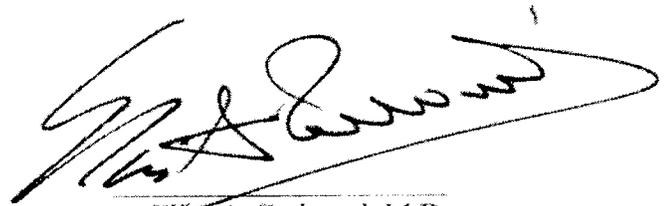


DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

STRATEGIC PLAN FOR BASIC BEHAVIORAL RESEARCH

A handwritten signature in black ink, appearing to read 'Elfas A. Zerhouni', written in a cursive style. The signature is positioned above a horizontal line.

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Director, NIH

Department of Health and Human Services
National Institutes of Health

STRATEGIC PLAN FOR BASIC BEHAVIORAL RESEARCH

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Strategic Plan for Basic Behavioral Research

Executive Summary

In House report No. 110-231, the House Committee on Appropriations requested that the National Institutes of Health (NIH) Director instruct the Office of Portfolio Analysis and Strategic Initiatives (OPASI), using OBSSR (Office of Behavioral and Social Sciences Research) expertise, to prepare a strategic plan for basic behavioral research. This plan should include the amount spent in fiscal years 2006 and 2007, by institute and center, on basic behavioral research, and a plan for NIH's investment in basic behavioral research for fiscal year 2008 and beyond. This strategic plan should also identify gaps in the NIH basic behavioral research portfolio.

This report, the NIH response to the House Committee's request, was prepared by OPASI and OBSSR, in consultation with the NIH Institutes and Centers (ICs) and the other programmatic offices within the Office of the Director. It was informed by public input and by recommendations from the National Academies of Science and the 2004 Report of the Working Group to the Advisory Committee to the Director of NIH on Research Opportunities in the Basic Behavioral and Social Sciences.

Since 2004, the NIH investment in basic behavioral and social sciences research (bBSSR) has been approximately \$1 billion annually. This support comes from many ICs and the Office of the Director. The ICs' current and future strategic priorities and activities in bBSSR are described herein, as are trans-NIH efforts such as the NIH Roadmap for Medical Research, the NIH Genes, Environment and Health Initiative, and the NIH Blueprint for Neuroscience Research.

In order to identify potential gaps in the NIH bBSSR research portfolio, OBSSR and OPASI reviewed internal and external reports relevant to bBSSR, as well as recommendations received from a broad array of stakeholders that responded to a Request for Information published in the *NIH Guide for Grants and Contracts*. Six scientific content areas were selected for a preliminary portfolio analysis using a prototype of the Research, Conditions and Disease Categorization system (RCDC). Since RCDC contains an incomplete data set, the analysis with RCDC was only exploratory in nature. The data obtained from the various analyses indicate that the following areas may represent exciting opportunities for stronger NIH support in the future: Genes and Social Environments; Pathways to Health and Illness; Systems Approaches to Understanding Complex Health Problems; The Bases for Sustainable Culture Change; Social Relationships, Networks and Communities; Psychosocial Stressors and Dysregulation of Biological Systems; and Factors Motivating Behavior Maintenance and Change.

I. Introduction

In its report for the Fiscal Year 2008 budget for the Department of Health and Human Services (DHHS), the House Committee on Appropriations stated:

The Committee is aware that basic behavioral research focused on such areas as cognition, perception, emotion, social interaction, and learning have led to important advances and improved treatments for depression, bipolar and other affective disorders, diabetes, compliance on behavior change related to diabetes, heart disease, cancer, obesity, and more effective public health announcements and interventions. In view of the fact that 8 out of the 10 leading causes of death have a significant behavioral component and that basic research is the underpinning of advances in behavioral research, the Committee is concerned with the continued lack of focus of scientific leadership at NIH for this important field of science. However, the Committee views the new Office of Portfolio Analysis and Strategic Initiatives (OPASI) within the Office of the Director as a potentially important source of leadership in encouraging NIH investment in behavioral science research. The recent NIH reauthorization placed OBSSR within OPASI.¹ As OPASI begins to perform its function of analyzing balance and content in all NIH areas of research, it would be appropriate for OPASI to set as an initial task a review of the NIH basic behavioral research portfolio. The Committee requests that the Director of NIH instruct OPASI, using OBSSR expertise, to prepare a strategic plan for basic behavioral research. This plan should include the amount spent in fiscal years 2006 and 2007, by institute and center, on basic behavioral research, and a plan for NIH's investment in basic behavioral research for fiscal year 2008 and beyond. This strategic plan should also identify any gaps in the NIH basic behavioral research portfolio. The Committee expects to receive the strategic research plan no later than May 1, 2008 (House Report 110 – 231, Page 173).

The following report has been prepared by the National Institutes of Health (NIH) of the DHHS in response to this request.

¹Note from NIH: Section 401(c) of the Public Health Service Act (added by P.L. 109-482, the NIH Reform Act of 2006) establishes the Division of Program Coordination, Planning and Strategic Initiatives (DPCPSI). Section 401(c)(2) lists the offices to be moved with DPCPSI, which includes OBSSR. Therefore, OBSSR is not an office within OPASI, but an office within DPCPSI.

II. Background

Over the past several years, the U.S. Congress has expressed concern about support for basic behavioral and social sciences research (bBSSR) at the NIH. The Congress recognizes and the NIH agrees that continued basic research in the behavioral and social sciences is vital in order for the agency to fulfill its role as the steward of medical and behavioral research for the Nation and to achieve its mission of science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. NIH's commitment to the support of bBSSR is demonstrated by the fact that through the scientific leadership of appropriate NIH Institutes and Centers (ICs), over \$1.0 billion each year has been spent in support of this research area since FY 2004.

Definition of Basic Behavioral and Social Sciences Research (bBSSR)

Basic research in the behavioral and social sciences is designed to further our understanding of fundamental mechanisms and patterns of behavioral and social functioning relevant to the Nation's health and well-being, and their interactions with each other, with biology and the environment.

As is the case with basic biomedical research, bBSSR is designed to elucidate knowledge about underlying mechanisms and processes, knowledge that is fundamental to improving the understanding, explanation, observation, prediction, prevention, and management of illnesses, as well as promoting optimal health and well-being. The range of focus includes different levels of complexity. Basic behavioral and social sciences research involves both human and animal studies and spans the full range of scientific inquiry, from processes at the intra-individual level ("under the skin"), to mechanisms "outside the skin" that explain inter-individual, group, organizational, community, population, macroeconomic and other systems level patterns of collective behavior. The domains and units of analysis can include intra-organismic as well as inter-organismic factors ("cells to society"), over varying units of time from nanoseconds to centuries, and including lifespan developmental phases and phenomena that may occur within and across generations. Some would argue that it is impossible to separate basic and applied science because one is bound up in the context of the other. Yet despite the complexities, it is useful to classify research into basic and applied categories, recognizing that there will always be a grey area or a band of uncertainty whose width will vary according to one's vantage point and the rapidly evolving state of scientific knowledge.

Some additional considerations for future directions in basic BSSR are noted here as one way to identify current gaps and opportunities and move the field forward. In OBSSR's new strategic prospectus (2007)

[http://obssr.od.nih.gov/Content/Strategic_Planning/Strategic+Plan_2007/ObssrIndex.htm], bBSSR is broadly conceived to include examination of "causes" in the biomedical "reductionist" tradition as well as of "causes of the causes" within the social-ecologic framework of public health science. Like two sides of the same coin, the biomedical domain and the social-ecological domain are inextricably intertwined. Their interaction

is at the core of our understanding of complex biological-behavioral-social-health relationships. High prevalence chronic diseases are simultaneously affected by variation in the macro-environment (e.g. poverty), in lifestyle behaviors (e.g. physical activity, diet, tobacco use), and in biological susceptibility (normal variation, genetic, epigenetic). These complex interactions, and the distribution of their variation across large populations, can produce rapid and widespread changes within a single generation, such as the epidemics of lung cancer in the mid 20th century or the new epidemics of obesity and type 2 diabetes. Thus “causal mechanisms” can reside in macroeconomic and social context, in cognitive-emotional expectancies or in biological/biobehavioral factors.

The newly evolving “systems approach” to behavioral, social and population sciences, like the successful systems approach to biomedicine, brings with it new demands on basic behavioral and social sciences. Advances in mathematics, computer sciences, statistics, informatics, imaging, internet communications, sensor technology, personal digital devices, and other technological tools provide new opportunities to transform the theories, models, measures, and methods of bBSSR. These advances will facilitate improvements in the precision, sensitivity and power of traditional bBSSR tools like self-report. New approaches to data collection will forge new conceptual models of behavioral and social processes in health and illness, at individual, group, and population levels of analysis. This contemporary view potentially redefines bBSSR as the search for complex interactions and contextual determinants of health and illness within a systems framework, a science whose fundamental mechanisms include non-linear dynamic feedback loops. This broader definition of basic BSSR as an interaction of “systems within systems” permits the discovery of emergent properties not apparent from studying the behavior of individual agents in isolation. This definition and expanded view of basic BSSR was developed by OBSSR as part of its strategic prospectus (2007) in consultation with behavioral and social scientists, and science organizations. This definition is used as a starting point to further subdivide basic behavioral and social research into three categories: (A) research on behavioral and social processes; (B) biopsychosocial research; and (C) research on the development of conceptual models or methods for improved measurement, analysis, and classification of behavioral or social processes.

(A) Research on behavioral and social processes

Research on behavioral and social processes involves the study of human or animal functioning at the level of the individual, small group, institution, organization, or community. At the individual level, this research may involve the study of behavioral factors such as cognition, memory, language, perception, personality, emotion, motivation, and others. At higher levels of aggregation, it includes the study of social variables such as the structure and dynamics of small groups (e.g. couples, families, work groups, etc.); institutions and organizations (e.g. schools, religious organizations, etc.); communities (defined by geography or common interest); and larger demographic, political, economic, and cultural systems. Research on behavioral and social processes also includes the study of the interactions within and between these two levels of aggregation, such as the influence of sociocultural factors on cognitive processes or emotional responses. Finally, this research also includes the study of environmental

factors (both natural and human created) such as climate, noise, environmental hazards, residential and other built environments and their effects on behavioral and social functioning.

Examples of research topics and their implications include:

- Sensation and perception (Implications: neurological and mental disorders and disorders associated with abnormalities in vision, hearing, taste and smell)
- Emotion and motivation (Implications: depression, anxiety, schizophrenia, conduct disorders, normal psychological development, eating disorders, obesity, addictions, sleep disturbances, behavioral and cognitive treatments)
- Vulnerability and resilience (Implications: psychopathology, violence, effects of child abuse and neglect)
- Attention, learning and memory (Implications: mental disorders involving abnormalities in cognitive processes (e.g., schizophrenia, major depression), attention deficit disorders, learning disabilities, Alzheimer's disease and other dementias, cognitive rehabilitation, education)
- Language development (Implications: communication disorders, autism, learning disabilities)
- Social influences and social cognition (Implications: all-cause mortality, psychopathology, behavioral and cognitive treatments)
- Family processes and social networks (Implications: domestic violence, divorce, child abuse, psychopathology, all-cause mortality, child development, aging)
- Sociocultural and environmental processes (Implications: better understanding of social, cultural, and environmental antecedents to mental and physical illnesses)

(B) Biopsychosocial research

Biopsychosocial research (also known as biobehavioral or biosocial research) involves the study of the interactions of biological factors with behavioral or social variables and how they affect each other (i.e., the study of bi-directional multilevel relationships).

Examples of research topics and their implications include:

- Gene by environment interactions, including and epigenetic effects, over time and lifespan developmental phases (Implications: better understanding of interactions among social, genetic and environmental factors affecting mental and physical illnesses, health and well-being, and health disparities, child development, in utero-exposures and later developmental trajectories)
- Behavior genetics (Implications: addictions, psychopathology, heart disease, gene expression, cancer risk, diabetes, oral health)
- Behavioral, cognitive, and social neurosciences (Implications: effects of brain injury, neurodegenerative diseases, learning disabilities, dementia, addictions, sleep disorders, schizophrenia, neurological development, and plasticity, stigma and stereotyping, chronic stress)

- Psychoneuroimmunology (Implications: stress effects on health, HIV-AIDS, dental problems, infections)
- Psychopharmacology (Implications: addictions, tobacco control, psychopathology, brain disorders, drug treatments)
- Behavioral cardiology (Implications: cardiovascular diseases, stroke, hypertension, comorbidities)
- Social Networks and the spread of vectors of disease (Implications: natural and man-made disasters, epidemics of infectious disease such as HIV or pandemic flu, social and cultural movements, adoption of fads and fashions that alter dietary habits or physical activity)

(C) Research on the development of conceptual models or methods for improved measurement, analysis, and classification of behavioral or social processes

Research on the development of integrative systems models, as well as procedures for improving on or developing new measurement, methodologies, analysis, and classification involve the development and refinement of procedures for measuring and analyzing behavior, psychological functioning, or the social environment. This research is designed to develop research tools that could be used in other areas of behavioral and social sciences or in biomedical, social-ecological research or their interaction. Basic sciences will also advance theories or conceptual and pragmatic models by testing existing theory or developing and validating new theories or models.

Examples of research topics in this area include:

- Systems-focused approaches to understanding health, health care delivery and health policy
- Basic mechanisms underlying efficient dissemination and implementation of community-based participatory interventions, health services delivery and health policy strategies
- Information technologies
- Statistical modeling techniques
- Memory assessment
- Behavioral observation procedures
- Psychometric analysis of self-report instruments
- Qualitative and ethnographic methods
- Neuropsychological assessment
- Psychophysiological methods
- Pain Assessment
- Instruments for determining dietary intake and physical activity
- Assessment of medical adherence

Although bBSSR does not directly address disease outcomes *per se*, behavioral and social processes play a critical role in understanding the links of molecular, genetic, and

neural processes with health and disease. Basic behavioral and social sciences research provides knowledge, methodology, and measures that are essential for prediction, prevention, understanding individual variation, and controlling illness, for minimizing the collateral impact of disease, and for promoting health.

NIH Investment in Basic Behavioral and Social Sciences Research

Since 2004, the NIH investment in total BSSR (basic and applied) has been approximately \$3 billion annually, approximately \$1 billion of which supports bBSSR. Support for BSSR and bBSSR, by IC during fiscal years 2006 and 2007, and estimates for investment in fiscal years 2008 and 2009 are shown in the Tables 1 and 2, respectively. Note that these estimates are derived from the traditional coding of NIH-funded projects by individual ICs. Because each IC applies different definitions, methods, and business rules when assessing support for any particular health topic, these figures are an approximation. More consistent portfolio analysis is the expected outcome of the *Research, Condition, and Disease Categorization* (RCDC) initiative, a knowledge management tool to mine text data from NIH-funded projects. Currently under development and scheduled for release in the spring of 2009, this project will allow all of NIH to improve the reliability and consistency of coding for all diseases and research areas (including BSSR and basic BSSR), speed up the process, standardize and facilitate budget reporting by disease topics and increase transparency and scientific validity.

Table 1
 NATIONAL INSTITUTES OF HEALTH
 BEHAVIORAL AND SOCIAL SCIENCE RESEARCH
 (Dollars in Thousands)

ICs	Sum of 2006	Sum of 2007	Sum of 2008 Est.	Sum of 2009 PB
NCI	305,562	311,931	311,931	311,931
NHLBI	137,371	175,064	175,064	175,064
NIDCR	17,711	20,513	20,513	20,534
NIDDK	144,290	160,700	160,700	160,700
NINDS	128,321	126,220	126,448	126,448
NIAID	36,624	39,598	39,598	39,598
NIGMS	20,480	21,692	21,564	21,391
NICHD	418,894	422,200	430,600	430,600
NEI	52,408	56,280	56,280	56,280
NIEHS	14,740	15,343	15,343	15,343
NIA	268,172	245,441	245,860	246,100
NIAMS	20,365	19,797	19,797	19,797
NIDCD	81,361	84,828	84,855	84,792
NIMH	437,498	425,839	425,839	425,839
NIDA	454,944	463,574	463,574	468,210
NIAAA	203,165	206,916	204,433	202,389
NINR	102,020	100,666	100,666	100,767
NHGRI	11,584	10,385	10,393	10,404
NIBIB	1,534	1,689	1,689	1,697
NCRR	64,885	58,379	56,044	53,242
NCCAM	26,659	19,610	19,800	19,800
NCMHD	7,285	13,790	13,790	13,790
FIC	11,030	12,050	12,050	12,050
NLM	4,892	4,226	2,815	520
OD	28,588	30,446	28,115	25,842
RMAP	1,082	13,139	13,139	14,154
TOTAL	3,001,465	3,060,316	3,060,900	3,057,282

Table 2
NATIONAL INSTITUTES OF HEALTH
BASIC BEHAVIORAL AND SOCIAL SCIENCE RESEARCH
(Dollars in Thousands)

ICs	Sum of 2006	Sum of 2007	Sum of 2008 Est.	Sum of 2009 PB
NCI	72,663	77,614	77,614	77,614
NHLBI	46,740	65,495	65,495	65,495
NIDCR	2,808	2,687	2,687	2,690
NIDDK ²	37,214	15,855	15,855	15,855
NINDS	60,408	55,985	56,042	56,042
NIAID				
NIGMS	20,480	21,692	21,564	21,391
NICHD	122,349	129,853	132,400	133,700
NEI	49,969	54,395	54,395	54,395
NIEHS	12,271	12,542	12,542	12,542
NIA	200,160	184,195	184,510	184,690
NIAMS	4,600	2,718	2,718	2,718
NIDCD	32,274	32,011	31,897	31,885
NIMH	96,103	84,493	84,493	84,493
NIDA	142,455	148,364	148,364	149,848
NIAAA	87,069	81,463	80,485	79,680
NINR	52,468	50,628	50,628	50,679
NHGRI	1,154	793	794	795
NIBIB				
NCRR ³	0	58,379	52,676	48,569
NCCAM	4,874	5,315	5,315	5,315
NCMHD				
FIC	5,169	5,197	5,197	5,197
NLM	4,892	4,226	2,815	520
OD	5,313	5,197	5,125	2,927
RMAP	359	4,499	4,499	4,846
TOTAL	1,061,792	1,103,596	1,098,110	1,091,886

² While NIDDK reports an overall increase in BSSR compared to past years, the new definition for basic BSSR research provided by OPASI this year led to a portfolio re-evaluation and a decrease in the number of grants reported as “basic” in 2007. Most of the new BSSR is interventional in nature. The full explanation for why we have an 11% increase in BSSR is two-fold: 1) A growing recognition of the importance of behavioral interventions has led to an actual increase in the number of grants investigating such interventions; 2) New reporting systems are catching more behavioral grants than were identified previously. Note that the increase does not apply to the subset of basic behavioral research. The reason for the 57% decline in bBSSR has to do with the new, more rigorous definition of bBSSR provided this year, which led to a re-evaluation of the portfolio. It is not, in general, that the research emphasis has changed, only that the grants included in this number are more narrowly selected.

³ NCRR reports that the zero figure for 2006 support of bBSSR is a data entry error that was discovered after the official NIH Office of the Budget figures were finalized; the correct figure is \$64,885,000.

These figures demonstrate that many ICs support bBSSR and the overall support for bBSSR at NIH has remained relatively stable over the last few years. The support for BSSR in total (basic and applied BSSR) has followed the same general pattern, holding steady at approximately \$3 billion annually for the last several years. Interestingly, the ratio of 2:1 for applied vs. basic BSSR is the reverse of the typical NIH pattern of support for applied vs. basic biomedical research.

Offices of Portfolio Analysis and Strategic Initiatives and of Behavioral and Social Sciences Research

The Office of Portfolio Analysis and Strategic Initiatives (OPASI), situated in the Office of the Director, provides the NIH and its constituent ICs with the methods and information necessary to manage their large and complex scientific portfolios, identifies – in concert with multiple other inputs – important areas of emerging scientific opportunities or rising public health challenges, and assists in the acceleration of investments in these areas, focusing on those involving multiple ICs. The mission of OPASI’s Division of Resource Development and Analysis is to employ resources (databases, analytic tools, and methodologies), and to develop specifications for new resources, when needed, in order to conduct assessments based on NIH and other databases in support of portfolio analyses and priority setting in scientific areas of interest across NIH. The Division of Strategic Coordination is responsible for integrating information and managing the process by which recommendations are developed to inform the priority-setting and decision-making processes of the NIH in formulating trans-NIH strategic initiatives. These initiatives will address exceptional scientific opportunities and emerging public health needs. The Division of Evaluation and Systematic Assessments will plan, conduct, coordinate, and support program evaluations, including but not limited to, IC-specific project evaluations, trans-NIH evaluations, and systematic assessments such as those required by the Government Performance and Results Act and the OMB Program Assessment Rating Tool.

The Office of Behavioral and Social Sciences Research (OBSSR), also situated within the Office of the Director, furthers the mission of NIH by emphasizing the critical role that behavioral and social factors play in health, health care and well-being. OBSSR serves as the focal point for coordination and development of NIH policies, goals, and objectives in the behavioral and social sciences at NIH. Briefly, OBSSR’s aims include: integrating a behavioral and social sciences perspective across the NIH; disseminating behavioral and social sciences research findings; and providing advice to and communicating with the NIH Director, the Congress, other government agencies, the research community and the general public on matters regarding behavioral and social sciences research. OBSSR serves as the nexus for cross-cutting research on the role that behavioral and social factors play in the etiology, treatment, and prevention of disease and in the promotion of health and of quality life years lived. The Office’s strategic, scientific vision is described in a later section of this report.

OPASI and OBSSR can work together to play a trans-NIH coordinating role in assisting the grant-making ICs and the Office of the Director (OD) to: (a) conduct portfolio

analyses to capture the existing NIH-wide portfolio of bBSSR, including areas of overlap, across the ICs; (b) identify potential gaps or new trans-NIH extraordinary opportunities in bBSSR; (c) describe and communicate to various audiences the depth and breadth of the NIH-wide portfolio and its overarching themes; and (d) encourage each relevant IC to respond to gaps and opportunities in their area. In the above sense, OPASI and OBSSR also play a central leadership role in bBSSR. Yet it is important to note that OD offices such as OBSSR and OPASI can only advise the ICs regarding their strategic priorities. The responsibility for setting priorities and for funding any particular bBSSR initiatives ultimately rests within the ICs.

The following sections of this report describe the current and future activities in bBSSR across the NIH ICs and the programmatic offices (within the Office of the Director, NIH) that support research in this area, and descriptions of relevant trans-NIH initiatives. There is diversity in both the depth and breadth of these activities because each IC has its own unique leadership and organizational structure that is designed to meet its particular mission. The report concludes with an analysis of gaps in the NIH bBSSR portfolio and presents opportunities for future research directions in this important scientific area.

III. Current and Planned Strategic Priorities and Activities

1. National Cancer Institute

Introduction: The National Cancer Institute (NCI) established the Behavioral Research Program (BRP) in 1997 to initiate, support and evaluate a comprehensive program of behavioral research from basic behavioral research to research on the development, testing, and dissemination of disease prevention and health promotion interventions in areas such as tobacco use, cancer screening, dietary behavior, and physical activity. This mission is supported through five research branches: Applied Cancer Screening, Basic and Biobehavioral, Health Communication and Informatics, Health Promotion, and Tobacco Control. Basic behavioral and social science research is supported in each branch; however, the Basic and Biobehavioral Research Branch (BBRB), was specifically chartered as the extramural foundation for research on fundamental behavioral science to develop theoretical models, identify underlying mechanisms and principles of behavior change and conduct pre-intervention research to inform the next generation of cancer control interventions and social policies.

BBRB seeks to promote, sponsor, and support basic behavioral and social research, including biobehavioral or biopsychosocial research. Studies that examine mechanisms, principles, and theoretical underpinnings of health-related behavior across ages, racial and ethnic groups, socioeconomic strata, and cancer diagnoses are supported. The BBRB research agenda includes, but is not limited to:

- basic research in social, cognitive, and psychological processes (e.g., social comparison, mechanisms underlying neurocognitive changes associated with cancer treatment, emotion and motivation);
- biological mechanisms of psychosocial or behavioral processes related to cancer control (e.g., stress-mediated regulation of tumor biology);
- medical decision making (e.g., role of numeracy in medical decision making, elucidating decision processes involved in maintenance of healthy lifestyle behaviors);
- methodology and measurement in behavioral science research (e.g., psychophysiological assessment, measurement of stress and other psychological constructs);
- development and testing of models and theories of health behavior;
- psychosocial and behavioral consequences of cancer risk assessment (e.g., risk perception);
- basic and applied research in health communication (e.g., message framing, use of heuristics, decision support);
- genetic and environmental influences on health behaviors related to cancer control; and
- mediators and moderators of adaptation and coping

FY08 Strategic Priorities, Programs, Activities, and Portfolio

Decision Making in Cancer - Single-Event Decisions ([PA-08-063](#) for R01s and [PA-08-064](#) for R21s): This is an ongoing program announcement that invites applications for research projects that will enhance understanding of human decision-making processes so that individuals can make more informed and satisfying choices regarding their health. Specifically, the National Cancer Institute (NCI) encourages research to elucidate single-event decision-making processes at the level of the individual patient or health care provider that are pertinent to cancer prevention, detection, treatment, survivorship, or end-of-life care. Decisions involving the individual patient, provider, patient-provider dyad, patient-caregiver dyad, patient-partner dyad, or the patient-family system are appropriate for study. For the purpose of this program announcement, a single-event decision is defined as a discrete decision made at a specific point in time. Examples of single-event decisions include selecting a particular cancer treatment, choosing to have mammography screening, and deciding to accept hospice care. Discrete, single-event decisions are distinct from decisions that must be made repeatedly, such as adhering to a weight-loss program or maintaining smoking abstinence.

Centers of Excellence in Cancer Communications Research (CECCRs): The CECCRs initiative seeks to advance cancer communication science through the generation of new knowledge, theories and methodologies. Several research projects seek to improve understanding of how patients process complex information about the benefits and risks of different medical options and make decisions in the face of considerable uncertainty (e.g., Risk Communication: A Tamoxifen Prophylaxis Decision Aid; and Story-Based Breast Cancer Communication For Black Women).

Biological Mechanisms of Psychosocial Effects on Disease (BiMPED): Psychoneuroimmunology (PNI) is the study of interactions among behavior, neural and endocrine function, and immune system processes. Psychoneuroimmunology paradigms have been successfully used to study an array of diseases and health conditions (e.g., HIV/AIDS, wound healing, autoimmune diseases, depression and other psychiatric disorders, and upper respiratory infection). The Basic Biobehavioral Research Branch (BBRB) of the Behavioral Research Program, Division of Cancer Control and Population Sciences at the NCI have used BiMPED as a programmatic framework to cultivate the discovery of biological pathways that mediate influences of biobehavioral factors on malignant growth. Animal models provide compelling evidence of behavioral stress and other influences on tumorigenesis that are mediated by the central nervous system. Additionally, clinical studies suggest associations between biobehavioral states such as chronic stress and depression, and variations in the progression of established tumors. NCI seeks to encourage mechanistic studies to identify biological signaling pathways that might inform such observations. Our intent is to evaluate and encourage research that explores how neurotransmitters and neuropeptides associated with biobehavioral factors influence tumor processes like angiogenesis, apoptosis, invasion, inflammation, and metastasis. BiMPED strives to support transdisciplinary research that bridges basic cancer biology and biobehavioral science to advance our fundamental knowledge of the extent and specificity by which central nervous system regulated factors like stress,

chronic depression, and social support might regulate tumor biology. This perspective is based on the fundamental premise that any causal influence on cancer pathogenesis must ultimately be mediated by changes in the function of tumor cells, their micro- and macro-environment, or their antecedents (activity of tumor inducing viruses or mutagens, failure of DNA repair, or epigenetic changes).

Transdisciplinary Research on Energetics and Cancer (TREC) Centers: The TREC initiative fosters collaboration among transdisciplinary teams of scientists with the goal of accelerating progress towards reducing cancer incidence, morbidity and mortality associated with obesity, low levels of physical activity and poor diet. The Centers involve scientists from multiple disciplines; and encompass projects spanning the biology and genetics of energy balance to behavioral, socio-cultural, and environmental influences upon nutrition, physical activity, weight, energy balance, and energetics. A brief description of the Centers and their research focus as it related to basic biobehavioral and social sciences follows:

- The Fred Hutchinson Cancer Research Center's TREC Center is working to determine the mechanisms by which energy balance modifies and influences the process of carcinogenesis across the lifespan in a broad range of settings including cell culture, animal models, small scale human experimental studies, and population-level experimental work. Overall, the studies will address how adiposity, diet quality and quantity, and insufficient physical activity relate to cancer development and progression.
- The University of Southern California's TREC Center is focused on minority children and is examining ethnic differences in obesity-related metabolic risk factors for cancer in Hispanic and African American youth and the potential role of strength training as an innovative intervention for improving these risk factors. Investigators also are examining the biological and behavioral basis for the decline in physical activity during puberty in minority girls, as well as the "built" environment and urban sprawl as risk factors for the development of obesity in children.
- The University of Minnesota TREC Center conducts transdisciplinary research, training, and outreach on obesity and cancer in youth, family, and young adults. The Center is addressing questions about the etiology, prevention, and treatment of obesity in youth and families, and is exploring biological pathways that may link obesity to cancer.
- The Case Western Reserve University's TREC Center is conducting a spectrum of mechanism-based laboratory, clinical, and population-based studies to identify targets for prevention and control of obesity and interruption of the linkage between obesity and cancer. They have outlined a logical progression from molecular mechanisms to population cohort studies involving energetics, weight control, and public policy, with particular attention to ethnic minority populations.

Centers for Population Health and Health Disparities (CPHHD): The CPHHD initiative is a trans-NIH collaboration among the NCI, the National Institute of Environmental Health Sciences, the National Institute on Aging, and the NIH Office of Behavioral and Social Sciences Research. It was designed to accelerate scientific progress in health

disparities spanning from cells to society by supporting sophisticated, transdisciplinary research that employs evidence and methods from many disciplines to address the problem at multiple levels of analysis. The inclusion of the basic sciences including molecular biology, biochemistry, and animal models into health disparities research allows the CPHHD to build on laboratory-based studies related to allostatic load, biological determinants of stress and social isolation, and the implementation of biomarkers to better understand the biological mechanism and processes that contribute to health disparities. Laboratory methods and infrastructure developed in these areas will facilitate additional biologically oriented studies of health disparities. These studies can proceed rapidly in the coming years to inform clinical interventions, clinical practice, and population-based studies.

Examples of Relevant Funding Opportunity Announcements:

- Small Grants Program for Behavioral Research in Cancer Control (R03) – PAR-06-458
- Exploratory Grants for Behavioral Research in Cancer Control (R21) – PA-06-351
- Decision Making in Health: Behavior Maintenance (R01 and R21) – PA-05-016 and PA-06-337
- Methodology and Measurement in the Behavioral and Social Sciences – PA-07-060
- Development, Application, and Evaluation of Prediction Models for Cancer Risk and Prognosis (R21 and R01) – PA-07-022 and PA-07-021
- Studies of Energy Balance and Cancer in Humans (R01 and R21) – PA-07-176 and PA-06-405

FY08 Conferences and Workshops:

- *Mechanisms of Physical Activity Behavior Change* – November 2007
- *Tobacco Modeling Workshop* – November 2007
- *AACR-TREC-NCI Conference on Energy Balance in Cancer: Mediators and Mechanisms* – February 2008: Conference examined obesity as a manifestation of disordered energy balance, develop strategies to better identify potential mediators connecting obesity to cancer, define their mechanisms of actions and interaction, and outline a research agenda to guide critical investigation and interventions in these areas. <http://www.aacr.org/home/scientists/meetings--workshops/energy-balance-in-cancer.aspx>
- *Third Annual Workshop on Behavioral Methodologies in Cancer Research for Underrepresented Minorities* – March 2008: <http://www.dfhcc.harvard.edu/center-initiatives/initiative-to-eliminate-cancer-disparities/announcements/single-announcement/article/200/178/>
- *Stress-mediated Regulation of Cancer Biology* – June 2008: Convenes scientific experts in cancer biology and biobehavioral science to discuss and critically evaluate current evidence for biological pathways by which stress and other CNS mediated factors might influence tumor initiation and progression.
- *Incorporating Innovative Social Psychological Theory in Cancer Control Research II* – June 2008: Meeting will review latest advances in basic research in

social psychological processes (self-regulation, discrimination, social cognitive neuroscience, personality, groups, and social influence).

Relevant Training Programs:

Since 2006, NCI has sponsored an annual training workshop on behavioral methodologies. The training develops requisite skills for research on the development of procedures for measurement, analysis, and classification of behavioral and social science. The workshop topics include mixed research methods, longitudinal research designs, mediation analysis, multi-level statistical methods, behavioral genetics methodology, and measurement issues for race/ethnicity and socio-economic status.

Plans for Future Investment – FY09 and Beyond

Transdisciplinary Research to Identify Mechanisms Mediating the Influence of the Physiologic Stress Response on Tumor Biology: NCI is currently developing a new funding opportunity announcement (FOA) in this area. Release of the FOA is planned for FY09. This initiative aims to foster transdisciplinary collaborations to advance knowledge of biological mechanisms that mediate the influence of the stress response on established tumor growth and progression. Within this context, we define “stress” as exposure to a noxious or aversive stimuli/external event (“stressor”) or perception of such events that engender psychologic and physiologic changes (“stress responses”) designed to approach, avoid, or defend against the external event. The proposed initiative will increase knowledge of relevant biological signaling pathways mediated by the stress response that either directly or through a cascading chain of events modulates tumor cell biology. The initiative aims to broaden our conceptual and methodological framework for basic biobehavioral research in this area. It strives to expand the scientific constituency engaged in this research as well. The long-term objective of this effort is to discover and define specific molecular targets for assessing stress-associated influences in tumor biology and to support the development of novel therapeutic approaches for relevant cancers.

Promoting Basic Behavioral and Social Science Research in Cancer Control and Population Science: NCI is currently developing new FOAs to broaden our fundamental knowledge base in basic behavioral and social processes and biobehavioral interactions. One FOA will support the use of experimental paradigms and controlled laboratory procedures in healthy samples to elucidate mechanisms, principles and theoretical underpinnings of psychological, behavioral, and social processes with relevancy to cancer control. Small (R03), exploratory (R21) and research program project (R01) applications will be solicited. The overall purpose of this FOA is to expand the basic behavioral and social science portfolio at the NCI.

The previously described FOA, *Decision Making in Cancer - Single-Event Decisions*, has been reissued and will continue through 2009 and beyond.

National Longitudinal Study of Tobacco Use and Quitting (NLSTUQ): There are significant gaps in our understanding of the process of smoking cessation among adult and adolescent cigarette smokers. Most of what is known about the quitting process has been derived from analyses of cross-sectional survey data and from results of intervention research (clinical and community trials). However, the limitations of cross-sectional data for inferring causality and short follow-up and lack of generalizability of many intervention studies have left many questions about what it takes to successfully quit smoking cigarettes unanswered. It may take up to 10 years from the time that smokers begin the quitting process (i.e., from intention to quit) until successful quitting (Pierce, 1990). Sophisticated continuums that describe where smokers are in this process of quitting and attempts to create artificial cohorts using cross-sectional data have led to greater understanding of important predictors of and trends in quitting, but also demonstrate the need for long-term longitudinal studies of quitting to examine the relationships and inter-relationships (including interactions) among a complex set of individual behaviors and characteristics and forces at the community level. Longitudinal studies of smoking initiation have shed important light on the factors that influence uptake and cessation among teens. Follow-up in several of these studies, however, was limited to three or four years. There is no comparable cohort study of adult quitting behavior. This initiative would fund the creation of both adult and adolescent cohorts that would be followed up for 10 years after enrollment. In the broadest sense, therefore, the purpose of the planned longitudinal study of tobacco use behavior (NLSTUQ) is to understand the process and causal determinants of successful quitting -- to describe the natural history (dynamics) of quitting and maintenance behavior. The NLSTUQ will examine the complex interplay of factors at multiple levels -- individual (e.g., genetic, physiologic, psychological) and group (e.g., community, social and policy environment) -- in modifying tobacco use behavior. To address the complexity of these issues, multilevel conceptualization and research designs are necessary and it is likely that the NLSTUQ will consist of several studies using different longitudinal designs.

2. National Heart, Lung, and Blood Institute

The National Heart, Lung, and Blood Institute (NHLBI) supports and guides research on the prevention, causes, diagnosis, and treatment of heart, blood vessel, lung, and blood diseases and sleep disorders. Numerous behavioral and social factors contribute to the pathophysiology of diseases and disorders within the Institute's purview and influence their incidence, prevalence, prevention, and treatment. Therefore, the NHLBI supports behavioral and social sciences research on diseases related to its mission. Although the majority of the Institute's behavioral and social sciences research budget is dedicated to applied and clinical research, basic behavioral and social sciences research is also included.

Basic behavioral and social sciences research supported by the NHLBI includes studies of behavioral and psychosocial factors that affect the prevention, development, progression, and treatment of cardiovascular disease and its risk factors, including hypertension, metabolic syndrome, and obesity. The NHLBI also supports basic research on behavioral factors associated with sleep disturbance, restriction, prolongation, and deprivation, including sleep disruption associated with obstructive sleep apnea. The studies investigate the biological mechanisms that link behavioral and psychological factors to health and disease and encompass a variety of psychological, behavioral, and social factors.

Many studies investigate genetic influences on the expression of psychological risk factors (e.g., negative emotions such as depression and stress) that influence risk for cardiovascular diseases. Other studies evaluate the specific characteristics, as well as the neural and endocrine pathways that link these psychological factors with cardiovascular risk. Several studies also address health disparities and the effects of ethnicity and socioeconomic status on cardiovascular risk.

The Institute remains committed to supporting bBSSR. In FY 2009, the NHLBI plans to support a new initiative to reduce obesity and promote cardiovascular health by translating findings from basic research on human behavior into more effective clinical, community, and population interventions.

3. National Institute of Dental and Craniofacial Research

Basic Behavioral and Social Sciences Research (bBSSR) Program

Introduction: The National Institute of Dental and Craniofacial Research (NIDCR) recognizes that behavior, and the social context in which it occurs, are key contributors to oral health. Engaging in preventive health behaviors, living a healthy lifestyle, seeking preventive care and treatment, and following the recommendations of health care professionals are all aspects of behavior that contribute to oral health. Social relationships, community characteristics, access to preventive care and treatment, and organization of health care systems also are key aspects of the social context that contribute to oral health. NIDCR's program of bBSSR reflects the Institute's commitment to understanding the fundamental mechanisms of behavioral and social processes related to oral health.

Current Program: NIDCR's bBSSR program focuses on several key aspects of oral health: the development and maintenance of oral health behaviors, psychoneuroimmunology, acute and chronic pain, health communication, and management of serious and/or chronic craniofacial illness or injury. Additionally, the program encourages work in 3 cross-cutting areas: research to understand the oral health needs of under-served or vulnerable populations (i.e., "health disparities" research); studies to develop measures, methods, and models of oral health; and training programs to develop oral health investigators equipped to study basic behavioral and social science aspects of oral health. Currently, all research projects in this subject area are located in the extramural program.

Planned Activities: NIDCR plans an initiative for Fiscal Years 2008-2009 focused on understanding the complex relationships between behavioral and social processes and oral health:

- *Developing Complex Models of Oral Health Behavior:* Traditional models typically explain health behavior in terms of a rational, linear, uni-directional set of causes and effects. While these models have facilitated a number of important advances, they do not adequately capture the complexity of oral health behavior, which has multiple interacting determinants, across multiple levels, many of which change over time. Researchers, providers of funding, and policy makers in the oral health field, as well as those in other health fields, have called for new approaches to modeling complex systems (Hollister and Anema, 2004; Surgeon General's Report on Oral Health, 2000; NIH Office of Behavioral and Social Sciences Strategic Plan, 2007; NIDCR Strategic Plan Implementation Working Group, 2006). The funding opportunity proposed here aims to build on the richness of data gathered from traditional models of health and oral health behavior, and to better capture the complexity of health behavior by developing new models and theories. The longer-term goal of developing complex models of health behavior is to identify potential targets for oral health interventions.

NIDCR has issued several Funding Opportunity Announcements (FOAs) encouraging research in these areas. These funding opportunities will continue at least through FY 2010. Below are brief descriptions of these opportunities; for the full-text of the announcements, please see

<http://www.nidcr.nih.gov/Funding/CurrentFundingOpportunities/default.htm> :

- *Oral Health of Special Needs and Older Populations (R01)*: Despite the fact that as many as one in five persons in the United States has some level of disability, that is developmental (e.g. mental retardation, cerebral palsy, syndromic disorders) or acquired (such as head or spinal cord injuries, HIV/AIDS, degenerative neurological disorders, psychiatric disorders), little clinical research related to their oral health has been conducted. Information regarding the types and severity of oral diseases and conditions; the biological, behavioral and environmental factors related to oral health; documentation of inequalities of oral health and oral health care within various populations with disabilities; and impact of oral health on social well being, quality of life and general health is needed to guide the development of effective and appropriate prevention and treatment of oral disease for people with developmental and acquired disabilities. This initiative encourages clinical research focused on the oral health of special needs populations, including those with developmental or acquired physical or mental disabilities, people with mental retardation (MR), people living with HIV/AIDS, and frail or functionally dependent elders.
- *Epidemiological and Behavioral Research in Oral Health (R01)*: The prevalence of most oral diseases is influenced by biological, behavioral, and environmental factors. Such factors include, for example, diet, personal self care behavior, tobacco and alcohol use, environmental influences such as the availability of fluoridated community water, access and motivation to seek preventive and therapeutic professional oral health care, health care providers' decisions and practice behaviors, genetic influences, bacterial exposures, and immunological status. This initiative encourages research that provides a better understanding of risk factors for oral diseases, and of the behavioral and environmental influences on oral health and dental treatment outcomes.

Additionally, NIDCR participates with other NIH Institutes in several FOAs encouraging basic BSS research. Examples of funding opportunities continuing at least through FY 2009 are:

- *Behavioral and Social Science Research on Understanding and Reducing Health Disparities (R01)*: Research to improve diagnosis, treatment, and prevention has led to improvements in health care for most Americans, and significant declines in disability, morbidity, and mortality from numerous diseases and conditions. However, these gains have not affected all segments of the population equally. US populations defined by lower socioeconomic status, certain racial/ethnic backgrounds, and rural residence continue to experience substantial disparities in the burden of disease and death when compared to the US population as a whole

or to European Americans. This FOA encourages behavioral and social science research on the causes and solutions to health and disabilities disparities in the U. S. population. Emphasis is placed on research in and among three broad areas of action: 1) Public policy, 2) health care, and 3) disease/disability prevention. Particular attention is given to reducing “health gaps” among groups. Proposals that utilize an interdisciplinary approach, investigate multiple levels of analysis, incorporate a life-course perspective, and/or employ innovative methods such as system science or community-based participatory research are particularly encouraged.

- *Mechanisms, Models, Measurement, & Management in Pain Research (R01)*: Although great strides have been made in understanding pain, such as identifying neural pathways of pain, pain and the challenge of its treatment have remained uniquely individual and largely unsolved. This initiative encourages proposals that seek to improve the understanding of the causes, costs, and societal effects of both acute and chronic pain and the relationships between the two. Additionally, proposals that link such understandings to the development of better approaches to therapeutic interventions, including complementary and alternative medicine (CAM) interventions, and management of acute and chronic pain are in keeping with the current translational focus of NIH and are encouraged. Studies potentially responsive to this FOA include those addressing models of pain, diagnosis and assessment of pain, pain management, epidemiology of pain, health disparities in pain, and translational pain research.
- *Dissemination and Implementation Research in Health (R01)*: Critical information is lacking about how, when, by whom, and under what circumstances research evidence spreads throughout agencies, organizations, and front line workers providing public health and clinical services. As a necessary prerequisite for unpacking how information can lead to treatment or service changes, basic research is needed to understand what underlies the creation, transmission, and reception of information on evidence-based psychopharmacological, behavioral, and psychosocial interventions in health care settings. This initiative encourages theory-driven studies to test conceptual frameworks of the processes of dissemination and implementation.
- *Research on Mind-Body Interactions and Health (R01)*: The Public Health Service has documented that many of the leading causes of morbidity and mortality in the U.S. are attributable to social, behavioral, and lifestyle factors (e.g., tobacco use, lack of exercise, poor diet, and drug and alcohol abuse). Numerous studies have also documented that psychological stress is linked to a variety of health outcomes, and researchers and public health officials are becoming increasingly interested in understanding the nature of this relationship. This initiative encourages research in three specific areas: 1) how cognitions, emotions, and/or personality (e.g., beliefs, attitudes, and values; modes of thinking) affect physical health; 2) how health beliefs, attitudes, and values are developed, maintained, and/or changed; and 3) how stress influences health.

4. National Institute of Diabetes and Digestive and Kidney Diseases

Introduction

The mission of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) includes a wide spectrum of diseases including diabetes, endocrine, and metabolic diseases; digestive diseases, nutrition, and obesity; and kidney, urologic, and hematologic diseases. Many of these diseases are influenced by behavioral and social factors. The NIDDK is committed to research addressing the role of behavior in preventing disease, disease management, and the promotion of health and well-being. Understanding the relationships between behavior and health is essential to treating illness and promoting well-being. Because of the significant effects of behavior on health and health outcomes, the NIDDK has had success in developing and testing behavioral interventions that treat or prevent diseases within its research mission. This approach is informed by the Institute's investment in basic behavioral and social sciences research. The NIDDK therefore supports research that examines the underlying causes and effects of behavior, and how behavior and psychosocial factors relate to disease states.

The NIDDK's portfolio of bBSSR includes support of over 100 projects, the majority of which are funded through the R01 mechanism. The goal of NIDDK-supported bBSSR is to provide essential knowledge necessary for better prediction, prevention, and control of illnesses. The bBSSR portfolio is divided into three categories: (A) research on behavioral and social processes; (B) biopsychosocial research; and (C) research on the development of procedures for measurement, analysis, and classification.

Current Strategic Priorities, Portfolio and Programs

A. Research on Behavioral and Social Processes

This category contains projects studying feeding behavior, motivation and beliefs, memory and cognitive functioning, and environmental factors that influence behavior and health or create barriers to health care. Examples of this category of research are illustrated below.

Feeding Behavior. There is a compelling need to identify the behavioral mechanisms and dietary attributes which foster overconsumption (hyperphagia) of food. Examples of NIDDK research in this area include investigations of:

- independent and interactive contributions to oral sensations (palatability), caloric density, and the unique post-ingestive effects of dietary fat to the control of intake.
- psychobiological factors that influence the preference for and consumption of carbohydrate-rich and fat-rich foods.
- mechanisms that regulate feeding behavior in individuals eating a high-fat diet, specifically by characterizing signals generated from the gastrointestinal tract that govern food intake.
- potential links between portion sizes and excessive food intake. One NIDDK study is attempting to determine the effect of portion size on children's

consumption of sweetened beverages and fruits and vegetables. This study is also examining how large food portions promote excessive intake by look at eating duration, bite size and frequency, and plate size.

Motivation and Control of Body Weight. Excess body weight has been associated with an increased risk of several medical conditions, including type 2 diabetes, cardiovascular disease, and certain cancers. Behavioral treatments have demonstrated successful short-term weight loss, though long-term results are quite poor. A number of NIDDK studies are attempting to identify motivational factors that may improve long-term weight loss or prevent excess weight gain, including:

- whether dissatisfaction with weight loss upon completion of a weight loss program is associated with weight regain. In an effort to improve satisfaction with weight loss, investigators will emphasize physical appearance changes or health changes or both during the standard behavioral weight loss treatment.
- whether motivational factors can influence children to increase physical activity and prevent excess weight gain.

Environment and Weight Gain. Environmental factors that promote increased caloric intake and decreased energy expenditure are believed to underlie much of the present trend towards excess weight gain. Investigators are exploring environmental factors related to the development of excess weight gain. The identification of environmental variables associated with excess weight gain has important implications for health policy and targeted prevention efforts.

Environmental and Cognitive Influences on the Success of Surgery. As surgeries are often the only solution for certain illnesses, NIDDK also supports bBSSR designed to identify and understand all the factors that influence the success of surgeries, including:

- studies of the resources available for self-care following kidney transplantation to evaluate why ethnic and socioeconomic disparities exist in survival rates of transplanted kidneys.
- measurements of post-liver transplant changes in cognitive function over time, and the relationship of cognitive function to other pre-operative risk factors and post-operative events.
- research aimed at understanding the relationship between eating behavior and the outcome of bariatric surgery.

Motivation, Belief, and Environmental Influences on the Management of Diabetes. The NIDDK believes it is important to evaluate how behavioral and social factors influence a patient's treatment and management of diabetes to develop preventative intervention measures to improve the health and care for these patients. Examples of these types of evaluations include:

- studies aimed at understanding the factors that influence self-management and adherence for youth with type 1 diabetes.
- analysis of the health implications of the transition to young adulthood for youth with and without diabetes to compare the level of difficulty in the transition

- between these groups. This study will consider factors such as mental health, peer relationships, risk behavior, and health care utilization.
- studies into racial and ethnic disparities in complications of diabetes. Identification of behavioral and/or social factors that lead to disparities in the frequencies of diabetes complications among certain racial and ethnic groups will assist in the development of effective interventions designed to prevent or reduce these complications in minority populations.

Barriers to Health Care. The NIDDK is supporting research that investigates barriers for patients to receiving high quality of health care. Areas of investigation within this category include:

- determination of the barriers for patients to receiving high quality of care for diabetes. Researchers aim to determine what barriers are provider-related, which are patient-related, and which of these barriers can be modified to optimize diabetes care for all patients.
- studies to evaluate the role of health disparities, inequalities in health insurance, access to medical care and the social and behavioral factors as contributors to the under-reporting of urological disorders such as urinary incontinence and interstitial cystitis/painful bladder syndrome. These results will highlight areas where medical care of urologic symptoms can be improved, and will guide the design of interventions to ensure that individuals receive the care they need.

B. Biopsychosocial Research

This category contains research projects studying behavioral neuroscience and behavioral genetics as well as investigations exploring the bi-directional interactions of biological factors with behavioral or social variables. Examples of this category of research are illustrated below.

Biological Influences on Body Weight. While there are likely to be external factors that impact eating behavior (i.e., social and cultural influences), internal factors such as genetics and physiology also play a role and the NIDDK supports research examining the relationship between biological factors and eating, including:

- an examination of the eating behavior of twins to determine whether appetite-regulating hormones and brain activation patterns are involved in abnormal eating behaviors.
- a study on the effect of maternal body weight on pediatric obesity to evaluate the influence of family background on growth and development.

Gender Differences in Energy Homeostasis. NIDDK-supported investigators are investigating the mode of action of insulin and leptin in the CNS by examining whether a gender difference exists in the central control of energy homeostasis, with insulin controlling the male system and leptin controlling the female system.

Biobehavioral Feedback in Diabetes. The NIDDK is also supporting research evaluating biobehavioral feedback in diabetes. Examples of these types of studies include:

- examination of the internal and external factors that lead to optimized glycemic control in type 1 diabetes patients, as measured by levels of the biomarker hemoglobin A1c, and how these factors influence one another to improve glycemic control. Internal factors include hormonal effects on metabolism. Externally, social and behavioral factors, such as availability and utilization by patients of information about symptoms, awareness, and risk of hypoglycemia, will influence management of diabetes.
- research aimed at understanding how stress impacts the progression, management, and treatment of diabetic complications. A study is evaluating the effect of emotional distress on the healing of chronic wounds, specifically foot ulcers, in diabetic patients to develop behavioral interventions to aid in healing.
- studies to determine how diabetes affects cognitive function, and thus behavior and quality of life. Investigators are interviewing 200 children from an earlier neuropsychological study of children with type 1 diabetes, now currently middle-aged, to detail their current cognitive ability, disease progression and quality of life. The results of this study will be used to evaluate whether impaired cognitive ability affects quality of life and whether these outcomes can be predicted by hypoglycemic events or psychosocial factors.

C. Research on the Development of Procedures for Measurement, Analysis, and Classification

This category contains research projects that support instrument development.

Software for Dietary Self-Management. Current NIDDK support of a Small Business Innovation Research phase II study may allow production and testing of a technically refined dietary self-management software suite. The final product will be examined for its effectiveness to improve dietary self-management and user satisfaction.

Measuring Energy Metabolism. Energy metabolism plays an important role in body weight control and overall nutrition. Changes in energy expenditure can alter energy balance. Advances in technology and biomedical engineering can facilitate the accurate measurements of autonomic nervous system activity, energy metabolism, and physical activity. NIDDK-supported scientists will utilize a unique combination of a whole-room indirect calorimetry chamber, a force platform floor, and an electronic activity sensing system to quantify the amount of energy expenditure and physical activity that occurs in a 24-hour period. In addition, multiple portable movement detectors and a novel force measurement insole device were developed to accurately determine the type, intensity, duration, and frequency of the physical activities performed during seven days of free living.

Measuring Physical Activity in Children. Physical activity is one method of promoting healthy living and combating obesity, but studies show that boys generally are more active than girls. An NIDDK-supported investigator is seeking to determine why this gender difference exists, and identify interventions that may decrease this difference. In support of this goal, the investigators are working towards the development of new and/or improved tools to measure physical activity in children. These tools will help assess

psychosocial, environmental, and cultural effects on physical activity in children ages 7 to 9. These tools will benefit the scientific enterprise, and the information gained from these studies may help modify physical activity programs to improve their benefit to all children.

Planned Future Investment in bBSSR

The NIDDK will maintain a focus similar to that described above in the next few years, and continue to look for further research and funding opportunities across NIDDK-related disease categories.

5. National Institute of Neurological Disorders and Stroke

Basic Behavioral and Social Science Research

The mission of the National Institute of Neurological Disorders and Stroke (NINDS) is to reduce the burden of neurological disorders by conducting research on the normal and diseased nervous system. The NINDS focus in basic behavioral and social science research (bBSSR) is primarily on biopsychosocial research (that which elucidates the cellular, molecular and physiological processes underlying normal brain function and behavior) and research leading to the development of new and improved methodologies and assessment tools. In pursuit of this mission, NINDS is committed to conducting high-quality research to advance the basis of knowledge in this field.

Extramural Research

The Division of Extramural Research (DER) at NINDS is structured around six clusters centered on different scientific themes. The majority of the bBSSR supported by NINDS is contained within the Systems and Cognitive Neuroscience (SCN) cluster, the lead cluster for coordinating bBSSR research at the Institute. The extramural bBSSR that NINDS supports is broad and includes studies on the neural bases of cognition, sensation, emotion, movement and communication. In addition, NINDS-funded researchers are developing and validating tools for assessing quality of life, pain, and executive function (higher order cognition), as well as designing improved methods for functional brain mapping, identifying novel markers of cognitive impairment, and developing quantitative tools for the analysis of brain circuitry. These studies are being done using molecular, cellular, physiological, and systems level approaches, providing for detailed insights into complex biological questions. Understanding the underlying mechanisms of complex behavioral processes is critical for the subsequent development of therapies to treat many neurological disorders (*e.g.* cognitive rehabilitation following traumatic brain injury, physical rehabilitation following stroke). In addition to investigator-initiated research, funding opportunity announcements (FOAs) are issued to stimulate research in this area.

Additionally, the NINDS is planning workshops on treatments for acute traumatic brain injury (TBI), and for understanding the cognitive and neurophysiological effects of blast injuries (covering topics that include determining what assessment tools are most useful for the diagnosis of blast injury, understanding how the behavioral consequences differ between TBI and blast injury, and exploring how cognitive rehabilitation strategies might differ for these unique disorders). Further, the 2008 Society for Neuroscience (SfN) Neurobiology of Disease Workshop will focus on TBI, and is sponsored by NINDS. The NINDS is also working to develop an initiative that would use the Small Business Innovation Research (SBIR) program to focus on methods and technologies to bridge behavioral and social sciences to biomedical research. In FY08, the Institute is looking forward to funding applications from a number of FOAs aimed toward developing new imaging tools to assess basic behavioral processes, developing new high-throughput tools for data acquisition for use in bBSSR, and advancing basic and translational research in

emotion. The NINDS will also continue to participate in the NIH Behavioral and Social Sciences Research Coordinating Committee.

Healthy Brain

NINDS, along with the National Institute on Aging (NIA), and the National Institute of Mental Health (NIMH) are part of a trans-NIH initiative, the *Cognitive and Emotional Health Project: The Healthy Brain*, designed to evaluate the state of epidemiologic research on demographic, social and biologic determinants of cognitive and emotional health in aging populations. To accomplish these goals, the “Healthy Brain Project” comprehensively reviewed measures in four domains of aging research, including cognitive health, emotional health, demographic/social factors, and biomedical/physiologic factors. The results of this review are posted on the project’s website at <http://trans.nih.gov/CEHP/ReviewDocs.htm>. A Critical Evaluation Study Committee was formed from the Healthy Brain Project to analyze the scientific literature pertaining to factors involved in maintaining cognitive and emotional health in adults. This committee identified factors contributing to poor mental health later in life, emphasized the importance of future studies evaluating cognitive and emotional health simultaneously, and suggested that standard questionnaires be developed to measure cognitive and emotional health. These findings were crucial to the subsequent development of the NIH Toolbox through the Blueprint for Neuroscience.

NIH Toolbox for Assessment of Neurological and Behavioral Function

The NIH Toolbox is an effort supported by the NIH Blueprint for Neuroscience Research (for which NINDS is a co-lead) to develop neurological and behavioral assessment tools with a particular emphasis on evaluating outcomes in large cohorts such as epidemiological, longitudinal, and prevention or intervention trials. In September 2006, a contract was awarded to design unified and integrated methods and measures of cognitive, emotional and motor and sensory health. Development of such uniform assessment tools will enhance the ability of researchers to compare data across studies and will help to maximize the efficiency and yield of data in large and expensive studies.

Cognitive Rehabilitation Interventions: Moving from Bench to Bedside

In September 2004, the NINDS sponsored a workshop to promote the use of evidence-based interventions in the evaluation, treatment and assistance of patients with disorders of the brain affecting higher cognitive processes. This workshop focused on a limited set of neurological conditions (*e.g.* stroke, TBI, brain tumor) where progress in cognitive rehabilitation would benefit from formal partnerships between clinicians and basic cognitive neuroscientists. The findings of this workshop supported the development of new sensitive, reliable and standardized assessment tools for evaluating the function and dysfunction of advanced cognitive processes. Furthermore, it was determined that more appropriate clinical trials models for stroke, TBI and brain tumor are needed, and thus recommended that a workshop be convened to determine best practices for cognitive rehabilitation. A summary of the workshop findings was published in 2006 (*Journal of Cognitive Neuroscience*; 18:7, pp1212-22), and is available on the NINDS website http://www.ninds.nih.gov/news_and_events/proceedings/execsumm07_19_05.htm.

NINDS EXAMINER (Executive Abilities: Methods and Instruments for Neurobehavioral Evaluation and Research)

Executive Function (EF), a term which encompasses numerous cognitive abilities, includes the ability to plan, organize, and sequence tasks and manage multiple tasks simultaneously. Appropriate EF also includes the ability to self-monitor and self-correct behavior. Many behaviors associated with EF can be compromised in older adults, and in individuals with neurological and age-related disorders. Through a contract awarded by NINDS, a battery of specific tasks for the assessment of various components of EF is being developed and validated. Such tools will greatly increase the probability for more precise clinical neurobehavioral evaluation and assessment. Instruments and methods resulting from this project will be used in future NINDS-sponsored clinical trials and research where EF is used as an outcome measure.

Quality of Life Outcomes in Neurological Disorders (Neuro-QOL)

Through a contract awarded by NINDS, a robust health-related quality of life (HRQL) assessment tool is being developed that will be utilized in both the neurology clinical trials and clinical research communities. A critical component in the conduct of clinical trials is the ability to evaluate potential intervention and prevention strategies for neurological disorders. This evaluation requires reliable measures for defining and measuring appropriate outcome variables. Currently, there is a lack of consensus in the clinical trials community for best practices and tools for measuring outcome variables, resulting in the inability to compare the relative burden of neurological conditions to each other, or to compare the benefits of one treatment over another. The Neuro-QOL project is designed to overcome some of these challenges and to develop a core set of questions to address dimensions of HRQL that are universal to patients with chronic neurological disease and to develop supplemental questions that address concerns that may be specific to particular groups of patients defined by disease, age, or other factors. The resulting instruments will become part of the NINDS clinical trials toolkit which will be incorporated into all future relevant NINDS-funded clinical trials.

Basic and Translational Research in Emotion

The NINDS in collaboration with NIA, NCI, NIMH, NIAAA, NICHD, and NIDA has issued a FOA (PA07-083) to promote basic and translational research on the processes and mechanisms involved in the experience, expression, and regulation of emotion. Studies of particular interest to NINDS are the physiological, psychological, social, cognitive, and developmental phenomena associated with emotion as it relates to perception, attention, motor control, learning and memory.

Mechanisms, Models, Measurement, & Management in Pain Research

In collaboration with 11 other ICs, the NINDS has issued a FOA (PA07-282) to inform the scientific community of the pain research interests of the NIH and to stimulate research efforts on the basic, clinical and translational studies on pain as they relate to the ICs involved. The NINDS is currently funding a study through this PA that is investigating a class of receptors (P2Y receptors) that contribute to pain signaling. One specific component of this study is to examine whether manipulation of this receptor is beneficial in animal models of acute and chronic pain. The study of this receptor class

may lead to identification of new targets for the development of therapeutic agents to treat pain disorders.

High Throughput Tools for Brain and Behavior

NINDS and NIMH have recently issued a joint FOA (PA08-001/2) to solicit applications from small businesses to develop technologies for high throughput data acquisition and analysis that could aid in neuroscience and bBSSR. Applications considered appropriate for this FOA could include those that propose the research and development of tools for high throughput measure at any level of analysis, from molecules to behavior in the brain.

Intramural Research

The Cognitive Neuroscience Section (CNS) within the Division of Intramural Research at NINDS conducts the vast majority of the bBSSR at the Institute. The major goal of this section is to identify the specific cognitive functions prescribed to a particular brain region (the prefrontal cortex), creating a functional map of this brain region.

Additionally, the CNS is working to understand how this functional map is altered with normal skill learning and following brain damage. This section utilizes cognitive, behavioral, and psychological methodologies with a variety of innovative imaging and brain stimulation techniques including functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation. Future plans include developing treatments for patients with frontal lobe damage, and improving our understanding of the functions of the human frontal lobes.

Planned Future NINDS Investment in bBSSR

NINDS will maintain support for bBSSR activities related to neurological disorders and stroke, in particular in the field of rehabilitation. In addition, understanding the neurophysiology of the healthy brain with regard to cognitive, emotional, and sensorimotor processing and behaviors will continue to be a priority of the NINDS extramural bBSSR portfolio in the future.

6. National Institute of Allergy and Infectious Diseases

The National Institute of Allergy and Infectious Diseases (NIAID) supports applied research in the behavioral and social sciences, but has no current programs/projects in basic BSSR and has no plans for future programs/projects in bBSSR.

7. National Institute of General Medical Sciences

The National Institute of General Medical Sciences (NIGMS) was founded in 1960 “to conduct and support ...research, training, and, as appropriate, health information dissemination, and other programs with respect to general or basic medical sciences and related natural or behavioral sciences which have significance for two or more other national research institutes or are outside the general area of responsibility of any other national research institute.” In keeping with this mandate, NIGMS supports bBSSR in areas related to the basic biomedical science research that the institute supports. This research is supported through investigator-initiated research through its Genetics and Developmental Biology and Minority Opportunities in Research divisions as well as its Center for Bioinformatics and Computational Biology. NIGMS has initiated several programs with substantial basic behavioral science research and training components in the past two years.

NIGMS Current and Planned Strategic Priorities and Activities in bBSSR

NIGMS supports basic behavioral and social sciences research and training in five areas that related to our other basic research and training activities: (1) basic behavioral research in model organisms; (2) computational modeling of human populations including behavioral and social factors; (3) studies of the efficacy of interventions in promoting research careers; (4) support of a range of behavioral and social sciences research at minority-serving institutions; and (5) predoctoral training at the interface between behavioral and biomedical sciences. All of these programs are extramural.

(1) Basic behavioral research in model organisms

Studies in model organisms have revealed fundamental mechanisms that are directly and indirectly applicable to understanding and improving human health. The model organism approach has proven to be tremendously powerful even in cases where the model organisms appear to be too “simple” to capture the appropriate characteristics of human beings. Furthermore, the power of the model organism approach has been dramatically enhanced by the successes of the human genome sequencing project as well as the corresponding sequencing projects in other organisms. The genome sequencing results provides highly effective mechanisms for linking results from one type of organism to another. NIGMS has supported behavioral genetics and other basic behavioral studies in model organisms such as *C. elegans* and *D. melanogaster* for some time. In October 2005 NIGMS released a funding opportunity announcement entitled “Collaborative Research for Molecular and Genomic Studies of Basic Behavior in Animal Models” (<http://grants.nih.gov/grants/guide/pa-files/PA-07-096.html>). This initiative is intended to facilitate collaborative research involving behavioral scientists and investigators with expertise in molecular biology and/or genomics, which addresses questions about basic mechanisms of behavior in animal models.

(2) Computational modeling of human populations

In 2001, NIGMS created a new Center for Bioinformatics and Computational Biology as an organizing center for the support of research and training at the interfaces between biomedical research and computer sciences, mathematics, physics, and engineering. This center now supports a wide range of research and training at these interfaces including research that relates to the development and validation of computer-based models for human populations. The largest effort in this area is related to the Models of Infectious Disease Agent Study (MIDAS) program. The MIDAS program has produced models of human populations to simulate the potential spread of infectious agents and to estimate the impacts of interventions. The MIDAS network involves collaborations among epidemiologists, computer scientists, statisticians, demographers, economists, and others to develop computational models of the interactions between infectious agents and their hosts, models of disease spread, prediction systems, and response strategies. Since its inception, the MIDAS network has been focused on the development models for the spread of influenza through communities. These models have received considerable attention because of their role in preparation for a potential influenza pandemic. During FYs 2006 and 2007, NIGMS has continued to fund eight grants in a novel research network that includes crucial components involving behavioral and social science research. Basic behavioral science research informs modeling of human behavior under normal conditions as well as behavioral responses that occur in response to the occurrence of an influenza pandemic. Increasingly, these models have attempted to include behavioral dimensions and the researchers involved have participated in discussions with the behavioral and social science research community such as the MIDAS Consultation on Social Behavior, see http://www.nigms.nih.gov/News/Reports/social_behavior_060621.htm . The inclusion of behavioral components is anticipated to increase as the MIDAS program moves into its next phase.

(3) NIGMS, like other components at NIH, has a long-standing interest in developing a biomedical workforce that is representative of American society at large. To meet these challenges, NIGMS supports a range of programs that utilize a number of mechanisms to facilitate students from diverse backgrounds entering and succeeding in careers involving biomedical research. However, in many cases, program development and evaluation would benefit from a stronger evidence base regarding the impact of specific interventions. To stimulate and support the social science research necessary to increase this evidence base, NIGMS has initiated a specific grant program “Efficacy of Interventions to Promote Research Careers”, see <http://grants.nih.gov/grants/guide/rfa-files/RFA-GM-07-005.html> . This program has stimulated considerable discussion including a workshop sponsored by the National Academy of Sciences, see http://books.nap.edu/catalog.php?record_id=12022 .

(4) NIGMS operates the Minority Biomedical Research Support (MBRS) program directed toward increasing the number of faculty, students, and investigators who are members of groups that are underrepresented in the biomedical sciences. MBRS grants are awarded to 2- or 4-year colleges, universities, and health professional schools with 50 percent or more student enrollment from underrepresented minority groups to support research by faculty members, strengthen the institutions' biomedical research capabilities,

and provide opportunities for students to work as part of a research team. This program supports research in a wide range of areas including basic behavioral sciences such as psychology.

(5) NIGMS has a strong commitment to training, particularly at the predoctoral level. For some time, NIGMS has run or participated in a number of training programs that include substantial basic behavioral research components, as described below:

- *Systems and Integrative Biology Predoctoral Research Training* (<http://www.nigms.nih.gov/Training/InstPredoc/PredocTrainingDescription.htm>). The current training grants fall into three broad areas of research training: neurobiology, physiology, and biomedical engineering. Support is provided for training in behavioral and cognitive neuroscience using multidisciplinary approaches to study the nervous system and the link between neural development, activity, and behavior. Included is research in sensory processing, sensory and cellular transduction, neuroethology, the biological basis of substance abuse and addiction, the neurobiology of stress, the neuropharmacology of social behavior, and the mechanisms of neurological and behavioral disorders.
- *Jointly Sponsored NIH Predoctoral Training Program in the Neurosciences* (http://grants.nih.gov/training/joint_predoc/jointpredoc.htm). NIGMS also participates in an NIH-wide neuroscience training program to encourage broad, early-stage training in the neurosciences. An example of one of the grants supported through this program, one cofunded by NIGMS, provides students in Stanford University School of Medicine's neurosciences program with an integrated education that involves the study of all levels of nervous system function from molecules to behavior.
- *Training at the Interface of Behavioral and Biomedical Sciences* (<http://grants.nih.gov/grants/guide/pa-files/PAR-06-503.html>). This recently initiated predoctoral, institutional training program is specifically targeted to basic behavioral sciences. The goal of the program is to develop basic behavioral scientists with rigorous broad-based training in biology and biomedical science, who are available to assume leadership roles related to the Nation's biomedical, behavioral, and clinical research needs. In July 2007, NIGMS funded the first awards under this program and anticipates making additional new awards in this program in upcoming years.

8. *Eunice Kennedy Shriver National Institute of Child Health and Human Development*

The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) supports research activities to ensure that every child is born healthy and wanted; that women suffer no harmful effects from reproductive processes; that all children have the chance to achieve their full potential for healthy and productive lives free from disease or disability; and to ensure the health, productivity, independence and well-being of all people through optimal rehabilitation. In support of this mission, the Institute conducts and supports basic behavioral and social sciences research, infrastructure, and training activities to identify the mechanisms and pathways that influence behavior, and its development.

Extramural Activities

Demographic, Behavioral and Social Sciences Branch (DBSB): The DBSB supports demographic, behavioral, and social sciences research on fertility, families, population movement, morbidity and mortality, HIV/AIDS, and population composition. The Branch supports individual research projects as well as research training and infrastructure in the population sciences. Specific areas of basic research include:

- Fertility and family formation, including childbearing, adoption, marriage, divorce, and cohabitation, including trends, determinants, and consequences at the population and individual levels
- Family functioning, family relationships and investment in children, including trends and patterns of child support and visitation with absent parents; the use of child care services; relationship between work and family
- Sexual behavior, contraception, intimate relationships, and other basic processes related to reproductive health and pregnancy⁴;
- Mortality and morbidity from conception through middle age, including infant mortality and low birth weight, obesity, and reproductive health;
- Population health and health disparities; methodological research relating to the measurement and analysis of health status at the aggregate level, changes in health over time, and the spatial distribution of health problems;
- Health trajectories across the life course, including the emergence of racial and ethnic health disparities early in life; the impact of early life socioeconomic disadvantage on later health, and relationships between human capital, education, and labor force participation and health;
- Demographic dimensions of population health, including immigrant health; health as related to geographic mobility and spatial distribution; interrelationships between family/household formation, processes, and dissolution and health; relationship of population composition (e.g., income inequality, racial/ethnic

⁴ Much of this basic research is funded using AIDS funds and may not be reported in FY 2006 and 2007 funding.

composition, age/sex composition) and health; effects of mortality and morbidity on social/economic structures.

- Mechanisms linking environmental processes and structures at the national, institutional, community, family, and interpersonal levels to health at the individual and population levels, ideally integrating biological, social, and behavioral pathways;
- Mechanisms underlying the effects of social context on child development, including the effects of family structure, family instability, father involvement, poverty, and residential mobility;
- Determinants and consequences of international and internal migration, residential segregation, and other spatial dimensions of population composition and change;
- Population diversity and change, including racial and ethnic identity and the consequences of population diversity and change for health and well-being; and
- Relationship of population change to the physical environment.

Child Development and Behavior Branch (CDBB): The CDBB supports research and research training relevant to the psychological, psychobiological, language, cognitive, behavioral, and educational development of children. Specific areas of basic research include:

- Developmental mechanisms that contribute to normal and atypical brain development and behaviors;
- Biological and behavioral indices of individual differences predictive of performance in sensory, motor, linguistic, cognitive, and social behavioral domains at different points of development;
- Neurobiological processes related to attention and attention deficits, perception, sensation, sensori-motor function, memory, learning, problem-solving, and socio-emotional behavior;
- Influence of genetic and environmental factors and their interactions on temperament, learning, cognition, and social and group behavior in the developing organism; and the effect of hormonal influences on behavioral development.
- Development of cognition, emergent literacy, language, numeracy and mathematics, social and emotional competence, metacognition and self-regulation, motor development, and physical health.
- Normative language development, including phonological, semantic, syntactic, communicative, and metalinguistic development language, from infancy through early adulthood;
- Factors that characterize, promote, or impede the acquisition of languages in addition to the first or native language, and factors that promote or impede the acquisition of English-language reading and writing abilities among children for whom English is a second language;
- Influences on mathematics and science learning and cognition, including genetic and neurobiological substrates, as well as cognitive, linguistic, sociocultural, and instructional factors in the development of mathematical proficiency, inductive

- and deductive reasoning, and the acquisition of scientific concepts such as experimental control and falsifiability;
- Normative social, affective, and personality development in children from the newborn period through adolescence, and on the impact of specific aspects of physical and social environments on the health and psychological development of infants, children, and adolescents;
 - Antecedents and consequences of child abuse and neglect, as well as psychosocial and psychobiological factors which shed light on the mechanisms by which child abuse and neglect result in harmful effects;
 - Development of aggressive and violent behavior in childhood and adolescence (including individual, family, and socio-cultural influences and developmental pathways); the effects of domestic and community violence on individual development during infancy, childhood, or adolescence, and factors within family, social, and school contexts which mitigate the consequences of violence on the physical, cognitive, social, and emotional development of children.
 - Behavioral and developmental aspects of health and health-related behaviors from infancy to young adulthood, with a focus on health risk and health promotion behaviors.

Other related activities: In addition to the portfolios managed at DBSB and CDBB, the NICHD is funding other bBSSR and training activities across the Institute. For example, researchers supported by the Reproductive Sciences Branch are examining how the brain and hormones interact and affect reproductive behavior. In other studies, investigators are examining endophenotypes of social behavior using mouse models, as well as examining how differences in behavior affect rehabilitation.

Examples of Relevant Funding Opportunity Announcements:

- Population Research Infrastructure Program – Short-term Support for Rising Programs (PAR-07-401)
- The Science and Ecology Of Early Development (SEED) (PA-07-149)
- Interagency School Readiness Consortium (RFA-HD-07-008)
- Mathematical Cognition and Specific Learning Disabilities (RFA-HD-07-005)

Relevant Training Programs:

- Mentored Research Scientist Development Award for Population Research (<http://www.nichd.nih.gov/research/supported/prsdap.cfm>)

Planned Activities for FY 2009 and Beyond:

The NICHD plans to continue to support research, infrastructure, and training activities in the basic behavioral and social sciences to better understand the physiological mechanisms and the environmental and genetic factors that influence child development, demographic and health-related behaviors, and population change. Future research directions will focus on addressing why and how families reshape themselves, the causes and consequences of population health, and how migration reshapes societies, communities, families, and people. In addition, the Institute will continue to archive and

disseminate data from a variety of research studies and will continue to support the population research infrastructure program. New programs will include understanding the cultural and structural factors and mechanisms that lead to unintended pregnancy, which in turn can be used to develop pregnancy prevention interventions. The Institute will also continue to fund studies that focus on developmental pathways leading to normal and atypical brain development and behaviors and their underlying developmental mechanisms at the molecular, genetic, cellular and network levels.

Intramural Activities

NICHD's scientists at the Division of Intramural Research conduct research that spans many scientific fields and uses integrated approaches to answer complex research questions about developmental biology, health maintenance, and disease prevention and treatment. As a part of this research effort, investigators across the division are conducting studies that focus on understanding the basic biological mechanisms underlying behavior.

Section on Metabolic Regulation: Scientists are investigating how signal transduction mechanisms affect synaptic transmission and plasticity, processes that are essential to learning and memory. Genetically modified mouse models are being used to characterize how a brain protein called neurogranin regulates these processes. The goal is to define the regulatory therapeutic approaches to improve cognitive functions, particularly in an aging human population.

Laboratory of Comparative Ethology: Through comparative longitudinal studies of non-human primate models, researchers are examining some of the basic mechanisms of biobehavioral development. The goals are to: a) characterize distinctive biobehavioral phenotypes in, b) determine how genetic and environmental factors interact to shape the development of, and c) assess long-term behavioral and biological consequences for individuals from different genetic backgrounds, when they are reared in different physical and social environments.

Section on Child and Family Research: Researchers are investigating how certain factors—mood, previous experiences, and environment—affect physical, mental, emotional, and social development in human beings, up to age 20. The aims are to describe, analyze, and assess a) the capabilities and proclivities of developing human beings, including their genetic characteristics; b) physiological functioning, c) perceptual and cognitive abilities, d) emotional, social, and interactional styles, and e) the nature and consequences for children and parents of family development, and children's exposure to and interactions with their natural and designed surroundings.

Section on Comparative Behavioral Genetics: Using non-human primate models, researchers are studying crying, a universal act in infancy and an essential signal that activates care-giving behavior. Virtually nothing is known about the neural basis of crying or about why crying can be such a compelling stimulus to the listener. The research goals are to a) determine the neural pathways that underlie cry production and

cry perception, b) track the developmental course of crying in infancy, in particular to determine the roles of inheritance and experience in individual variability in crying behavior, and c) to examine the interaction between cries with the hormonal status and previous care-giving status of an individual, and how this interaction influences the individual's response to a crying infant.

Section on Cell Biology and Signal Transduction: All organisms need to know what is going on in the world around them; therefore, brain mechanisms have evolved to gather and organize sensory information and to build transient and sometimes enduring internal representations of an organism's surroundings. Using insect models and focusing primarily on olfaction, researchers are combining electrophysiological, anatomical, behavioral, and other techniques to examine the ways neural circuits, driven by sensory stimuli, process information. This research reveals basic mechanisms by which sensory information is processed as it makes its way through the nervous system.

Section on Tissue Biophysics & Biomimetics: Many obstacles have impeded developments in neuroimaging research on childhood brain disorders, including difficulties in obtaining data from children given their limited ability to comply with procedures; the lack of an adequate normative database with which to characterize normal brain development and against which to identify and measure aberrant brain development; the lack of adequate image-analysis tools for characterizing developmental changes in the brain; and the lack of adequate means for disseminating and sharing data analytic tools. To help fill this gap, NICHD scientists are processing and analyzing diffusion tensor magnetic resonance imaging (DT-MRI) data as a part of a trans-NIH effort to characterize brain development in normal, healthy children and adolescents.

Planned Activities for FY 2009 and Beyond:

NICHD intramural scientists will continue to seek answers to fundamental biological questions about behavioral development, from how cells transmit information to how experiences in life influence behavior. For example, researchers will begin filling in the data gap of health behaviors in adolescents, from before high school (age 11) to one year after high school, by developing longitudinal studies that identify health behaviors and factors that influence those behaviors in adolescents across the country. The goal is to add to the Health Behaviors in School-Age Children survey to examine how changes in personal, social, and environmental factors affect health risk behaviors in adolescents. In understanding normal developmental events, the intramural program's research can determine what makes these processes go off track and how such biological "derailment" may give rise to certain behavioral disorders.

9. National Eye Institute

In 1968, the Congress established the National Eye Institute (NEI) to conduct and support research, training, health information dissemination, and other programs with respect to blinding eye diseases, visual disorders, mechanisms of visual function, preservation of sight, and the special health problems and requirements of the blind. Although seldom fatal, eye diseases cause suffering, disability, and loss of productivity for millions of people in this country and throughout the world. The most pronounced effects of diseases of the eye and disorders of vision are on an individual's quality of life. They affect the ability to act independently, recognize family and friends, read, drive a car, and perform a host of other activities that we consider routine daily tasks.

NEI Current and Planned Strategic Priorities and Activities in bBSSR

Our ability to perform routine tasks under neurosensory control is one of the most fundamental and critical of our human abilities and one that has been an important area of current NEI-sponsored research. Much of this work has concentrated on the visual/oculomotor system that controls sensory-motor coordination. By understanding how visual system neurons convey complex messages, scientists can explore how physical and behavioral components of the message contribute to higher visual cognitive functions like perception, attention, and memory. Although NEI has no specific portfolio on bBSSR, this information is vital to our understanding of visual system deficits. In its latest strategic plan, *A National Plan for Eye and Vision Research (2004)*, the NEI set research priorities for current (FY08) and future research (FY09 and beyond) that is directly related to bBSSR. The following were among the priorities identified:

- Determine the cellular mechanisms that give rise to changes in visual sensitivity associated with attention and perceptual learning.
- Discover the larger role of neuronal plasticity in the formation of visual associative memories and imagery.
- Develop a mechanistic understanding of the origin of the signals that control attention and how they alter the responses of neurons in visual processing and sensorimotor transformations.
- Bridge the knowledge of what happens at the cellular level in the visual system with the knowledge of visual psychophysics.
- Develop molecular/cellular approaches and imaging technologies to gain an understanding of the role of the cell activity that underlies behavior.
- Develop a better understanding of the cellular mechanisms underlying plasticity in the oculomotor system that ensure accurate gaze shift and alignment of the eyes.
- Develop an understanding of visual and nonvisual requirements for performing everyday tasks. Develop comprehensive definitions of visual disabilities.
- Develop an understanding of perceptual and cognitive factors involved in the performance of everyday tasks such as driving, other forms of mobility, and reading.

Extramural Research Activities/Initiatives

Global Research Initiative Program, Behavioral/Social Sciences: The purpose of this initiative is to provide funding opportunities for the increasing pool of foreign social and behavioral scientists, clinical investigators, nurses and other health professionals, with state-of-the-art knowledge of research methods. It is expected that this program will advance critical issues in global health through behavioral and social sciences research upon return of the investigators to their home countries. After their term of research training, low- to middle-income country participants supported by this announcement are expected to continue independent and productive scientific careers, including providing expert training and consultation to others, and/or research on behavioral and/or social science issues within their home institutions. Research related to the vision health effects of human exposures to environmental agents is encouraged. Research focused on behavioral and social determinants and their effects on ocular health is also encouraged and is expected to provide valuable insight into the development of eye disease and visual disability.

Behavioral and Social Science Research on Understanding and Reducing Health Disparities: The purpose of this initiative is to encourage behavioral and social science research on the causes and solutions to health and disabilities disparities in the U. S. population. Health disparities between, on the one hand, racial/ethnic populations, lower socioeconomic classes, and rural residents and, on the other hand, the overall U.S. population are major public health concerns. Emphasis is placed on research in and among three broad areas of action: 1) public policy, 2) health care, and 3) disease/disability prevention. Particular attention is given to reducing “health gaps” among groups. For example, the prevalence of diabetic retinopathy is greater in African Americans, Hispanic Americans, American Indians, certain Pacific Islanders and Asian American populations, and in economically disadvantaged people than in the overall European American population. Additional research into these areas is expected to help develop strategies to ameliorate these disparities.

Intramural Research Activities/Initiatives

Brain Mechanisms for Vision and Eye Movements: The Laboratory of Sensorimotor Research studies the brain mechanisms of visual processing and the control of eye movements, including the pathways and behaviors that connect the two. Current activities focus on recordings from and manipulations of the brains of monkeys trained to perform a variety of behavioral tasks. Ongoing and future research priorities include:

- Identifying the pathways that bring visual information to the cortex (in particular the role of the pulvinar), and how these are modified by behavior (the effect of attention on thalamic nuclei).
- Identifying how these signals are then elaborated to produce a useful representation in the visual cortex, and how these signals then influence perception and behavior.

- Elucidating the role of the frontal eye fields in representing the salience of visual stimuli, and supporting directed attention.

A substantial modeling effort aims to describe how neural circuits interact with the mechanics of the globe to control eye position, with results that can help explain abnormalities in human patients. Finally, the study in human subjects of reflexive eye movements that reflect early visual processing, should provide a key link between the studies of the monkey brain and human behavior.

10. National Institute of Environmental Health Sciences

Division of Extramural Research and Training

Projects in Neurobehavioral Toxicology

The NIEHS supports a wide variety of research in the field of neurobehavioral toxicology from animal to human-based studies. A majority of the studies have looked at the neurotoxic effects of heavy metals and the mechanisms by which they affect the developing brain (the period of greatest vulnerability to most neurotoxicants). For example, lead studies that the Institute has supported have influenced public policy in lowering the acceptable level of lead contamination tolerated in children and adults. These studies explore adverse neurocognitive effects of lead on the hippocampal area of the brain which is involved in learning and memory. Other NIEHS-supported work examining neurotoxicity of organic mercury has also contributed to public health policy in the form of contaminated fish advisories especially regarding women of child-bearing age, again due to results from epidemiological and basic studies. Other areas of neurobehavioral toxicology supported by the Institute involve agricultural chemicals and industrial chemicals that have neuroendocrine disrupter properties.

Centers for Children's Environmental Health and Disease Prevention Research

The goal of this program is to promote translation of basic research findings into applied intervention and prevention methods. Designed around a central scientific theme, the Children's Centers conduct multidisciplinary basic and applied research in combination with community-based prevention research projects to support studies on the causes and mechanisms of children's disorders having an environmental etiology, to identify relevant environmental exposures, to intervene or to reduce hazardous exposures and their adverse health effects, and to eventually decrease the prevalence, morbidity and mortality of environmentally-related childhood diseases. Several of the Centers are focused on neurodevelopment.

Obesity and the Built Environment

This program examines two specific areas related to the built environment and obesity: 1) understanding the role of the built environment in causing/exacerbating obesity and related co-morbidities; and 2) developing, implementing, and evaluating prevention/intervention strategies that influence parameters of the built environment in order to reduce the prevalence of overweight, obesity and co-morbidities. The NIEHS is supporting projects that are exploring the significance and impact of the built environment on individual and population health by understanding the roles played by planning, housing structure, transportation issues, and the availability of public and green spaces as determinants of physical activity, nutrition, and access to healthy foods. Of particular interest is in studies conducted in vulnerable populations (such as, children, aging, low SES communities). The outcome of this program is to improve public health and impact policy by developing models that would promote environmentally healthful lifestyles. Participating NIH institutes include NCI, NICHD, and OBSSR, and two Centers within the CDC.

Health Disparities Program

The goal of the NIEHS Health Disparities Program is to improve the knowledge and behavior of disadvantaged or underserved community members regarding prevention, detection, and treatment of environmentally related diseases and health conditions, and thereby reduce incidence and mortality rates of such diseases and conditions. Through this program NIEHS is advancing the science to elucidate underlying causes and mechanisms responsible for disparities in health.

Epigenetic Environmental Influences on Neurodevelopment and Behavior

Projects related to how the environment influences epigenetic modifications are another area related to Basic Behavioral and Social Science Research (bBSSR). Several bBSSR projects were among those awarded in response to our RFA on Environmental Influences on Epigenetic Regulation. Researchers are investigating gene-environment interaction and epigenetic alterations in gene expression in neurodevelopment and behavioral outcomes as influenced by environmental exposures such as metals, persistent organic pesticides, and stress.

Examples of Relevant Funding Opportunity Announcements:

<http://grants.nih.gov/grants/guide/rfa-files/RFA-ES-05-004.html>

Title: Centers for Children's Environmental Health and Disease Prevention Research
RFA Number: RFA-ES-05-004

<http://grants.nih.gov/grants/guide/rfa-files/RFA-ES-04-003.html>

Title: Obesity and the Built Environment
RFA Number: RFA-ES-04-003

<http://grants.nih.gov/grants/guide/rfa-files/RFA-ES-00-004.html>

Title: Health Disparities: Linking Biological and Behavioral Mechanisms with Social And Physical Environments
RFA Number: ES-00-004

<http://grants2.nih.gov/grants/guide/rfa-files/RFA-ES-05-007.html>

Title: Environmental Influences on Epigenetic Regulation
RFA Number: RFA-ES-05-007

Plans for Initiatives in FY09 and Beyond

The NIEHS plans to renew its program of Centers for Children's Environmental Health and Disease Prevention Research; behavioral and neurodevelopmental outcomes (such as autism) are an important component of the solicitation.

Division of Intramural Research

NIEHS intramural research related to Basic Behavioral and Social Science Research (bBSSR) includes efforts on the actions of stress response hormones, pesticides, lead, and

other environmental exposures that may play a key role in various neurological and behavior-related diseases. Intramural studies range from mechanistic laboratory studies, to neurotoxicology, to epidemiology. A current major study involves studying farmers, licensed pesticide applicators, and their families and is one of the largest cohorts of farmers studied to date. Five-year follow up studies will explore the relationship to pesticides and diseases such as Parkinson's Disease, macular degeneration, lupus, and childhood diabetes.

11. National Institute on Aging

Strategic Directions for Research on Aging in Basic Behavioral and Social Sciences Research

Research supported by the National Institute on Aging (NIA) is focused on the ultimate goal of improving our understanding of healthy aging and disease and disability among older adults. An extensive portfolio of research in behavioral and social science research coupled with enhanced understanding of the biology of aging promises to make possible the development of interventions that take into account the full range of issues confronting our aging society and the needs of older adults.

NIA strategic directions for basic behavioral and social science will continue to build the foundation for better understanding aging and the consequences of an aging society from several perspectives including cutting edge research in relatively unexplored areas.

Behavioral and Population Genetics of Aging. New research will integrate the study of genetics with economics by bringing together economists, psychologists, and neurobiologists to examine unexplored avenues for better understanding the dynamics of aging; trends in disability, mortality and longevity; and the role of genetics in early childhood risk and resilience factors related to aging processes.

Demography and Sociology of Aging. These studies will shed light on a broad range of issues related to retirement and labor force behavior; income, wealth, and intergenerational economic relationships; patterns of availability and access within families; division of labor among the family, market, and state for care of older adults; interaction of disability dynamics and mortality; socioeconomic differences in adult mortality and health status; geographic concentration, migration, and population redistribution; and research in developing countries. They will also increase our understanding of social networks, neighborhoods, and health; the macroeconomic-demographic aspects of population aging; and the integration of biological and genetic data.

Cognitive Aging. Advances in functional imaging and psychophysiology, the longitudinal study of cognition and social cognition, and the use of biomarkers and genetic information promise to increase scientific understanding of cognitive aging.

Stress, Aging, the Brain, and the Body. Research on the interactions among stress, the immune system, and the brain will seek to identify neural pathways and to understand the use of neurotransmitters, hormones, and cytokines to shed light on the effects of these interactions upon a person's health, and help determine the underlying molecular and cellular mechanisms.

Decision Making and Aging. Better understanding decision making processes of older adults and the factors that influence them will aid in the development of better ways to help them face challenging economic decisions, including those about retirement, pension savings, health care and pharmaceuticals, and end-of-life care.

Emotion and Aging. Emotion research will encompass a broad array of topics including age differences and age-related changes in the subjective experience of emotion, self-regulation, motivation and responses to incentives, contextual influences on emotional processes, and the biological mechanisms and pathways through which negative emotions and psychosocial stressors give rise to health declines in older age and through which positive emotions may buffer against them.

Sleep, Learning, and Memory and the Aging Brain. This research will take advantage of recent technological and scientific advances to explore the relationships among sleep, cognition, and aging, and the underlying neurophysiologic and molecular mechanisms. A sufficient base of data and converging lines of evidence suggest that sleep loss is a contributing factor to some late-life cognitive decline as well as to other metabolic, medical, and behavioral conditions in aging populations.

Mechanisms and Management of Pain in the Aged. Researchers will examine the social and behavioral aspects of pain measurement, management, and intervention in the aged populations including management of pain at the end of life, disparities in pain experience and management, and decision-making issues.

Stereotypes of Aging. Research on social stigma, self-concept, and health outcomes will explore the destructive influences of ageist beliefs and the protective influences of positive expectations of aging on behavior and function, health and well-being, and mortality among older adults and seek to understand the psychological and physiological mechanisms through which positive beliefs and negative stereotypes exert their effects.

The NIA strategic objectives described below are organized into three broad areas of pursuit:

- Research on Behavioral and Social Processes
- Biopsychosocial Research
- Research on the Development of Systems Models and Procedures for Measurement, Analysis, and Classification

Each set of objectives is accompanied by descriptions of representative NIA initiatives.

Strategic Objectives for Research on Behavioral and Social Processes

A. To improve our understanding of age differences and age-related changes in emotion, motivation, cognition, sensation, perception, social relationships, NIA will continue research across several areas.

- *The psychological science of aging.* Understanding age-related psychological change remains essential for advancing our understanding of how age impacts behaviors and decisions that, in turn, shape the subjective well-being, social relationships, physical and mental health, physical function, and economic well-being of older adults. Advances in psychological science are needed to improve behavioral interventions and to understand the pathways and mechanisms through

which psychological and social factors impact health. NIA will continue to support research on basic psychological and social processes associated with normal aging; their relationship to individual, contextual, and environmental factors that impact these outcomes; and their neurobiological and genetic bases.

- *The impact of social interaction on health and well-being.* Although research suggests that positive social interaction is health protective, we must improve our understanding of the mechanisms and pathways through which these factors improve both physical and mental health. We must also better identify the characteristics of social relationships and social environments that promote healthy aging. NIA-supported research to deepen our understanding in this area will aid in tailoring interventions to improve the health and quality of life of older adults.
- *The role of cognition in everyday functioning, including work environments, decision making, and interaction with technology.* NIA will support research to examine the influence of contexts – behavioral, social, cultural, and technological – on the cognitive functioning of older adults; investigate the effects of age-related changes in cognition on activities of daily living, social relationships, and health status; and develop strategies for improving everyday functioning through various interventions such as cognitive training.

B. To accelerate discovery of the behavioral and social causes and risk factors associated with disease and disability among older adults, NIA will continue research to:

- *Identify, analyze, and track changing patterns of disability for older adults and better understand factors contributing to these patterns.* NIA-supported research will address disability dynamics at several levels including longitudinal research to understand the determinants of onset, severity, and recovery from disabling conditions. At the population level, NIA will foster research to understand the pathways to disability and the causes of change in mobility and function over time as well as subgroup disparities.
- *Understand how older people interact with the health system.* According to one study, fewer than 40 percent of people experiencing symptoms associated with heart and circulatory or musculoskeletal systems seek a physician's care. Similarly, women often avoid seeking care for urinary incontinence. NIA will seek to better understand how older people recognize the implications of disease-related signs and symptoms and when they consult a physician or other health care provider.
- *Understand societal roles, interpersonal support, social isolation, and elder abuse.* NIA will support methodological research to help determine the prevalence of elder physical, psychological, and financial neglect and abuse. This research will inform the development of measurement tools for assessing neglect and abuse and interventions to reduce its incidence.

- *Understand the psychological, social, and economic aspects of family caregiving.* Intergenerational family support is the most common way in which a family assembles and allocates its resources of money, skills, and time to care for all its members. NIA will work to:
 - Identify the causes of caregiver, family, and patient stress and understand the factors involved in helping older people cope with chronic disease and clarify needs and patterns of family caregiving and how people make decisions on providing care. This research will inform guidance for improving social support, skills training, and assistive services both for those who cope with chronic disease and for their caregivers on support and skills, including a focus on families with diverse ethnic and socioeconomic backgrounds.
 - Assess and evaluate family relationships over time. This research will help us understand the effects of changing relationships on the health and well-being of older people, and gain insight into the caregiving, emotional support, and family level economic aspects of aging.
 - Address issues centered on the increased demands faced by family caregivers in light of changing patterns of work and family demographics. We will pay particular attention to the ways in which characteristics such as gender, marital status, income, socioeconomic status, race, and ethnicity influence these demands.
 - Better understand the special caregiving needs of patients with Alzheimer's disease (AD) and other dementias, many of which can lead to lasting psychological and even physical consequences.
- *Understand age-associated changes in health, income, function, and roles.* NIA-supported research will inform decisions about complex issues of health, finances, and family roles in late life, both for individuals and policymakers. Researchers will compile up-to-date information about patterns of work and retirement, sources of retirement income, intergenerational income transfers, and status of health and disability at the regional, national, and global levels. This compilation will be used to develop and make available information and other resources for people as they plan for later life transitions and possible loss of independence as well as to inform policy decisions.
- *Understand decision making for long-term and end-of-life care.* There is a pressing need to define organizational mechanisms that will ensure quality, affordable health care for older people. There is also a critical lack of empirically generated knowledge on how to maximize quality at the end of life. Medical culture is oriented primarily to patient care and not to addressing the multifaceted needs of dying patients and their families. To better understand these issues, NIA will:
 - Examine component parts of health care delivery systems and their impact on medical, social, functional, and cost outcomes.
 - Understand caregiving patterns and the care needs of the physically frail.

- Assess the impact of health care organizations and provider interactions on the quality of life for dying individuals.
- C. To improve our understanding of the consequences of an aging society, NIA will continue to support research on the social, economic, and demographic consequences of the rapidly aging population in the United States and other countries. In addition, NIA will continue to support research on how social and economic factors across the lifespan affect health and well-being during old age. Researchers will work to:
- *Understand how population aging and changes in social, economic, and demographic characteristics of cohorts reaching old age affect health and well-being in the United States and other countries.*
 - Explore the effects of education and other social and demographic factors on health and well-being at older ages.
 - Assess the impact of changing family structures on health and caregiving.
 - Conduct comparative analyses to evaluate the impact of institutions on population and individual well-being and foster longitudinal studies on aging.
 - Conduct research to understand the dynamic changes that occur across the life course.
 - Examine the bases for individual and societal attitudes toward older people and develop effective strategies to improve them.
 - *Understand how social, economic, and health system factors produce disparities in health at older ages.*
 - Encourage cross-national comparative and historic research as an approach to understanding the burden of disease and health disparities.
 - Encourage interdisciplinary biodemographic, health systems, social, and economic perspectives to understand gender differences in health and disease at older ages.
 - *Understand how social and economic factors throughout the lifespan affect health and well-being at older ages.*
 - Support research on social insurance and health insurance systems (e.g., Social Security and Medicare) to assist other agencies in promoting the health and well-being of the elderly while assuring program efficiency.
 - Support continued work to understand the biological, behavioral, economic, and social basis for decisions of individuals, employers, and families that affect income security in retirement and the financing of long-term care.
 - Support research that models and measures the economic risks of old age with the potential for developing interventions to insure against these risks.
- D. To improve our ability to reduce health disparities and eliminate health inequities among older adults, NIA will continue to support essential research to increase our

understanding of and reduce health disparities and inequities among older adults; establish the scientific basis for redressing differences and inequities affecting older adult populations; and understand the extent to which genetic, behavioral, social, and other factors that show variation across racial and ethnic groups influence health and longevity and specifically to understand health differences and health inequities among older adults. The Institute will support research to:

- *Understand normal aging processes across various ethnic/racial and low SES populations.* Researchers will characterize normal processes of aging in minority and low SES populations to increase our understanding of the course of disease and disability, and to identify the similarities and differences among racial and ethnic groups and among groups living in different geographic locations.
- *Gather data that further classify patterns of health differences, inequities, and causes.* Researchers will compile data from multiple sources to assemble the necessary volume and types of information needed. NIA will use ongoing data collection programs to over sample minority populations. These data will provide important information on living arrangements, income, health care needs, and other topics. Researchers will also continue to support surveys focused on specific groups and concentrated on issues of illness and well-being.
- *Determine the influences of and interactions among race, culture, ethnicity, economic status, education, and work experiences in health.* NIA will learn more about risk interrelated factors for disease and preventive factors contributing to good health by researching these influences individually and in concert. Researchers will place a special emphasis on longitudinal data, which provide information about individuals across their lifespans, to untangle the multitude of factors that affect health and well-being.
- *Track and analyze disease prevalence and course in diverse older adult populations.* Researchers will work to determine the causes of disparities in the prevalence of diseases and conditions such as heart disease, obesity, hypertension, frailty, diabetes, comorbidities, and certain types of cancer among minority and underserved populations. NIA-supported researchers will explore socioeconomic factors such as education, language, and access to health care as well as how genetic, molecular, and cellular factors contribute to differences across populations. In addition, they will work to determine the reasons for variation in the prevalence of cognitive decline and Alzheimer's disease across population groups.
- *Conduct research to better understand effective strategies for communicating health messages that are culturally appropriate in various racial/ethnic and low SES populations.* Because of language, educational, and cultural differences, underserved groups do not always receive the information they need about healthy lifestyle behaviors. NIA-supported communication research with specific target audiences will assist the development of appropriate health messages and dissemination channels.

- *Study population changes and underlying causes of health and function of older adults across the lifespan.* Many studies have identified significant risk factors for the development of chronic diseases that pre-date onset of symptoms by at least a decade. Population-based studies in which individuals are tracked from birth and across the lifespan help researchers understand the changes in health over time and the large variations in health across racial and ethnic populations. NIA-supported research will continue to develop, maintain, and analyze longitudinal data sets.
- *Track and analyze patterns of aging and the burden of disease within and across diverse populations.* Researchers will gather and analyze data on burdens and costs of illness, healthy life expectancy, longevity, and mortality trajectories. This research will provide valuable information for projecting the specific needs for health care services within various population groups. NIA will also support the development of cross-national and sub-national databases on health outcomes, risk factors, and SES structural factors, such as societal inequality.
- *Determine the reasons for variation in the prevalence of cognitive decline and Alzheimer's disease (AD) across population groups.* NIA will support research to better understand the differences in the prevalence of AD among African Americans, Asians, and Hispanics compared to non-Hispanic whites. For example, Japanese Americans living in Hawaii have lower prevalence of stroke-related dementia and higher rates of AD than Japanese nationals. Researchers will continue to examine a range of possible causes of these disparities including the impact of diseases such as hypertension, cardiovascular disease, and diabetes; health behaviors; and disease processes in minority populations.

Example Initiatives and Related Publications for Research on Behavioral and Social Processes

Extramural

- Health and Retirement Study (HRS). The HRS is one of the most innovative studies ever conducted to better understand the nature of health and well-being in later life. The purpose of the study is to examine the ways in which individuals and families are preparing for the economic and health requirements of advancing age and the types of actions and interventions – at both the individual and societal levels – that can promote or threaten health and wealth in retirement. Now in its second decade, the HRS is the leading resource for data on the combined health and economic circumstances of Americans over age 50. The HRS has drawn a detailed portrait of America's older adults, helping us learn about this growing population's physical and mental health, insurance coverage, financial situations, family support systems, work status, and retirement planning. Through its unique and in-depth interviews with a nationally representative sample of older adults, the HRS provides an invaluable, growing body of multidisciplinary data to help address the challenges and opportunities of aging. Launched in 1992, the study follows more than 20,000 men

and women over 50 offering insight into the changing lives of the older U.S. population. A report on the study, *Growing Older in America: The Health & Retirement Study*, was published in 2007 to help familiarize researchers, policymakers, media, and organizations concerned with health, economics, and aging with this data resource. (www.nia.nih.gov/ResearchInformation/HRS.htm)

- Global Aging. On March 15, 2007, NIA partnered with the U.S. State Department to host a Summit on Global Aging. In support of this event, NIA prepared a document entitled, *Why Population Aging Matters: A Global Perspective*, to provide a succinct description of population trends that are transforming the world in fundamental ways. Using data from the United Nations, the U.S. Census Bureau, and the Statistical Office of the European Communities as well as regional surveys, the report identifies nine emerging trends in global aging: An Aging Population, Increasing Life Expectancy, Rising Numbers of the Oldest Old, the Growing Burden of Noncommunicable Diseases, Aging and Population Decline, a Changing Family Structure, Shifting Patterns of Work and Retirement, Evolving Social Insurance Systems, and Emerging Economic Challenges. These trends present a snapshot of challenges and opportunities that will stimulate a cross-national scientific and policy dialogue. The report paints a compelling picture of the impact of population aging on nations and provides a succinct description of population trends that are transforming the world in fundamental ways. The purpose of the report is to stimulate dialogue about biomedical, economic, and behavioral issues and encourage international study to determine the best ways to address this universal human experience. (www.nia.nih.gov/ResearchInformation/ExtramuralPrograms/BehavioralAndSocialResearch/GlobalAging.htm)
- National Research Council Studies. A National Research Council (NRC) study commissioned by the Behavioral and Social Research Program at NIA has broad implications for all of the behavioral and social science research conducted at NIH. In 2006, the NRC Committee on Assessing Behavioral and Social Science completed their report, *A Strategy for Assessing Science: Behavioral and Social Research on Aging*. The report offers strategic advice on the perennial issue of assessing rates of progress in different scientific fields. It considers available knowledge about how science makes progress and examines a range of decision-making strategies for addressing key science policy concerns. These include avoiding undue rigidity that may arise from the influence of established disciplines; achieving rational, high-quality, accountable, and transparent decision processes; and establishing an appropriate balance of influence between scientific communities and agency science managers. The report also identifies principles for setting priorities and specific recommendations for the context of behavioral and social research on aging. (www.nap.edu/catalog.php?record_id=11788)

The Behavior and Social Research Program at NIA also commissioned a study by the NRC to further advance understanding of how social and individual factors can improve the health and functioning of older adults. In response, the NRC Committee on Aging Frontiers in Social Psychology, Personality, and Adult Developmental

Psychology was formed and charged with exploring research opportunities in social, personality, and adult developmental psychology and identifying research opportunities that would draw on recent developments in the psychological and social sciences, including behavioral, cognitive, and social neurosciences, are related to experimental work in social psychology, personality, and adult developmental psychology, and cross multiple levels of analysis. In their 2006 report entitled, *When I'm 64*, the committee emphasized areas that have clear applicability to the everyday lives of the nation's older population. The group also stressed the need for a lifespan perspective that looks not only at older people, but at people who will become old in the coming decades, recognizing that old age outcomes are the product of cumulative effects of behavioral and social processes that occur throughout adulthood. They recommended four substantive areas for NIA research: motivation and behavioral change, socioemotional influences on decision making, the influence of social engagement on cognition, and the effects of stereotypes on self and others. (www.nap.edu/catalog.php?record_id=11474)

- Panel Study on Income Dynamics (PSID). NIA supports the PSID with the National Science Foundation. It is a longitudinal study of a representative sample of U.S. individuals and families. As the longest running national panel on human and social behavior, it has consistently achieved re-interview response rates of 96-98%. PSID is perhaps the most widely used social science data set in the world. For the two most recent waves of data collection (2003 and 2005), NIA supported content on health, including the collection of Medicare numbers for the first time in 2005, wealth and active savings, and pensions. The PSID is now positioned to become the only data ever collected on the full life course and multigenerational health and well-being in a long-term panel representation of the U.S. population.
- Survey of Health, Ageing and Retirement in Europe (SHARE). NIA supports SHARE through an interagency agreement with the U.S. Census Bureau and the World Health Organization. SHARE is an interdisciplinary data collection on European citizens over age 50. Data collected include health, psychological, economic, and social support variables. SHARE is designed to be comparable with the Health and Retirement Study and the English Longitudinal Study of Ageing. NIA support is used to: increase participation of the oldest old by permitting longer field times, more frequent contact attempts, and interviews at two points in time and by enabling longer and specialized interviewer training geared to the oldest old; add several experimental anchoring vignettes to enable improved cross-national and cross-cultural comparability of subjective health measurement; and increase sample sizes to permit cross-national comparisons between HRS and SHARE. Data collected by January 2005 have already been distributed to the scientific community, free of charge. The Belgian data which were collected late 2005 and early 2006 are now available on the SHARE Intranet and ready for official release together with all release 2 data, which will be released on the Internet soon. Data from nine sites (eight countries) are now available from SHARE.
- Centers on the Demography and Economics of Aging (DAEs) (RFA-AG-04-001). NIA supports 13 DAE centers, which seek to foster research in demography,

economics and epidemiology of aging and to promote use of important datasets in the field. To achieve these aims, the centers support infrastructure development and seed projects. An evaluation of the Centers to assess their overall effectiveness and determine what changes might be warranted for a future funding cycle, including potential adjustments to program scope, goals, and objectives, was recently completed. The evaluation results indicate that as a whole the centers have met the stated RFA objectives, were appropriately balanced, and should continue to be rooted in population research.

- Retirement Economics (PA-07-075, PA-05-036). The retirement economics initiative encompasses research on the work and retirement decisions that people make at older ages and the health and economic circumstances of individuals as they evolve before retirement, at the time that work transitions take place, and throughout retirement. It is about the complex interrelationships among work, economic circumstances, public policy, health, and other aspects of later life.
- Research on the Economics of Diet, Activity, and Energy Balance (PA-06-292). This initiative is intended to support research in the area of energy balance – i.e., the relationship between diet, physical activity, and obesity – for researchers with expertise and experience in health economics and health services research who might otherwise not be aware of the opportunity to apply these disciplines to this area. Research areas supported include consumer economics, industrial organization, community structure, policy, and cost-effectiveness/cost-benefit studies. NIA joined this initiative to support aging related research in this area.
- Research on Health Disparities. In conjunction with the NIH Office of Behavioral and Social Science Research (OBSSR) and several NIH Institutes and Centers, NIA is soliciting Behavioral and Social Science Research on Understanding and Reducing Health Disparities (PAR-07-379, PAR-07-380). NIH established this initiative to solicit research project grant applications employing behavioral and social science theories, concepts, and methods (1) to improve understanding of the causes of disparities in health and disability among the various populations in the United States and (2) to develop and test more effective interventions for reducing and eventually eliminating health disparities. The goal is to move beyond documenting the existence of health and disability disparities to addressing causes and solutions.
- Basic and Translational Research on Emotion (PA-07-083). Under this initiative supported by the National Institute of Mental Health, NIA, the National Institute on Alcohol Abuse and Alcoholism, the National Cancer Institute, the National Institute of Child Health and Human Development, the National Institute on Drug Abuse, and the National Institute of Neurological Disorders and Stroke, NIH invites research grant applications to expand basic and translational research on the processes and mechanisms involved in the experience, expression, and regulation of emotion. The study of emotion encompasses a wide range of physiological, psychological, social, cognitive, and developmental phenomena. Central and peripheral nervous system activity and expression, regulation and

modulation of emotion are important objects of study, as are the contributions of emotional and motivational systems to cognitive faculties such as perception, attention, learning, memory, and motor control. The study of emotion includes investigations of overt behaviors such as aggression or withdrawal, interpersonal relationships, communication and decision making, and the environmental circumstances and experiences that shape and elicit emotions.

- Health Literacy PAR-07-020, PAR-07-019. The ultimate goal of this initiative is to encourage empirical research on health literacy concepts, theory and interventions as these relate to the U.S. Department of Health and Human Services' public health priorities that are outlined in its HealthierUS and Healthy People 2010 initiatives. Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.
- Social and Cultural Dimensions of Health (R01; PA-07-045). This initiative is designed to encourage the development of health research that integrates knowledge from the biomedical and social sciences. This announcement invites applications to (a) elucidate basic social and cultural constructs and processes used in health research; (b) clarify social and cultural factors in the etiology and consequences of health and illness; (c) link basic research to practice for improving prevention, treatment, health services, and dissemination; and (d) explore ethical issues in social and cultural research related to health.

Strategic Objectives for Biopsychosocial Research

- A. To advance knowledge of the genetic, biological, clinical, behavioral, social, economic, psychological, and environmental factors affecting healthy aging, well-being and longevity, NIA will continue studies to advance understanding of:
- *Factors that contribute to exceptional health or its decline across the lifespan.* The study of older people is shedding light on the behavioral and social factors associated with healthy aging. Researchers will continue studies to link laboratory and longitudinal population-based studies, providing insights into the factors that define resilient individuals and contribute to well-being in old age.
 - *The interplay among the biological, social, emotional, cognitive, and functional changes associated with normal aging.* NIA will use the approaches of social neuroscience and neuroeconomics to study how the neurobiological changes associated with aging influence or are influenced by social, emotional, cognitive, and motivational factors.
 - *The interplay among genetic, biological, clinical, social, economic, psychological, and environmental factors affecting aging and longevity.* Researchers will seek to identify factors across the lifespan that contribute to exceptional health or its decline through research that links laboratory and

longitudinal population-based studies, providing insights into the factors that define resilient individuals and contribute to well being in old age.

- *The biological mechanisms and pathways through which social, psychological, and environmental stresses contribute to declines in health and well-being among older adults.* Individual differences in the subjective experience and physiological and psychological impact of stressors may exacerbate or buffer the impact of stressors on health. NIA will encourage multi-level and interdisciplinary research in collaboration with relevant NIH Institutes on the interactive effects of genes, behavior, and social environments on health and well-being as people age.

B. To improve our understanding of Alzheimer's disease (AD), other dementias of aging, and the aging brain, NIA will continue to:

- *Support research on the nervous system and behavioral changes that occur with normal aging and how brain function is maintained and enhanced.* Changes in brain structure and function, some of which may compensate for age-related decrements, may continue throughout life. Researchers will continue to explore the role of physical and mental exercise in promoting healthy cognitive, emotional, and motor functioning and in activating the cellular machineries that protect the brain from damage and promote its repair. This research will help form the basis for future investigation of more subtle neural changes that occur with age, including selective neuronal loss or dysfunction that impacts memory and other functions, impaired neuronal connections, early brain atrophy, and changes in the responses of glial cells involved in neuron survival and brain plasticity and possibly inflammation.
- *Determine how genetic, molecular, cellular, and environmental factors interact for optimal brain health and functioning.* NIA will work to gain a greater understanding of the multiple factors that interact to maintain brain function, including compensatory mechanisms and adaptive or dynamic changes. This research will enhance our understanding of, and potentially our ability to prevent, brain function decline in aging and disease. In basic behavioral and social science research, NIA will support research to better understand the neurological and behavioral effects of environmental factors, both early and later in life.

Example Initiatives for Biopsychosocial Research

Extramural - Large projects

- National Survey of Mid-Life Development in the US (MIDUS II). MIDUS II is a follow-up study to a telephone survey of 4,000+ community-dwelling adults first interviewed in 1995-6, when they were aged 25-74. Participants are being re-contacted in 2003-2008, when they are aged 34-85. Data are collected by telephone and mail questionnaires and diaries. The main research interest is in midlife

development, psychosocial well-being, and the health consequences of stress and allostatic load. Subsets of participants undergo a full clinical exam, participate in a daily diary study of life stressors and cortisol, and undergo neuroimaging and psychophysiological assessment of affective reactivity, recovery and regulation. A major goal of MIDUS II is to characterize cognitive functioning during midlife and into old age. It includes a telephone cognitive battery designed to measure working memory span, episodic verbal memory, speed of processing, and abstract reasoning. MIDUS includes an oversample of minority respondents from Milwaukee, a subsample of 900+ siblings of respondents and an additional subsample of some 2,000 twin pairs, nationally representative. An oversample from the Boston area was tested on a multi-factor cognitive battery, stress reactivity and control beliefs, for analyses of effects of stress and psychosocial variables on cognitive performance in midlife. A parallel study is being established in Japan (MIDJA) with plans for U.S.-Japan comparative analyses.

- The English Longitudinal Study of Ageing (ELSA). The ELSA sample includes 8,780 core members (and a subset of 652 spouses or partners), originally selected from respondents to the 1998-2001 Health Survey for England. Two waves of data have been collected so far, and further waves are planned. Data collection includes face-to-face interviews and self-administered questionnaires, plus a home visit by a nurse. Items cover perceptions of ageing, cognitive function, physical performance, lung function, anthropometry, psychosocial variables, and expectations, as well as a rich array of demographic, economic and social variables. NIA funding has supported incorporation of measures designed to be comparable to corresponding Health and Retirement Study variables, as well as comparative analyses.
- The Whitehall II Studies: Socioeconomic Status and Changes in Health. The principal aim of the Whitehall I Study of British Civil Servants, a prospective cohort study collecting measures of health, behavior and socioeconomic status, is to study social inequalities in health; this project has been underway in the UK since 1985. The principal aim of the Whitehall II study is to understand the social inequalities in health by elucidating psychosocial, behavioral, and pathophysiological pathways by which social circumstances affect health functioning and risk of disease.

Extramural - Research Initiatives

- Social Neuroscience. The emerging discipline of social neuroscience directly addresses relations between genetic, neural, endocrine, and immune systems and aspects of emotional function, social behavior, and the socio-cultural environment. This includes research addressing how social network size, social context, social demands, and relationship quality impact neurobiological function as well as studies of the neurobiological and genetic underpinnings of emotional regulation and understanding, attitudes, affiliation, moral behavior, communication, trust, and social exchange. Despite a recent surge of interest and activity in social neuroscience, relatively little attention has been paid to these phenomena in the context of adulthood and aging. The National Research Council report, *When I'm 64*, pointed to social neuroscience research on aging as a critical next step for the

behavioral and social sciences. There is a need to understand (1) how social behaviors and social motives and their neurobiological underpinnings develop and change over the lifespan; (2) how changes in social networks at different life phases (marriage, parenting, caregiving, widowhood, retirement, reductions in network size due to functional limitations or death of network members) influence neurobiological systems for social and emotional function; and (3) how these developmental changes in social context and social behaviors impact mental health and psychological well-being at different stages of life.

In 2005, NIA joined the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism in issuing RFA-DA-06-004 on Social Neuroscience to stimulate investigations of the cognitive/behavioral processes and neurobiological mechanisms of social behavior relevant to decision making and judgment over the life course.

In 2007, NIA joined the National Institute of Mental Health in issuing RFA MH-08-070, Basic and Translational Research Opportunities in the Social Neuroscience of Mental Health. This initiative solicits applications that examine the neurobiological bases of social behavior, including its genetic, developmental, cognitive, and affective components. In the Funding Opportunity Announcement, NIA expressed interest in research examining the neurobiological basis of social behaviors of relevance to aging, with particular emphasis on the mechanisms and pathways linking social behaviors and social environments to the psychological well-being of middle-aged and older adults.

- Research on Mind-Body Interactions in Health (PA-07-046). *Mind-body interactions and health* refers to the relationships among cognitions, emotions, personality, social relationships, and health. A central goal of this initiative is to encourage interdisciplinary collaboration and innovation towards understanding the processes underlying mind-body interactions and health as well as towards the application of such basic knowledge to interventions and clinical practice in the promotion of health and the prevention or treatment of disease and disabilities. NIA's interests in this area include (1) mind-body effects on acute and chronic health, quality of life, functional capacity, and life expectancy/mortality; (2) how diseases common in late life – e.g., hypertension, Type II diabetes, osteoarthritis, Alzheimer's disease – are modulated by the interaction of physiological and neurological mechanisms with cognitive, affective, perceptual, and psychosocial factors experienced by the older individual; and (3) integrative approaches – e.g., social neuroscience, psychoneuroimmunology – to understanding the psychological and neurobiological mechanisms underlying the relations among social connectedness, social isolation, psychological well-being, self-regulation and the health and well-being of middle aged and older adults.
- Behavioral and Social Research on Disasters and Health (PA-07-141). The goal of this initiative is to stimulate research in the behavioral and social sciences on the

consequences of natural and man-made disasters for the health of children, older adults, and vulnerable groups, with an ultimate goal of preventing and mitigating harmful consequences and health disparities. Disasters include severe weather-related events, earthquakes, large-scale attacks on civilian populations, technological catastrophes or perceived catastrophes, and influenza pandemics. For older adults and for children and youth, the health outcomes of greatest interest include mortality, disability and resilience, severe distress and clinically significant morbidity (as opposed to mild or transient symptoms and dysphoria), and economic hardship sufficient to harm health. While the special needs of older adults, the chronically ill and disabled, and families with children are frequently mentioned in the literature, existing empirical research is insufficient to provide adequate guidance to public- and private-sector organizations for planning, prevention and mitigation. Research and translation efforts can help inform planning by drawing on lessons from disasters of multiple types and locations.

- Research on Pathways Linking Environments, Behaviors, and HIV/AIDS (PAR-07-143). Concern about the current and potential future impact of the HIV/AIDS epidemic around the globe has increased dramatically in recent years. According to the U.S. Census Bureau's report, *The AIDS Pandemic in the 21st Century* (issued March 2004), HIV/AIDS is having its greatest impact in the developing world, and the emerging downward trends in life expectancy and population growth, the distortions in age structures and the breakdowns in support systems are already being seen in some sub-Saharan African countries. At the same time, many in the scientific community have recognized that the AIDS epidemic is driven not only by individual behaviors, but also by environmental factors that influence behavior and the spread of disease. A comprehensive understanding of this epidemic requires an examination of the various interacting pathways that contribute to its dynamics.
- Focal Cognitive Deficits in CNS Disorders (R21 and R03; PA-07-035 and PA-07-034). The purpose of this FOA issued by the National Institute of Nursing Research, NIA, the National Institute of Neurological Disorders and Stroke, and OBSSR is to invite grant applications to expand basic and translational research on the types, nature, and functional consequences of focal or specific cognitive deficits experienced by persons with central nervous system disorders.
- Neuroeconomics of Aging (RFA-AG-06-011). Studies in neuroeconomics focus on better understanding the psychological mechanisms that guide economic behaviors and the underlying neurobiological mechanisms that are involved. Fueled by methodological advances in neuroscience, including the development of neuroimaging technologies such as functional Magnetic Resonance Imaging (fMRI), the neuroeconomics approach provides opportunities for a systematic investigation of the neurobiological mechanisms involved in behaviors such as reward processing, temporal discounting, subjective and objective valuation, overconfidence, delay of gratification, decision making in an environment of risk and uncertainty, and affective influences on choice. Recent neuroeconomics research has also focused on social phenomena involved in the motivation of economic behavior including altruistic punishment, cooperation, competition, fairness, persuasion, trust, and reciprocity.

These functions implicate the involvement of neural mechanisms associated with reward processing, motivation, affect, and social cognition. NIA has invited applications examining the social, emotional, cognitive, motivational processes and neurobiological mechanisms of economic behavior as these (1) influence social, financial, and health-related decisions affecting the well-being of middle-aged and older adults, and (2) inform the development and refinement of integrative economic theories of utility, learning, and strategic choice relevant to aging.

Intramural

- Health, Aging, and Body Composition (Health ABC) Study. The Health ABC initiative is designed to investigate the hypothesis that change in body composition (muscle, fat and bone) acts as a common pathway through which weight-related health conditions and behavioral factors contribute to loss of independence in older people. The cohort consists of 3,075 men and women aged 70-79 at baseline in 1997-98. Forty-five percent of the women and 33 percent of the men are African American. All cohort members reported no difficulty walking 1/4 mile or up ten steps at baseline on two separate interviews prior to enrollment. This study has been one of the first to implement a comprehensive multidisciplinary approach to a population study of aging by inclusion of major weight-related health conditions common in old age including diabetes and metabolic disorders, osteoporosis, osteoarthritis of the knee, cardiovascular disease, pulmonary disease, and depression. The study completed the last clinic examination in May 2007. A planned expansion will be for five-years of focused event follow-up to include report of function and cognition, selected disease endpoints (fracture, heart disease, cancer, and stroke), cause-of-death assessment, and maintenance of the biorepository.
- Elite Aging Study. Although research has been done on the correlates of long life and functional decline, we still know relatively little about why certain individuals live in excellent health into their 80's while others fail much sooner. The Elite Aging Study will compare a cohort of individuals from the long-running Baltimore Longitudinal Study of Aging cohort of individuals who were no longer healthy or fully functional after reaching 80 years of age with the Elite cohort, a group comprised of individuals who have already reached the goal of healthy longevity. The Elite Aging Study will focus on several areas, including the identification of genes that distinguish Elite from non-Elite individuals, the identification of biological, physiological, environmental, and behavioral factors that distinguish Elite from non-Elite individuals, and the identification of genetic, physiological, environmental, and behavioral characteristics that are risk factors for "losing the Elite condition" over several years or longer.

Strategic Objectives for Research on the Development of Systems Models and Procedures for Measurement, Analysis, and Classification

To develop the tools and other resources needed to promote high quality research, NIA will continue to:

- Support the development of population based data sets, especially from longitudinal studies, suitable for analysis of biological, behavioral, and social factors affecting health, well-being, and functional status through the life course.
- Support data archiving and data sharing, with adequate protections for confidentiality and privacy of research participants and their families.
- Support the development of internationally harmonized social and behavioral longitudinal data on aging to foster cross-national research.
- Support computer technologies to record and analyze interdisciplinary research findings on long-term population based data.
- Develop better ways of distinguishing people with normal brain aging from those who will develop mild cognitive impairment (MCI), Alzheimer's disease (AD), and related conditions. Identification of biomarkers of the transition from normal function to different levels of cognitive impairment is facilitating our efforts. NIA will work to:
 - Identify neuroimaging and other biological markers for early detection of cognitive decline, MCI, and AD and for understanding the progression from normal cognitive aging to MCI to early AD.
 - Improve neuropsychological assessment of cognitive function. Despite remarkable advances in neuroimaging, neuropsychological assessment of cognitive function continues to be the gold standard by which AD is diagnosed. NIA will continue to support development of better tools for assessing cognitive function in the clinic, in the primary care setting, and in the home environment. A standardized assessment tool will help track and compare behavioral change over time in longitudinal and epidemiological studies, in clinical trials, and eventually in primary care and other non-research settings.
 - Improve methods of assessing changes in sensory and motor systems as markers of age-related change and AD. NIA will continue to examine how the use of sensory testing to predict early neurodegeneration could assist in clinical diagnoses and continue to explore possible correlations between changes in sensory perception and AD.
- Support development of measurement tools for assessing elder neglect and abuse. NIA will support methodological research to help determine the prevalence of elder physical, psychological, and financial neglect and abuse. Researchers will also work to develop and disseminate reliable measurement tools for assessing neglect and abuse and interventions to reduce its incidence.

Example Initiatives for Research on the Development of Systems Models and Procedures for Measurement, Analysis, and Classification

Extramural

- Harmonization of Longitudinal Cross-National Surveys of Aging (PAS 07-387). NIA

will provide support through the exploratory and developmental grant mechanism to facilitate the harmonization of international longitudinal surveys of aging populations to the NIA-supported Health and Retirement Study (HRS) to maximize cross-national comparability of data. Developing surveys in countries with changing health care or pension institutions or significantly different age structures can provide opportunities for analysts to explore important behavioral and social research questions in aging. Cross-nationally comparable data provides researchers with opportunities to explore important behavioral and social science research questions. A key to creating such data occurs in the developmental stage of each survey. The HRS provides a uniquely rich, nationally representative longitudinal dataset for researchers who study the health, economics and demography of aging in the United States. The data can simultaneously support cross-sectional descriptions of the U.S. population over the age of fifty, longitudinal studies of a given birth cohort and research on cross-cohort trends. The HRS has served as a model for the survey instruments used by the English Longitudinal Study of Ageing, the Survey of Health, Ageing, and Retirement in Europe (SHARE), the Mexican Health and Aging Study, SHARE Israel and the Korean Longitudinal Study of Aging.

- Methodology and Measurement in the Behavioral and Social Sciences (PA-06-343, 06-344, 07-060). The goal of this initiative is to encourage research that will improve the quality and scientific power of data collected in the behavioral and social sciences, relevant to the missions of the NIH Institutes and Centers, particularly research that addresses methodology and measurement issues in diverse populations, issues in studying sensitive behaviors, issues of ethics in research, issues related to confidential data and the protection of research subjects, and issues in developing interdisciplinary, multi-method, and multilevel approaches to behavioral and social science research as well as approaches that integrate behavioral and social science research with biomedical, physical, or computational science research or engineering.
- Developing Integrated Economic Models of Health and Retirement (RFA-AG-07-007). The NIA established this initiative to stimulate studies to develop comprehensive econometric models of retirement from the labor force and to integrate health and disability, wealth, and family factors into a single retirement modeling framework.
- Technological Enhancements for Surveys of the Elderly (PA-06-471, PA-06-472). The purpose of this FOA is to support research for the enhancement of data collection in household surveys for the elderly. This announcement invites applicants to develop technology that will increase the portability, speed, ease and cost-effectiveness of collecting biological data and performance indicators in population-based household surveys and behavioral interventions.
- Developmental Research on Elder Mistreatment (R21; RFA-AG-06-009). This FOA addresses initial scientific stages for understanding Elder Mistreatment in community and institutional settings. These research priority areas include: (1) innovative methods for estimating incidence; (2) standardization of definitions and measurement; (3) elaboration of risk factors; (4) methods of survey, clinical, and psychosocial identification of Elder Mistreatment; and (5) identification of Elder

Mistreatment in institutional settings. NIA seeks scientific pilot or developmental research on the tools required and feasibility of conducting a national incidence study of elder mistreatment.

- Sociobehavioral Data Analysis and Archiving in Aging (R03; PA-06-102). NIA has supported the development of major data collection efforts in areas such as cognition, genetics, long term care, retirement and economic status, caregiving, behavioral medicine, and the dynamics of health and functional change in the very old. This FOA issued by NIA is seeking small grant (R03) applications to: (1) stimulate and facilitate data archiving and secondary analyses of data related to caregiving, cognition, demography, economics, epidemiology, behavioral genetics and other behavioral research on aging; (2) provide support for preliminary projects using secondary analysis that could lead to subsequent applications for other research project grant award mechanisms; (3) provide support for rapid analyses of new databases and experimental modules for purposes such as informing the design and content of future study waves; (4) provide support for the development, enhancement and assembly of new databases from existing data; and (5) provide support for pilot research on under-utilized databases.

NIA FY 2008 Conferences and Workshops

Allostatic Load, November 29-30, 2007. This NIA-supported exploratory workshop, held in Washington D.C., explored theoretical and measurement issues relating to the concept of allostatic load, and more specifically on the question of assessing multiple and cumulative aspects of physiological aging and dysregulation - including its antecedents (e.g., life experiences) and health consequences. This workshop focused on measurement of cumulative physiological dysregulation in both survey and laboratory contexts and explored how the integration of these approaches and of findings from human and animal studies can inform our understanding of these relations. The goals of the workshop were to identify research needs and strategies for advancing the science in this area.

Workshop on National Health Accounts, December 6-7, 2007. This exploratory workshop was held in Cambridge, MA to inform the work of David Cutler and Allison Rosen on the development of a revised set of National Health Accounts. Participants included agency officials involved in the production and dissemination of national health account information and academic researchers working on related issues of health accounting, health production functions, and burden of illness.

Genetic Mechanisms and Life Course Development, February 11-12, 2008. There is a growing body of research showing that early life experiences may have enduring effects across the life span and influence the trajectories of psychosocial resilience or decline in old age. There are also an increasing number of well-crafted, longitudinal studies covering broad spans of development whose methods, observations, analyses, and findings are helping to delineate patterns of behavioral and social development in mid and late life. And findings from genetic studies, using quantitative and molecular genetic approaches, are suggesting mechanisms that may account for continuities and discontinuities in psychosocial competencies across broad spans of development. This

workshop explored areas where the integration of lifespan development and genetics can clarify developmental mechanisms that promote selected domains of psychosocial competence in aging.

Workshop on Meditation for Health Purposes, Spring 2008. This workshop will be led by NCCAM. One of NIA's areas of emphasis includes behavioral and mind-body interventions. Part of the scope of this workshop is to determine whether or not meditation is beneficial to physical, emotional and cognitive health. NIA will work with NCCAM to identify new opportunities that may promote knowledge on meditation and health outcomes. The purpose of the workshop will be to consider the data and conclusions from an Agency for Healthcare Research and Quality review conducted in 2005 of what is known regarding the health benefits of meditation as well as to assess the state of the science and suggest directions for future research.

Workshop on Cognitive Interventions, Spring or Summer 2008. The National Academy of Sciences (NAS) held a meeting in October 2007 to evaluate results from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) clinical trial and help determine what appropriate next steps might be taken. The NAS Board on Behavioral, Cognitive, and Sensory Sciences recommended that NIA hold a workshop on measurement and methodology issues before launching any future large scale randomized clinical trial. Different types of interventions should also be considered to determine which are most promising. Participants at the Cognitive Aging Summit co-sponsored the same month by the McKnight Brain Research Foundation and NIA also felt that future cognitive intervention trials would benefit from refinement of these issues. Social, behavioral, and environmental interventions for health promotion, disease prevention, and postponement of disability are an emphasis for NIA and this workshop will further efforts to start the next cognitive intervention trial.

12. National Institute of Arthritis and Musculoskeletal and Skin Diseases

Strategic Priorities: The National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) developed a long-range research plan for FY2006-2009, which is a broad outline of scientific opportunities, needs, and gaps that provides a framework for the Institute's priority setting process. It includes several behavioral and social science research topics relevant to the Institute's mission (http://www.niams.nih.gov/about_us/mission_and_purpose/long_range.asp).

In the plan, the NIAMS identifies the need for research on factors that influence decisions about adopting and adhering to treatment and preventive interventions, as they relate to understanding behavioral and social processes in chronic diseases. Studies of the impact of biological factors, behavioral diversity, sex differences, ethnic background, family environment, previous trauma, education, or a combination of factors, on the variability of patient outcomes will be important contributions to the scientific and medical communities.

An important area of emphasis is research in biological mechanisms of psychosocial or behavioral processes related to disease onset, progression, and outcomes. This includes genetic and environmental influences on behaviors relevant to health, and understanding neuroimmune and neuroendocrine pathways.

In addition, more valid, reliable, efficient assessment instruments and methodologies are needed to measure symptoms and health-related quality of life variables that are important to patients. Studies to determine effective information dissemination systems to target audiences, including procedures for translating knowledge into behavioral change will also be critical.

Portfolio Activities: The NIAMS currently supports a variety of bBSSR projects (highlights below).

A. Research on behavioral and social processes

- Rheumatoid arthritis (RA) is a debilitating, chronic inflammatory disease, and some patients use exaggeration of their conditions, or catastrophizing, as a pain coping strategy. Catastrophizing may generate negative social responses that, in turn, could worsen interpersonal relationships and pain responses, such as self-management of pain.
- Chronic physical pain following minor motor vehicle collisions is very common in the U.S., but there are few preventive strategies for this outcome. Selected neurobiological and demographic factors may confer higher risk of chronic pain and psychological sequelae to some motor vehicle trauma victims. Researchers are studying whether brief assessments of these factors during medical treatment

immediately following motor vehicle trauma can predict future chronic pain and associated psychological problems.

- Psychosocial characteristics of patients undergoing total knee arthroplasty (TKA), and their expectations of procedures, can have a significant impact on outcomes. Research is being conducted to understand the psychosocial and educational factors that affect patient satisfaction and successful results after TKA. More effective exercise and weight-loss strategies are being developed for overweight patients with knee pain from osteoarthritis, to reduce their pain, disability, and psychological distress.
- Exercise and adoption of coping skills have been beneficial to patients suffering from widespread pain associated with fibromyalgia. However, many patients are reluctant to participate in exercises and coping skills training programs. The NIAMS is supporting a project that will identify strategies that may effectively motivate sedentary fibromyalgia patients to learn and use coping skills, increase physical activity, and participate in educational training. Fear of movement, because it may exacerbate the disorder's fatigue and pain symptoms, is also being studied as a potential cause of high patient attrition rates in exercise programs.
- Relaxation training and prescribed aerobic fitness are being tested as methods for personal pain control in fibromyalgia patients. Functional magnetic resonance imaging (fMRI) will be used to determine if these pain control therapies create changes in the brain area that regulates pain responses, to provide more information on pain processing mechanisms.

B. Interaction of behavior and biology

- Environmental factors that may modify genetic effects on bone density are being investigated in a Mexican American population, in correlation with extensive interviews. Data are being collected on lifestyle variables, such as dietary habits and physical activity levels, which may introduce environmental influences on bone mass.
- Stress-induced changes in the central nervous system, the autonomic nervous system, the hypothalamic-pituitary-adrenal (HPA) axis, and other systems associated with the stress response in anticipation of pain, are being examined in several disorders associated with chronic pain, including motor vehicle trauma and fibromyalgia. Research is being conducted on neurobiological factors, as well as genetic and environmental influences, that may be associated with chronic pain risk in these health conditions. These factors are also part of an observational study of discordant female twins (one with chronic widespread pain, which is common in fibromyalgia, and one pain-free), to evaluate genetic or environmental factors that predispose patients to chronic widespread pain.

- Researchers are studying psychosocial factors that may influence systemic lupus erythematosus, or lupus, disease activity flares, and increase the risk of vascular disease in people with the illness. Some lupus patients who do not suffer from severe neurological or psychiatric disorders, report cognitive dysfunction. Investigators are pursuing the underlying mechanisms of central nervous system changes in these patients. Quantitative examination of brain structures with magnetic resonance imaging (MRI) and measurement of neuronal metabolites (through proton magnetic resonance spectroscopy) are being used to evaluate biological abnormalities.

C. Development of systems models and procedures for measurement, analysis, and classification

- Along with other NIH institutes, the NIAMS leads the management of a trans-NIH project entitled, “Patient-Reported Outcomes Measurement Information System (PROMIS),” which is one of the NIH Roadmap initiatives designed to re-engineer the clinical research enterprise. PROMIS is developing new ways to measure patient-reported outcomes (PROs), such as pain, fatigue, physical functioning, emotional distress, and social role participation that have a major impact on quality of life across a wide variety of chronic diseases. These measurement tools will be administered through a computer adaptive testing (CAT) system, to gather and process information efficiently. An ancillary project supported by the NIAMS is identifying and addressing challenges to incorporating CAT for PROs into multicenter clinical trials. This project will assess the readiness of multicenter clinical trials to integrate CAT into data collection, and conduct simulations to identify costs and benefits of using PRO data collection models.

Portfolio Programs: The NIAMS, in cooperation with other NIH institutes and centers, participates in several funding opportunities that support topics in behavioral and social science research. These program announcements underscore the NIAMS’s interest in understanding chronic diseases and health disparities that are affected by a variety of factors: biological (genetics, neurophysiological and neuroimmunologic pathways, organ systems), lifestyle, environmental (physical and family environments), as well as social and cultural processes.

Functional Links between the Immune System, Brain Function and Behavior

<http://grants.nih.gov/grants/guide/pa-files/PA-06-533.html>

<http://grants.nih.gov/grants/guide/pa-files/PA-07-088.html>

Social and Cultural Dimensions of Health

<http://grants.nih.gov/grants/guide/pa-files/PA-07-045.html>

Behavioral and Social Science Research on Understanding and Reducing Health Disparities

<http://grants.nih.gov/grants/guide/pa-files/PAR-07-379.html>

<http://grants.nih.gov/grants/guide/pa-files/PAR-07-380.html>

Reducing Health Disparities Among Minority and Underserved Children

<http://grants.nih.gov/grants/guide/pa-files/PA-07-392.html>

<http://grants.nih.gov/grants/guide/pa-files/PA-07-391.html>

13. National Institute on Deafness and Other Communication Disorders

Introduction

Established in 1988, the National Institute on Deafness and Other Communication Disorders (NIDCD) is mandated to conduct and support biomedical and behavioral research and research training in the normal and disordered processes of hearing, balance, smell, taste, voice, speech, and language. The Institute also conducts and supports research and research training related to disease prevention and health promotion; addresses special biomedical and behavioral problems associated with people who have communication impairments or disorders; and supports efforts to create devices which substitute for lost and impaired sensory and communication function.

Basic behavioral and social sciences research supported by the NIDCD includes studies in each of the mission areas of the Institute. Studies evaluate normal and disordered communication processes, language development and speech acquisition, cognition and perception, and normal and disordered sensory-motor function.

NIDCD bBSSR Extramural Research

Basic Behavioral and Social Sciences Research (bBSSR) is supported in all the program areas of the NIDCD Division of Scientific Programs. Naturally, the voice, speech, and language programs have the largest share of bBSSR. Much of the research is in human communication abilities such as speech perception, speech production, language learning, and neurolinguistic rehabilitation. Psychophysics of hearing, taste, and smell constitute other robust areas of bBSSR supported by NIDCD. The extramural bBSSR portfolio of NIDCD is mostly supported by R01 awards. NIDCD's bBSSR portfolio is also represented by other grant mechanism, including R03s, R21s, Fs, Ks, and T awards. NIDCD has a representative that attends the NIH OBSSR-Coordinating Committee meetings and facilitates interface between NIDCD and OBSSR.

NIDCD BBSSR Intramural Research

NIDCD conducts bBSSR in its intramural labs in the area of brain imaging and modeling of human communication.

Examples of Recent NIDCD bBSSR-Related Activities

- NIDCD Workshop on Outcomes Research on Children with Hearing Loss, December 12-13, 2006. <http://www.nidcd.nih.gov/funding/programs/hb/outcomes/>. The purpose of the workshop was to determine and prioritize research needs and discuss design considerations unique to outcomes research in children with hearing loss. The Office on Disability at the Department on Health and Human Services (DHHS) has initiated a National Initiative to Close the Gaps in Health Care and Educational Services for Infants and Young Children with Hearing Loss. This initiative includes many federal agencies. A report of the meeting between the HHS Constituent Working Group on Hearing Loss in Young Children and Representatives of Federal

Agency Partners held on August 14, 2006, included recommendations in three areas: Education, Healthcare, and Research. Within the research recommendations, the first recommendation was to “*Fund prospective and longitudinal research related to interventions and outcomes. Include interactions of child, family, cultural, demographic, and geographic factors.*” The purpose of the *NIDCD Workshop on Outcomes Research in Children with Hearing Loss* was to consider this recommendation further, specifically to discuss research needs and design considerations in outcomes research in children with hearing loss.

- NIDCD Funding Opportunity Announcement: Epidemiological Research on Disorders of Hearing, Balance, Smell, Taste, Voice, Speech and Language (R01) <http://grants.nih.gov/grants/guide/pa-files/PA-07-251.html>. This Program Announcement (PA) is seeking grant applications from investigators to initiate or competitively supplement studies on the prevalence or incidence and risk factors of communication disorders of hearing, balance, smell, taste, voice, speech, and language. The purpose of the PA is to encourage the submission of applications for epidemiological research studies characterized by their population-based study design.

14. National Institute of Mental Health

Brief Description of Programs, Portfolios and Strategic Priorities of the National Institute of Mental Health (NIMH)

Basic Behavioral and Social Sciences Research (bBSSR) provides fundamental knowledge, tools, and principles that are critical in fulfilling NIMH's mission of reducing the burden of mental and behavioral disorders. In pursuit of this mission, NIMH is committed to bBSSR through support and conduct of high quality research that builds on our record of achievement in mental health research. To meet priorities in public health, the National Advisory Mental Health Council (NAMHC) in 2005 issued a report that identified several over-arching principles necessary for advancing bBSSR. These include emphases on: (1) basic research undertaken in service of the NIMH public health mission, (2) an interdisciplinary, integrated systems approach across multiple levels of analysis, and (3) the development of novel tools that allow integrative study of environment and behavior.

Taking into account this report, as well as solicited input from our various stakeholders—patients and their advocates, families, scientists, physicians and their professional societies, Congress, and the NAMHC—NIMH has sharpened and refocused the priorities of its bBSSR portfolio toward research with particular relevance to the NIMH mission, potential traction for making rapid progress, and capacity for innovation. NIMH will apply these criteria by encouraging and supporting basic research that 1) links brain, behavior, and experience and 2) informs, and is informed by, our understanding of etiology, our need for diagnostics, and our quest for new interventions to prevent or treat mental and behavioral disorders.

The Extramural bBSSR portfolio of NIMH is broadly organized within branches and programs that fall in five separate research Divisions:

The **Division of Neuroscience and Basic Behavioral Science (DNBBS)** ensures that relevant basic science knowledge is harvested to create improved diagnosis, treatment, and prevention of mental and behavioral disorders. The Division supports research targeted at understanding the neurobiological traits of normal, healthy behavior in order to elucidate the etiology behind abnormal behaviors that may lead to psychiatric disorders. Within DNBBS, the Behavioral Science and Integrative Neuroscience Branch supports research targeted at understanding the normal operation of brain structures and functions and how these may be dysregulated in psychiatric disease. Programs collectively focus on cognitive, affective, social, motivational, and regulatory systems and their development across the lifespan in humans, in non-human primates, and in other animals. The Affect and Social Behavior Program focuses on the basic processes, development, and regulation of emotion, mood, agonistic and affiliative behaviors, and social communication. The Cognitive Science Program emphasizes higher-level perception, action planning and monitoring, attention, conditioning, learning, memory, knowledge, reasoning, decision-making, and executive function. The Neural Bases of Cognition Program supports research on the brain mechanisms underlying learning,

memory, emotion, attention, intention, cognitive control, and decision-making processes, from the behavioral, systems, and cellular perspectives in humans and animals. The Circadian Rhythms, Sleep, and Regulation of Behavior Program supports research on the role of sleep in learning and memory and mechanistic studies of the neurobiology of sleep and circadian rhythms and how these processes influence cognitive and emotional functions in waking state. The Molecular, Cellular, and Genomic Neuroscience Branch supports basic research on the elucidation of the genetic, molecular, and cellular mechanisms underlying brain functions. Current emphasis is placed on developing new and using existing animal models and measures of fundamental processes altered in mood and cognitive disorders. In addition, the Branch has a focus on using unique animal models to understand the genetic basis of behaviors relevant to mental disorder. The Branch also supports research aimed at identifying molecular and cellular mechanisms responsible for the differential behavioral effects of acute and chronic drugs. Programs in this Branch supporting behavioral research include the Functional Neurogenomics Program, the Developmental Neurobiology Program, Signal Transduction Program, the Neuroendocrinology and Neuroimmunology Program, The Clinical Therapeutics Program and the Psychopharmacology Program.

The **Division of Developmental and Translational Research (DDTR)** supports research that employs a developmental perspective on a variety of related basic behavioral processes and the psychopathology that arises from their dysfunction. DDTR emphasizes research on biobehavioral processes that regulate emotion, mood, appetite, circadian rhythms, and developmental changes in behavior (such as CNS maturation and neuroendocrine development), as well as the environmental influences on these processes. In addition, DDTR sets high priority on refining standardized behavioral assessment tools that are sensitive to developmental change, cultural diversity, and variation in functioning. Within this Division, the Neurodevelopmental Disorders Branch supports research on basic biobehavioral processes involved in childhood psychiatric disorders, such as attentional and perceptual processing, executive function, inhibitory controls (e.g., sensory gating), social cognition and communication, and affiliative behaviors.

The **Division of AIDS and Health and Behavior Research (DAHBR)** places high priority on identifying the basic behavioral processes that determine health behaviors (e.g., smoking, diet, exercise, adherence) among people with mental disorders in order to develop interventions to improve functional outcomes and reduce morbidity and mortality. The Health and Behavior Research Branch supports research on basic behavioral processes (such as cognition, emotion, decision-making, and motivation) through the Behavioral Change Research Program. In addition, the Stigma and Health Disparities Program supports research on basic behavioral and social processes in stigma and discrimination associated with mental illness. The Center for Mental Health Research on AIDS supports research examining the emotional and social cognitive mechanisms involved in HIV sexual risk behavior.

The **Division of Services and Intervention Research (DSIR)** supports research on the effectiveness of treatment services and prevention strategies. Its research portfolio includes scientific research focused on optimizing and understanding the mechanisms of clinical intervention and the real-world barriers and facilitators of effective mental health services at the individual, community and national level. Within the Services Research and Clinical Epidemiology Branch, the Methodological Research Program supports high quality method development and measurements research conducted by biostatisticians in collaboration with scholars from the behavioral and social sciences.

The **Division of Adult Translational Research and Treatment Development (DATR)** promotes research on how fundamental biobehavioral mechanisms (such as emotion, cognition, motivational processes, and interpersonal relationships) impact the development, onset, and course of adult psychopathology. Emphasis is placed on studies that combine approaches from neuroscience and behavioral science to elucidate the role of psychosocial factors in the alterations of brain functioning associated with mental disorders.

Several laboratories within the **Intramural Research Program** at NIMH conduct basic behavioral and social science research. The Laboratory of Neuropsychology utilizes a multi-disciplinary approach to conduct basic research on brain mechanisms underlying learning, memory, attention, and perception in humans and nonhuman primates. The Laboratory of Brain and Cognition conducts research in neurocircuitry, functional brain imaging, cognitive neuropsychology, and learning and plasticity in humans and non-human primates. The goals of these laboratories are to further explore the underlying brain mechanisms of cognition and to produce and improve upon the advanced techniques necessary to understand the neural pathways involved in behavior. The Laboratory of Behavioral Neuroscience generates new rodent behavioral tasks and applies emerging technologies to investigate genes regulating complex behavioral traits. Their behavioral tasks are widely used by the scientific community for behavioral models of human diseases, including autism, anxiety, depression and schizophrenia. The Section on Neural Gene Expression investigates the regulation of genes in the central nervous system, with particular emphasis on those involved in social and maternal behaviors.

Future Planned Activities

- In February 2008, NIMH will support the Gordon Conference on Genes and Behavior, which will focus on the growing area of research at the interface of genetics and basic behavioral science. A diverse set of genetic, molecular, genomic, neurobiological, evolutionary and ecological interests and approaches will merge on the theme of the behavioral phenotype.
- DSIR will plan the 14th NIMH Biennial Research Conference on the Economics of Mental Health in 2008. This conference will include the work of DSIR-supported grantees from the behavioral and social sciences which will include research by psychologists, economists, sociologists, social work and education

researchers, political scientists, anthropologists, medical historians, and researchers focusing on the interface between mental illness and the legal system.

- NIMH is currently in the process of developing a new strategic plan to guide the Institute's activities for the next 3-5 years. The plan is organized into four strategic objectives. The first of these addresses the promotion of discoveries in the brain and behavioral sciences to fuel research on the causes of mental disorders. Within the objective are several strategies relevant to the basic behavioral and social sciences. For example, one strategy is aimed at better integrating behavioral and brain processes to provide the foundation for understanding mental disorders.

Examples of Relevant Funding Opportunity Announcements:

- PA-07-060, "Methodology and Measurement in the Behavioral and Social Sciences (R01)" (expires May 9, 2009)
- RFA-08-070 "Basic and Translational Research Opportunities in the Social Neuroscience of Mental Health (R01)"
- RFA-MH-08-090 "Adapting Basic Cognitive Measures for Clinical Assessment of Schizophrenia (R01)"
- RFA-MH-08-110 "Prefrontal Cortical Influences on Brain systems Supporting Complex Mental Function"
- PA-06-428 "Neurodevelopment and Neuroendocrine Signaling in Adolescence: Relevance to Mental Health (R21)" (expires September 8, 2009)
- PA-07-208 "Neurodevelopment and Neuroendocrine Signaling in Adolescence: Relevance to Mental Health (R01)" (expires July 6, 2008)
- PA-06-533 "Functional Links between the Immune System, Brain Function and Behavior (R21)" (expires September 8, 2008)
- PA-05-054 "Functional Links between the Immune System, Brain Function and Behavior (R01)" (expires March 6, 2008)
- PA-06-334 "Women's Mental Health and Sex/Gender Differences Research (R21)" (expires May 8, 2009)
- PA-07-164 "Women's Mental Health and Sex/Gender Differences Research (R01)" (expires January 8, 2009)
- PAR-08-040 "Reducing Mental Illness Stigma and Discrimination (Collaborative R01)" (expires January 8, 2011)

- PA-08-029 “Research on Co-Morbid Mental and Other Physical Disorders (R01)” (expires January 8, 2011)
- PAR-07-155. Building Translational Research in Integrative Behavioral Science (R01)” (expires March 6, 2009)

15. National Institute on Drug Abuse

Overview of NIDA's FY08 bBSSR Portfolio

Science supported by the National Institute on Drug Abuse (NIDA) addresses the most fundamental and essential questions about drug abuse, ranging from the molecular level to managed care and from DNA to community outreach. Animal research, epidemiological and clinical studies, and new uses of neuroimaging and genetics tools are providing new knowledge about how the brain reacts to drugs of abuse and how this leads to addiction—specifically how drugs affect the structure, function, and development of the brain, resulting in the behaviors that define addiction. Particular areas of study include those examining individual differences in genetic, neurobiological, and behavioral factors that underlie increased risk and/or resilience to drug abuse, addiction, and drug-related disorders; studies of behavioral, pharmacological, and combined treatments that identify strategies to help people avoid relapse; and studies looking at the role of drug use and its related behaviors in the evolving dynamics of HIV/AIDS epidemiology, natural history/pathogenesis, treatment, and prevention. In addition, translational research is showing us the best ways of getting effective drug abuse interventions into the hands of practitioners trained to use them at the community level.

Basic behavioral and social science research is critical to all of these components and is why NIDA encourages research that encompasses these areas. In fact, NIDA is the co-lead with OBSSR on a Roadmap RFA to facilitate interdisciplinary research via methodological and technological innovation in the behavioral and social sciences. Other illustrative projects funded by NIDA are summarized in the pages that follow.

NIDA's Plans for Future Investment in bBSSR

NIDA plans to continue to fund studies that explore the behavioral and social science aspects of drug abuse and addiction. Increasingly, genetic and environmental factors will be applied to understand the myriad factors that shape a person's propensity for and vulnerability to drug taking and abuse, as well as the related behavioral implications that affect both persistent drug use and treatment success. In this regard, NIDA will continue to discover more about how drugs affect people's brains at different points in their development, and how environmental and social influences shape this impact. Resulting knowledge will help us to zero in on the best times to intervene with various populations and will elucidate the most promising strategies to both prevent and treat this disease.

Recognizing the importance of behavioral therapies for the treatment of drug addiction, NIDA will continue to support research in this area through its Behavioral Therapies Development Program. Included are various forms of psychotherapy, cognitive therapy, couples and marital therapy, group therapy, skills training, counseling, and other rehabilitative therapies. Through this program, a number of treatments for drug addiction have proven to be efficacious, including cognitive behavioral therapy, contingency management, and family therapies. NIDA is committed to continuing to study, test, and

evaluate effective drug abuse treatments, relying on behavioral and social science findings to keep the field moving forward.

Strategic Program Areas: Highlights of NIDA's bBSSR Research Portfolio

Extramural Portfolio

Examining the Interplay of Genes, Environment, and Development to Better Understand How to Prevent and Treat Addiction. Because addiction vulnerability and progression result from the complex interaction of drugs, genes, and environmental and developmental factors, NIDA has made the study of these interactions a priority. A FY 2007 RFA entitled the Genes, Environment, and Development Initiative (GEDI) is expected to elicit basic and clinical research investigating whether and how these associations affect the etiology and course of drug addiction throughout the lifespan. Funded researchers will use samples from existing longitudinal studies to assess subjects at multiple points over time, helping to identify markers of individual and environmental influences on key outcomes. Interdisciplinary partnerships among geneticists, psychologists, developmental neuroscientists, neuroimagers, and statisticians are paramount to this initiative's success.

Supporting the development of translational research centers on the clinical neurobiology of drug abuse and addiction. With advances in human genetics and structural, functional, and chemical imaging, recent clinical neurobiologic studies have provided new insights into the factors that can influence drug use and vulnerability to addiction. Despite increasing technical advances, however, the ability to probe processes in the human brain is limited, with animal research offering more opportunities for mechanistic studies of the neurobiology of drug abuse and addiction—studies that cannot be conducted in humans. Most frequently, animal investigations and human investigations proceed on parallel tracks and, while clinical and preclinical findings may inform each other, the integration of the two is only rarely accomplished in a setting having their integration as an explicit goal with an infrastructure to support it. In response to this need, NIDA is encouraging interdisciplinary/multidisciplinary teams of investigators to develop exploratory research programs (specifically planning grants) focused on defined issues in drug abuse and addiction that are capable of both clinical and preclinical investigations, and that continually inform one another over the course of the research program.

Imaging the Brain to Test the Effectiveness of Drug Abuse Prevention Messages. Modern brain imaging technologies are increasingly being used as part of drug abuse and addiction research to provide real-time insight into how the brain interacts with social influences in the context of drug abuse or decision-making. Having a better understanding of the mechanisms underlying peer influences, for example, will be important in terms of prevention in adolescents. Taking this idea a step further, NIDA's recent RFA, "Brain Imaging Drug Use Prevention Messages," seeks to stimulate exploratory research on neurobiological responses to substance abuse prevention messages across developmental stages and age groups. Brain imaging may provide biological markers of the impact of prevention messages, along with information that could help increase or even predict their effectiveness. Indeed, resulting studies may

spawn a new generation of effective, tailored, anti-drug messages. Such research will help explain the differential processing of messages among different populations—children, adolescents, young adults, and parents—varying by factors such as age, gender, and propensity for risk-taking. Studies that examine brain information processing based on such individualized factors can help hone message targeting and effectiveness.

Advancing Tools to Quantify Exposure to Psychosocial Stress and Addictive Substances. This NIDA activity is part of an overall effort by NIH in establishing an Exposure Biology Program as part of a larger NIH Gene and Environment Initiative (GEI) (announced in February 2006). The NIH GEI seeks to investigate the interactions between genetic and environmental factors that underlie complex human diseases. In that regard, repeated exposure to psychosocial stress and addictive substances is associated with myriad human diseases that cause tremendous public health burden (e.g., cancer, drug addiction, heart disease, depression). The objective of this program, therefore, is to develop new technologies to detect and quantify personal exposure to psychosocial stress and/or addictive substances (licit and illicit) with optimal precision and reliability, which would then be transformed into verified field-deployable tools for use within large-scale studies of diverse populations to greatly improve the study of gene-environment interaction in human disease. Transdisciplinary alliances between academic researchers, technology experts, and analytical laboratory scientists will be part of this effort.

Epigenetics of Neurobiology and Addiction: NIDA-supported research has already identified many factors that can either enhance or mitigate an underlying propensity to initiate or continue drug abuse. For example, research has shown that gene expression can influence substance abuse vulnerability and can change throughout development as a result of epigenetic changes. Epigenetics is the study of how environmental factors—including exposure to drugs of abuse—can lead to long-term, potentially heritable changes in gene function without changes in the DNA sequence. Presently, little is known about how epigenetic mechanisms contribute to changes in cellular functions in a person exposed to drugs and other environmental influences (socioeconomic status, parenting style, peer group impact). Knowledge gained from epigenetic research will lay the groundwork for analyzing the interacting factors governing substance abuse and related phenotypes (i.e., characteristics determined by both genetic makeup and environmental influences), and may in fact bring a new understanding to the long-term effects of drug addiction. NIDA has therefore issued a call for studies that link epigenetic changes to other biological changes (e.g., neuroplasticity)—from gene expression to behavior (e.g., addiction). Information about the many contributors to drug abuse and addiction and the different ways they operate in individuals is critical to designing better counter strategies.

Social Neuroscience: The social environment is relevant to substance abuse, as studies continue to reveal how the interplay of biological and social influences affect individual choices and decisions about drugs. NIDA recognizes that social networks (e.g., families, peer groups, institutions, and societies) can affect brain development and function, cognition, emotion, and behavior. Research is needed to identify the specific pathways

by which social behavioral processes and experiences influence and are influenced by brain function across life stages. NIDA is committed to address this research gap by taking advantage of modern imaging and genetics tools, and has spearheaded, together with NIAAA and NIA, a broad initiative to encourage interdisciplinary studies to examine the neurobiological mechanisms of social behavior and how these influence or are influenced by alcohol and drug abuse. NIDA is particularly interested in targeting the influence of social factors both in individual and group decision-making, a critical focus to understand drug abuse and other behaviors. For instance, a social neurobiological perspective is being applied in NIDA studies investigating the mechanisms underlying adolescents' increased sensitivity to social influences (e.g., peers) and decreased sensitivity to negative consequences of their behavior that together make them particularly vulnerable to drug abuse. Research to develop a comprehensive taxonomy of social and built environments (including family, peers, school, neighborhood, community, and culture) that can be monitored at various life stages will help characterize treatment needs for more targeted approaches. This could include strategies such as mapping community risk factors for drug use (e.g., education level, socio-economic status, crime, and drug availability) and using that data to drive research on neurobiological factors that influence risk (or protection) for drug abuse. A better understanding of the neurobiology of social behaviors is relevant both for the treatment of drug addiction and for psychotherapeutic interventions for mental illness, which also involve social aspects of human behavior.

The evolving HIV/AIDS epidemic: Early in the HIV/AIDS epidemic, drug abuse and HIV were typically connected in people's minds with injection drug use and needle sharing. However, this view greatly underestimates the impact that drug abuse in general can have on the spread of HIV and AIDS through the dangerous risk behaviors it engenders. Drug and alcohol intoxication affect judgment and can lead to risky sexual behaviors that place people in danger of contracting or transmitting HIV, particularly as heterosexual transmission has become one of the fastest growing vectors in the spread of the disease. Indeed, the proportion of total AIDS cases attributed to heterosexual transmission has increased six-fold since 1989, from 5 percent to 31 percent. Gathering meaningful data on the drug abuse aspects of HIV/AIDS, particularly non-injection drug abuse, will be integral to efforts to combat HIV spread by these growing vectors.

Intramural Portfolio

Real-time methods for assessing drug craving and use, as well as precipitating factors: One of the greatest challenges in addiction treatment is the prevention of relapse, which occurs at high rates even after prolonged abstinence. While "relapse" to drug seeking in laboratory animals can be precipitated by stressors, drug-associated cues, or priming doses of drug, the assumed parallel between these precipitants and the triggers of relapse in humans is based largely on retrospective human studies in which weeks or months intervene between the relapse and its recollection, leaving ample time for the formation of *post hoc* explanations for the relapse. NIDA intramural scientists are investigating the use of Ecological Momentary Assessment (EMA) methods to enable patients to report, in real time, their activities and moods during craving or before a relapse on handheld data-

collection devices such as a PDA (Personal Digital Assistant). When drug use occurs, data on its precipitants will be used to confirm the clinical relevance of such constructs as “cue-induced” or “stress-induced” relapse. In addition, information gained from these methods will be used to improve the efficacy of relapse-prevention medications by revealing the medications’ differential effects on specific triggers of relapse.

NIDA intramural scientists are also studying possible *geographical* precipitants of drug craving or use. In this series of studies, polydrug-abusing participants will carry not only electronic diaries (EDs), but also global-positioning-system (GPS) devices, so that behavior can be examined in light of neighborhood-level influences. NIDA researchers will be combining these data with an index of measures of the “drug environment” and an index of measures that reflect neighborhood psychosocial hazards to examine the effects of neighborhood drug environment and psychosocial hazards on individual drug use individual psychosocial stress, respectively. This is an unprecedented effort to integrate ongoing assessment of drug use, craving, and stress with dynamic changes in individuals’ day-to-day environments, in a quantifiable way.

16. National Institute on Alcohol Abuse and Alcoholism

Introduction

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) supports research efforts to reduce alcohol-related problems in a wide range of scientific areas including genetics, neuroscience, epidemiology, health risks and benefits of alcohol consumption, and prevention, and treatment of alcohol use disorders (AUD). The focus of research in these areas contributes to increased understanding of normal and abnormal biological functions and behavior relating to alcohol use and to improving the diagnosis, prevention, and treatment of alcohol abuse and dependence. NIAAA has a longstanding commitment to basic behavioral and social science research in a broad range of programmatic areas including neuroscience, gene/environment interactions, prevention and treatment research. These programmatic areas (both current and future) are summarized below.

NIAAA's Current Programs -- Extramural

Mechanisms of Change in the Treatment for Alcohol Use Disorders.

How and why changes in health behavior are initiated and maintained are research questions of broad interest across the NIH. The principal aim of the NIAAA Mechanisms of Behavior Change (MOBC) Initiative is to develop new knowledge on the underlying mechanisms that drive behavior change within and outside the context of evidence-based behavioral treatments for alcohol use disorders. Mechanisms of behavior change refer to the underlying psychological, social, and neurophysiological processes through which health behavior change occurs. These processes include, but are not limited to, factors such as client expectancies, therapeutic alliance, therapist empathy, therapeutic ritual, and mastery and attributions of outcome. In the first phase of this multi-stage initiative, we released an RFA entitled "Mechanisms of Behavior Change in the Treatment of Alcohol Use Disorders" (RFA AA-07-005) in November, 2006. This RFA solicited Exploratory /Developmental (R21) applications only. Well over 30 applications were received and 13 projects were funded. In the second phase of this initiative, NIAAA will take advantage of progress in areas of science such as cognitive, affective and social neuroscience, neuroimaging, social psychology, animal model research, genomics, systems theory and computational biology to further understand how and why health behavior change occurs. We plan to establish the Mechanisms of Behavior Change Interdisciplinary Research Consortium (MIRC). This interdisciplinary collaboration will include behavioral and social scientists, basic researchers in neuroscience and genetics, imaging experts, and mathematicians and computational biologists. Input on how to structure the MIRC and the key research questions to be addressed will be obtained using the "DARPA" process. DARPA stands for the Defense Advanced Research Projects Agency, which has developed an approach to planning and implementing high risk and potentially high payoff research projects. This process will lead to an RFP (in late FY 2008) to fund the MOBC Interdisciplinary Research Consortium (MIRC). This consortium will consist of approximately 4-5 groups and a coordinating center. MIRC will be a contract process, with very active program management by NIAAA staff. We anticipate a very interactive process, with several

meetings per year as well as other forms of communication among groups (e.g. conference calls, web conferences, email, listservs). Each group will need to bring relevant datasets and interdisciplinary expertise to bear on the complex challenges facing this research. The final product will be a shared conceptual framework for moving forward with research of both an exploratory and explanatory nature. A special focus will be on identifying in what areas interdisciplinary research is feasible in the near future. Finally, NIAAA has taken the lead in establishing a trans-NIH Interest Group focused on Mechanisms of Behavior Change. This group has met several times over the last year and has established a speaker series on Mechanisms of Behavior Change.

Research on Etiology and Prevention of Alcohol Use Initiation and Excessive Alcohol Use

NIAAA supports research on a broad variety of environmental, social and interpersonal influences on alcohol consumption across the lifespan. The research focuses on elucidating mechanisms (mediators and moderators of outcomes) leading to harmful patterns of alcohol use as well as testing interventions to alter the risks and trajectories of harmful alcohol-related behavior. Studies explore hypothesized relationships grounded in multiple theoretical models of behavior change such as: self-efficacy, self-regulation, impulsivity, executive cognitive functioning, mood regulation, readiness to change, perceived social norms, and social networks. Research projects utilize longitudinal and cross-sectional panel studies to investigate developmental (biological and psychological), social (e.g., familial/peer) and environmental influences on the delay of onset of alcohol use initiation and to prevent progression and escalation to more hazardous alcohol use among underage drinkers. In younger populations studies focus on the influences of parental, sibling and peer interactions (including examination of decision-making processes) on psychosocial development and emergent alcohol use behaviors; while in college-aged populations, studies investigate the etiology, natural history, and consequences of pathological alcohol endorsement. Interventions range from motivational interviewing and social norms-based brief interventions in college and family settings to emergency department-based interventions. Studies on adults also incorporate basic mechanisms of social bonding and affect that influence alcohol consumption in varied situations (e.g., inter partner violence) and settings (e.g., restaurants and bars and the workplace). Analyses of mediating individual processes have implications for tailoring alcohol treatments according to individual receptivity to and readiness for treatment modalities.

Some etiological and intervention studies are beginning to combine these approaches with the identification of genes associated with susceptibility to AUD, and examine gene-environment interactions across the lifespan from youth through young adulthood and midlife. Other studies focus on identification of alcohol-related diagnoses, traits and behaviors which may be representative of alcohol-related endophenotypes, as well as genes that may: alter vulnerability to self-regulatory problems or negative affect; hypothesized genetic moderation of alcohol initiation and frequency of escalation; and gene by social context interactions (family/peer support, life stress—e.g., racial discrimination, limited economic opportunities).

Based on neurological findings in prior morphometric and imaging studies on human adolescents, NIAAA issued an FOA entitled, “Impact of Adolescent Drinking on the Developing Brain” (RFA-AA-07-006), to expand research on the effect of alcohol on the adolescents’ brains during pubertal development. For example, neuropsychological and functional magnetic resonance imaging (fMRI) studies have shown that heavy alcohol use during adolescence is associated with poorer scores on tests of information retrieval, attention, visuospatial functioning, and abnormal brain response during spatial working memory. These findings have implications for the development of longitudinal studies to examine how alcohol use initiation, escalation and sustained excessive use during adolescence may alter the normal trajectory of human brain and behavioral development.

Alcohol and HIV/AIDS

NIAAA conducts basic social and behavioral research on factors influencing alcohol-related HIV risk behaviors and on the social, behavioral, and medical consequences of HIV disease as a result of alcohol misuse. The goal of this research is to support basic social and behavioral research to strengthen understanding of the determinants, processes, and cultural and contextual issues influencing alcohol-related HIV related risk and protective behaviors and the consequences and impact of HIV disease, including treatment for and management of HIV infection. This includes domestic and international research that examines the societal, community, organizational, social network, dyadic, and individual barriers to and facilitators of the adoption and utilization of effective preventive and treatment interventions across the life course. Despite findings of associations between men’s alcohol use and risky sexual behavior, the role of alcohol use in HIV transmission risk is understudied. These studies involve the assessment of antecedents of engaging in safe health behaviors among men and women through measures of risk perception, risk exposure and behavioral intentions of engaging in risky behavior. NIAAA supports 16 applications that are strategically coded for Basic Behavioral research under the Office of AIDS Research, Strategic Coding Initiative (Area 5B) in the following areas: Understanding how basic cognitive processes impacted by alcohol use change risk-taking behaviors in highly vulnerable populations of gay men, women and youth, racial/ethnic minorities, and those who live in slum communities, or are migrant workers.. This research includes a) laboratory-based challenge trials and b)neuropsychological assessment of HIV+ individuals. In addition, NIAAA has sponsored workshops on HIV/AIDS and prevention science.

Mechanisms of Underage Alcohol Abuse and Dependence.

Alcohol is the most commonly abused substance among adolescents. According to the 2002 Monitoring the Future Study, 47 percent of 8th graders, 67 percent of 10th graders, and 78 percent of 12th graders have used alcohol in their lifetime. Of greater concern is the widespread occurrence of heavy episodic drinking defined as drinking five or more drinks in a row during the past two weeks. The prevalence of this behavior among high school seniors is 29 percent. We know that substantial changes in brain biology, physiology, and architecture occur during the transitions from pre-adolescence through adolescence and into young adulthood. Furthermore, recent research suggests that emotional responses particularly sensation-seeking and risk-taking are the hallmark of adolescence, and that poor affect regulation may contribute to the high incidence of binge

drinking in this group. Finally, hormonal changes associated with the onset of puberty may contribute to the onset of gender differences in alcohol drinking as well as affect and mood regulation. Thus, given the early onset of drinking and its frequency, studies are needed to identify and characterize the risk factors associated with adolescent drinking and the impact of alcohol exposure (particularly heavy episodic or “binge” drinking) on these maturational changes and associated neurocognitive, emotional, social and decision-making processes. NIAAA supports research to:

- Understand alcohol’s effects on maturation of the brain regulatory and reward systems (frontal lobes, striatum, amygdala, hippocampus).
- Study the relationship between reproductive hormones and stress-related hormones as they influence gender differences in drinking patterns from childhood through adulthood.
- Understand vulnerabilities to and patterns of recovery from brain structural/functional and neurocognitive deficits associated with adolescent drinking.
- Understand emotional and co-morbid risk factors associated adolescent alcohol use disorders.
- Determine differences between adolescent and adult decision making processes as they relate to alcohol drinking behavior and development of the reward system.

Pubertal Hormones, Stress Hormones, and Sex Differences in Alcohol Abuse.

Converging evidence from National surveys indicate that adolescent males and females between the ages of 12 and 17 have similar patterns of alcohol use (frequency and quantity) as well as prevalence of DSM-IV alcohol abuse and dependence. By about age 17, however, the sex-specific patterns and prevalences begin to diverge and remain disparate across the ages surveyed (17 – 65+), with females exhibiting fewer drinking days in the past month, fewer days of drinking 5 or more drinks in the past month, and lower prevalence of alcohol abuse and dependence. The usual interpretation for this finding is that social factors and stressors may mediate the development of these sex differences in drinking patterns. However, biologically based mechanisms for the emergence of sex differences in alcohol drinking patterns during puberty, such as changes in reproductive hormones and stress responses and their effects on brain developmental processes, remain relatively unexplored.

The purpose of this initiative is to stimulate research on the relationships among reproductive hormones, stress-related hormones, and sex differences in drinking patterns and prevalence of alcohol abuse and dependence that unfold during the course of puberty. Specifically, this RFA (Alcohol, Puberty, and Adolescent Brain Development RFA-AA-07-007 and 07-008) seeks research on 1) whether there is a direct relationship between the activation of gonadal hormones during puberty, the initiation of drinking, and the development of sex differences in drinking patterns; and 2) the degree to which changes in gonadal steroids at puberty interacting with exposure to life stresses, including alcohol consumption, may modulate neural circuits associated with alcohol seeking behavior. These studies will increase our understanding of mechanisms underlying sex differences

in alcohol drinking patterns and vulnerability to alcohol abuse and dependence which become more apparent during the transition from late puberty to young adulthood.

Basic Behavioral Research on Alcohol-Behavioral Birth Defects.

Alcohol is the leading known behavioral teratogen, that is, the leading environmental agent capable of causing behavior-related birth defects. At the most severe end of the range of fetal alcohol spectrum disorders (FASD) is fetal alcohol syndrome (FAS), which in addition to behavioral and neurocognitive deficits is characterized by the presence of both morphologic alterations and growth deficits. FAS in the U.S. appears to occur at a frequency of 0.5 - 2 cases per 1000 live births. Occurring at a rate several times that of FAS is alcohol-related neurodevelopmental disorder (ARND), where prenatal alcohol elicited deficits in neurodevelopment function are present in the absence of growth or morphologic features. Without the growth or morphologic features, it is not possible to identify ARND in the neo-natal period, the time when most birth defects are identified. This fact significantly delays the initiation of early clinical or educational interventions. Most cases of ARND are either identified too late for early interventions, or their diagnosis is totally missed. NIAAA has initiated research studies to enhance our understanding of neurobehavioral deficits within ARND to facilitate early case identification. Defining the behavioral phenotype of FAS and ARND has necessitated research to define normal developmental behavior on a broad range of brain-derived behaviors, and the comparison of these behaviors among normal children, FAS and ARND children, and children with other developmental disorders. Among the areas of basic behavioral developmental research that NIAAA supported scientists have studied are:

- Speed of information processing
- Sleep behaviors
- Sleep arousal behaviors
- Left and right hemisphere communication and coordination
- Cerebellar reflex conditional
- Hippocampal trace conditioning
- Memory acquisition
- Memory retrieval
- Executive functioning including: working memory, planning, ability to comprehend tasks and instructions.
- Social functioning including inter-personal behavior
- Math abilities, including numerosity, an ability exhibited by normal infants at very early age
- Geo-spatial abilities
- Language comprehension
- Social functioning
- Attention deficits including perseveration behavior (impairment in the ability to shift between tasks)
- Neuroendocrine related behaviors such as those related to stress response.

Also under study is the inter-relation of brain structural deficits with the neuro-development impairments noted in the list above. For example, hypoplasia of the corpus callosum, a myelinated white matter brain structure constituting the axons of neurons inter-connecting the left and right hemispheres, is often missing or of decreased size in children with FAS and ARND. The consequence of this deficit likely includes the diminished ability of FAS and ARND individuals to coordinate functions between the right and left brain hemispheres.

Biobehavioral Manifestations Leading to the Development of Alcoholism.

In order to understand the etiology and risk of developing alcohol abuse and dependence, it is important to identify the characteristic traits and behaviors (phenotypes or endophenotypes) in alcoholics and their offspring. Over the past twenty years, the focus has been on identifying genetically transmitted neurobehavioral and neurobiological traits in offspring of alcoholics that can serve as markers to identify individuals at high risk. The most well known endophenotype is altered brain function as measured by event-related potentials (ERPs), electroencephalograms (EEGs), and event-related oscillations (EROs). More recently, research on children and adults with a family history of alcoholism points to cognitive, personality and temperamental traits of impulsivity, disinhibition, poor self-control, working memory, impaired emotional regulation, and externalizing disorders as characteristics predisposing to alcohol abuse. Human and animal literature suggests that emotional and other physiological responses such as sleep patterns and stress-reactivity may serve as important phenotypic or risk markers for alcoholism and other co-morbid disorders). For example, research in the area of affective neuroscience (the study of the brain mechanisms underlying emotion and mood) indicates that the frontal lobes and amygdala are the brain structures primarily associated with emotional and affective responses. Although these two brain areas are also implicated in the alcohol reinforcement circuit, little is known about the underlying neural bases of mood and emotional changes produced by alcohol in humans, and their relationship to the development of alcohol use disorders. A similar connection could be made between disinhibited/impulsive behavior, frontal lobe dysfunction, and liability for alcoholism. With modern imaging techniques, particularly functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), it may be possible to understand the relationship between behavioral traits, (e.g., emotional responses and/or sleep patterns), changes in corresponding brain circuits, and propensity to develop alcohol use disorders.

Neurobiological Consequences of Alcohol Consumption.

Alcohol consumption can induce a variety of widespread pathologies on the many tissues and organs within the human body. The brain is a major target for the actions of alcohol, and prolonged, excessive alcohol consumption can lead to brain damage, impairment of neuronal function, and changes in behavioral responses to alcohol. The goal is to identify and characterize the neurobiological mechanisms that cause the functional, structural and behavioral consequences of excessive alcohol consumption. Over the next five years, the NIAAA will address basic behavioral research on alcohol-related cognitive and emotional deficits.

The frontal lobes within the cortex of the brain are responsible for the processing of a variety of "executive functions" that includes planning, abstract thinking, reasoning, memory, impulsivity, and decision processes, and of affective functions such as emotion, motivation, and reward. Newly emerging scientific evidence suggests that the cerebellum might also provide feedback to cognitive and emotional processing via its neural connections to the frontal cortex. Given that the frontal lobes and the cerebellum are prominent targets of chronic alcohol dependence, it might be expected that abnormal activity and neuronal communication within neural circuits between frontal, cerebellar and other (limbic system) brain structures contribute to alcohol-induced cognitive and emotional deficits observed in chronic alcoholics and children at risk of developing alcohol abuse disorders.

This initiative will stimulate basic and interdisciplinary research in the burgeoning areas of frontal lobe and/or cerebellar functioning as it relates to etiology, risk factors, and consequences of alcoholism. Using advanced neuroimaging technologies and anatomical/physiological techniques, the specific aims of this initiative would be to 1) relate the architecture of frontal and cerebellar circuits to cognitive and emotional deficits in chronic alcoholics and high-risk children, and to identify potential risk markers for alcoholism; 2) study frontal/cerebellar systems and their relation to neuroanatomical and neurochemical circuits of intoxication and reinforcement in cellular and animal models, including nonhuman primates; 3) assess the progression of alcohol-induced cognitive and brain damage and recovery of function in chronic alcoholics; and 4) promote translational research on the role of cognitive/affective changes in recovery/relapse and the application of cognitive remediation strategies to chronic alcoholics and children at risk.

The Collaborative Study on the Genetics of Alcoholism (COGA) .

In its 18th year, COGA is a multi-site, multi-disciplinary family study with the overall goal of identifying and characterizing genes that contribute to the risk for alcohol dependence and related phenotypes. COGA investigators have collected data from more than 300 extended families (consisting of more than 3,000 individuals) who are densely affected by alcoholism. Several genes have been identified including GABRA2, ADH4, ADH5, and CHRM2, which influence the risk for alcoholism and related behaviors such as anxiety, depression, and other drug dependence. In addition to genetic data, extensive clinical neuropsychological, electrophysiological, and biochemical data have been collected and a repository of immortalized cell lines from these individuals has been established to serve as a permanent source of DNA for genetic studies. These data and biomaterials are distributed to qualified investigators in the greater scientific community to accelerate the identification of genes influencing vulnerability to alcoholism. COGA will continue to identify genes and variations within the genes that contribute to the development of alcohol and related phenotypes, the development of neurophysiological and clinical/behavioral phenotypes, and, through a prospective study, examine how genes and the environment interact to influence the developmental course of alcoholism and related phenotypes.

Animal Models of Human Behavioral Endophenotypes/Phenotypes relevant to Gene X Environmental interaction.

Animal models of alcohol related behaviors have provided significant insight into the neural pathways responsible for alcohol response and alcohol consumption. However these models have largely been developed on the basis of face validity rather than predictive validity. Further, these models typically represent broad behavioral constructs such as “intoxication”, “motor impairment”, “impulsivity” or “anxiety”. It is becoming increasingly evident that a battery of individual animal models may be required to accurately characterize a single human behavioral trait. A further consideration is that multiple genetic influences contribute to complex behaviors and these separate contributions may be best identified by separate animal models. Thus there is a need to parse alcohol related behaviors in humans into specific responses, to select a set of paradigms that measure components of this complex behavioral response, and then establish the predictive validity of the animal models for the specific human behavior.

The goal of this initiative is to develop animal models that measure environmental influences on drinking behavior. This initiative will also advance investigations on the interactions between environmental factors and genetic variation. At present there is a lack of animal models that accurately represent human behaviors. Until such models are provided the powerful tools of genetic manipulations available in rodents can not be exploited productively.

Medications Development for the Treatment of Alcohol Dependence, Addiction and Toxicity.

Research into the mechanisms of alcohol action on the central nervous system and behavior has yielded unprecedented opportunities to develop medications for alcohol misuse and its deleterious consequences. The decision to develop medications for alcoholism will be facilitated by the ability to discriminate clinically effective compounds quickly. This capability rests on tests, or batteries of tests, that have this discriminative capacity. Several laboratory models reflect aspects of alcoholism such as excessive drinking driven by heredity and dependence, and lapse and reinstatement of drinking after abstinence. Potential medications for alcoholism have been tested in these and other paradigms, but testing conditions have been varied, complicating determination of how well these paradigms predict clinical efficacy.

Compounds which have been fairly well characterized in the clinic have not been tested in a complete set of preclinical paradigms. Preclinical assessments are most valuable when they can provide information rapidly and inexpensively. More rapid assays are needed which capture the essential mechanistic features of the more time-consuming paradigms. Effective use of medications in the clinic will be enhanced by our understanding of their effects in comorbid disorders such as nicotine dependence and depression. Finally, changes in reliable biomarkers of alcohol dependence and toxicity would allow for early identification of clinical response, or lack thereof, and for individuation of treatment. Research objectives in medications development include:

- Validate protocols and develop rapid screening assays for animal laboratory paradigms that model alcohol behavior.
- Develop agents that block/reverse ethanol effects on fetal alcohol spectrum disorders (FASD).
- Develop agents that block/reverse both ethanol and nicotine effects.
- Identify biomarkers for alcohol consumption and brain toxicity.

Alcohol-Nicotine Interactions.

Smokers drink and drinkers smoke. Smoking kills more alcoholics than does drinking. Basic research suggests that nicotine, alcohol and diverse other compounds subject to misuse/abuse may serve as positive reinforcers through any of a number of neuropharmacological effects that ultimately converge on a final common neurobiological pathway.

The overall goal of this initiative is to spur efforts to gain further understanding of the interaction of ethanol and nicotine. Intermediate goals may include: identification of targets in the central nervous system upon which alcohol and nicotine exert a concerted effect, assessment of whether treatments for alcohol dependence should incorporate treatment for nicotine dependence; identification of factors that result in the association of initiation of drinking coincident with initiation of smoking; and the development of medications that treat dependence on both alcohol and tobacco.

Studying Mechanisms of Vulnerability to Compulsive Alcohol Misuse through Modeling Approaches.

Genetic influences may play crucial role in the transition from voluntary to involuntary alcohol drinking. Alcohol procurement and use involve the complex interplay of multiple affective, cognitive and behavioral control systems. Small parametric deviations in their function have profound effects over time. Risk genes for alcoholism are not likely to be specific for alcohol action. Instead, risk genes most likely have neuroanatomical, physiological and pharmacological actions which alter affective, cognitive and behavioral control systems. Some of these actions may be manifested in the expression of endophenotypic traits prior to alcohol use. In some cases, they may take the form of distinct initial responses to alcohol, which affects the resulting alcohol use trajectory. We propose a full spectrum of testing in animal models on anxiety, depression and impulsivity so that we can ultimately isolate the *components of these traits* that are predictive of subsequent alcohol actions and identify neural substrates and genetic influences. Key issues and research opportunities in this area include (1) incorporating comprehensive measurements of the trait of interest in multiple genetic models, (2) evaluating alcohol interactions with the trait, and (3) experimentally establishing the genetic and neurochemical basis for the association. These objectives will allow better understanding of the contributions of inherited traits to alcohol misuse.

Integrative Neuroscience Initiative on Alcoholism (INIA).

To facilitate advancement within the field of alcohol research, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) established the Integrative Neuroscience Initiative on Alcoholism (INIA) consortia. These consortia take an integrative

experimental approach that combines the collection of molecular, cellular, and systems level measures of brain function using defined animal behavioral models of alcohol abuse, to facilitate data interpretation, and thereby, enhance the understanding of the functional, structural and behavioral neuroadaptations resulting from excessive alcohol consumption. Currently there are two separate consortia within INIA.

- *The Neurobiology of Excessive Consumption of Alcohol Consortium.* The research goals of this consortium are to identify the molecular, cellular, and behavioral neuroadaptations that occur in the brain reward circuits within the extended amygdala and its associated neural connections. The hypothesis is that genetic differences and neurobiological neuroadaptive processes within this circuitry are responsible for individual differences in vulnerability to excessive alcohol consumption. The specific aims of this consortium include: establishing animal behavioral models to study specific neurobiological targets for vulnerability that lead to excessive alcohol consumption at the molecular, cellular and neural circuit levels of analyses; identifying the specific brain sites involved in the neuroadaptive response within the amygdala circuitry; and characterizing specific clusters of genes whose expression is regulated by alcohol and which are responsible for any given model of excessive alcohol consumption.
- *Stress-Anxiety of Alcohol Abuse Consortium.* The research goals of this consortium are to identify the neurochemistry and neural circuitry of alcohol-stress interactions. The aims of this consortium are to gain much needed information about the neural effects of stress, alcohol, and stress-alcohol interactions on the level of expression and function of key neuronal molecules, neuronal activities and synaptic efficacy. Also, the neurophysiology of key systems involved in stress and alcohol interactions, and the genetic factors that contribute to alcohol-stress interactions, stress-related conditioning and other behavioral models related to stress, are being studied. The experimental approaches being used include molecular, cellular and synaptic measures of the effects of alcohol on the brain circuitry involved in responses to stress and the neuroadaptive changes to these neural circuits after chronic alcohol exposure, and genetic methods that include searching for quantitative trait loci (QTLs) for alcohol intake and withdrawal, examining single nucleotide polymorphisms (SNPs) from anxious alcoholics, and determining the effects of genetic manipulations (random mutagenesis and knock-out animals) on stress-alcohol interactions.

Examples of Relevant Funding Opportunity Announcements:

- [RFA-AA-07-020](#); 07-021 Integrative Prevention Research for Alcohol Users At-Risk for HIV/AIDS (R01; R21)
- [RFA-AA-07-013](#); 07-014 Animal Models of Endophenotypes and Intermediate Phenotypes for Alcohol Related Behaviors (R01; R21)
- [RFA-AA-07-015](#); 07-016 Mechanisms of Nervous System Dysfunction: Impact of Alcohol Abuse on HIV-1 Neuropathogenesis (R01; R21)
- [RFA-AA-07-006](#) Impact of Adolescent Drinking on the Developing Brain (R21)

- [RFA-DA-06-004](#) (NIDA lead, also with NIA) Social Neuroscience (R01, R21)
- [PA-07-448](#); 07-449; 07-450 Epidemiology and Prevention in Alcohol Research (R01; R21; R03)
- [PA-07-406](#); 07-407; 07-408 Screening and Brief Alcohol Interventions in Underage and Young Adult Populations (R01; R21; R03)
- [PA-07-036](#); 07-005; 07-006 Structural Interventions, Alcohol Use, and Risk of HIV/AIDS(R01; R21; R03)
- [PA-07-028](#); 07-063; 07-064 Research on Alcohol and HIV/AIDS (R01; R21; R03)
- [PA-07-071](#); 07-557; 07-558 Secondary Analysis of Existing Alcohol Epidemiology Data (R01; R21; R03)
- [PA-07-083](#),(NIMH lead) Basic and Translational Research on Emotion (R01, R21, R03)
- [PA-07-329](#); 07-330; 07-331 (NIDA lead) Women and Sex/Gender Differences in Drug and Alcohol/Dependence (R01; R03; R21)

NIAAA's Current Programs -- Intramural

Examining Behavioral and Social Processes: Implications for Understanding Alcohol, Drug and Mental Disorders.

The Laboratory of Epidemiology and Biometry of the National Institute on Alcohol Abuse and Alcoholism conducts national surveys on alcohol, drug and mental disorders. The current survey is the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a longitudinal survey conducted in 2001-2002 and 2004-2005. The behavioral and social science component of this research focuses on examining risk factors for major alcohol, drug and mental disorders. In this research, behavioral factors related to vulnerability and resilience, emotions and motivation, attention and learning, social influences and cognition, social networks, and family, sociocultural and family processes (e.g., social network, social support, adverse childhood events, physical activity, violence, spousal abuse) are studied as complex antecedents in the development of major alcohol, drug and mental disorders. The outcome of this research should increase our understanding of behavioral processes and mechanisms underlying the development and persistence of major substance use and mental disorders with a view towards improving treatment and prevention.

Alcohol Seeking Behavior: Relation to Reward Seeking and Stress.

We study alcohol seeking behavior and its relation to natural reward-seeking and sensitivity to stress. Our studies attempt to identify the molecular substrates of these behaviors, and develop pharmacological treatments that can alter them. Models range from genetically modified mice, through rats, to humans. As an example of results, our rodent studies have identified that following a history of alcohol dependence, reinstatement of alcohol seeking in response to stress, as well as other aspects of behavioral sensitivity to stress are long-term up-regulated. Furthermore, while stress does not influence voluntary alcohol consumption in non-dependent subjects, in animals with a history of dependence stress will further increase the already excessive drinking levels. The brain adaptations underlying these behavioral changes have been identified, and

found to be driven by an up-regulation of Corticotropin-Releasing Hormone (CRH) signaling in brain areas of key importance for emotionality such as the amygdala. The participation of several other molecular systems, such as neurokinins, neuropeptide Y (NPY) and nociceptin has also been studied.

In human studies that closely parallel those in the animal models, we have examined how stress and alcohol associated cues induce cravings for alcohol in dependent subjects, and how new pharmacological interventions with an ability to block stress effects, such as antagonists at neurokinin 1 (NK1) receptors attenuate those craving responses. In collaboration with Dan Hommer's group, we have demonstrated how in parallel, the same anti-stress treatment is able to reverse the pathological shift in processing of affective stimuli normally found in recently abstinent alcoholics, as visualized by functional brain imaging using fMRI. While untreated alcoholics have previously been shown by the Hommer group to display exaggerated brain responses to negative affective stimuli and attenuated responses to positive stimuli, anti-stress treatment restores the normal responses. Based on this research, two series of molecules, one targeting the CRH1 receptor and one targeting the NK1 receptor, are currently in development for treatment of excessive alcohol consumption and relapse to alcohol seeking in collaboration with an industrial partner. Two other, targeting NPY2 and nociceptin receptors, are under preclinical evaluation.

Future Plans for FY 2009 and Beyond

Behavioral mechanisms in the transition to habitual alcohol seeking and drinking. Alcoholism involves transitions from occasional drinking, through habitual use to compulsive harmful drinking that is difficult to regulate. Repeated alcohol drinking may produce distressing withdrawal symptoms following alcohol cessation. The avoidance of withdrawal symptoms increases the motivation to seek alcohol, yet it does not fully explain addictive-like characteristics of dependence such as the persistence of relapse to drinking. Relapse is often precipitated by cues, such as people, places, or drug paraphernalia. Indeed, the cue-dependent activation of habitual alcohol-seeking has been hypothesized to play a major role in relapse after a long period of abstinence. It is not well understood, however, how these cues come to control behavior and elicit relapse.

Motivational and emotional systems enabling behaviors necessary for survival must adapt to changing circumstances. This behavioral adaptation in the form of learning is supported by networks that integrate neocortex with subcortical regions such as the amygdala, hypothalamus, striatum and hippocampus. In the course of learning and memory, the function and activity of these networks are modified through extracellular and intracellular molecular signaling mechanisms. Research suggests that alcohol's ability to exert effects through the very same neural pathways and mechanisms contributing to learning may be a key to its ability to establish addictive behavior. The direct evidence, however, linking alcohol's pharmacological actions to well-defined learning mechanisms as they pertain to the development of alcoholism is not clear.

NIAAA supports research to:

- Understand learning and memory processes in the development of habitual alcohol seeking and consumption.
- Identify alcohol's effects upon neural substrates of learning and memory as they contribute to behavioral characteristics of alcohol dependence.
- Identify the role of implicit cognitive factors and their underlying neural substrates in the development of impulsive and compulsive drinking and relapse.

Early Environmental Influences on Response to Alcohol.

Both genetic makeup and environment have been shown to influence the risk for alcohol abuse. Recent research has demonstrated that environmental factors experienced during early developmental stages can have consequences that persist throughout life. Early exposure to stress can modify physiological and behavioral functions. Other early experiences such as alcohol sensitization or pattern of rearing similarly can affect adult behavior and the risk for alcohol use disorders. It seems likely that exposure to specific environments, including early exposure to alcohol, nicotine and other drugs, may be more potent on gene expression during certain times of development such as prenatal, early post natal, and up to early adulthood.

The goal of this future initiative will be to identify early environmental influences that produce prolonged changes in behavioral response. Early environmental experiences have the potential to produce prolonged epigenetic modifications or alterations in developmental programming

Affective Neuroscience.

Affective neuroscience is the study of the brain mechanisms underlying emotion and mood. There is a longstanding relationship between alcohol use problems and disturbed affective responses. Research shows strong connection between emotional state, particularly anxiety or mood disorders, and alcoholic relapse. Changes in mood, arousal and expectancies about alcohol all have an important influence on motivation to drink. In addition to the motivating effects of emotions on the desire to drink, chronic alcohol consumption produces impairments in the cognitive processing of emotional signals. Recent research suggests that emotional responses, particularly sensation-seeking and risk-taking are the hallmark of the adolescence, and that poor affect regulations may contribute to the high incidence of binge drinking in this age group. Research in the area of affective neuroscience has indicated that the frontal lobes and amygdala are the brain structures primarily associated with emotional and affective responses, two areas that are also important in the alcohol reinforcement circuit. Although research in animals strongly indicates the central nucleus of the amygdala as a prominent structure in alcohol reinforcement, little is known about the underlying neural bases of mood and emotional changes produced by alcohol in humans, and their relationship to the development of alcohol use disorders. A few studies have indicated activation of limbic structures, including the amygdala, to alcoholic cues in both adults and adolescents. These activations were associated with measures of craving or urge to drink. However, the relationship between measures of craving, affective responses, and changes in brain

circuits remains to be determined. With modern imaging techniques, particularly functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), it may be possible to identify the functional brain changes underlying emotional processing deficits in alcoholics. Through imaging and electrophysiological processes, we may be able understand the relationship between emotional responses, changes in corresponding brain circuits, and propensity to develop alcohol use disorders. Finally, recent non-human primate fetal alcohol studies suggest that behavioral outcomes of animals exposed to the same alcohol and rearing regimens, but having different genetic variants of the 5-HT transporter, are quite different, consistent with a ‘two-hit’ model (one genetic and one environmental) for determination of behavioral phenotype. Other genetic variants are likely to be of similar importance in determination of alcohol-related behaviors.

The specific aims of this future program are to encourage research which investigates the relationships between emotionality, brain structure/function and risk for alcoholism; emotionality, brain structure/function and consequences of alcohol consumption; and emotionality, brain structure/function and genetic variation. Thus the overall aim is to map out the relationships between measures of emotionality, such as impulsivity, with brain structure and function as assessed by modern neuroimaging approaches and genetic variants, e.g., 5HT transporter, all in the context of alcohol risk and alcohol related behaviors.

Chronobiology of Alcoholism.

Clinical findings indicate that chronic alcoholics have difficulty falling asleep and remaining asleep. Conversely, sleep disruption may contribute to the perpetuation of drinking behavior as a result of self-medication with alcohol. Previous research has established a strong association between circadian rhythms (which include sleep patterns) and alcohol consumption. Recently clock genes that regulate circadian rhythms were found to influence the “reward pathway” implicated in drug abuse. Determining the relationship between circadian rhythm regulation and risk for alcohol abuse can identify new therapeutic targets.

Understanding Implicit Mechanisms of Alcohol Addiction: Contributions of Cognitive, Affective, and Social Neuroscience.

Cognitive, affective and social neuroscience (and related areas of neuro- and behavioral economics) are recently developing areas of research that use neuroscience techniques (neuroimaging, electrophysiology, and other physiological and endocrine responses) to answer questions about the underlying neural systems involved in cognitive, emotional, and social behaviors. Although the fields of cognitive, affective and social neuroscience are treated as distinct disciplines with independent neural circuitry, in reality these three aspects of behavior are often highly interrelated and their neural mechanisms interconnected. For example, social relationships are the stimulus for many emotional reactions, and emotions often affect cognitive processing. This is true for drinking behavior, which is often the result of an interaction among social, emotional, and cognitive factors. To date, neuroscience research in humans in the alcohol field has

largely concentrated on cognitive and emotional deficits, and their associated brain changes, following acute or chronic alcohol consumption. Thus, while there is a large body of research on the long-term consequences of chronic alcohol use on cognitive and brain functioning, much less research has focused on the cognitive, emotional, and social factors that affect the transition from controlled social drinking to the “loss of control” associated with alcohol abuse and dependence. Furthermore, much more emphasis has been placed on conscious, deliberate, or explicit decisions to drink, rather than on cognitive, emotional, or motivational factors of which the individual is unaware. Key issues and research opportunities in this area include:

- Studies on the role of implicit cognitive, emotional, and social associations in development of uncontrolled drinking and the neural substrates underlying these processes.
- Studies of how socialization processes (parents, peers, siblings, teachers) interact with physiological and neural aspects of emotion to promote or protect against the development of alcohol abuse or dependence over the lifespan.
- Understanding how cognitions and emotions and their underlying neural circuits (prefrontal and amygdala) interact to produce deficits in self-regulation of drinking behavior.

17. National Institute of Nursing Research

Introduction

The National Institute of Nursing Research (NINR) supports research to establish the scientific basis of care across the lifespan, including research to: improve the management of symptoms during illness and recovery; enhance quality of life in those with chronic illness; promote healthy lifestyles and behaviors; reduce the risk of disease and disability; and enhance end-of-life and palliative care. Understanding the fundamental behavioral and social aspects of promoting health, preventing disease, and improving quality of life is an essential aspect of all research of strategic importance to NINR. Therefore, basic behavioral and social sciences research (bBSSR) is an area of research that cuts across all of the research programs managed by the Institute. This document summarizes current activities related to bBSSR conducted within several representative NINR extramural programs: Self-Management, Symptom Management and Caregiving Research; Health Promotion and Disease Prevention Research; and End-of-Life Research. It also describes plans for bBSSR in future years. Across all NINR research and training programs, bBSSR will constitute a major area of research emphasis into FY 2009 and beyond.

A Strategic Focus on Biobehavioral Research

NINR released a new Strategic Plan in 2006, entitled “Changing Practice, Changing Lives.” This Strategic Plan lists areas of research on which NINR will maintain a strategic focus in the coming years. One of the areas of opportunity discussed in the Plan is biobehavioral research, a major component of bBSSR. Biobehavioral research explores the interplay between biology and behavior, and plays an essential role in the research that NINR supports on health promotion, disease prevention, and quality of life. For example, behaviors such as exercise may confer as yet undefined and far-reaching benefits through a combination of biological and psychological mechanisms. Biology, in turn, influences behavior, often through genetic mechanisms that may determine, for example, who will respond positively to a behavioral intervention. NINR research seeks to define these interactions, implement behavioral interventions to achieve biological outcomes, and intervene in biological processes to influence behavior. Behavioral measures and biological markers together serve as important tools in diagnosis, assessment of disease progression, and evaluation of treatment outcomes. In FY 2009 and beyond, NINR will maintain its strategic focus in biobehavioral research, with an emphasis on identifying and using biological markers to evaluate the effectiveness of behavioral interventions and elucidating the biological bases and predictors of response to behavioral interventions.

Self-Management, Symptom Management, and Caregiving Research

Program Overview

Improving the quality of life of individuals, both in clinical practice as well as the home setting, is a fundamental tenet of the NINR mission. NINR studies quality of life as a

continuum composed of three key elements: self-management, symptom management, and caregiving. The NINR Self-Management, Symptom Management, and Caregiving program seeks to address the challenges of short- and long-term disease and disability management by enhancing the individual's role in managing disease, relieving symptoms, and improving health outcomes for individuals and caregivers. Research on self-management examines strategies to encourage individuals to incorporate health promotion and disease prevention behaviors into their personal lifestyles, as well as empowering them, as much as possible, to take a greater role in attending to their own health. Symptom management research focuses on reducing the burden caused by adverse symptoms of disease and illness. This research examines the biological and behavioral components of health and illness with the goal of improving recognition of, and response to, disease symptoms by individuals, clinicians, and caregivers. Some individuals must rely on others for assistance with various aspects of their care; thus, caregiving research examines the need for, and the quality of, caregiving across health conditions and settings, as well as ways to reduce the burden of caregiving on the caregiver.

Current Activities in bBSSR under this Program and Future Plans

Understanding the fundamental behavioral and social aspects of disease and disability is critical to improving the quality of life of individuals with chronic illness. Therefore, current NINR activities in self-management, symptom management, and caregiving research involve bBSSR to a significant degree, with the interactions between biology and behavior playing a large role in symptom management research in particular. In one current NINR-supported study, investigators are exploring the effects of chronic sleep deprivation on biobehavioral functioning. Using mathematical modeling and physiological measures, these scientists are studying the amount of sleep necessary to improve cognitive function, mood, and physiological outcomes following a period of sleep deprivation, in order to provide information on issues of sleep need relevant to public health. Another group of NINR-supported investigators are examining the effectiveness of a behavioral intervention designed to improve self-adherence to antiretroviral therapy in individuals with HIV. As part of this study, researchers will assess behavioral factors related to treatment adherence, such as mood, personality, and interpersonal relationships. They will also explore the relationships between individuals' judgments of their own capabilities to self-manage their illness and their overall quality of life and health outcomes. A third group of scientists is developing an educational intervention to reduce stress in caregivers of loved ones with Alzheimer's disease. These researchers will assess the ability of the intervention to improve both behavioral outcomes, such as reduced stress and enhanced coping skills, as well as biological functions, such as strengthened immune response. These NINR-supported studies represent the broad range of bBSSR-related activities currently underway as part of this research program. Consistent with its Strategic Plan, NINR will continue to support a wide array of bBSSR projects within the Institute's Self-Management, Symptom Management, and Caregiving program in FY 2009 and in years to come.

Health Promotion and Disease Prevention Research

Program Overview

Ultimately, the most effective way to improve quality of life with respect to disease and disability is to prevent adverse conditions from occurring at all. The NINR Health Promotion and Disease Prevention program studies the key biological, behavioral, and social factors that prevent the development of disease and achieve long-term, positive health outcomes in individuals of all ages. Research supported under this activity seeks scientific discoveries of health predictors and prevention strategies across conditions, diseases, and settings. As such, health promotion and disease prevention science transcends the disciplines of basic, translational, and clinical research. Research supported by NINR explores the connections among lifestyle, biology, behavior, the environment, geographic influences, socio-cultural contexts, technologies, economic factors, and health outcomes. Under this wide scope of research, efforts can range from promoting behavioral changes in individuals, to evaluating health risks in diverse communities, to assessing issues of patient safety. Finally, translational and clinical strategies under this activity can include: applying genetic insights to understanding injuries and recovery of health; addressing the influence of diet and psychological factors in various conditions; and understanding the role of behaviors in maintaining health.

Current Activities in bBSSR under this Program and Future Plans

A critical aspect of finding better ways to promote health and prevent disease is an understanding of the behavioral and social factors that cause individuals to engage in healthy lifestyle choices and avoid behaviors detrimental to physical and mental health. Across the Institute's program in Health Promotion and Disease Prevention, NINR-supported investigators use bBSSR to analyze these factors, and to design and test interventions that improve outcomes in individuals from a large variety of cultures, backgrounds, and socioeconomic groups. For example, one group of investigators is currently exploring the biobehavioral relationships between Post Traumatic Stress Disorder (PTSD) and adverse pregnancy outcomes. These researchers are assessing the association between risk behaviors, stress-related biomarkers, and childbearing outcomes in pregnant, PTSD-diagnosed women. Information from this study could lead to improved maternity care guidelines for mothers with PTSD, and better health outcomes for both the mothers and their children. Other NINR-supported researchers are analyzing data from a study of over 3000 children to develop an improved understanding of the biological, behavioral, and social factors that lead to overweight in children. Improved knowledge in this area may lead to better methods for preventing the unhealthy behaviors in children that lead to obesity and the many chronic illnesses associated with it. A third group of NINR-supported scientists is assessing the influence of stress on susceptibility to infection and the effectiveness of vaccination. These investigators are using a Hepatitis B vaccination model with measures of immune responses to systematically explore the behavioral and biological pathways linking stress to antibody development following inoculation. Increased knowledge of the biobehavioral mechanisms related to stress and immune responses could eventually lead to improved methods for reducing susceptibility to infectious diseases in a variety of settings. As part of its overall mission

to promote healthy lifestyles and reduce risk for disease and disability, NINR will continue to incorporate a wide range of bBSSR-related studies in its Health Promotion and Disease Prevention program in FY 2009 and beyond.

End-of-Life Research

Program Overview

The life expectancy of the American people has reached a historic high, but along with increased life expectancy comes an increase in the number of people living with, and dying from, chronic debilitating diseases. Prolonged courses of decline at the end of life, palliative treatment options, and life-sustaining technologies have raised many important research questions within the last decade. End-of-life science seeks to understand dying with respect to the needs of dying persons and formal and informal caregivers. It includes research on issues such as: alleviation of symptoms; psychological care; near-death preferences; advance directives; and family decision-making. Likewise, end-of-life research addresses the cultural, spiritual, age- and disease-specific considerations that make each person's experience at the end of life unique. Consequently, the NINR End-of-Life research program applies biological, behavioral, and social science strategies to advance the understanding of the dynamic interactions of these various factors, and to develop interventions that optimize patient and caregiver quality of life across care settings and cultural contexts. NINR-supported clinical studies explore topics such as: decision-making about care options for children; communication for the chronically critically ill; assessment of pain in non-communicative patients; and issues in hospice care settings.

Current Activities in bBSSR under this Program and Future Plans

A fundamental understanding of the behavioral, social, and cultural factors that contribute to end-of-life preferences and decision-making is essential to improving patient and family care in end-of-life situations. To further this understanding, NINR supports a variety of bBSSR-related projects as part of its program in end-of-life research. For example, one group of NINR-supported researchers is assessing the behavioral determinants of decision-making regarding life support and end-of-life care in parents of extremely premature infants. These investigators are exploring the decision-making process from the perspective of both the parents and the attending physicians, with the goal of developing an intervention to improve the ability of physicians to assist parents in making informed decisions in these difficult situations. Another group of researchers is conducting a study to describe the experiences of parents whose children died in a neonatal intensive care unit (NICU), and to assess the impact of the death on long-term outcomes related to grief, mental health, and family functioning. These scientists anticipate that an improved understanding of these experiences and outcomes could allow providers to better identify parents and families at risk for adverse long-term outcomes and target these families for early intervention. As part of its ongoing mission to improve end-of-life care, and consistent with its role as the lead NIH Institute for end-of-life research, NINR will continue to support bBSSR as part of its end-of-life research program in FY 2009 and beyond.

Examples of Relevant Funding Opportunity Announcements:

FOA Number: RFA-NR-07-003

Title: Culturally Appropriate Research to Prevent HIV Transmission and Infection in Young People

FOA Number: PA-07-282

Title: Mechanisms, Models, Measurement, and Management in Pain Research

FOA Number: PA-07-074

Title: Symptom Clusters in Cancer and Immune Disorders

FOA Number: PA-07-072

Title: Biobehavioral Methods to Improve Outcomes Research

FOA Number: PA-07-062

Title: Research on Clinical Decision Making in Life-Threatening Illness

FOA Number: PA-07-061

Title: Parenting Capacities and Health Outcomes in Youths and Adolescents

NINR-Sponsored Programs to Enhance Research Capacity in Basic Behavioral and Social Sciences Research:

Program Names:

- Nursing Science Centers of Excellence in Self-Management or End-of-Life Research (P30)
- Nursing Science Centers in Self-Management or End-of Life Research: Building Research Teams for the Future (P20)

NINR will continue its focus in the coming years on the training of new investigators in all program areas, supporting the development of collaborative resources at institutions committed to furthering interdisciplinary science. Consistent with this focus, NINR solicited applications for the Nursing Science Centers of Excellence in Self-Management or End-of-Life Research in 2007. The first awards under these programs were made in September, 2007. These Centers should serve as a nexus for enhancing research capacity in self-management and end-of-life research, training investigators from multiple backgrounds and enhancing collaboration to increase the quality and quantity of innovative, interventional research projects in these areas of science. Support for these Centers will continue into FY 2009 and beyond. Because of the cross-cutting nature of bBSSR across all of NINR's research programs, it is anticipated that these Centers will incorporate bBSSR as a fundamental component

18. National Human Genome Research Institute

The National Human Genome Research Institute (NHGRI) funds bBSSR in the Division of Intramural Research, and not in the Division of Extramural Research.

With the completion of the Human Genome Project in 2003, the NHGRI created a vision document to guide the institute into a new era of genomic research. The vision, formulated into three major themes: genomics to biology, genomics to health, and genomics to society, includes six crosscutting elements (resources, technology development, computational biology, training, ethical, legal and social implications, and education) relevant to all three themes. As part of making this vision a reality, the NHGRI supports a portfolio of behavioral and social science research performed by intramural researchers.

Social and Behavioral Research Branch

The Social and Behavioral Research Branch (SBRB) has the overarching and broad objective to conduct innovative, leading-edge research to investigate social and behavioral factors that influence how genetic and genomic discoveries might best be used for health promotion, disease prevention, and health care improvements. For clarification in understanding our priorities, SBRB intentionally distinguish the terms “genetics” and “genomics”, with the former used to refer to research related to single gene heritability and the latter to refer to the research involving interactions of all the genes in the genome, including their interactions with environmental factors (World Health Organization, 2004). To this end, SBRB’s research agenda includes research directed towards applying genetic and genomic discoveries to improve health and well-being. Additionally, SBRB conducts research that helps colleagues outside of NIH to advance social and behavioral research related to genetics and genomics. Thus, the SBRB directs research (whenever possible) to developing products and recommendations that can be used by the scientific community at large.

Consistent with this mission, investigators in SBRB are encouraged to conduct innovative research in genetics and genomics in the following four broadly defined areas:

- Improving behavior change interventions for populations and for clinical settings;
- Applying social, behavioral, and communication theories to understand the essential elements of decision-support, and for communicating genetic risks and benefits effectively;
- Developing and refining theory-based methods for communicating with and providing services to affected individuals, families, communities and populations; and
- Understanding how social factors (e.g., interpersonal, organizational, cultural and societal) influence access to and diffusion

To accomplish this mission, work by SBRB Investigators is focused on the following areas:

- Developing and evaluating of communication strategies to convey genetic/genomic information in understandable and usable ways.
 - Methods development aimed at understanding family-system-level responses to genetic/genomic risk information.
 - Developing and evaluating effective ways to incorporate genetic/genomic feedback into behavioral interventions.
 - Improving clinical decision-making related to genetics/genomics to improve patient outcomes.
 - Understanding the social, ethical, and policy implications of genetic/genomic research.

For FY09 and beyond, the SBRB anticipates deepening their research portfolio in communications and social network methods as the tenure-track faculty have the opportunity to move ahead with new protocols. Additionally, in the coming four years, the SBRB plans to focus strategically on areas where they currently are lacking in expertise.

NHGRI Funds Two Research Programs in bBSSR.

Family Risk and Lung Cancer Study

The objective of this study is to evaluate the impact of a loved one's lung cancer diagnosis on their relatives' willingness to seek and process information related to risks of smoking, genetic susceptibility, and smoking cessation services.

The Influence of the Familial Social Context on Risk Communication

The focus of the current research is twofold: 1) to develop statistical methods for modeling the complexities of familial social relationships when only partial information is provided; and 2) to utilize social network methodologies to understand the how the family cultural and social context impacts the diffusion of hereditary risk information, as well as coping with risk status.

19. National Institute of Biomedical Imaging and Bioengineering

The National Institute of Biomedical Imaging and Bioengineering (NIBIB) mission is to improve human health by leading the development and accelerating the application of biomedical technologies. The Institute is committed to integrating the physical and engineering sciences with the life sciences to advance basic research and medical care. The Institute supports the development of several technologies whose applications extend into the behavioral and social sciences.

At present, the NIBIB supports two extramural research projects with relevance to basic behavioral and social sciences research (bBSSR). Both projects are part of the Collaborative Research in Computational Neuroscience (CRCNS) program, a trans-agency initiative of the National Science Foundation (NSF) and the National Institutes of Health (NIH), and both projects focus on the enhancement of imaging and data processing techniques to study brain function. The strategic priorities of the NIBIB, with respect to basic behavioral and social sciences research, are centered on continued support for the development of computational and imaging technologies for neuroscience research. The NIBIB currently participates in two additional initiatives aligned with the goals of bBSSR: the Neurotechnology Research, Development, and Enhancement program; and the Collaborations with National Centers for Biomedical Computing (NCBC) program. The purpose of the Neurotechnology Research, Development, and Enhancement program is to support the research and development of innovative technologies, methodologies, or instrumentation for use in basic or clinical studies of the brain or behavior in humans or animals. The Collaborations with National Centers for Biomedical Computing (NCBC) program leverages the computational infrastructure of the NCBCs to enhance computing capabilities in biomedical and behavioral research. The development of enhanced research tools will empower basic and fundamental research, so that a greater understanding of human behavior can be achieved. Advanced research tools in the areas of functional imaging including fMRI, PET, EEG, MEG, and optical imaging are being developed by the NIBIB. The NIBIB does not currently have an Intramural portfolio in basic behavioral and social science research.

Although the NIBIB has not planned any future initiatives directly focused on the behavioral and social sciences, research on technology development supported by the Institute may be applicable to behavioral research. The Institute will continue to support the ongoing initiatives mentioned above, as well as other trans-NIH initiatives in the neurosciences. The NIBIB also participates in the NIH Neurosciences Blueprint, which may potentially release future funding opportunities relevant to basic research in the behavioral and social sciences.

20. National Center for Research Resources

The National Center for Research Resources (NCRR) provides laboratory scientists and clinical researchers with environments and tools that they can use to prevent, detect, and treat a wide range of diseases. This support enables discoveries that begin at the molecular and cellular level, move to animal-based studies, and then are translated to patient-oriented clinical research, resulting in cures and treatments for both common and rare diseases, some of these diseases are behavioral in nature (e.g. drug abuse, mental health). NCRR's resources underpin the basic behavioral research supported by the categorical NIH ICs. As such, NCRR does not focus its initiatives on specific diseases or research areas. The extent to which NCRR supports basic behavioral research is guided by the needs of NIH funded investigators. To keep informed of these needs, NCRR participates in the NIH Behavioral and Social Sciences Research Coordinating Committee.

Behavioral and social science research can be found throughout NCRR programs, but the two main NCRR programs in which this research is being pursued are the General Clinical Research Centers (GCRC) and the National Primate Research Centers (NPRC). The GCRCs are a national network of centers that provide optimal settings for medical investigators to conduct safe, controlled, state-of-the-art, in-patient and out-patient studies of both children and adults. GCRCs also provide infrastructure and resources that support several career development opportunities. The NPRCs provide animal models, mainly nonhuman primates, which investigators can use for biomedical and behavioral research. The centers' specialized resources are intended to support investigators who receive their primary research project funding from NIH, but they also may be used by investigators who are funded by other federal, state, and local agencies, as well as by research foundations and the private sector.

21. National Center for Complementary and Alternative Medicine

The mission of the National Center for Complementary and Alternative Medicine (NCCAM) is to explore complementary and alternative healing practices in the context of rigorous science, train complementary and alternative medicine (CAM) researchers, and disseminate authoritative information on CAM research to healthcare practitioners and the public. In January 2005, NCCAM released its second five-year strategic plan: *Expanding Horizons of Health Care: Strategic Plan 2005-2009*. This plan outlines NCCAM priorities and plans in four primary areas: research; training and career development; outreach; and integrative medicine.

FY 2008 NCCAM Activities in Basic Behavioral and Social Sciences Research

Mind-body Medicine.

NCCAM research in bBSSR is encompassed primarily in the mind-body medicine portfolio, which includes studies in a variety of CAM approaches and disciplines, including yoga, tai chi, meditation, and guided imagery. These interventions and approaches have the potential to prevent or ameliorate disease, facilitate adherence to treatment regimens, and enhance health and well-being.

NCCAM-supported research in mind-body medicine includes studies to elucidate the mechanisms of mind and body communication and interaction, and the effect of mind-body interactions on health and disease. Strategic priority goals relevant to bBSSR include: (1) identification of the common and specific features of widely used mind-body medicine practices; and (2) exploration of the value of CAM therapies to reduce the burden of stress-related chronic illnesses, such as depression and anxiety.

- Extramural Research Activities
 - Active Funding Opportunity Announcements relevant to bBSSR
 - *Research on Mind-Body Interactions and Health* (PA 07-046) - to support CAM-related mind-body research that: (1) elucidates the mechanisms by which personality, cognitions, behaviors, emotions, beliefs, and attitudes can affect physical health; (2) determines how and whether CAM mind-body interventions can enhance healing and reduce the physical manifestations of illness; and (3) draws upon tools of neurobiology, neuroimmunology, and neuroendocrinology using state-of-the-art imaging, and cellular, biochemical, and molecular approaches
 - *Methodology and Measurement in the Behavioral Social Sciences* (PA 07-060, PA 06-343, PA 06-344) - to encourage research to improve the quality and scientific power of data collected on CAM-related research in the behavioral and social sciences
 - *Social and Cultural Dimensions of Health* (PA 07-045) - to encourage the development of CAM-related health research to: (1) elucidate basic social and cultural constructs and processes used in health research; (2) clarify social and cultural factors in the etiology and consequences of

- health and illness; (3) link basic research to practice for improving prevention, treatment, health services, and dissemination; and (4) explore ethical issues in social and cultural research related to health.
- *Behavioral and Social Sciences Research on Understanding and Reducing Health Disparities* (PAR 07-379, PAR 07-380) - to encourage behavioral and social science research on the causes of health and disabilities disparities in the U.S. population and to research CAM-based solutions to resolve these disparities.
 - Investigator-initiated research - to support research that leads to new knowledge and understanding of CAM mind-body medicine using state-of-the-art tools and techniques to elucidate the underlying mechanisms at the cellular, molecular, and genetic levels. For example, NCCAM-supported investigators are using electroencephalography and functional magnetic resonance imaging (fMRI) data to gain new insights into the long-term impact of meditation on basic affective and attention functions and into the brain mechanisms that subserve these processes, and examining the effects of mindfulness-meditation training on the human attention system using behavioral and fMRI measures; and NCCAM-supported researchers are investigating the hypothesis that the regular practice of meditation results in cortical thickening of brain regions that are routinely engaged during meditation practice, and that these changes may mediate the healthful effects reported by long-term practitioners. This research should lead to a better understanding of the relationship between neural structure and cognitive functioning in the cortical regions.
 - NCCAM plans to convene a workshop on the scientific issues and challenges in meditation research.
 - NCCAM-supported training - to provide CAM practitioners with training in areas critical for an investigator with a focus on the studies of acupuncture and placebo treatment. The rigorous training integrates strong didactics and multidisciplinary expertise to teach the investigator how to synthesize information from diverse fields and apply it to the study of acupuncture and acupuncture mechanisms.
 - Intramural Research Activities
 - NCCAM Division of Intramural Research is conducting a randomized trial to evaluate the effect of tai chi versus structured exercise on physical fitness and stress in cancer survivors. Participants will complete questionnaires about their quality of life and stress; undergo musculoskeletal and cardiorespiratory fitness testing; and give blood samples to measure blood cell counts, cholesterol, lipids, hormones, minerals, and selected neuroimmune markers. Neuroimmune markers will also be measured in sweat samples, and salivary samples will be tested for cortisol content. (ClinicalTrials.gov number NCT00246818)
 - NCCAM has established an Integrative Medicine Consult Service at the National Institutes of Health (NIH) Clinical Center. The Service will coordinate the resources of existing services, which includes acupuncture, Reiki, hypnosis, guided imagery, massage therapy, tai chi, and qi gong, to meet the needs of the Clinical Center patients. In addition to offering clinical consultation on CAM therapies, the Service will establish a research program embedded in NIH's

clinical and translational research structure and provide CAM education for NIH staff, patients, and their families.

Planned Future Investment in bBSSR

NCCAM will continue to encourage investigator-initiated bBSSR research in CAM-relevant areas and welcome the opportunity to partner with other NIH Institutes and Centers on developing and supporting research and activities in this area.

22. National Center on Minority Health and Health Disparities

Description of Current NCMHD Program

As part of its mission, the National Center on Minority Health and Health Disparities (NCMHD) encourages and supports bBSSR that examines the multiple and complex factors contributing to minority health and health disparities. With respect to racial and ethnic populations, the NCMHD behavioral and social sciences research efforts seek to examine the multi-factoral causes of diseases that statistics show disproportionately impact these populations, and identify effective interventions. In support of this endeavor, NCMHD has a variety of research projects in its portfolio. The majority of these projects are funded through the NCMHD Community-Based Participatory Research (CBPR), the Centers of Excellence (COE) and the NCMHD's two Loan Repayment Programs. NCMHD also collaborates with other ICs in supporting research projects focused on behavioral and social sciences. NCMHD projects involved in behavioral and social sciences research are linked in their purpose to enhance existing approaches and develop innovative models that take into account the social and behavioral factors associated with minority health and health disparities.

NCMHD's strong investments in behavioral and social sciences research are evidenced by the 95 projects and program activities funded in fiscal years 2006 and 2007. NCMHD projects and activities that address behavioral and social sciences research fall across the spectrum of NCMHD efforts to enhance the diversity of the research workforce, promote strong partnerships between scientists and affected communities, foster research collaborations across disciplines and advance effective disease intervention strategies. NCMHD research collaborations in behavioral and social sciences focus on those diseases and conditions of highest community need and concern, and partnership efforts are intended to accelerate the identification and testing of behavioral and social interventions at individual, group and community level. NCMHD research programs will aim at enhancing existing approaches and developing innovative behavioral and social sciences research to reduce and eliminate health disparities with the goal of translating and disseminating research outcomes to racial and ethnic minority populations, other health disparity populations, academic/healthcare institutions, health care professionals, and community-based organizations.

NCMHD Loan Repayment Programs (LRP).

These programs seek to recruit and retain health professionals at the doctorate level to conduct health disparities and/or clinical research at a qualified institution for two or more years. In exchange for this research service, the programs repay a portion of the participant's outstanding educational loan debt. The NCMHD supports two loan repayment programs: 1) The *Health Disparities Research Loan Repayment Program* encourages health professionals to engage in basic, clinical, behavioral, community-based, and health services research that is directly relevant to health disparities issues. 2) The *Extramural Clinical Research Loan Repayment Program* encourages health professionals from disadvantaged backgrounds to conduct clinical research. Since 2001

NCMHD Loan Repayment Programs have made more than 1400 awards to health professionals in various research disciplines including psychology, health policy, and behavioral science. Racial and ethnic minorities consist of approximately 60 percent of the health professionals receiving NCMHD loan repayment awards.

Basic behavioral and social science LRP projects currently funded by NCMHD include themes that range from the socioeconomic, psychological and/or behavioral impact of a disease to cultural competence and communication between physicians and patients. In reducing, and ultimately eliminating health disparities, it must be acknowledged that multiple intrinsic and extrinsic factors act in concert to cause disease, and therefore, emphasis must be placed on the elucidation of these factors and the biological pathways as they contribute to health disparity outcomes. Logically, the identification of these factors necessitates culturally competent health professionals. Health professionals must learn how to relate to and communicate with the target audience in order to affect behavior modification. The lack of cultural competence in and of itself represents an obstacle to effectively interacting with society's diverse populations, and contributes to the prevalence of health disparities in this country. Some of the fiscal year 2006 and 2007 loan repayment program activities with a focus on behavioral and social sciences research include:

- Acculturation, racial identity and health behaviors of African Americans in Charlotte, NC;
- Ellangneq (Awareness);
- Asian and Pacific Islander Youth Violence, Health Disparities, Urban Policy and Planning;
- Social Determinants of Therapeutic Effectiveness in Multi-Ethnic Populations;
- The Process of Migration and Latino Health: A Study of Health Differentials of Racial and Ethnic Minorities in the United States;
- Behavioral health in Hawaii
- Individual and familial alcoholism: Behavioral, health, and social consequences.

NCMHD Centers of Excellence (COE).

The NCMHD centers were established to develop novel programs across the country that would make significant advances and contributions in preventing, reducing, and ultimately eliminating health disparities in several priority diseases and conditions. The centers are helping to build the nation's research capacity by establishing novel partnerships between different types of institutions, for example, Historically Black Colleges and Universities (HBCU) and research-intensive institutions, and by engaging the efforts of community and faith-based organizations. The NCMHD centers provide opportunities to partner in the conduct of rigorous basic, applied population and community-based research. The centers program also provides opportunities to partnering and independently funded institutions for increasing the pool of investigators from health disparity populations through research training, faculty development, disseminating health information, and increasing the participation of health disparity populations in clinical trials.

Since 2002, the NCMHD has established a total of 88 Centers of Excellence. The program began with three components: Resource-Related Centers, (discontinued) Exploratory Centers, and Comprehensive Centers. The use of three different funding mechanisms has allowed the NCMHD to help level the playing field among institutions with varying experience in biomedical research, and to leverage the different skills and capabilities of the nation's geographically and culturally diverse institutions. The NCMHD Centers are located in 31 states, the District of Columbia, Puerto Rico, and the U.S Virgin Islands. The types of institutions are broad and include majority research institutions, medical schools, Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges, and liberal arts colleges.

The NCMHD Centers conduct research on all of the following priority diseases and conditions: cardiovascular disease, stroke, cancer, diabetes, HIV/AIDS, infant mortality, mental health, and obesity. The scope of activities at NCMHD Centers includes the conduct of original and innovative basic, behavioral, clinical, or population-based research directed toward improving minority health, eliminating health disparities, or both. Support is provided for full-length research and pilot projects, research training, student and faculty development activities, and outreach and community engagement. Special emphasis has been placed on research addressing co-morbidities within health disparity populations.

Significant research accomplishments of NCMHD COEs include success in engaging minority and health disparity populations and organizations in the research process, and scientific advances in minority health and health disparities research as documented in hundreds of papers authored by NCMHD COE researchers in the past five years. Examples of these accomplishments include the following:

- The NCMHD COE partnership between Johns Hopkins University and Morgan State University is a multi-site cohort study that examines the nature of health disparities within racially integrated communities without racial disparities in socioeconomic status. Data consisting of a structured questionnaire and blood pressure measurements were collected from adults of two contiguous racially integrated census tracts. Baseline results from the first site, a low income urban community in Baltimore, MD, indicate that accounting for race differences in exposure to social conditions reduces or eliminates some health-related disparities. The findings suggest that solutions to the seemingly intractable health disparities problem that target social determinants may be effective, especially those factors that are confounded with racial segregation and recommends future research into understanding socio-economic status and racial segregation.
- The New York University Center for the Study of Asian American Health (CSAAH) has continued its efforts to develop formative research projects such as the Asian American Community Health Needs and Resource Assessments in NYC. The primary purposes of these assessments are to determine: 1) the degree to which the health issues exist in ethnic-specific Asian American communities; 2) the resources available; and 3) the best approaches to meet the needs of these

communities in New York City. The first such assessment was developed in 2004 to better understand the health needs and resources available in the Filipino American community. In 2007, CSAAH published a series of community health needs and resource assessments on Filipino, Cambodian, Chinese, Korean, South Asian, and Vietnamese communities in NYC. In 2008 CSAAH will complete similar assessments in the Japanese community, and will conduct in-depth analysis of findings from the three major South Asian communities: Bengladeshis, Indians and Pakistanis.

- Researchers at the University of Puerto Rico-Medical Sciences Campus in partnership with the Cambridge Health Alliance—an NCMHD-funded partnership—developed a new theoretical mechanistic model accounting for the asthma disparities observed among minority children, particularly within subgroups of Latino children. The researchers applied a modified Institute of Medicine model to explain asthma disparities as a complex interaction among four major factors: (1) the health care system, (2) the practices and beliefs of primary care providers, (3) patient-based individual variables (i.e., physical factors such as genetic factors, and socio-cultural factors such as beliefs and practices), and (4) external environmental factors. This model has been used to guide the development of a comprehensive multi-level, community-based intervention program.

NCMHD IC Collaborations.

NCMHD also seeks other opportunities through NIH IC collaborations to include basic behavioral and social science research projects in its portfolio. Examples of NCMHD collaborations are the National Longitudinal Study of Adolescent Health and the Jackson Heart Study.

The **National Longitudinal Study of Adolescent Health** (Add Health) is a nationally representative study originally designed to examine how social contexts (such as families, friends, peers, schools, neighborhoods, and communities) influence teens' health and risk behaviors. The study is now examining how health changes over the course of early adulthood. The study began in 1994 under a grant from the NICHD, with co-funding from NCMHD and other federal agencies. The Add Health study is the largest, most comprehensive survey of adolescents ever undertaken. Initially, the goals of the study focused only on adolescents. Researchers designed the study to determine how families, friends, peer groups, schools, neighborhoods, communities, and individual characteristics influence health, health behaviors and use of health care. Recent phases of the study have examined health and health behaviors during the transition from adolescence into adulthood and the early years of adulthood. Researchers will study how adolescent experiences and environments influence what happens during the transition to adulthood and explore the early causes of behavioral and disease processes that lead to adult chronic disease.

The Jackson Heart Study is examining the factors that influence the development of cardiovascular disease in African American men and women. It is supported by a grant from NHLBI with co-funding support from NCMHD. In addition, the Jackson Heart Study is an effort to empower African Americans in the Jackson Metropolitan Area to reduce the risk factors associated with cardiovascular disease such as obesity, hypertension and lack of physical activity. The Jackson Heart Study is the first large-scale cardiovascular disease study in African Americans. The results will significantly impact not only African Americans in Mississippi, but African Americans throughout the United States. The study will enhance the community's awareness and understanding of cardiovascular disease through seminars and workshops on cardiovascular disease, diabetes, hypertension, cholesterol and nutrition. It will enhance research capabilities at minority institutions by developing partnerships, and it will develop programs to attract minority students into careers in public health and epidemiology. The Jackson Heart Study provides African American communities with opportunities to give meaningful input into the development of a major research project that impacts their health.

Future Planned Initiatives

Future NCMHD initiatives to address basic behavioral and social sciences research and increase the current research portfolio, will continually be developed in the NCMHD's statutorily mandated programs and new initiatives. These programs include the Loan Repayment Program for Health Disparities Research, and the Centers of Excellence Program. NCMHD will continue to encourage the grantees to conduct research to study the interactions of significant biological factors with behavioral and social variables, how they affect each other, and how these interactions influence and contribute to minority health conditions and health disparities. This new knowledge is expected to lead to the development of biopsychosocial interventions and strategies for improving minority health and eliminating health disparities.

Themes for future research directions are the continuation of interdisciplinary minority health and health disparities research, including basic, clinical, and behavioral and social sciences research to advance understanding of disease development and progression, and the development of interventions for preventing or delaying the onset and progression of disease. Another theme is designing studies to improve approaches for disease diagnosis, prevention, and treatment. The NCMHD extramural research programs also plan to conduct research that examines how disparities in health outcomes occur, including but not limited to behavioral and social factors, genetic variations, and other underlying biological, gender, ethnic and familial factors, policies, and environmental exposures.

23. John E. Fogarty International Center for Advanced Study in the Health Sciences

The Fogarty International Center (FIC) is dedicated to advancing the mission of the National Institutes of Health 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 the next generation of scientists to address global health needs. Fogarty pioneers new fields in global health, stimulating research and research training programs in new areas of science as well as filling gaps in the global health research workforce and enterprise. Many initiatives are interdisciplinary and conducted with partners in other agencies as well as NIH ICs.

Extramural Portfolio: The following section provides a brief description of the FIC current portfolio of programs that address bBSSR.

Fogarty International Research Collaborative Award – Behavioral and Social Science (FIRCA-BSS).

The FIRCA program aims to facilitate collaborative behavioral and social science research between U.S. scientists supported by the National Institutes of Health (NIH) and investigators in developing countries. PI's for this program may be either a US scientist or a foreign investigator who has participated in the FIRCA. An important role of the program is to foster discovery and reduce global health disparities through the support of international research cooperation across the continuum of basic and applied social and behavioral health sciences.

AIDS International Training and Research Program (AITRP).

The AIDS International Training and Research Program (AITRP) began in 1988 as one of a generation of research training programs sponsored by the Fogarty International Center at the NIH. This program provides training for scientists from institutions in low- and middle-income countries to strengthen HIV-related research and public health capacities at their institutions. The primary goal of this program is to build multi-disciplinary biomedical, behavioral and social science research capacity for the prevention, care and treatment of HIV/AIDS and HIV-related conditions for those adults and children affected by HIV/AIDS in the collaborating country.

Global Research Initiative Program for New Foreign Investigators (GRIP).

The Global Research Initiative Program for New Foreign Investigators (GRIP) provides support for new investigators on their path to independence and promotes productive re-entry into their home countries as part of a broader aim to enhance the scientific research infrastructure in developing countries. The specific goal of this initiative is to provide funding opportunities for the increasing pool of foreign biomedical and behavioral scientists, clinical investigators, nurses, and other health professionals with state-of-the-art knowledge of research methods to advance critical issues in global health through biomedical, behavioral and social sciences research upon returning to their home countries. Upon completion of their research experiences using this grant mechanism, developing country participants supported by this Funding Opportunity Announcement

are expected to continue to pursue independent and productive careers, including expert training and consultation and/or research within their home institutions.

International Clinical, Operational, and Health Services Research Training Award (ICOHRTA).

The International Clinical, Operational and Health Services Research and Training Award (ICOHRTA) for non-communicable diseases and disorders supports training to facilitate collaborative, multidisciplinary, international clinical, operational, health services and prevention science research between U.S. institutions and those in low- to middle-income countries to support the development and implementation of evidence-based interventions. These awards are intended to strengthen the global capacity to conduct clinical, operational, health services and prevention science research necessary to measure incidence and prevalence of non-communicable disorders and diseases; characterize disease burdens; devise, evaluate and implement practical and affordable therapeutic or preventive interventions; and to help developing nations contribute to and benefit from international efforts to apply current knowledge and new discoveries to clinical and public health practice. To meet this goal, the objective is to develop a cadre of researchers in clinical, operational, health services and prevention science research at institutions in low- to middle-income countries that can respond to global health threats related to non-communicable disorders and diseases, particularly those that are priority health issues in their countries and regions. They will be prepared to build and take advantage of collaborative research efforts with partners globally, as well as within their countries and regions.

International Tobacco and Health Research and Capacity Building Program (Tobacco).

This program supports trans-disciplinary research and capacity building projects that address the burden of tobacco consumption in low- and/or middle-income nations by 1) pursuing observational, intervention and policy research of local importance and 2) building capacity in these region in epidemiological and behavioral research, prevention, treatment, communications, health services and policy research. The program is designed to promote international cooperation between investigators in the United States and other high-income nation(s) pursuing research programs on tobacco control, and scientists and institutions in low- and/or middle-income nation(s), where tobacco consumption is a current or anticipated public health problem. The major portion of the research is conducted in a low- and/or middle-income nation(s), and greater than 60 percent of the direct costs requested must be used in a low- and/or middle-income nation(s) or “in-country” for either research and/or capacity strengthening of foreign institutions.

Global Research Training in Population Health (POP).

This program supports research training of low- and middle-income country scientists with the long-term objective of strengthening low- and middle-income country research programs and institutions related to population health, including the study of: a) demographic processes, including: aging, child health, adult health, mortality, morbidity, fertility, migration, urbanization, population dynamics and environment, nutrition, sex and gender, and other social, behavioral, and economic factors that influence population dynamics; and b) reproductive processes (including biology, immunology, genetics,

endocrinology), fertility and infertility, contraceptive development, contraceptive clinical trials, contraceptive and reproductive health evaluation. It provides a variety of short-, medium- and long-term advanced training opportunities for participants from low- and middle-income country institutions within the context of ongoing U.S. research collaborations. The program is expected to strengthen the ability of scientists from low- and middle-income countries to contribute to global population research efforts and to communicate and disseminate knowledge in support of population policies appropriate for their home countries and established international guidelines. It contributes to building and maintaining centers of research excellence with significant research resources in population health sciences to serve as loci in low- and middle-income countries and regions for research training.

Stigma and Global Health Research Program (Stigma).

The purpose of the Stigma and Global Health Research Program is to stimulate interdisciplinary, investigator-initiated research on the role of stigma in health, and on how to intervene to prevent stigma and mitigate its negative effects on the health and welfare of individuals, groups and societies world-wide. The objectives of this program are to encourage research across a variety of scientific disciplines including the biomedical, social and behavioral sciences, to elucidate the etiology of stigma in relation to public health as well as to develop and test interventions to mitigate the negative effects of stigma on health outcomes. Studies may examine stigma and public health in domestic, international and cross-cultural contexts, with an emphasis on studies that are relevant to global health issues. Applicants are encouraged to undertake interdisciplinary studies, where possible, using behavioral, social and biomedical science approaches.

Brain Disorders in the Developing World: Research across the Lifespan (Brain).

The purpose of the Brain program is to develop collaborative research and capacity building projects on brain disorders throughout life, relevant to low- and middle-income nations. The emphasis of the program is on development of innovative, collaborative research programs that will contribute to the long-term goal of building sustainable research capacity in nervous system function and impairment throughout life. More specifically, the collaborative research programs are expected to contribute to the long-term goal of building sustainable research capacity to address neurological/neurodevelopmental (including sensory, motor, cognitive and behavioral) function and impairment throughout life.

International Clinical, Operational, and Health Services Research and Training Award for AIDS and Tuberculosis (ICOHRTA-AIDS/TB).

This program supports research training to strengthen the capacity of institutions to conduct clinical, operational and health services research in low- and middle-income countries where AIDS, TB, or both are significant problems. The proposed research training addresses the skills needed at institutions to design and conduct HIV/AIDS and TB research for the scale-up of promising interventions to the population and health care system level.

The Fogarty International Collaborative Trauma and Injury Research Training Program (Trauma).

This program addresses the growing burden of morbidity and mortality in the developing world due to trauma and injury. The program addresses training across the range of basic to applied science, the epidemiology of risk factors, acute care and survival, rehabilitation, and long-term mental health consequences of trauma.

FIC strategic priorities in bBSSR

FIC is in the process of finalizing the next strategic plan which covers the period from 2007 to 2011. While the specific activities associated with basic BSSR will not be expressly stated in the plan, the new strategic plan is likely to have several implications with respect to basic BSSR.

First, capacity building for implementation research will be an important goal of the strategic plan. As we now have the tools and understanding to confront some of the most challenging health problems in the developing world, implementation science focuses on the study and evaluation of strategies for delivering evidence-based interventions to communities and populations. A major share of the underlying research on which this agenda will be based will be BSSR, of which basic BSSR will be a significant part.

Second, FIC will expand its portfolio to address the growing burden of non-communicable diseases. While FIC will continue to address research on infectious diseases in developing countries, it will strengthen research on non-communicable diseases and related capacity building. Since prevention of non-communicable disease is associated with changes in life style and individual and group behavior, the increased focus on non-communicable disease research is likely to result in strengthened behavioral and social sciences research and capacity building.

Third, FIC training programs will continue and enhance capacity building in multi-disciplinary research to tackle priority health problems in developing countries. With increased need and emphasis in multiple level (biological, individual, organizational and societal) and system approaches in scientific research, the training programs will focus on building the capacity of inter-disciplinary collaborations. As such BSSR will increasingly be integrated into the portfolio of health research to supplement and complement traditional biomedical research.

Intramural Portfolio – FIC does not have an intramural portfolio

24. National Library of Medicine

The National Library of Medicine (NLM) is the world's largest medical library. The Library collects materials in all areas of biomedicine and health care, as well as works on biomedical aspects of technology, the humanities, and the physical, life, and social sciences. The NLM's Extramural Programs Division provides grants to support research in medical informatics, health information science, and biotechnology information, as well as for research training in these areas. Network planning and development grants support computer and communication systems in health institutions and the study of new opportunities with high-speed computer networks in the health sciences. Health science library resource grants assist in improving information access and services for health professionals. Research and publications in the history of medicine and the life sciences are also supported.

The four projects in bBSSR supported by National Library of Medicine in FY 08 and beyond are the following:

Clinical Decision Support in Community Hospitals: Barriers & Facilitators, Joan S. Ash, PI (R56-LM006942-07A1). When computerized provider order entry (CPOE) is coupled with real-time computer-based decision support (CDS), medical errors decrease and costs can drop. CPOE with CDS is not in widespread use in community hospitals. Since 96% of U.S. hospitals are in this category, the implementation gap between community and teaching hospitals has serious consequences for patient safety. This project details the barriers and facilitators to CDS use in community hospitals, including personal, organizational, technological, and knowledge management aspects. In addition, the project will finalize and widely disseminate CDS tools that can be used by community hospital staff to facilitate future CDS implementations by reducing barriers and strengthening facilitators.

The Value of CPOE in Pediatric Inpatient Units and Its Impact on Safety and Work, Ben-Tzion Karsh, PI (R01-LM008923-01A1). One potentially significant aspect of computer order entry (CPOE) implementation and use is the interaction between CPOE and a pharmacy information system (PhIS). To address the lack of any research on medication safety interfaces (MSI) between CPOE and PhIS in general, and the lack of HIT research in pediatrics specifically, this project is an observational study in a pediatric hospital of the impact and value of this health information technology (HIT) on medication errors, quality of care, workflow, clinician working conditions, technology acceptance and cost-benefit. The aims are to determine the impact of a MSI on: medication errors and quality of care; working conditions, employee outcomes, technology acceptance and workflow; and the cost/benefit value of a MSI.

Histological Reasoning: Visual Cognition in Microanatomy, John R. Pani, PI (R01-LM008323-02). This project is a multidisciplinary study of cognition in the practice of histology, the microanatomy of tissues, which pathologists use to diagnose a variety of medical disorders. This project investigates the current and optimum methods for gaining expertise in basic histology through a variety of experimental studies. The results of this

research will lead to a detailed understanding of cognition in histology and to advances in theories of visual symbol systems used in the interpretation of images generated by human technology (e.g., x-ray, MRI, aerial photographs). This project has the potential to generate substantial change in the methods for developing skill in histology at both the undergraduate and the medical school levels.

Cybermedicine for the Patient and Physician, Warner Vincent Slack, PI (R01-LM008255-02). Cybermedicine is the use of computing to enhance communication in health care. The project delivers to patients, in their homes over the Internet, interactive interviews that obtain their medical histories and offer health-related information and suggestions. The results of these interviews will be incorporated into a Web-based electronic medical record. A randomized, controlled clinical trial will ascertain the effect of the interviews on variables such as the number of office visits by patients, the time per visit, and the satisfaction of patients and physicians with the computer interviews. The long-range goal of this project is to provide economically feasible, interactive, computer-based, health-related interviews that have been demonstrated by experimental trials to be of benefit both to patients and their physicians.

25. Office of Disease Prevention

The Office of Disease Prevention (ODP) includes ODP as well as the Office of Medical Applications of Research (OMAR), the Office of Dietary Supplements (ODS), and the Office of Rare Diseases (ORD). The ODP offices do not have any current or planned activities in basic behavioral & social sciences research.

26. Office of AIDS Research

Annual Office of AIDS Research (OAR) Trans-NIH Planning and Budget Development Process

As mandated by law, the Director, OAR, annually develops the *Trans-NIH Plan for HIV-Related Research* to ensure the AIDS budget is used to fund high priority AIDS-related research. The Plan shapes the NIH investment in biomedical and behavioral AIDS-related research and provides the framework to translate critical research findings into improved prevention and treatment strategies. It is developed in collaboration with scientists from NIH Institutes and Centers (ICs), other government agencies, and non-governmental organizations (e.g., academia, pharmaceutical and biotechnology companies, etc.), as well as advocacy groups and community representatives. The fiscal year (FY) 2006 and FY 2007 Plans can be accessed on <http://www.oar.nih.gov/public/public.htm>.

The trans-NIH AIDS research budget, which is developed by OAR, is explicitly tied to the objectives of the strategic Plan. Annually, the ICs submit their AIDS research budget requests to OAR for each scientific area, presenting their proposals for new, renewed, or expanded program initiatives over the amounts committed for existing multi-year awards, coded to specific Plan objective(s). OAR reviews the IC initiatives in relation to the Plan, its priorities, and to other IC submissions to eliminate redundancy and to assure cross-Institute collaboration. The NIH Director and the OAR Director together determine the total amount to be allocated for AIDS-related research within the overall NIH budget. Within that total, OAR determines each IC's allocation for AIDS-related research based on the scientific priority of each proposed initiative. At the time of the appropriation, OAR informs each IC of its AIDS-related budget allocation level, specifying amounts for each approved initiative. The individual ICs award and manage AIDS-related research grants and contracts and intramural research projects.

OAR AIDS-Related bBSSR: Programs and Budget Policy

FY 2008 AIDS-Related bBSSR Program (Trans-NIH Plan for HIV-Related Research, Behavioral and Social Science Objective 5B).

One of the research objectives for NIH AIDS-related research is to conduct basic social and behavioral research on factors influencing HIV risk behaviors and on the consequences of HIV disease. This is accomplished by supporting basic social and behavioral research to strengthen our understanding of the determinants, processes, and cultural and contextual issues influencing HIV-related risk and protective behaviors and the consequences and impact of HIV disease, including the treatment for and management of HIV infection. This includes domestic and international research that examines the societal, community, organizational, social network, dyadic, and individual barriers to and facilitators of the adoption and utilization of effective preventive and treatment interventions across the life course.

FY 2008: OAR AIDS-Related bBSSR Budget Policy.

In FY 2008, nearly all of the AIDS-related bBSSR budget will be allocated by OAR to individual ICs for support of AIDS-related research grants, contracts, and intramural projects aligned with the objectives articulated in the *FY 2008 Trans-NIH Plan for HIV-Related Research*. The amount of funds allocated to individual ICs was determined by OAR after thorough review and analysis of each IC's budget requests. A small portion of the NIH AIDS budget has been reserved for allocation by the OAR Director to individual ICs to fund emerging scientific needs and opportunities in bBSSR that require funding in the current fiscal year.

FY 2009 and Beyond: Planned Future Investment in AIDS-Related bBSSR

It is anticipated that the FY 2009 and beyond AIDS-related bBSSR objectives will be similar to objective 5B of the *FY 2008 Trans-NIH Plan for HIV-Related Research*. The Plan will be reviewed annually and revised as necessary.

27. Office of Behavioral and Social Sciences Research

The Office of Behavioral and Social Sciences Research (OBSSR), situated in the NIH Office of the Director, furthers the mission of NIH by emphasizing the critical role that behavioral and social factors play in health, health care and well-being. OBSSR serves as the focal point for coordination and development of NIH policies, goals, and objectives in the behavioral and social sciences at NIH. OBSSR's vision is to bring together the biomedical, behavioral, and social science communities to work more collaboratively to solve the pressing health challenges facing our nation. OBSSR's strategic priorities include facilitating: (a) the next generation of basic behavioral and social science research; (b) transdisciplinary "team science" that integrates biomedical, behavioral and social-ecological perspectives; (c) research that integrates the systems and multiple levels of analysis – from cells to society – required to understand and model how individual, group, societal and contextual factors interact; and (d) the translation, implementation, dissemination and maintenance of best practices to strengthen the science of dissemination, put what is known into widespread practice, reduce the burden of chronic disease and help eliminate inequities in health and health care. OBSSR's vision is described in more detail in its just published, *The Contributions of Behavioral and Social Sciences Research to Improving the Health of the Nation: A Prospectus for the Future* (http://obssr.od.nih.gov/Content/Strategic_Planning/Strategic+Plan_2007/ObssrIndex.htm)

OBSSR participates in many research initiatives developed by individual ICs. In addition, OBSSR plays coordinating and leadership roles in developing new research initiatives in collaboration with ICs. It is important to note, however, that OD program offices can only advise the ICs regarding their strategic priorities. The responsibility for funding any particular bBSSR initiatives ultimately rests within the ICs. The following are examples of ongoing, OBSSR-led initiatives supporting basic BSSR.

Current Activities in bBSSR

Research on Mind-Body Interactions in Health.

OBSSR worked with several ICs to solicit applications for and establish five Centers for Mind-Body Interactions and Health in 1999. This success of the Centers program spawned a number of additional initiatives in 2003 and beyond to support additional infrastructure, developmental/exploratory efforts, and research projects on mind-body interactions and health (RFA OD-06-005; PA 07-046). Among the current studies supported under this program are projects studying neighborhood and family effects on stress and health; social disparities in epigenetic regulation of neurodevelopment; health beliefs and behavior; effects of mindfulness-based stress reduction on immune response to the human papilloma virus; stress and immunity in older adults; and social inequality and health.

Social and Cultural Dimensions of Health (PA 07-045).

This initiative is designed to stimulate research to elucidate basic social and cultural constructs and processes used in health research, to clarify social and cultural factors in

the etiology and consequences of health and illness, to link basic research to practice for improving prevention, treatment, health services, and dissemination, and to explore ethical issues in social and cultural research related to health. Projects currently receiving support focus on health effects of racial segregation in aging adults; neighborhood design and obesity in older women; stigma and the cultural context of residential settings for the elderly; religion and cancer-related behaviors in African Americans; and socioemotional pathways involved in cardiovascular risk disparities.

Methodology and Measurement in the Behavioral and Social Sciences (PA 07-060, PA 06-343, PA 06-344).

This program was created to encourage research to improve the quality and scientific power of data collected in the behavioral and social sciences. Projects currently funded through this initiative focus on the measurement and use of geospatial factors; modeling risk in context; modeling inequalities in health, poverty and location; HIV risk assessment reactivity; measures of patient-reported, cultural and linguistic competence; neuropsychological assessment in children; assessment of social, cognitive and physical function; pain assessment in non-communicative, palliative care patients; integration of cell phones into random digit dial health surveys; and development of methods for statistical analysis that will improve research in many behavioral and social science disciplines.

Understanding and Promoting Health Literacy (PAR 07-018, PAR 07-019, PAR 07-020).

The goal of this program is to promote research that identifies and measures the nature and scope of low health literacy, lifespan and cultural differences in health literacy (especially those related to health disparities), as well as the impacts and consequences of low health literacy on health outcomes, prevention, treatment, adherence, risk assessment of environmental factors, chronic disease management, and health care related activities. Currently funded projects include studies of health literacy and cognitive function in older adults; development of instruments to measure health literacy and health numeracy; examination of oral health literacy; and the role of health literacy in patient adherence. Type 2 diabetes, oral health, maternal health, attention deficit hyperactivity disorder; cardiovascular disease, hypertension, and cancer are some of the health issues that are specifically examined.

Behavioral and Social Science Research on Understanding and Reducing Health Disparities (PAR 07-379, PAR 07-380).

OBSSR is partnering with numerous ICs on these FOAs soliciting research grant applications employing behavioral and social science theories, concepts, and methods (1) to improve understanding of the causes of disparities in health and disability among the various populations of the United States and (2) to develop and test more effective interventions for reducing and eventually eliminating health disparities. Emphasis is placed on research in and among three broad areas of action: 1) Public policy, 2) health care, and 3) disease/disability prevention. The first round of applications has been received and awards are expected to be made in late FY 2008.

Planned Future Activities in bBSSR

NIH Revision Awards for Studying Interactions Among Social, Behavioral, and Genetic Factors in Health (PAR 08-065, PAR 08-066, PAR 08-067).

In January, 2008, OBSSR, in partnership with numerous ICs, issued a number of program announcements soliciting applications for competitive supplements (i.e., revisions) that will allow investigators funded for genetics research to add a behavioral/social science component or vice versa, i.e., investigators funded for behavioral/social science research to add a genetics component. The goal of this program is to improve our understanding of how interactions among genetics/genomics, behavior, and social environment influence health and disease. The first round of awards is expected to be made in early FY 2009. This is one of several activities aimed at addressing the recommendations made in the Institute of Medicine report, *Genes, Behavior and the Social Environment: Moving Beyond the Nature/Nurture Debate* (2006), which was sponsored by OBSSR, NIGMS and NHGRI. In FY 09, OBSSR also plans to support the development of a web-based course to provide genetics training to behavioral and social scientists.

Using Systems Integrative Science Methodologies to Protect and Improve Population Health.

In FY 2009, OBSSR and several IC partners plan to issue a new FOA calling for research projects that use systems integrative science methodologies to address one or more specific opportunities to protect and improve population health. Systems approaches, take a “big picture” view of a problem, examining the dynamic interrelationships of variables at multiple levels of analysis (e.g., from cells to society) simultaneously (often through causal feedback processes), while also studying the impact on the behavior of the system as a whole over time. OBSSR’s success in attracting a large global audience for its webcasts of the *2007 Symposia Series on Systems Integrative Science and Health* (more than 7,000 viewings) and the *2007 Conference on Complex Approaches to Population Health* (more than 5,000 viewings) is evidence of enormous interest in these scientific methodologies. Just as systems biology revolutionized molecular biology, systems approaches yield insights that can help devise the necessary complex solutions and are required to understand and model how individual, group, societal and contextual factors interact to influence health.

28. Office of Research on Women's Health

The mission of the Office of Research on Women's Health (ORWH) is to stimulate and encourage meritorious research on women's including the role of sex and gender in health and disease. Every year the *ad hoc* Research Subcommittee of the Coordinating Committee on Research on Women's Health (CCRWH) considers gaps in knowledge and emerging scientific opportunities in conjunction with the Advisory Committee on Research on Women's Health (ACRWH) to develop recommendations for research priorities in women's health. Research opportunities are described in terms of overarching themes, special emphasis areas and areas of research interest.

Research proposals must consider the following four overarching themes, which are as relevant to behavioral science as they are to women's health: *Lifespan, Sex/Gender Determinants, Health Disparities/Differences and Diversity, and Interdisciplinary Research*. Special emphasis areas of research for FY2008 of direct relevance to bBSSR are Prevention and Treatment, Biological and Behavioral Basis of Sex and Gender Differences, Basic and Clinical Research Methodology, Quality of Life, and Career Development and Advancement of Girls and Women in Science (cf. FY2008 NIH Research Priorities for Women's Health, <http://orwh.od.nih.gov/>).

Extramural Portfolio for Extramural Research

In Fiscal Year 2006, ORWH committed to funding, through its partner ICs, a sizeable portfolio of bBSSR projects that will extend through a 5 year period, including FY 2008 and beyond. These are described briefly below and classified under three categories of bBSSR, Biopsychosocial Research, Research on Behavioral and Social Processes, and Research on the Development of Procedures for Measurement.

Biopsychosocial Research: Five relevant studies were funded in this research area. One project is studying the effects of estrogen levels on psychological stress on pain perception by testing the hypothesis that increases in clinical pain and symptoms across the menstrual cycle are associated with estrogen withdrawal and increased perceived stress. A second part of her study will manipulate the behavioral and hormonal factors hypothesized to influence temporomandibular joint and muscle disorder (TMD) pain by comparing the effects of three interventions: continuous oral contraceptive use to suppress the menses and stabilize the hormonal environment, a self-management intervention focus on and timed to the chronobiology of TMD symptoms across the menstrual cycle, and a usual self-management intervention not timed to biological events. This study should provide important and unique information on the relationships of the biological and psychosocial aspects of pain perception and should improve treatment for women.

Another project is studying the neuroimmune mechanisms underlying the effect of stress management on physical health and immune regulation in people with chronic fatigue syndrome (CFS) who receive a health promotion telephone intervention (T-HP) based on an effective cognitive behavioral stress management (CBSM) intervention for CFS

developed by this group and adapted for telephone delivery. Biological measures will be correlated with behavioral outcomes throughout the study. The study design is a 2X3 randomized experimental design with group (T-HP vs TCBSM) as the between group factor and time (pre-, post-intervention and 6 month follow up) as the within group factor. This will permit evaluation of the extent to which a T-CBSM aimed at building skills in anxiety reduction, distress tolerance, stressor appraisals and adaptive coping strategies may improve physical health status and immune regulation by modulating neuroimmune interactions.

A third project centers on the mechanisms by which successful psychosocial treatments for TMD achieve their effects. Men and women with at least a 3 month duration of chronic pain were recruited from the University Dental Clinic and from the community via advertisement and were randomized to either Standard Conservative Treatment (STD) consisting of an intraoral splint plus anti-inflammatory agents or to a STD plus Cognitive Behavioral Treatment Program (STD+CBT) that in addition to STD includes a focus on changing self-efficacy and decreasing catastrophization. Dependent variables will include self-report measures of distress, pain, and interference with usual activities as well as blood plasma levels of cortisol and selected cytokines measured at the end of the 6-week treatment period and at specified points thereafter up to a 12-month follow up. It is expected that there will be measurable changes in self-efficacy and catastrophization among the STD+CBT group, that these outcome differences will be associated with changes in inflammatory mediators or cytokines. It is also expected that ongoing treatment process variables will be associated with cytokine levels. These findings will have important implications for the development of more effective treatment programs.

Another ORWH-supported project uses a unique mouse model of preterm neonatal pain/stress and narcotic exposure to explicate the important human health issue of the long term effects of neonatal stress/pain on the developing brain, including disorders such as depression and addiction and the neurodevelopmental effects of prolonged narcotic exposure to alleviate such stress/pain. The central hypothesis is that repeated neonatal stress induces the release of endogenous dynorphin peptides which persistently activate kappa opioid receptors which then causes a sensitization to the rewarding properties of narcotics experienced later in life. They also hypothesize that neonatal morphine treatment will ameliorate the long term effects of neonatal stress and pain by decreasing the neonatal release of endogenous dynorphin. Findings should help clinicians to care more effectively for such vulnerable infants and perhaps block or ameliorate the long term effects on the brain.

A fifth project uses an ovariectomized rat model to address unanswered questions regarding the vulnerability of the middle-aged brain to ischemia. In young rats, the levels of estradiol before and after ischemia have neuroprotective effects. This study will examine whether estradiol retains its neuroprotective effects in middle age and whether the age related decline in insulin like growth factor-I (IGF-I) increases vulnerability to ischemia-related neurodegeneration and cognitive decline, as yet unknown. The study will address this by examining the roles of age, estrogen, and IGF-I in the survival and function of hippocampal neurons in a rat model of global ischemia. The experiments

should yield new information on the potential for hormone therapy instituted during the perimenopausal transition to protect the brain from damage due to global ischemia.

Research on Behavioral and Social Processes

Vulnerability factors in drug abuse.

One investigator is using an animal model to determine how the major vulnerability factors in drug abuse, including avidity for nondrug rewards, impulsive behavior, sex and ovarian hormones influence response to both behavioral and pharmacological treatment efforts. In addition, the treatment approaches will be studied as they are applied during the key phases of addiction, i.e. escalation to uncontrolled use and relapse after a period of abstinence. Drugs of interest are methamphetamine and cocaine. Medication to be tested will be baclofen (GABAB) and progesterone. This study should demonstrate how drug seeking behavior in vulnerable phenotypes can be reduced at the most critical phases of drug abuse through behavioral and pharmacological interventions. A positive result would also lead to viable treatments for stimulant abuse.

Racial disparities related disadvantage in childhood and pregnancy outcomes.

ORWH is also supporting a study of the relationship between racial disparities in childhood exposure to disadvantage and adult pregnancy outcomes. The study will use data collected in 3 waves of the National Longitudinal Study of Adolescent Health to address whether structural disadvantage in childhood is associated with increased risk of Preterm Birth (PTB), assess whether the effects of disadvantage in childhood are multiplicative or cumulative, explore the potential behavioral, psychosocial and biological mediators of these relationships and finally to examine whether differential experiences of structural disadvantage during childhood explain racial differences in PTB. This study may lay the foundation for reducing racial disparities in PTB.

Research on the Development of Procedures for Measurement

User acceptability of microbicide formulations.

Another project was funded to develop a new and more efficient way to assess and predict microbicide acceptability within the framework of formulation development by integrating behavioral with biophysical determinants of acceptability parameters. This study is focused on the development of a behavioral tool using qualitative interviews, item development strategies and cognitive interviews simultaneously with the development of measures of biophysical functioning, through computation by formulation scientists of measurements of two current over the counter vaginal microbicides. The goal is to demonstrate that these two measurement systems can be employed synergistically towards optimizing microbicide properties that govern effective deployment and biofunctionality as well as to measure vehicle acceptability. Eventually this work will contribute methodology leading to the development of microbicide formulations that co-optimize vaginal distribution and retention with user acceptability.

Specialized Centers for Research on Sex/Gender Factors Affecting Women's Health (SCOR).

In September 2007, ORWH funded 11 new or continuing SCOR awards. Each SCOR focuses on a central theme and must include basic and clinical studies to increase the transfer of science from the laboratory to clinical practice. Each SCOR is associated with one or more medical centers and focuses on major medical problems affecting women and comparing sex/gender contributions to health and disease. The disciplines mobilized in each SCOR are inter-departmental, inter-collegiate, and inter-institutional. Five of these awards are classifiable as biopsychosocial research, 3 are concerned with aspects of substance abuse or addiction, 1 takes a translational approach to fetal antecedents in depression, and 1 is a coordinated study of stress, pain, emotion, and sexual factors underlying the pelvic visceral disorders of inflammatory bowel disease and interstitial cystitis

Training Programs

Building Interdisciplinary Research Careers in Women's Health (BIRCWH); RFA OD-06-004. In September, 2007, ORWH funded 15 new BIRCWH awards nationwide, in addition to the eleven centers funded in 2006, bringing the total to 36 centers. BIRCWH awards have been funded continuously since they were first established in the fall of 2001. These career development awards (K12) “offer supportive opportunities for career development for men and women in interdisciplinary women's health research through strong mentoring by established scientists with diverse and broad experience”(Dr. Vivian Pinn, NIH Press Release, 24 September 2007). Depression is among the research areas studied by BIRCWH scholars.

Conferences and workshops

Because they following conferences partially support some research programs and include presentations that are relevant to bBSSR, they have been included. The ORWH sponsored the following bBSSR relevant meetings in 2007: Annual BIRCWH Scholars Meeting, Annual BIRCWH Directors Meeting, Annual SCOR Directors Meeting, Fourth Annual Interdisciplinary Women's Health Research Symposium, and Grantsmanship Workshop for Research on Chronic Fatigue Syndrome (information available at <http://orwh.od.nih.gov/>).

ORWH, together with other NIH ICs, HHS components, and non-federal partners, launched a Vulvodynia Awareness Campaign in FY 2008. ORWH launched this multi-year campaign because Vulvodynia, an example of a chronic pelvic pain disorder that is an under-diagnosed and under-treated condition that can adversely affect the quality of a woman's life and her sexual functioning, can benefit from improved provider-patient communication and awareness.

In FY 2008, ORWH co-sponsored a scientific workshop, entitled *Teen Dating Violence: Developing a Research Agenda to Meet Practice Needs*, bringing together federal staff, researchers, practitioners and advocates to discuss existing research and practice on teen dating violence, gaps in knowledge, and future research for practice needs, especially

those related to reducing risky behaviors on the part of teens, and ways to reduce bullying. The NICHD, NIDA, NIAAA, NIMH, NINR and OBSSR were partners in this effort. Other HHS participants include the Office of Women's Health, HHS; Health Resources and Services Administration; the Centers for Disease Control and Prevention; and the Administration on Children and Families. Other federal participants include the Department of Justice; the Department of Defense; and the U.S. Department of Agriculture. Results from these meetings will continue to inform NIH and ORWH scientific efforts on the societal impact of violent behavior. (More information is available at <http://orwh.od.nih.gov/>).

ORWH investment plan for bBSSR, FY 08/ FY 09 and beyond

The opportunities and programs described are examples of ORWH investment in behavioral and social science research and ORWH will continue to develop and fund initiatives that are relevant to bBSSR and as are emphasized in the NIH research priorities for women's health. The ORWH will also continue to develop new initiatives that will be relevant to bBSSR research.

ORWH is advancing new interdisciplinary research on how sex and gender factors affect women's health. In FY 2007, ORWH published two (2) new program announcements (PAs) with funding set-asides. These PAs are intended to promote innovative research that will advance concepts in women's health research and the study of sex/gender differences. This new program, *Advancing Novel Science in Women's Health Research (ANSWHR; PAS 07-381, PAS 07-382 (R21 and R03))*, includes 21 NIH Institute and Center scientific partners, including NIDCR, NINDS and NHLBI. The two PAs will remain active through FY 2010.

Examples of Relevant Funding Opportunity Announcements:

- RFA-06-003, SCOR
- PA 07-263; 07-264; 07-265 (R03, R21, R01) Chronic Fatigue Syndrome: Pathophysiology and Treatment
- RFA-06-002, Neuroimmune Mechanisms and CFS

29. Trans-NIH Initiatives

NIH Roadmap for Medical Research

The NIH Roadmap provides a framework of the priorities NIH as a whole must address in order to optimize its entire research portfolio. It lays out a vision for a more efficient and productive system of medical research. The NIH Roadmap identifies the most compelling opportunities in three main areas: new pathways to discovery, research teams of the future, and re-engineering the clinical research enterprise. Several NIH Roadmap initiatives include ongoing support for bBSSR, as described below:

The NIH Director's Pioneer Awards.

The NIH Director's Pioneer Awards are designed to support individual scientists of exceptional creativity who propose pioneering – and possibly transforming – approaches to major challenges in biomedical and behavioral research. The term “pioneering” is used to describe highly innovative approaches that have the potential to produce an unusually high impact on a broad area of biomedical or behavioral research, and the term “award” is used to mean a grant for conducting research, rather than a reward for past achievements. To be considered pioneering, the proposed research must reflect ideas substantially different from those already being pursued in the investigator's laboratory or elsewhere. Current awardees include researchers addressing the following basic behavioral science issues: the impact of evolution on psychological features; the fundamental nature of emotion, as revealed by the integration of neuroscience, social psychology, psychophysiology, and cognitive science; constructs and the functions of sleep in model organisms and in human beings; and the extent to which familial, environmental, gene-environment, and diagnostic drift/substitution contribute to autism. In addition, neuroscientists are pursuing projects to elucidate the neural circuitry underlying the behavioral states that characterize general anesthesia; to define the links between behavioral decisions and specific neurons, with the goal of achieving an integrated understanding of how the brain computes; to understand the roles of non-coding RNA (ribonucleic acid) function in brain development, and how these underlie behavioral measures of vision, audition and social behaviors; to examine how seizures in early life alter neuronal networks in the developing brain to cause cognitive disorders such as learning deficits, neuropsychiatric symptoms, and autism; and to pursue an understanding of neural dynamics in the fruit fly, with a focus on neural circuits involved in sensorimotor decision-making. For additional information, see <http://nihroadmap.nih.gov/pioneer/AwardRecipients.aspx>.

Facilitating Interdisciplinary Research via Methodological and Technological Innovation in the Behavioral and Social Sciences (R21).

This initiative supports research to develop technologies and methodologies that enhance the interdisciplinary integration of human social and/or behavioral science with other disciplines across varying levels of analysis. Seventeen applications were funded in FY 2007 from NIH Roadmap set-aside funds and additional support by various ICs and OBSSR. Projects funded under this program include research to develop tools for assessing human action in the workplace; improved statistical modeling software;

techniques to measure and analyze levels of the stress hormone, cortisol, in population health studies; improved measures of navigation; and cyberinfrastructure (see <http://nihroadmap.nih.gov/interdisciplinary/fundedresearch.asp>).

Interdisciplinary Research Consortia.

Also funded in FY 2007 under the NIH Roadmap are nine new Interdisciplinary Research Consortia. The consortia consist of multiple research projects with multiple principal investigators, core research support facilities, training, career development, and education components. A number of the consortia have strong bBSSR components, including the study of feeding behaviors as related to obesity; research on stress and self-control as related to addiction; geroscience; and behavioral phenotyping as related to neuropsychiatry. See <http://www.nih.gov/news/pr/sep2007/od-06.htm> for a complete listing of Research Consortia awardees.

Patient-Reported Outcomes Measurement Information System (PROMIS)

The goal of this NIH Roadmap activity is to improve assessment of self-reported symptoms and other health-related quality of life domains across many chronic diseases. Core domains include pain, fatigue, emotional distress, physical function, social function, and overall general health. One activity is to develop a publicly available, adaptable and sustainable Internet-based system that will provide short form instruments, and individually tailored questionnaires. The advantages of such instruments are to reduce response burden, increase scale reliability to detect group differences, compare or combine results from multiple studies, and to electronically link symptom and quality of life information with patient's medical records to enhance decision making. The next cycle of PROMIS will address the following major objectives: clinical trial validation of existing item banks, development of additional domains, Spanish translation testing (and other languages), and more. In summary, standardized measures will enhance our ability to evaluate the effectiveness of interventions and treatments in clinical research and practice.

Epigenomics

NIH has recently launched its Roadmap Epigenomics Program. Epigenetics is an emerging frontier of science that involves the study of changes in the regulation of gene activity and expression that are not dependent on gene sequence. While *epigenetics* refers to the study of single genes or sets of genes, *epigenomics* refers to more global analyses of epigenetic changes across the entire genome. The overall hypothesis of the NIH Roadmap Epigenomics Program is that the origins of health and susceptibility to disease are, in part, the result of epigenetic regulation of the genetic blueprint. Specifically, epigenetic mechanisms that control stem cell differentiation and organogenesis contribute to the biological response to endogenous and exogenous forms of stimuli that result in disease. The first set of FOAs issued under this program call for projects to coordinate and develop a series of reference epigenome maps, analogous to genome maps, which will be publicly available to facilitate research in human health and disease. One of the future goals of the Roadmap Epigenomics program is to evaluate epigenetic mechanisms in aging, development, and exposure to the physical, behavioral and social environments,

and modifiers of stress. See <http://nihroadmap.nih.gov/epigenomics/> for additional information about the Roadmap Epigenomics Program.

NIH Genes, Environment and Health Initiative

The overarching goal of the NIH Genes, Environment and Health Initiative (GEI) is to discover the genetic and environmental roots of common diseases. Established in FY 2007, GEI has two components. The Genetics Program is a pipeline for analyzing genetic variation in groups of patients with specific illnesses. The Exposure Biology Program is an environmental technology development program to produce and validate new methods for monitoring environmental exposures that interact with a genetic variation to result in human diseases.

The Exposure Biology Program is supporting a number of bBSSR projects. RFA DA 07-005, *Field-Deployable Tools for Quantifying Exposures to Psychosocial Stress and to Addictive Substances for Studies of Health and Disease (U01)*, developed under the leadership of NIDA, supports research to develop new technologies and measures to assay psychosocial stress and/or addictive substances (licit and illicit) for use within large-scale studies of diverse populations. RFA CA 07-042, *Improved Measures of Diet and Physical Activity for the Genes and Environment Initiative (GEI) (U01)*, developed under the leadership of NCI and NHLBI, supports projects to develop new or to adapt existing technologies (such as sensors; scanning and/or measurement devices; imaging techniques; wireless technologies; and bioinformatics tools and solutions) for dietary intake and physical activity assessment. See <http://www.genome.gov/26022424> for additional information.

NIH Blueprint for Neuroscience Research

The NIH Blueprint for Neuroscience Research is a cooperative effort among 15 ICs and OBSSR (<http://www.neuroscienceblueprint.nih.gov/>). By pooling resources and expertise, the Blueprint supports the development of new tools, training opportunities, and other resources to assist neuroscientists in both basic and clinical research. A number of Blueprint activities support bBSSR, including the following:

- *NIH Toolbox for Assessment of Neurological and Behavioral Function*, a contract to Evanston Northwestern Healthcare Research Institute that supports development of a set of standardized neurological and behavioral measures of cognition, emotion, sensation and motor function. The toolbox will foster uniformity among the basic measures used and allow comparisons or data compilations across multiple studies. This innovative approach to measurement will be responsive to the needs of researchers in a variety of settings, with a particular emphasis on measuring outcomes in clinical trials and functional status in large cohort studies, e.g. epidemiological studies and longitudinal studies.

- *Neuroscience Information Framework*, a contract to create a public online inventory of neuroscience resources, searchable by particulars or by concept.
- *NIH Study of Normal Brain Development*, which is tracking brain and behavioral development in about 500 healthy American children, from birth to age 18.
- *The NIH Neuroscience Microarray Consortium*, which makes “gene-chip” technology more available to NIH investigators. Using this technology, it has recently been shown, for example, that shown that people with one variant of a gene that is active in the brain have better episodic memory – the ability to remember events and facts – than do people without that variant.
- *Neuroimaging Informatics Tools and Resources Clearinghouse (NITRC)*, a web-based bank of software and other tools used for neuroimaging. Users can add tools to the site, and rate tools already on the site, which is currently in beta-testing.

IV. Gaps and Future Directions

The preceding sections of this report illustrate the depth and breadth of current and planned bBSSR activities at the NIH. To identify gaps in the bBSSR portfolio and potential future directions in bBSSR, OPASI and OBSSR consulted with the ICs and used input from a variety of other sources, including a number of National Academy of Sciences⁵ and NIH⁶ reports. In addition, OPASI and OBSSR elicited stakeholder opinions on priorities in bBSSR by issuing *Request for Information (RFI): To Solicit Input and Ideas on Priorities in Basic Behavioral and Social Sciences Research*, in the *NIH Guide for Grants and Contracts* in October, 2007 (<http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-008.html>).

Two questions were posed in the RFI, the first querying preferences for continuing or discontinuing current topics in NIH bBSSR research, and the second asking about priorities that should be emphasized by NIH in the future. Given inconsistent familiarity with current opportunities on the part of respondents, the latter question, focusing on priority identification, was analyzed here. The request garnered a volunteer sample of concerned stakeholders including 141 online responses from individuals, in addition to 11 formal responses from nine professional associations and two large research groups that were treated together as institutional responses.

It is of note that we tapped a broad segment of BSSR stakeholders. Most respondents who chose to provide affiliations were from academic institutions (82%), while just over 11% indicated affiliation with a not-for-profit organization and the rest indicating state or federal government or the private sector (7%). Thus, while we are aware of the potential for volunteer bias in an RFI approach such as this, we were fortunate in eliciting comment from a broad swath of the stakeholder community.

Along with descriptive numeric tabulations on available characteristics of the sample, analysis of the textual data involved use of *N-Vivo* software for qualitative materials (QSR, 2007). First, each response, whether individual or institutional, was coded for a

⁵Institute of Medicine (2000) *Bridging Disciplines in the Brain, Behavioral, and Clinical Sciences*, Terry C. Pellmar and Leon Eisenberg, eds.; Institute of Medicine (2001) *Health and Behavior: The Interplay of Biological, Behavioral and Societal Influences*. Institute of Medicine (2006) *Genes, Behavior and the Social Environment: Moving Beyond the Nature/Nurture Debate*. Lyla M. Hernandez and Dan G. Blazer, eds.; National Research Council (2001) *New Horizons in Health: An Integrative Approach*. Burton H. Singer and Carol D. Ryff, eds; National Research Council and Institute of Medicine (2000) *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Jack P. Shonkoff and Deborah A. Phillips, eds; all Washington, D.C.: National Academy Press.

⁶ NIH (2004) *Report of the Working Group of the NIH Advisory Committee to the Director on Research Opportunities in the Basic Behavioral and Social Sciences*. (http://obssr.od.nih.gov/Documents/BSSRCC/Meetings/Minutes/Minutes_2005/Basic%20Beh%20Report_complete.pdf); Office of Behavioral and Social Sciences Research, NIH (2007) *The Contributions of Behavioral and Social Sciences Research to Improving the Health of the Nation: A Prospectus for the Future* (http://obssr.od.nih.gov/Content/Strategic_Planning/Strategic+Plan_2007/ObssrIndex.htm)

major theme or themes inductively using a technique known as open coding. An enumeration of the most frequently responded categories (some of which were applied, rather than basic BSSR) and their frequencies across all responses are found in Table 3. Coding categories were non-discrete and allowed to overlap.

Table 3. Most commonly identified priority categories and their total frequencies based on open-coding of all RFI responses.

children and youth	26
communication	20
behavior change	17
disparities	16
multi- or interdisciplinary research	16
cognition	15
intervention	15
decision making	12
nutrition and physical activity	11
environment	11
mental disorders	11
emotion	10
translation	10
culture	9
obesity	9
stigma	8
learning	7
adherence	7
conflict	7
resilience	6
therapeutic modalities (psychological)	6
women's health issues	5
global health issues	5
theory	5
disseminations	4
aging	4
community	4
neuroscience	4
perception	4
network	4
personality	4
evolutionary perspectives	4
tobacco	4
effectiveness research	4

Following this, responses were mapped to the ten recommended priority areas outlined in the *Report of the Working Group of the NIH Advisory Committee to the Director on Research Opportunities in the Basic Behavioral and Social Sciences* (hereafter referred to as the 2004 ACD Report) and highlighted as “Next Generation” Basic Science in OBSSR’s Strategic Prospectus . The results of these analyses for the individual and institutional responses are shown in Table 4.

Table 4. Frequencies of individual RFI responses having priorities in accord with 2004 ACD Report priority areas, tabled by respondent affiliation.

	Affiliation (individual responses)				Institutional Responses	Total
	Not for Profit	Not Identified	Government	Academic		
CAS	2	3	1	13	8	27
TMMC	2	3	2	10	8	25
IHO	2	1	0	8	6	17
ITB	0	1	0	7	1	9
SISC	3	5	1	6	7	22
BSM	2	4	1	6	4	17
GEI	0	3	0	4	5	12
SMPC	0	1	0	3	2	6
SH	0	0	0	1	0	1
WRS	0	0	0	0	0	0

Report priority categories:

- BSM – biopsychosocial stress markers (biopsychological causation, allostatic load)
- CAS – complex adaptive systems (multilevel thinking and systems science)
- GEI – gene-environment interactions (behavior and genomics research)
- IHO – inequality and health outcomes (socioeconomic and ethnic disparities)
- ITB – intergenerational transmission of behavior (child socialization, longitudinal life-course concerns)
- SH – spirituality and health
- SISC – social integration and social capital (social networks, sources of psychological resilience)
- SMPC – social movements and policy change
- TMMC – technology, measurement, methodology and cyberinfrastructure
- WRS – work-related stresses

The greatest overlap between the individual responses and the advisory committee priorities fell under the rubrics “complex adaptive systems”; “technologies, measurement and methodology, and cyberinfrastructure”; “social integration and social capital (social networks sources of psychological resilience)” and “biopsychosocial stress markers (biopsychological causation, allostatic load)”. Despite the RFI instruction to discuss priorities in *basic* BSSR, the respondents’ recommendations tended to have a strong applied and translational cast.

Institutional RFI Responses

The Institutional respondents were careful to address concerns with underlying social and behavioral processes, as well as with fundamental mechanisms in keeping with the focus on basic BSSR. There was also concordance between the institutional responses and the 2004 ACD Report priorities, with the institutional representatives identifying the clear need for basic research. Once again, complex systems and methodological concerns led the list of elements identified, although a majority of institutional statements also underlined the salience of social integration and social capital as topical foci (Table 4). Issues of inequality in health outcomes were a concern of the majority of institutional respondents as well. The emphasis on gene-environment interaction, biopsychosocial

stress and social movements appeared in fewer statements, while there was no mention of spirituality and health or work-related stress.

In general, we can make several observations from the stakeholder response to the RFI:

- Recurring themes across responses include work directed toward children and youth, the importance of health communication in the broadest sense, and the need for better understanding about behavioral change and honing change interventions. Health equity remains a central concern of BSSR stakeholders, as do continuing work in cognition and decision making. The single largest health area taken as an exemplar or seen as a domain for social and behavioral science application extends across the realms of nutrition, physical activity and obesity.
- Looking across responses, there is considerable overlap between the priorities of the 2004 ACD report and this stakeholder response. The greatest concordance is in the realm of understanding complex adaptive systems as well as methods and technology development and social integration and social capital. The enthusiasm for advancing work in health equity — a task that begs for basic research as well as effective intervention, translation and action strategies — is likewise well represented in the BSSR constituency.
- A very small number of respondents complain of NIH failure to fund basic BSSR in their priority evaluations. This minority of stakeholders tends to draw an artificially sharp line between basic and applied science, and believe that basic behavioral science has been slighted as a result of a biomedical emphasis and the ICs' focus. Considerably more respondents emphasize the need for interdisciplinary research, work that involves diverse communities and health intervention more generally.

A review of these sources of information and discussions among NIH staff led to the selection of the following six topic areas for more detailed portfolio analysis:

- Genes and Social Environments: Pathways to Health and Illness
- Systems Approaches to Understanding Complex Health Problems
- The Bases for Sustainable Culture Change
- Psychosocial Stressors and Dysregulation of Biological Systems
- Social Relationships, Networks and Communities
- Factors Motivating Behavior Maintenance and Change

NIH Portfolio Analysis

The Research, Conditions and Disease Categorization (RCDC) prototype using a limited dataset was used to capture a partial set of FY 2007 NIH-funded research projects that might fall into each of the six content areas. This tool, still under development, employs text-mining algorithms (i.e., “fingerprints”) to search the titles, abstracts, specific aims, and the public health relevancy sections of NIH-funded grants. The fingerprint is a set of

descriptive terms that can be differentially weighted to reflect their relevance to the scientific concept at hand. Each research project captured by a given algorithm is assigned a score that reflects how strongly it matches the fingerprint. Review of the list of captured projects allows the setting of a threshold score, above which projects are considered to be correctly assigned to the category described by the fingerprint.

To get a snapshot of research awards relevant to the six topics, OPASI and OBSSR piloted a rapid portfolio analysis process that uses the RCDC software. RCDC fingerprints for each topic were developed “on the fly”, using terms already present in the tool’s thesaurus, and applied to the subset of FY 2007 NIH-funded projects already identified as “Behavioral and Social Sciences” by the current version of the RCDC fingerprint for that reporting category. Since the NIH-wide fingerprint for “Basic Behavioral and Social Sciences” is still under development, all projects captured by the “on the fly” fingerprints were reviewed by OBSSR staff to select only projects that fit the definition of *basic* behavioral and social sciences. OBSSR staff also reviewed the project lists to ensure adequate matching of the project to the scientific content area. Only NIH R and U mechanisms, i.e., grants and cooperative agreements, are reported. (Note: When the RCDC tool is fully operational, extramural contracts and intramural research efforts will also be included.)

The portfolio analyses provided here should be considered “rough drafts”. They were based on the current version of the RCDC thesaurus (based on 6 thesauri used at NIH including MeSH from the National Library of Medicine), which may or may not have the most relevant terms for an idea. Also, the set of NIH R and U projects was incomplete. For both reasons, all grants relevant to a particular topic may not have been captured. Moreover, the process of accurately mapping terms to a topic, determining how they affect a project list that is generated, and modifying the fingerprint until it accurately identifies the meaningful grants is a lengthy, iterative process that was greatly truncated in this case. Thus, the portfolio analyses provided here represent a very broad overview of research being done that is somehow relevant to the six topics. These lists may be more or less useful in prioritizing bBSSR ideas, depending on how broad or narrow the ideas are and how many useful terms for the idea are actually available in the RCDC thesaurus.

The following sections describe the proposed scientific content gap areas, the RCDC analyses for each area, and an assessment of whether these content areas in their entirety or partially, do, in fact, represent gaps in the NIH research portfolio. Note that there is overlap among the areas.

Genes and Social Environments: Pathways to Health and Illness

What?

Most diseases arise from complex interactions between genetic susceptibility (resulting from the activity of multiple genes) and environmental exposures over the course of a lifetime. For example, interactions between variants of the serotonin transporter gene and exposure to highly stressful environments during childhood influence the likelihood of suffering from depression during adulthood.⁷ We are just beginning to understand how environmental exposures influence gene expression and ultimately phenotype. Animal studies have shown that rat maternal behaviors exert epigenetic effects and thereby influence expression of the glucocorticoid receptor gene in the hippocampus of their offspring, thus permanently altering offspring responses to stress.⁸ Current NIH initiatives are making progress towards understanding how interactions between genes and the physical/chemical environments influence health and illness. However, much less attention has been given to interactions among genes and *social* environments (e.g., family and peer interactions; worksite and school environments; culture; stigma; discrimination; poverty; lack of social support), and how these influence physiological systems affecting health and illness.

NIH-commissioned Institute of Medicine and National Academy of Sciences reports⁹ highlight the important role of social environments in influencing gene expression at different periods in an organism's life. The reports recommend research on topics such as gene expression and prenatal development, personal ties and gene expression in midlife, animal models and consequences of mother-child interactions, intergenerational transmission of behavior, and plasticity of genetic trajectories. These reports also emphasize the need to improve (a) characterization of social/cultural environments as well as (b) research and statistical designs for evaluating interactions between genes and social environments.

In particular, basic behavioral and social sciences research is required to:

- Elucidate interactions between social environments and genes from prenatal development through old age
- Understand the mechanisms by which social environments influence gene expression

⁷ Caspi A, Sugden, K, Moffitt TE, Taylor A, Craig, IA, Harrington, H, McClay, J, Mill, J, Martin, J, Braithwaite, A and Poulton, R (2003) Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. *Science* 301:386-389.

⁸ Szyf M, Weaver IC, Champagne FA, Diorio J, Meaney MJ (2005) Maternal programming of steroid receptor expression and phenotype through DNA methylation in the rat. *Front Neuroendocrinol* 26(3-4):139-62.

⁹ Hernandez, LM and Blazer, DG, eds. (2006), *Genes, Behavior, and the Social Environment*. Washington, DC: National Academy Press; Singer, BH and Ryff, CD, eds. (2001) *New Horizons in Health: An Integrative Approach*. Washington, DC: National Academy Press.

- Develop research methods and analytic strategies to capture complex interactions among multiple factors that change over time
- Establish databases for collection sharing of data on genotype, and social environmental exposures

Why now?

Completion of the mapping of the human genome and the HapMap, the advent of genome-wide association studies and the promise of epigenomics provide the unprecedented opportunity to elucidate how gene-behavior-social environment interactions influence health. Precise and rigorous measurement of behavioral and social variables is critical now if we are to make sense of the wealth of data emerging from these efforts. Transdisciplinary research to enhance our understanding of the synergisms between environmental risks with genetic factors that potentiate disease will be key to future gains against chronic illness and mortality.

Why NIH?

Research on the social environment and its interactions with genetic factors should improve our ability to understand individual differences in susceptibility and resistance to disease, illness, and disability. Such knowledge would be useful in developing “personalized medicine” as well as public health initiatives directed at specific population groups to reduce common health problems and related health disparities. Finally, understanding of these factors will help us create social environments that may mitigate the genetic risks for disease.

Portfolio Analysis

This RCDC analysis captured 31 projects that met the definition of basic behavioral and social sciences research and fit the concept definition of research designed to elucidate how interactions between genes and the social environment influence behaviors, physiology and health. Nearly half of these projects are concentrated at NIMH and NIDA, with the remainder distributed across NIEHS, NICHD, NIAAA, NHLBI, FIC, NCRR, NIDCR, NIA and NCI. The projects tend to focus on family interactions (siblings, parents), psychosocial stress, social support, and socioeconomic status as components of the social environment, and genes related to mental health, substance abuse (tobacco, alcohol, opiates, other drugs), and oral health. A number of studies take advantage of the fact that several ongoing, longitudinal studies that routinely collect rich social environment data (e.g. the National Longitudinal Study of Adolescent Health; the Whitehall Study) are now collecting biological specimens for genetic analyses. Finally, many of the identified projects were focused on humans, with fewer studying animal models of the social environment (e.g., social defeat in rodents; maternal behavior in baboons), and several using both humans and laboratory animals).

In developing this fingerprint, it became apparent that NIH is supporting basic research on how other, non-social environmental factors interact with genes to influence

physiological function and health. This includes investigation of the chemical environment (e.g., pollutants) and behavioral environments (e.g., dietary intake, smoking). There is, however, a real paucity of studies of how the many aspects of the social environment (e.g., family and peer interactions; worksite and school environments; culture; stigma; discrimination; poverty; and other social stressors) interact with genes to influence health. Moreover, experts in this field have noted that traditional epidemiological approaches using aggregate group tests of genetic vulnerability fail to capture *individual* variation in genotype and measured environmental exposures (including social ones)¹⁰. Taken together, these data lead us to conclude that this is a true gap in the current NIH research portfolio.

¹⁰ Moffitt, TE, Caspi, A and Rutter, M (2005) Strategy for investigating interactions between measured genes and measured environments. Arch Gen Psychiatry 62(5):473-81.

Systems Approaches to Understanding Complex Health Problems

What?

There is growing recognition that many of the seemingly intractable and most challenging problems we face in public health are so because they are complex in nature^{11,12}. For example, tobacco use and successful cessation are influenced by genetic predisposition, peer influence, media exposure (both tobacco promotion and health messages), cultural norms, prior tobacco exposure, pharmacotherapy availability and usage, history of quit attempts, workplace smoking bans, and a host of other factors¹³. These problems have typically been approached using correlation based analytic methods (e.g., regression), which are useful for identifying linear relationships but are by themselves, insufficient, because of their inability to set up and test a web of causal relationships. Systems science methodologies are expressly useful for identifying and testing causal structures and theories, and not surprisingly, these very approaches have been called for to address public health problems^{14,15,16}. Systems science methodologies provide a way to address complex problems, while taking into account the “big picture” and context of such problems. These methods enable investigators to examine the dynamic interrelationships of variables at multiple levels of analysis (e.g., from cells to society) simultaneously (often through causal feedback processes), while also studying the impact on the behavior of the system as a whole over time^{17,18}. Systems dynamics

¹¹ Kearns, A., Beaty, M., & Barnett, G. (2007). A social-ecological perspective on health in urban environments. *N S W Public Health Bulletin* 18:48-50.

¹² Sterman, J.D. (2006). Learning from Evidence in a Complex World. *American Journal of Public Health* 96 (3): 505-514.

¹³ National Cancer Institute. (2007). *Greater Than the Sum: Systems Thinking in Tobacco Control*. Tobacco Control Monograph No. 18. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. NIH Pub. No. 06-6085.

¹⁴ Gerberding, J. (2007). *Health Protectionomics: A New Science of People, Policy and Politics*. Public Health Grand Rounds, September 19, 2007. George Washington University School of Public Health and Health Services: Washington, D.C. Retrieved January 3, 2008 from <http://www.gwumc.edu/sphhs/events/phGrandRounds.cfm>

¹⁵ Homer, J.B. & Hirsch, G.B. (2006). System dynamics modeling for public health: background and opportunities. *Am J Public Health* 96(3):452-8

¹⁶ Madon, T, Hofman, KJ, Kupfer, L, & Glass, RI (2007) Implementation Science. *Science* 318:1728-1729.

¹⁷ Midgley, G. (Ed). (2003). *Systems Thinking*. Thousand Oaks, CA: Sage Publications.

¹⁸ Meyers, R.A.. (Ed) (in press). *Encyclopedia of Complexity and Systems Science*. New York: Springer.

modeling¹⁹, agent based modeling²⁰, discrete event simulation²¹, and network analysis²².²³ are a few of the specific techniques, but there are many others.

Why now?

Systems science methodologies are extremely useful for understanding why programs and interventions fail to have their intended effects (and in the worst cases magnify the problem²⁴). They are also useful for making implicit assumptions about complex phenomenon explicit, which exposes gaps in knowledge about the problem. Moreover, simulation modeling can be used to generate “alternative futures” allowing decision makers (e.g., policy makers) to simulate the impact of various policy decisions and how they play out over time before actually putting them into practice²⁵. For example, insights gained by the use of simulation models can help policy makers choose the most effective option among competing strategies when resources for combating the problem are limited.

Advances in computer sciences and information technology provide us with the computational power to efficiently analyze complex, dynamic, and interrelated determinants of health and disease and other social problems²⁶. The majority of chronic health problems have strong behavioral and social components²⁷, which tend to be complex in nature, change over time, and thus, lend themselves to examination with systems science methodologies²⁸. Basic research is needed to facilitate the development of conceptual frameworks, tools, data systems, and methods needed to apply systems approaches to the study of health and disease²⁹.

¹⁹ Sterman, J.D. (2000) *Business Dynamics. Systems Thinking and Modeling for a Complex World*. Boston: McGraw-Hill.

²⁰ Epstein, J. M. (2006) *Generative Social Science: Studies in Agent-Based Computational Modeling*. Princeton, N.J.: Princeton University Press.

²¹ Banks, J., Carson, J., Nelson, B., & Nicol, D. (2005) *Discrete-event system simulation*. 4th edition. Englewood Cliffs, New Jersey: Prentice Hall.

²² Wasserman S., & Faust, K. (1994) *Social network analysis: methods and applications*. Cambridge, England: Cambridge University Press.

²³ Scott J. (2000) *Social network analysis: a handbook, 2nd edition*. Thousands Oaks, CA: Sage Publications.

²⁴ Sterman, J.D. (2000) *Business Dynamics. Systems Thinking and Modeling for a Complex World*. Boston: McGraw-Hill.

²⁵ Sterman, J.D. (2006). Learning from Evidence in a Complex World. *American Journal of Public Health* 96 (3): 505-514.

²⁶ Forrester, J. (1971) Counterintuitive Behavior of Social Systems. *Theory and Decision* 2, 109-140.

²⁷ Mokdad, A.H., Marks, J.S., Stroup, D.F., & Gerberding, J.L. (2004) Actual causes of death in the United States, 2000. *JAMA*;291(10):1238-45. Review. Erratum in: *JAMA*. 2005 293(3):293-4, 298.

²⁸ Homer, J., Hirsch, G., & Milstein, B. (2007). Chronic illness in a complex health economy: the perils and promises of downstream and upstream reforms. *System Dynamics Review*; 23(2/3):313–343.

²⁹ Carello, C., & Moreno, M.A. (2005). Why Non-linear Methods? In M. A. Riley & G. C. Van Orden (Eds.), *Tutorials in contemporary nonlinear methods for the behavioral sciences* (pp. 353-400).

Retrieved December 14, 2007, from <http://www.nsf.gov/sbe/bcs/pac/nmbs/nmbs.jsp>

Systems science methodologies have begun to be employed for planning and preparing against acute threats to public health³⁰ such as global spread of a pandemic flu³¹. There is a vast array of obdurate chronic diseases and risk factors for which systems science approaches would enhance our understanding and decision making (e.g., heart disease, diabetes, obesity, high blood pressure, eating behavior, physical activity, smoking, drug and alcohol use).

We still need to identify which problems are best suited to examination by which system science methodologies and at what point in their lifecycle. Developing such a resource, along with a catalogue of the ways in which various types of solutions to complex health problems commonly fail, would facilitate and enhance the application and utility of systems science methodologies in public health.

Why NIH?

Many investigators who aim to solve complex public health problems look to NIH to provide them with the appropriate funding. With 27 institutes and centers and an array of health and disease topics covered, NIH is well poised to pursue initiatives to address this “systems” gap. Already, NIH IC’s with sizeable investments in modeling, e.g., NCI ‘s Cancer Intervention and Surveillance Modeling Network (CISNET; <http://cisnet.cancer.gov/index.html>), NIGMS’s Models of Infectious Disease Agent Study (MIDAS; <http://www.nigms.nih.gov/Initiatives/MIDAS>), and the NIBIB-led Interagency Modeling and Analysis Group (IMAG; <http://www.nibib1.nih.gov/Research/MultiScaleModeling/IMAG>) and associated IMAG initiatives for multiscale modeling (<http://grants.nih.gov/grants/guide/pa-files/PAR-08-023.html>, <http://www.nibib.nih.gov/Research/MultiScaleModeling>) have begun to recognize the contribution that behavioral and social science could make to these initiatives and are seeking to fill the gap identified here in partnership with OBSSR. Moreover, NIH has a genuine commitment to working across agencies in support of its mission and has already developed relationships with CDC and NSF with the aim of addressing this “systems” gap.

Portfolio Analysis

This RCDC analysis captured 23 R and U projects that met the definition of basic behavioral and social sciences research and fit the concept definition of systems science approaches to understanding health and disease. The projects are concentrated at NIDA (seven projects) and NCMHD (six projects), with the remainder distributed across ICs: NIA (three projects), NIGMS, NIAAA, and NIMH (two projects each), and NIDCR (one

³⁰ Lasker RD. (2004). *Redefining readiness: terrorism planning through the eyes of the public*. New York, NY: The New York Academy of Medicine; September 14, 2004. <http://www.cacsh.org/eptpp.html>

³¹ Germann, T.C., Kadau, K., Longini, I.M., Jr, & Macken, C.A. (2006). Mitigation strategies for pandemic influenza in the United States. *Proceedings of the National Academy of Sciences USA*; 103(15):5935-40.

project). Greater than half (17) of the projects focus on social networks, and the vast majority of these address sexual contact and drug use networks in the context of HIV/AIDS. All of the identified projects were focused on humans, except one which is a study of social behavior in infant rat pups.

In developing this fingerprint, it became apparent that NIH is supporting a small amount of basic research applying network analysis to better understand social networks, mostly to understand HIV/AIDS risk and transmission. NIH is funding a very small amount of systems science research outside of network analysis that is basic in nature and addresses behavioral and social aspects of health (6 projects). These projects utilize a variety modeling/simulation approaches to address a wide range of diseases and conditions. Specifically these projects aim to develop: agent-based models of infectious disease spread; computational simulation models to facilitate drug discovery; a computational model of executive function and search behavior; computer simulation to elucidate the role of child, family, and neighborhood factors in the development of caries in children; individual-based models to study individual, social and group behavior; and predictive models of parenting and child development on an American Indian reservation. Thus, at NIH there are few projects that aim to develop or utilize systems science methodologies to address behavioral and/or social aspects of health and disease.

The Bases for Sustainable Culture Change

What?

NIH's mission to improve health requires an ongoing understanding about how long-term cultural change occurs. Most importantly, we need to better understand the role of policy initiatives and new communications modalities for influencing fundamental shifts in shared ideas, beliefs, values, and practices within groups or populations that bring lasting changes in public health.

While the general topic of "culture change to improve the nation's health" is one that ultimately translates into applied science, research that is targeted at understanding the fundamental processes, mechanisms, and the development of new conceptual models, measures or methods to add to the current knowledge base are all regarded as basic science. The disciplines of the social and behavioral sciences began addressing classic mechanisms of change (e.g. diffusion, acculturation) over a century ago. Yet the new cultural terrain created by previous changes, and the introduction of new technological, environmental and demographic variables into the equation require that we refine our understandings to address new challenges.

Fundamental to NIH's mission, health promoting behaviors such as exercise, health risk behaviors such as steroid use, and the acceptance and adoption of new technologies for prevention, screening, and treatment all are sensitive to shared cultural beliefs and values. If a prescription for good health or improved medical treatments runs counter to shared values and practices, either within a specific group or the population at large, it is unlikely to be adopted. However, culture does change, sometimes rapidly and dramatically, as illustrated by the transformation of public opinion on the acceptability of smoking in public places.

Research in this area investigates the mechanisms through which cultural change occurs, including the following:

- enhanced understanding about the diffusion of innovations in the context of emergent communications technologies
- better knowledge about how policy shifts trigger sustained adjustments to social and cultural systems, or alternatively fail to gain traction or create health solutions
- social learning (basic research on how people learn in social contexts)
- migration and acculturation in the 21st century
- social movements, outcomes and impacts
- actions of social institutions such as media, schools, and government

Research is needed to improve our knowledge of these mechanisms; to understand how they play out in the context of different communities; to explore how mechanisms may vary depending on the content of the message or idea; to understand why ideas change

rapidly in some circumstances and slowly or not at all in others; to understand how and why “tipping points” can transform unpopular ideas into fashionable ones, and what determines whether a tipping point is reached. We need to understand what factors differentiate a passing fad from a normative shift at different levels of social structure that leads to permanent adoption of a new set of values. Conducting this research requires the contributions of scientists across the disciplinary spectrum, from neuroscience and psychology to anthropology, sociology, communication, and economics.

Why now?

The present convergence of environmental change and scientific advances underscores the imperative for moving this research agenda forward. With respect to the environment, we live amidst an explosion of technologies for communication and social networking (e.g., Internet sites like Myspace and Facebook, PDAs, kiosks, cell phones) that have transformed social processes, delinking them from spatial proximity and altering even familiar forms of acquaintance. The changing ethnic structure of our nation reflects growing riches in cultural diversity, just as it may further complicate the task of communicating about health and medicine — or assuring access to quality care as a human right. Growing public awareness about risks posed by products from tobacco to trans fats leave uneven patchworks of policy across different political levels. We need to know how localized initiatives gain traction and grow, or alternatively reflect anomalous, short-term solutions to problems that are oftentimes characterized as “policy resistant.” We live in a time when our exposure to new ideas, people and technologies is nearly limitless, yet we find social activity framed by “identity politics” and movements that now insist on an active, participatory role in relationship to matters of health. Knowledge about the mechanisms of cultural change must be re-examined in the context of our shifting cultural and social environments.

At the same time, scientific advances in social neuroscience, the cognitive sciences, social psychology, and sociology have paved the way for improving theory and measurement in relation to culture change. New methods of measuring implicit beliefs, advances in the science of social networks, and methods for modeling diffusion processes and complex environmental systems all contribute to this potential.

Why NIH?

NIH research has produced robust knowledge from the biopsychosocial, behavioral, and social sciences to prevent, reduce, and manage mental and physical conditions on a person-by-person basis. Population-based approaches have the potential to be far more cost-effective, since small changes in behavior, adopted across a large population can result in large long-term payoffs for societal health. However, the knowledge base for such approaches remains thin. Scientific knowledge about cultural change processes will inform the development of effective communication campaigns to reduce risky behaviors or improve health literacy, guide interventions that work with social processes instead of against them, facilitate the dissemination and translation of medical advances, and help forecast the behavioral responses to changes in public policy. In short, basic research on

how ideas and information are spread, perceived as credible, and motivate both health care providers and patients will enable the NIH both to develop new, efficient strategies for improving health and to increase the payoff of its many discoveries to date.

Portfolio Analysis

Given the broad, multilevel and diffuse nature of this domain, the approach taken was to use search terms that might elicit different culture change mechanisms individually, rather than attempting an overarching definition. The situation is analogous to an index developed for a complex construct having multiple dimensions (e.g. quality of life) compared with a scale that could be represented unidimensionally (e.g functional disability), lending itself to a clear hierarchy of items and a single fingerprint. This method also emphasized sensitivity over specificity.

The approach revealed obvious gaps for some basic research terms, as in the case of “anthropological culture,” and a small amount of policy research with BSSR relevance. Analysis yielded 29 R and U mechanism awards (extramural research grants and cooperative agreements) that met the definition of basic behavioral and social sciences research and fit the concept definition of research on *The Bases for Sustained Culture Change*.

The gap in understanding contemporary culture change may have been inapparent due to broad NIH support for related basic and applied areas of research. For example a well-addressed area is epidemiologic research examining changing patterns of disease in different ethnic groups and areas. These basic studies meet criteria of cultural diversity, with longitudinal studies hinting at the margins of ongoing social change. However, this work does not look at culture change mechanisms — ethnicity remains a static and often loosely-applied variable. Some basic research into economic predictors of behavior in relation to various health-related states is encountered. Numerous basic studies looking at health-related cultural characteristics of ethnic groups or social contexts with critical health implications are funded by NIH, but are cross-sectional and do not address culture change. Conversely, close, theoretically-oriented attention to culture change (here taken as broad ideational, normative shifts) is addressed in a handful of behavior change interventions, although these studies remain classed as applied given an emphasis on intervention effectiveness.

The few basic research studies that approach our goal of better knowledge about sustainable culture change aim at improving knowledge about migration and acculturation. Clearly there is room to expand basic BSSR on cultural change as the discussion indicates. The gap analysis underlines the particular need for focusing research on processes underlying broader health-related cultural changes arising in response to emerging communications media, changing policy initiatives, social movements and a constantly evolving social and cultural landscape.

Psychosocial Stressors and Dysregulation of Biological Systems

What?

There is a growing body of research regarding the effects of social factors on physiology, including cardiovascular, neuroendocrine, and immune function, as well as on health outcomes³². It is hypothesized that disadvantaged environments expose individuals to experiences (such as financial insecurity and low control over how and when work-related tasks are done) that accumulate over time to create chronic stress, which in turn is manifested in dysregulation of biological systems³³. How an individual perceives and responds to the stressors in the social environment has been shown to depend on a complex interplay among genetics, events in early development, behavior and lifestyle choices as well as the social and psychological characteristics that the individual brings to the situation(s). What is lacking, however, is basic research to elucidate the mechanisms underlying the perception and transduction of stimuli from the social environment into biological signals that influence physiology.

Why now?

Increased sophistication of biosocial surveys and recent technological developments, such as molecular imaging, real time data assessment and experience sampling, and GIS have improved our ability to assess social, psychological, cognitive, and physiological functioning in the context of daily experience and social context. New analytic tools, such as multilevel modeling to handle these more complex data, offer significantly enhanced methodologies for understanding individuals' interactions with (and reactions to) their social and physical environments, including patterns of associated physiology.

Why NIH?

Although evidence is mounting on the link between psychosocial stressors and increased risk for dysregulation of biological systems, many critical questions remain. Among these is the question of whether differential exposure to stressors is a causal mechanism for the unequal burden of disease across populations. Basic research on the interactions among social, behavioral and biological processes may elucidate the underlying pathways that lead to disparities in health outcomes across the lifespan and across populations. We are now in a position to answer questions about how environmental stressors, such as poverty, interact with biology, and how this plays into disease etiology and progression. Further research in this area would provide crucial information to enhance our understanding of the determinants of disease with a goal of informing the development of interventions to reduce disease risk and, ultimately, improve health.

³² Hernandez, LM and Blazer, DG, eds. (2006). *Genes, Behavior, and the Social Environment*. Washington D.C.: National Academy Press.

³³ Adler, NE, and Rehkopf, DH (2008) U.S. Disparities in Health: Descriptions, Causes and Mechanisms. *Annu. Rev. Public Health* 29:10.1-10.18.

Portfolio Analysis

This RCDC analysis captured 32 R mechanism awards (there were no U mechanism - cooperative agreement - awards) that met the definition of basic behavioral and social sciences research and fit the concept definition of research designed to elucidate the mechanisms underlying the perception and transduction of stimuli from the social environment into biological signals that influence physiology. Supplements with associated parent grants were counted as one, leaving a total of 30 eligible studies. Of these 30, 16 projects (53%) are supported by NIDA and NIMH, with the remainder distributed across NHLBI, NICHD, NIAAA, NIAID, NIA, NIDDK, NINR and NCI. Projects tended to focus on abnormal adaptations to stress as they relate to vulnerability to substance abuse or the association between exposure to stress and adverse mental health and behavioral outcomes. There is a lack of research addressing behavioral and physiological mediators accounting for the links between social stressors and disease, and very limited work defining important parameters of stressful events or perceived stress, such as the types of stressors (chronic vs. acute) and duration of the stressor.

The results of this fingerprint analysis suggest little basic research exists to identify the pathways through which exposure to stressors in the social environment influence biological systems. We therefore conclude that this is a true gap in the current NIH research portfolio.

Social Relationships, Networks and Communities

What?

Humans are social animals. They depend upon contact with other people for basic needs and mental and physical health. Social relationships are constrained, channeled, and motivated by genetic and neural mechanisms as well as by institutional and community structures. Relationships interconnect people with others through social networks, and networks interlock to form complex structures that define and span entire populations. In addition to having important effects on individuals, these networks play a critical role in the production of national, community, and institutional cultures as well as cohesion, the diffusion of information, and the spread of disease.

For the last half-century, the science of social networks has grown in sophistication and influence. Today's network methodologies permit researchers to describe, integrate, and analyze spatial, mathematical and substantive dimensions of the social structures formed as a result of interpersonal ties. Researchers can represent networks graphically, locate them spatially, and describe and analyze their properties mathematically. These spatial and mathematical relations can then be related to the content and quality of interpersonal ties, individual phenotypes and behaviors, and the well-being and dynamics of groups and communities. Network methods can be used to yield more meaningful measures of social integration in studies focusing on individual outcomes, and to investigate the social dynamics underlying community function and population health. They can be used to study the transmission of viral infections, the spread of obesity through a population, or the diffusion of medical practices.

Although network science has already demonstrated its utility in understanding health- and disease-related processes, basic research in the field could be strengthened to address critical unanswered questions. Research targets include:

- (1) Research on the large scale structure of social networks, essential for research on epidemics;
- (2) Research on the poorly understood mechanisms through which individual interactions combine to produce emergent properties and dynamics in the larger networks in which they are embedded;
- (3) Advanced models of global cascades in large networks that are essential for understanding individual and population susceptibility, contagion, and diffusion processes;
- (4) Implications of network dynamics at smaller scales (e.g., small groups) for the dynamics of higher-scale networks (e.g., community or global networks), and vice versa;
- (5) Dynamic models of network change and evolution, essential for increasing the specificity of network science to address time-dependent processes;
- (6) Models that integrate space, and physical environments with human agency to inform network structures;

- (7) The integration of network science with empirical research and theory in other sciences focused on human and group relations as well as on human behaviors and health; and
- (8) Research on network-based behavior change processes essential for understanding how networks can be used to accelerate diffusion of behaviors or inhibit the spread of disease.

Why Now?

We live in an age of both profound interconnectedness and isolation. Thanks to advancing technologies, the global interchange of information, goods, and social relations has reached unprecedented proportions. Understanding the structure of global networks is critical for our ability to monitor risk and protect health. Global connectivity has important implications for the rapid spread of infectious disease because the interconnections among densely connected clusters of persons (network components) make possible multiple simultaneous epidemic outbreaks. The burgeoning field of network science is also developing novel yet universal statistical methods to cope with the non-independence of data, which pervades all of the social and biological sciences. In addition, many contemporary noninfectious “epidemics” have a critical diagnostic component – e.g., autism, bi-polar disorder, and attention deficit disorder. Network processes shape the dynamics of diagnostic trends and accurate estimation of underlying disease epidemiology depends on understanding their effects.

At the same time, American social networks have been shrinking³⁴. The number and size of networks to which Americans belong have been declining for decades, and the proportion of individuals who are socially isolated has increased. Both developments have important consequences for people and society, yet the basic sciences that could lead to understanding and addressing these trends are not fully in place. The potential for new scientific tools to strengthen both network science and its integration with other disciplinary sciences is high. The availability of new sources of data (e.g., the rapidly expanding volume of electronically-recorded data on individual characteristics and their day-to-day transactions) and advanced computational power and methods now allow for the integration of complex data, the modeling of dynamic systems, and the development of new statistical methods. Moreover, new hybrid disciplines such as “social neuroscience” are emerging that could benefit network analysis.

Why NIH?

Social networks are deeply interwoven in the production of health and disease. Social isolation increases morbidity and mortality from widely varying causes, while social support protects against morbidity and mortality. The importance of social isolation as a risk factor for poor clinical outcomes is comparable to high blood pressure and obesity. Disruptions of personal ties are among the most stressful events people experience;

³⁴ McPherson, M, Smith-Lovin, L, Brashears, ME (2006). Social isolation in America, 1985-2004. *American Sociological Review* 71(3): 353-375.

combined with genetic or biological susceptibilities, these events can trigger mood disorders, psychotic symptoms, or social apathy. Membership in networks exhibiting unhealthy risk factors (e.g., obesity, smoking, substance abuse, STD/HIV risk, among others) increases significantly the probability that a person will develop the risk factors over time³⁵. Membership in supportive relationships and networks is predictive of maintaining health and recovery from disease. Network science provides a more powerful tool for understanding these effects than the individual-level methods typically used in health studies because the effects of individual relationship ties are conditioned by the structure of the larger network.

Networks structure the diffusion of information, ideas and behaviors, a process fundamentally important to population health, and relevant both to the adoption of new medical technologies and the reduction of health-risk behaviors³⁶. Moreover, networks structure the spread of epidemics: understanding small- and large-scale network structure is essential for modeling effective strategies for vaccination as well as behavioral prevention. Algorithms and methods developed by network scientists have been shown to apply to network processes at molecular, biological, and behavioral levels of analysis. Finally, the relations among network structures at different levels have crucial implications for health, because the effects of action at one level can be strengthened or undercut by system dynamics at different levels. Strengthening the NIH investment in network science will greatly enhance the ability to integrate research on social relationships and social processes with research on disease processes, and advance interdisciplinary research on health.

Portfolio Analysis

This RCDC analysis identified 86 grants supported via R and U mechanisms as relevant to social relationships, networks and communities. Based upon a review of ten percent of the research projects, 58 were estimated to be basic research in the behavioral and social sciences. NIDA, NIA, NIMH, and NICHD funded two-thirds of these basic research projects. In the ten-percent sample of projects, complex models of social networks, especially system research or theory approaches, were lacking. Similarly, most studies did not employ dynamic analyses over time. Frequently projects were included based in their measurement of social support or social networks as ancillary concepts and not as the primary focus of the studies. In sum, only a small number of funded research projects were identified as basic science on this topic.

³⁵ Christakis, N and Fowler, JH (2007) The spread of obesity in a large social network over 32 years. *New Engl J Med* 357(4):370-379.

³⁶ Valente, TW *Network Models of the Diffusion of Innovations*. Cresskill, NJ: Hampton Press, 1995; Valente, T. W., Models and methods for innovation diffusion. In P. J. Carrington, J. Scott, and S. Wasserman (eds.), *Models and Methods in Social Network Analysis*. Cambridge, UK: Cambridge University Press, 2005.

Factors Motivating Behavior Maintenance and Change

What?

Research is needed to address the gap in our understanding of how context interacts with neurobiological processes to produce the complex behaviors underlying healthy choices. Behavior accounts for enormous differences in individual health outcomes. But what leads people to behave in unhealthy or health promoting ways is determined by a whole host of factors that together form a complex web of influence on behavior. These include reward expectations, contextual cues, information processing, perception of risk and effort, shared norms, developmental history, genetic predisposition, self efficacy, and habitual response. Some of these factors are intrinsic (neurobiological, cognitive, emotional, genetic), while others are extrinsic (environmental, contextual, cultural, psychosocial), but all, as well as their interactions, affect how behavior is changed and maintained. Basic research is required to better understand the adoption, maintenance, and abandonment of complex behaviors over extended periods of time.

Why now?

Research on motivation, perception, memory, and cognition has a lengthy history. However, new developments in technology and approach open up opportunities for understanding behavior in ways never before available.

Neuroimaging

Recent advances in neuroimaging technologies now allow researchers to study the human brain in action. In the past we have depended largely on animal research for our understanding of the biological basis of behavior, because laboratory conditions are relatively easy to control and animal research allows for the use of more invasive techniques to study activity of the central nervous system underlying behaviors. But animal research cannot capture complex cognitive processes (e.g. executive function), and psychological processes (e.g., self modulation, self regulation) that are uniquely human. These processes are of critical importance in the regulation of complex human behavior. Elegant behavioral experiments employing neuroimaging are increasing our understanding of the neurobiological underpinnings of attention, reward evaluation, temporal discounting, affect discrimination, response inhibition and goal-directed behavior. Moreover, these methodologies may be used repeatedly in the same individuals, allowing for the study of structural and functional changes in brain activity and behavior over the course of the lifespan. The new imaging technology facilitates the observation of neurobiological processes and structure in the context of social, behavioral, and physical environmental conditions, thereby illuminating their interrelationships.

Behavioral methodology

Other advances in behavioral methodology allow us to measure mental/cognitive constructs in new ways. For example, the Implicit Association Test (IAT), a new behavioral, reaction-time test, circumvents the need to rely on self-report and thus can be

very valuable in assessing sensitive topics that people may be motivated to conceal, like substance use or violent behavior. For example, investigators have used the IAT to measure people's implicit associations about suicide/self-injury. These behavioral methods are very well suited for testing mechanisms of behavioral change and maintenance, as they measure constructs like implicit associations/thoughts, attention bias, and other constructs involved in behavioral decision-making. Ecological momentary assessment (EMA) techniques are another example of recent methodological breakthroughs in bBSSR. These techniques have been used by addiction researchers, to record participants' "in-the-moment" urges/cravings while capturing other important components of social and (with Geographic Information System technology), spatial/location context. Similarly, the new wearable mobile devices, such as "life vests" that record physiological data (e.g., heart rate), now allow researchers for the first time to determine what's going on "under the skin" in specific social situations.

Why NIH?

Basic research on mechanisms that drive behavior is fundamental to our understanding of how to prevent or change unhealthy behavior patterns (e.g., adolescence as a period of increased impulsive and risk-taking behavior that can lead to suicide, substance abuse, HIV, and accidents). We also need this research to determine how health promoting routines (e.g. exercise, proper nutrition, immunization, regular physical examinations) once adopted, can be made to endure in different population subgroups. Basic behavioral and social science methods and measures must be developed, enhanced, and utilized to help us better understand the fundamental processes underlying health related behavior patterns across the lifespan. Furthermore, increased understanding of the neural bases of motivational influences is essential for developing individual and community-based prevention strategies, by identifying patterns or substrates that are activated and subsequently associated with positive intervention outcomes (e.g., a neuroimaging study revealing sensory and emotional responses to images of high calorie foods may inform strategies for obesity prevention; behavioral economics approaches to track decision-making under different reward contingencies will inform the design of interventions for addiction).

The bBSSR of the future, based on new methodologies, can provide us with groundbreaking opportunities to promote health and prevent disease. Ecological momentary assessment (EMA) techniques can be used to record individual's reactions to their immediate social context at specific time points. These techniques open up the opportunity to assess factors in the social environment that are impacting health behaviors, without having to rely on memory and self report. Similarly, studies are starting to examine the ability of behavioral tests like the IAT and the Dot-Probe Test to *change* people's health-related behaviors. In addition, recent work with new intentional training techniques, already demonstrating their ability of to change anxiety and mood, is stimulating some of the most exciting new research in clinical psychology. Early promising results suggest that intentional training may ultimately revolutionize current procedures for clinical assessment and treatment. For example, computer-based assessment and treatment that is tailored specifically to an individual's problems could

eventually replace weekly talk therapy. Future research might pair neuroimaging with technologies that expand the types of stimuli available in these experiments (e.g. immersive virtual reality), to elucidate the neural basis of more complex social interactions. Portable neuroimaging techniques could be developed that would enable the real-time capture of brain activity during specific social and environmental contexts.

Interdisciplinary teams of the future must combine breakthroughs in technology and methodology with findings from the basic behavioral, biological, and social sciences to understand the complex stimuli, complex decisions, and complex environments which surround health-related behaviors. This research will inform next generation applications attempting to reach and motivate individuals, families, and communities, both to engage in behavior change and to maintain their motivation in the face of inevitable setbacks.

Portfolio Analysis

Starting with the RCDC “Behavioral and Social Science” fingerprint, a subset fingerprint was created using available behavior, change, or maintenance-related terms and combinations:

This RCDC analysis captured only one research project, an R01 funded by NEI, that met both the concept and bBSSR definitions and also studied factors motivating behavior maintenance and change with a new technological breakthrough. The vast majority of other projects explored with RCDC were fMRI studies examining neural mechanisms of attention, memory, dysfunction etc., without any investigation of motivation, behavior change, or behavior maintenance. A few additional studies were largely tests of behavior change interventions, and these typically neither used a new technology nor considered mechanisms underlying the behavior of interest. Thus it was concluded that this research area is indeed a gap in the NIH bBSSR portfolio.

V. Conclusion

It is clear from the information herein that NIH supports a broad array of bBSSR. Since 2004, and continuing through the present, the NIH investment in bBSSR has been approximately \$1 billion annually. This support comes from many ICs and the Office of the Director. In addition, the major trans-NIH initiatives (the NIH Roadmap for Medical Research, the NIH Genes, Environment and Health Initiative and the NIH Blueprint for Neuroscience Research) also support bBSSR.

Analysis of the current (FY 2007) NIH projects database revealed several scientific content areas that can be characterized as gaps in the NIH bBSSR portfolio. These can be described as follows: Genes and Social Environments: Pathways to Health and Illness; Systems Approaches to Understanding Complex Health Problems; The Bases for Sustainable Culture Change; Social Relationships, Networks and Communities; Psychosocial Stressors and Dysregulation of Biological Systems; and, Factors Motivating Behavior Maintenance and Change. These topics are exciting directions for NIH bBSSR in the future.