patient care and the environment clinical researchers need to advance clinical science. It was named in honor of Senator Mark O. Hatfield of Oregon, who supported medical research throughout his congressional career.

The 870,000-square-foot Hatfield building has 200 inpatient beds and 93 day-hospital stations. This arrangement can be easily adapted to allow more inpatient beds and fewer day-hospital stations, or vice versa, because the facility's design is highly flexible.

### Nutrition Research Services

Clinical Research Dietitians consult with NIH Institute and Center investigators to plan, design, and implement nutrition-related components of proposed research protocols. Dietitians recommend optimal methodologies to assure valid and reliable data and assist with data collection, analysis, interpretation, and manuscript preparation. Dietitians advise on the benefit and appropriateness of adding nutrition services to existing research protocols.

Nutrition Research Services include:

- **Research Meals**  
Purpose: to control food and nutrient intake to meet protocol needs. Research meals are prepared in a dedicated kitchen utilizing specialized equipment and software.
- **Dietary Intake and Eating Behavior Assessments**  
Purpose: to quantify energy and nutrient intake for a defined period of time; to characterize eating behaviors. Specialized software and questionnaires are utilized to analyze food intake.
- **Body Composition Analysis**  
Purpose: to assess lean and fat mass.
- **Nutrition Counseling**  
Purpose: to provide nutrition education and counseling to research subjects as part of protocol requirements.

## **CONTACT**

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