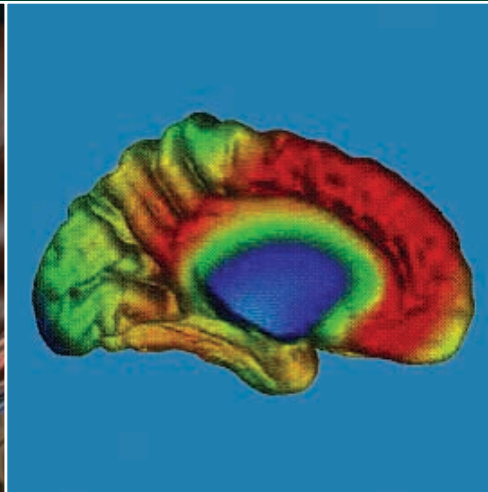


Child Development and Behavior Branch (CDBB) NICHD



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EXECUTIVE SUMMARY

The Child Development & Behavior (CDB) Branch seeks to improve the health and well-being of individuals from infancy through early adulthood by supporting research into healthy growth and development, including all aspects of child development. The study of typical child development—of behavior, how to predict or change behavior, and how to recognize and intervene in learning and behavior difficulties—across the diverse population of American children today is among the defining features of research supported by the Branch. One must understand behavior in order to change it; any intervention, behavioral or medical, requires behavioral change to be successful. Further, many biological and behavioral factors interact such that understanding one enhances investigations of the other. The central mission of the CDB Branch is to examine in-depth the behavioral, neurobiological, and genetic aspects of typical development and factors that place such development at risk, and to determine the optimal prevention and intervention approaches and under what conditions and in what contexts interventions can be most effective for specific subsets of individuals.

The Branch's overall research portfolio supports both basic and applied research within the following research program areas:

- Developmental Cognitive Psychology, Behavioral Neuroscience, and Psychobiology (Dev-CBNP) Program
- Early Learning and School Readiness (ELSR) Program
- Language, Bilingualism, and Biliteracy (LBB) Program
- Mathematics and Science Cognition and Learning: Development and Disorders (MSCL) Program
- Reading, Writing, and Related Learning Disabilities (RWRLD) Program
- Social and Affective Development/Child Maltreatment and Violence (SAD/CMV) Program
- Pediatric Behavior and Health Promotion (PBHP) Program

Branch-supported studies use a variety of methods and designs, including cross-sectional and longitudinal designs, experimental and qualitative methods; most Branch-supported activities are multidisciplinary. The neurobiology and genetics of all of these research program areas are also reflected in the overall Branch portfolio.

The CDB Branch funds its research at a level of just less than \$130 million annually for both research and training, supporting approximately 360 research grants per year. The annual funding amount has changed little from that of fiscal year 2003, and funding levels have remained relatively constant during the reporting period from 2004 to 2007 ([Figure 1](#), [Figure 2](#), [Figure 4](#)). The research project grant (R01) accounts for slightly more than 62 percent of Branch funds for the four-year reporting period, with the next largest proportion going to support R03 small grants ([Figure 3](#)). R03s are used to support new investigators, exploration of new areas of science, and secondary data analyses. The Branch also includes one relatively small centers program (Learning Disabilities Research Centers) and a modest number of program projects (P01s), which the Branch uses to build areas of complex investigation. The Branch has been

responsible for one cooperative agreement network, which sunsets in fiscal year 2008, and one small cooperative agreement, which will begin in fiscal year 2009.

Although the Branch advances its mission using a variety of grant types, it relies primarily on investigator-initiated projects but also uses selected calls for research in specific areas. To encourage synergy and collaboration, Branch program directors often bring researchers together into research consortia (see [Appendix B](#)). To take stock of current areas of science and identify research gaps and areas of need, Program directors also develop and hold workshops and conferences. ([Appendix F](#) presents a listing and description of workshops and conferences sponsored or co-sponsored by the Branch.) Program directors also produce targeted publications to both share findings and stimulate further research (see [Appendix C](#) for a listing of publications). The CDB Branch engages in collaborative relationships across Institutes of the National Institutes of Health (NIH) as well as across federal agencies, and through Public-Private Partnerships with professional and advocacy organizations and corporations. These collaborations often result in co-sponsorship of workshops and conferences and serve to facilitate communication across disciplines; they also provide a bridge between research and practice communities and facilitate the dissemination of research findings to a variety of audiences.

A few of the important advances the Branch has supported are explained below; more are presented in the program-specific sections of the full report. From 2004 to 2007, the Branch has continued to support work in cognition, learning, and learning disabilities across the domains of reading, math, and science. Recent advances are changing how the field of child development views learning; research shows that children learn more, earlier than had been believed, and scientists are just beginning to better understand these results. For example, early number sense can be an indicator for later math achievement and may be as important to mathematical learning as phonemic awareness is to reading.

Several programs across the CDB Branch support research that seeks to integrate neurobiology and genetics with behavior. The recent release of data from the Pediatric Magnetic Resonance Imaging (MRI) Study of Normal Brain Development database, along with the future data from diffusion-tensor imaging of the same sample, should enhance such efforts. In addition, recent advances using neuroimaging techniques have demonstrated specific areas of neural activation characteristic of certain learning activities, for both reading and mathematics. Individuals with reading difficulty show a characteristic pattern, which alters as a result of successful reading interventions, and which resembles the changes in brain activation seen in early studies of typical learning as young learners move from novice to successful reading.

Other Branch-funded research has shown that both reading and math learning difficulties are highly heritable, although environment clearly plays a major role. Researchers established *DCDC2* as a dyslexia-susceptibility gene and demonstrated that it plays a role in migration of neocortical neurons; this gene was later shown to possess a robust genetic association with dyslexia. However, it is clear that genes alone are not the cause of reading disability.

Intervention research has also shown advances in several areas. Preschool interventions, which target both academic and social skills, can have significant short-term and long-term impacts on the children's overall school readiness abilities. Interventions targeting executive function,

academic skills, and social-emotional skills demonstrate short-term gains in overall school readiness skills among disadvantaged populations at high risk for school difficulties. One intervention, conducted from pre-kindergarten through the third grade, encouraged a high level of parental involvement and provided intensive instruction in reading and math; the outcome showed that, in adulthood, program participants demonstrated higher educational attainment, lower rates of serious crime and incarceration, and lower rates of depressive symptoms than did non-participants.

In terms of both reading and math difficulties, researchers demonstrated success in remediating students. Explicit instruction has proven important for learning in both areas; further, early reading intervention was demonstrated as effective in reducing the number of children who fail to learn to read. The same outcome is also true for English-language learning (ELL) students. In addition, for native Spanish-speaking ELL students, reading instruction in Spanish actually facilitates reading in English. In other research, math tutoring interventions in calculation, word problems, and algebra effectively helped third grade students who had math and math-plus-reading difficulties. Two-layer math difficulty prevention (e.g., classroom instruction plus small-group tutoring as needed) was more effective than either classroom instruction or small-group tutoring alone.

Another facet of the Branch portfolio involves studies of intergenerational risk transmission, which is especially relevant for social and emotional development and child maltreatment. Researchers are now using intergenerational studies to examine the transmission of neglect, abuse, adjustment problems, and substance use. In another effort, researchers used a rat model to demonstrate that the effect of the post-weaning environment on juvenile offspring depended on the level of mother-infant interaction, and that the effects were often transmitted to the next generation. Post-weaning isolation reduced exploratory behavior, maternal nurturing behaviors, and oxytocin receptor binding in the offspring of high-nurturing mothers; social enrichment enhanced exploration, maternal nurturing behavior, and oxytocin receptor binding of poorly nurtured offspring. Thus, maternal nurturing and the neural mechanisms that regulate this behavior exhibited a high degree of plasticity in response to changes in environment both within and beyond the postnatal period; results have implications for the transmission of behavioral response to novelty and maternal care across generations.

Over the next several years, the CDB Branch will continue to support a wide range of interdisciplinary research efforts, including continued support for research that taps into the rich array of behaviors children produce, and that directly measures such behaviors using new measures, methods, and innovative approaches to continuously move the field forward. Understanding the important impact of behavior and its multiple influences on and contexts of child health and development has broad implications on public health, education, national policies, and the economy.

As part of the NICHD's continued efforts to improve strategic planning for its components, the CDB Branch sought feedback on its possible future directions from an expert panel, which included a member of the NACHHD Council, two representatives from relevant professional associations, plus individuals with expertise in developmental, cognitive, and neuro- and biopsychology, demography, pediatrics, neuroimaging, genetics, human development, and

linguistics (see [Appendix D](#) for a list of panel members). The panel provided extensive review and analysis of current research efforts supported by the Branch, as well as trends in funding and training. The Branch consolidated its future directions into four overarching themes:

- Cognition, learning, and learning disabilities
- Social-emotional behavioral interventions
- Genetics and epigenetics studies
- Brain imaging and brain development work

In addition, the expert panel emphasized that the CDB Branch should continue to study children's development and the settings and contexts in which growth and development occur, across the diversity of the national population, using longitudinal and multilevel descriptive and experimental designs. The Branch will also continue to support ongoing work on the development of innovative methodologies for the in-depth study of child development and health. Additional information about the panel's discussion and the Branch plans are included in the [Future Directions for the Branch](#) section of this report.

BRANCH MISSION AND OVERVIEW

Development is a window into the life of a child and lays the foundation for the life course of the mature adult. The study of typical child development—of behavior, how to predict or change behavior, and how to recognize and intervene in learning and behavior difficulties—across the diverse population of American children today is among the defining features of research supported by the Child Development and Behavior (CDB) Branch. One must understand behavior in order to change it; any intervention, behavioral or medical, requires behavioral change to be successful. Further, many biological and behavioral factors interact such that understanding one enhances investigations of the other. Thus, the research supported by the CDB Branch, within the Center for Research for Mothers and Children (CRMC), is central to the mission of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD).

From the moment of conception, genes signal complex developmental processes in the central nervous system that unfold over time. These neurobiological processes interact with the environment in principled ways, which manifest as individual differences in behavior. By studying behavior and the gene-brain-environment linkages that underlie development, science can begin to identify associations and functions not apparent by studying only one aspect of this process. Behavior, both at discrete time points and as it changes over time, is a measurable outcome of these neurobiological and genetic processes and an active agent in the integrated unfolding of genes, brain, and behavior. Development, then, is a complex process that supports varying levels of child and adult adaptation.

In many pediatric studies, behavioral assessments of Intelligence Quotient (IQ), language, motor function, and different indices of quality-of-life and adaptation are primary outcomes by which

the destructiveness of a genetic or neural anomaly or the effectiveness of an intervention is gauged. Variability in outcomes is principled; understanding this variability helps explain why some children do well and others less well. Child development is often the marker of success in medical and biological research—children who have developmental disabilities or difficulties are able, with successful interventions, to lead healthy lives. The CDB Branch supports the study of typical child with rigorous science and responsible oversight.

Because behavioral science is neither a unitary nor a unidisciplinary activity, Branch-supported research rarely studies an aspect of behavior in isolation; instead, it usually involves one or more of its determinants—genes, brain, and environment—in an effort to understand mechanisms that support the range of health and developmental outcomes associated with growth and development. Broadly, behavioral science is the study of multiple systems as they interact with the environment, including the physical and social environment (e.g., the neighborhood, school, child care, home) in which a child is developing and all of the influences of those environments; at the same time, the child is also growing physically, cognitively, socially, and emotionally. All of these factors *influence* outcomes, whether the outcomes of interest involve physical growth, the development of diseases or disorders or their remediation, cognitive development and learning, social adjustment or adaptation, aggression and emotion regulation, or language proficiency (in one or many languages), among other topics. Complex research designs are required to determine such outcomes, and measurement is challenging, especially to delve deeper into any aspect of development. Because of the complex nature of the study of behavior, no single discipline “owns” this science, and most studies are multidisciplinary of necessity. Many studies also include a longitudinal component because of the need to assess developmental change, often by combining both quantitative and qualitative methods and approaches.

Behavioral scientists are often the leaders of these transdisciplinary research efforts, which employ and train graduate students, pre- and postdoctoral fellows, and junior faculty. The CDB Branch has, through various grant mechanisms, helped to develop an entire generation of behavioral scientists who now take the lead on transdisciplinary issues and who often work in conjunction with other behavioral scientists, physicians, and clinicians seeking to treat various conditions.

The CDB Branch, housed within the CRMC, is one of the three largest Branches in the NICHD in terms of the numbers of grants that it oversees. The Branch comprises seven programs, each of which supports research training, measurement and methodology development, and basic and translational research. Each program encompasses a broad scientific domain within the overall mission of the Branch, while also addressing cross-cutting issues that involve multiple Branch programs, other Branches, and other Institutes and agencies. These seven programs, listed below, are individually described in detail throughout the remainder of the report:

- Developmental Cognitive Psychology, Behavioral Neuroscience, and Psychobiology (Dev-CBNP) Program
- Early Learning and School Readiness (ELSR) Program
- Language, Bilingualism, and Biliteracy (LBB) Program
- Mathematics and Science Cognition and Learning: Development and Disorders (MSCL) Program

- Reading, Writing, and Related Learning Disabilities (RWRLD) Program
- Social and Affective Development/Child Maltreatment and Violence (SAD/CMV) Program
- Pediatric Behavior and Health Promotion (PBHP) Program

The leadership structure of the Branch, which had been the traditional one of a Branch chief and deputy or associate chief, was recently restructured. Because of the clear need for administrative backup for the chief, the Branch named a deputy Branch chief (replacing the outgoing associate chief). In addition, because of the level of activity in the areas of neurobiology and neuroscience that cut across all Branch programs and multiple initiatives across the National Institutes of Health (NIH), the director of the Dev-CBNP Program was named associate chief for neurobiological research. In the short time it has been in place, this structure has served the science well and has enhanced the teamwork already typified by the Branch. The inter-relatedness of Branch programs, despite each having unique foci, has not only made such teamwork essential, but has also ensured high-quality stewardship and scientific oversight.

BRANCH RESEARCH FUNDING

The CDB Branch funds research on child development, behavior, and health at a level of just less than \$130 million annually, supporting approximately 360 research grants per year. The annual funding amount has changed little since the Branch's last report to the National Advisory Child Health and Human Development (NACHHD) Council, and funding levels have remained relatively constant during the reporting period from 2004 to 2007 ([Figure 1](#)), although the level of funding in constant dollars has decreased ([Figure 2](#)). The research project grant (R01) accounts for slightly more than 62 percent of Branch funds for the four-year reporting period, with the next largest proportion going to support R03 small grants ([Figure 3](#), [Figure 4](#)). R03s are used to support new investigators, exploration of new areas of science, and secondary data analyses. The Branch portfolio includes one relatively small centers program (Learning Disabilities Research Centers) and a few program projects (P01s), which the Branch uses to build areas of complex investigation in lieu of centers. The Branch has been responsible for one cooperative agreement network, which sunsets in fiscal year 2009, and one very small cooperative agreement network, which will begin in fiscal year 2009.

Because understanding development often requires studying change over time, nearly half of the grants supported by the CDB Branch involve a longitudinal design; of those, nearly one-half begin studying children in infancy or during the preschool period. Nonetheless, Branch-supported grants study an age-range distribution that covers the lifespan from infancy to adulthood ([Figure 6](#)), employing a variety of research designs and methods. Although increased annual funding is what most scientists would like to see, the value of maintaining a steady state, in what have proven to be very constrained fiscal times, should be reassuring to the scientific community. ([Appendix E](#) includes a listing of all Branch-related funding solicitations and announcements for the reporting period.)

BUILDING RESEARCHER CAPACITY (TRAINING)

The most obvious way that CDB Branch contributes to building researcher capacity is by funding institutional training grants (T32s), fellowships (Fs), and career awards (Ks). Overall for the four-year reporting period, the Branch was responsible for \$32.5 million in training support ([Figure 5](#)). Many of these grants train researchers to study diverse populations and involve diverse groups of trainees.

The Branch also builds researcher capacity through mentoring by funded research investigators. Researchers who receive R01, R03, and P01 awards often hire promising young students or postdoctoral individuals as research assistants, associates, or project managers; center grants explicitly include a training function. In addition, the NICHD offers diversity supplements to those holding NICHD research grants as an incentive to have researchers specifically mentor minority students, postdoctoral fellows, young faculty, and those with disabilities and bring them into the potential pool of researchers within the field. During the four-year reporting period, the CDB Branch has overseen several diversity supplement awards: eight awards in fiscal year 2004; nine in fiscal year 2005; 12 in fiscal year 2006; and 10 in fiscal year 2007 for a total of 39 diversity supplement awards.

In addition, the CDB Branch also contributes to building researcher capacity by planning and conducting a week-long research training institute. This effort, the Applied Research in Child and Adolescent Development Institute, was first held in June 2007 and was co-funded by the NIH Office of Behavioral and Social Sciences Research (OBSSR). This training institute was designed to promote research skills in young researchers who had not received formal training in applied developmental research. Of the nearly 100 applicants, 20 participants from diverse disciplines and research backgrounds were selected to take part in the institute, which included presentations, interactive seminars, and small group work to support the acquisition of advanced skills in planning and conducting applied research with children. Faculty and speakers from various disciplines included leading members of the research, policy, and communications communities. Institute faculty also mentored small groups of attendees and provided individual consultations. Featured topics included the basics of applied research in child and adolescent development; research designs and methods; fostering collaborations to conduct applied research; special issues in research on diverse populations; research ethics, including the challenges of Institutional Review Board approval and human subjects' protection; and policy relevance of applied research in child and adolescent development. A second training institute is planned for summer 2009; for more information, visit <http://www.nichd.nih.gov/about/org/crmc/cdb/summerinst/index.cfm>. In addition, Branch staff plan to release *Applied Research in Child and Adolescent Development: A Practical Guide* in 2009. It is expected that this guide will serve as the primary text for future training institutes.

SCIENTIFIC LEADERSHIP

The CDB Branch promotes leadership in the various scientific fields that fall within its mission in multiple ways, including:

- Organizing workshops in areas that are under-developed, emerging, or of high national and international priority. Such efforts are often done in partnership with representatives from other Institutes; federal agencies, such as the Administration for Children and Families (ACF) or the Office of the Assistant Secretary for Planning and Evaluation (ASPE) within the U.S. Department of Health and Human Services (DHHS), or the Institute of Education Sciences (IES) or other Offices within the Department of Education (ED); and professional associations (see *Collaboration and Dissemination*, below). These events (see [Appendix F](#)) take stock of science in a particular area, gather information about research needs, and, when sufficient information exists, develop implications for translation to practice. The workshops usually result in a scientific journal article, a thematic journal issue, or an edited volume, usually edited or co-edited by Branch program scientists (see [Appendix C](#) for a list of Branch-related publications). These documents reach a broad audience of researchers and serve as guides to the types of research needed to move fields forward; practitioners who want to keep up with scientific progress in those areas are an important audience for these documents.
- Organizing investigator meetings to establish research consortia once projects are funded. In some cases, these consortia comprise a cohort of investigators funded at the same time as a result of a specific Funding Opportunity Announcement; in other cases, they include researchers whose investigator-initiated applications have topics in common, and who can benefit from sharing information and exploring potential collaborations. During the four-year reporting period, the CDB Branch managed several research consortia, which are discussed within the individual program sections and are listed in [Appendix B](#).
- Establishing research networks to create a synergistic relationship among a cohort of researchers funded through cooperative agreement grants. In such networks, a Branch scientist serves as a member of the research team, and another Branch member provides the oversight administrative function. Networks are discussed within the individual program sections throughout the report and are listed in [Appendix B](#).

BRANCH COLLABORATION AND DISSEMINATION

The Branch relies on a wide network of relationships and collaborations both to support research and to disseminate research findings. Branch members do a considerable amount of work with professional organizations and associations, non-profit organizations, and commercial companies to co-sponsor workshops and conferences, present symposia at national meetings, and produce documents to share research findings and research needs with investigators, practitioners, and the public.

For many years, it was suggested that educational research was often not scientifically rigorous. The Branch has led the way in promoting a scientific approach to understanding the causes of academic and behavioral difficulties at levels involving genes, the brain, and the environment. As a result, CDB Branch-supported researchers go into schools and conduct intervention studies in settings where children spend much of their time and where learning occurs. Many of these investigators, whose findings have been widely acknowledged for their impact on teaching and learning, have served on major federal panels related to education, including those charged with authoring reports on scientific principles in educational research (for the National Research

Council); minority overrepresentation in special education; mathematics; special education (for the President's Commission on Excellence in Special Education); and bilingualism, reading, and mathematics (for IES and ED). These reports often contribute directly to policy and legislative changes. The NICHD and the Branch are widely acknowledged for bringing a scientific perspective to these types of panels.

The list below highlights several examples of collaborations that the CDB Branch has forged with agencies and organizations to leverage the ability to disseminate research findings and call for additional research. Other examples are discussed within the program-specific sections of this report.

- In 2005, the Branch collaborated with the National Council of Accreditation for Teacher Education (NCATE), a professional accrediting body for teacher preparation, to examine research findings in child development that could inform teacher education. Both NICHD and NCATE were uniquely positioned to bring the science of child and adolescent development and the science of pedagogy and practice to bear in examining the state of evidence-based knowledge of child and adolescent development in teacher education programs and to identify important applications of this knowledge. Expert panels shared their knowledge and insights, providing a consensus on ways that research evidence could shape teacher preparation and practices. The NICHD and NCATE jointly produced a document summarizing the recommendations of these roundtable discussions (available at http://www.nichd.nih.gov/publications/pubs_details.cfm?from=&pubs_id=5684). As a result of this collaboration, the NCATE benefitted from subsequent opportunities for non-federal funding and collaboration.
- In 2007, the CDB Branch staff and representatives from the Mars, Inc., met to discuss the importance of human-animal interaction (HAI) research, especially in relation to child development and health. The NICHD and Mars established a Public-Private Partnership to explore ways to advance the research field. Building on a 1987 NIH Technology Assessment Workshop on the health benefits of pet ownership (see the resulting [Workshop Summary](#)), the CDB Branch and the Waltham Centre for Pet Nutrition, a Division of Mars, Inc., co-funded the *Directions in HAI Research: Child Development, Health, and Therapeutic Interventions* workshop, held in October 2008. This event included researchers from various disciplines with an interest in HAI to take stock of HAI science and contribute to the development of an interdisciplinary research agenda. Details regarding the workshop and subsequent efforts are available at http://www.anthrozoology.org/HAI_workshop.

Branch program staff were also invited to present funding and research information to various audiences during the reporting period. Such presentations typically highlight the science supported by the Branch and its programs and share findings with clinical or practitioner audiences. In 2007, the Dev-CBNP Program director was invited to present information on early brain development to the Brazilian National Seminar on Zero to Three-Year-Olds; the seminar was presented in both Brasilia and Rio de Janeiro and aired on Brazilian national television. In another example, during her oversight of the RWRLD Program in 2005, the CDB Branch chief was invited to present the keynote address on reading and reading disabilities research to the British Columbia Branch of the International Dyslexia Association in Vancouver, Canada; at that time, she was also interviewed and filmed for British Columbia's public television (Knowledge

Network); clips of the presentation are available at http://www.knowledgenetwork.ca/dyslexia/base_loader.html.

The remainder of this report describes the Branch's research programs, their initiatives, selected findings from their supported research, and their efforts at collaboration and dissemination. The last section of the report, *Future Directions for the Branch*, describes the discussions of the expert panel (see *Appendix D* for membership) convened by the Branch as part of the NICHD's continued efforts to improve strategic planning. This final section of the report outlines the panel's review, analysis, and recommendations of possible research directions for the CBD Branch for the next four years.

DEVELOPMENTAL COGNITIVE PSYCHOLOGY, BEHAVIORAL NEUROSCIENCE, AND PSYCHOBIOLOGY (DEV-CBNP) PROGRAM

The Dev-CBNP Program develops and supports research to identify linkages among the developing brain, behavior, the environment, and genes. Specifically, the Program supports work on pathways to normal brain development and behaviors; the identification of underlying mechanisms at molecular, genetic, cellular, and network levels relevant to the developing brain and behavior; and research that identifies biological and behavioral indices of individual differences predictive of performance in sensory, motor, linguistic, cognitive, and social behavioral domains at different points of development. The Program encourages research examining the influence of genetic-environmental interaction factors on temperament, learning, cognition, and social and group behavior in the developing organism and research investigating the effects of hormonal influences on behavioral development. Within this context, the Program emphasizes research on the development of gender-specific behaviors, the role(s) of endocrines in social, emotional, and cognitive development, and the interaction of hormones and stress-related behaviors during development.

As of 2007, the Program supported approximately 100 grants for a total of \$26.4 million in research and approximately \$1.8 million in training grants. More than 18 percent of the Dev-CBNP Program portfolio focuses on non-human approaches (animal models) to understanding biobehavioral development. These grants investigate topics ranging from maternal-infant behaviors, to specific species brain mapping, to the neuroanatomical and neurofunctional substrates of various cognitive and communicative behaviors in non-human primates. Between 2004 and 2007, Branch-funded researchers published 739 scientific articles in research journals, including those that addressed not only child development, but also genetics, neuroscience, and broad mainstream medical and scientific topics. Eight Principal Investigators supported by the Dev-CBNP Program received NICHD MERIT (Method to Extend Research in Time) Awards or MERIT Extension Awards between 2004 and 2007.

The Dev-CBNP Program is a leader in supporting neuroimaging research aimed at understanding normal brain development and how brain and behavior interactions develop from infancy through young adulthood. The number of grants supported by the Program that used a

neuroimaging technique ranged from 17 to 28 during the reporting period. These projects reflect a breadth of neuroimaging techniques, including magnetic resonance imaging (MRI), functional MRI (fMRI), diffusion-tensor imaging (DTI), magnetic resonance spectroscopy (MRS), and electroencephalography. In addition, the Program director serves as a mentor for and consultant on neuroimaging issues for the other programs in the Branch because many support projects that integrate functional neuroimaging, such as the neurobiological substrates of reading and math learning disabilities and of bilingualism.

PROGRAM INITIATIVES

In 2003, the Dev-CBNP Program was restructured, expanding the focus on developmental psychobiology and behavioral neuroscience to include research in developmental cognitive psychology. While retaining a focus on grants that exclusively address cognitive development, this reorganization has permitted the Program to combine cognitive development research with related developmental biobehavioral research; thus, the Program is now better able to foster interdisciplinary interactions among cognitive developmentalists, pediatric neuroimagers, developmental cognitive neuroscientists, and molecular geneticists within one portfolio. Such a focus enables all of these disciplines to look at the developmental behavioral effects of neuroendocrines, genetics, neural pathways, and developing anatomical structures and functional brain circuitry. From 2004 through 2007, the Program organized a number of workshops that brought together scientists from several domains to address research progress and questions relevant to pediatric functional neuroimaging, neurocircuitry in adolescent reward and decision making, the effects of stress on developing brain and social behavior, and the neurobiology of child sleep behaviors. Further, the restructuring increased the number of grants supported by the Program using multidisciplinary approaches for understanding development from 55 percent in 2004 to 70 percent in 2007.

In addition, in 2005 the Dev-CBNP Program proposed that the Pediatric MRI Study of Normal Brain Development add a DTI component to its longitudinal study of children (newborn through 18 years of age). Proposals obtained were reviewed and awarded by the NIH Institutes and Centers involved in the NIH Blueprint for Neuroscience Research. The funds allow the production of DTI data with greatly increased resolution quality and the development of user-friendly DTI analysis software; the latter is made available to researchers by the Tissue Biophysics and Biomimetics Section within the NICHD Program on Physical Biology in the Division of Intramural Research. Complete DTI data for approximately 360 children in the study will be released in early 2009 (see <http://www.bic.mni.mcgill.ca/nihpd/info/> for more information).

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Research supported by the Dev-CBNP Program has yielded fundamental new insights into understanding early cognitive and behavioral development that have the potential to change how and at what ages pediatricians and developmental psychologists evaluate typical cognitive, social, and behavioral development during infancy. Some of these findings are described below.

- As infants near their first birthdays, they become increasingly sophisticated social learners. Infants begin to infer what others are thinking or others' intentions by following the gazes of those around them. This skill first appears at 10 months to 11 months of age and is not only an important marker of a baby's emotional and social growth, but can also predict later language development.
- Infants as young as three months to four months of age use many of the perceptual organizational principles used by adults. Contrary to previously held views, this very early perceptual organization does not rely on an extended period of learning visual shapes and images. Understanding these organizing principles may lay an empirical foundation for effective strategies for early infant learning.
- Early temperament, together with physiological markers, may predict later behavioral development in young children. Behavioral measures (e.g., negative or positive reactions to novel stimuli, motor activity) and biological measures (e.g., heart rate and brain wave activity) at nine months of age predict withdrawal, shyness, and inhibition at four years of age, but only for males who had elevated levels of cortisol at age nine months. Further, the early brain-wave correlates of withdrawal indicate that infants who show negative reactions to novel stimuli display a pattern of asymmetry in their brain waves in the right frontal area of the cerebral cortex, while infants who react positively show left frontal brain wave asymmetry. The accumulating evidence suggests that early temperament coupled with psychophysiological markers, such as cortisol levels and brain wave asymmetry, are strongly associated with later behavioral development in young children.

Developmental biobehavioral research supported by Dev-CBNP Program looks at interactions between biological factors and behaviors or among environment, biological factors, and behavior. Some important findings from Program-supported research during the last four years include the following:

- Caregiver behavior can modify genetic influences on social behavior. Children with the short allele of the serotonin gene (*5-HTT*) whose families offered low levels of social and emotional support were found to be at increased risk for behavioral inhibition during infancy and for extreme shyness and social withdrawal in middle school years. Alternatively, in children whose families offered high levels of support, the short allele of the serotonin gene did not convey increased risk for withdrawal or shyness in middle school years. Thus, behavior of a child's caregivers (i.e., social and emotional support) can modify a genetic influence associated with extreme shyness and social withdrawal during early puberty.
- Androgen exposure appears to influence behavior in specific ways. Females with Congenital Adrenal Hyperplasia, which causes increased prenatal androgen exposure, score higher on measures of autism spectrum disorder (ASD) behaviors than do control females. The effect was noted primarily in terms of relative deficits in social skills and increased attention to details. These results suggest that high levels of prenatal androgen may contribute to autism-related traits, but that these traits may not be severe enough to warrant an ASD diagnosis. Additional genetic or environmental factors are likely to be involved in ASD diagnoses. An interesting related finding was that approximately one-third of typically developing preschool-aged children showed extreme interest in details of specific object or activity categories (e.g., spherical objects, brooms and brushes, blenders, dinosaurs). Although none of these children met criteria for an ASD diagnosis, these intense interests are similar to the

preoccupations and circumscribed interests shown by children with ASD. Such extreme interests were much more common for boys than for girls and, because boys are exposed to more prenatal androgen than girls, the speculation that these interests are related to androgen effects on brain development is sparking further research in this area.

Other Program research seeks to understand not only the anatomical maturation of the typically developing brain, but also the neurofunctional substrates of cognitive, social, and emotional behaviors and attention and executive function in typically developing children and adolescents. Some findings from this type of Program-supported research include the following:

- Understanding how a mother's brain responds uniquely to her own infant, when the infant is smiling or crying, may be the first step in understanding the neural basis of mother-infant attachment. As observed using fMRI, when first-time mothers observed their own infant's face, key dopamine-associated reward-processing regions of the brain were activated, including the midbrain ventral tegmental area/substantia nigra regions, the striatum, the prefrontal cortex, and the primary motor area. Smiling, but not neutral or sad, faces specifically activated nigrostriatal brain regions interconnected by dopaminergic neurons, with a graded response that depended on infant affect: happy infant affect elicited a stronger response than neutral infant affect, which elicited a stronger response than sad infant affect.
- The maturation of brain structures and white-matter connecting pathways is essential for the development of both cognitive and motor functions. Although most of the myelination in brain white matter is complete by the age of five years, maturation of brain white matter seems to be an ongoing process, which continues into at least the second or third decade of life. Research with DTI, which enables investigation and visualization of white-matter pathways, in human subjects ages five years to 18 years showed increases in both white-matter density and organization. These increases were seen mainly in association and commissural fibers, which connect different areas of the cortex with each other. Specifically, increases were documented in primary and supplementary motor areas consistent with refinement of fine motor control in finger movements; long fiber tracts connecting parietal and temporal areas; and the arcuate fasciculus in the left hemisphere, which functions in the interaction of two major language areas, Wernicke and Broca.
- Researchers are studying brain asymmetry in non-human primates using a variety of newer technologies. For example, the Program supported the first voxel-based morphology studies and analyses using MRI in non-human primates; this effort is providing the field with another approach and framework for comparative neuroanatomical studies in primates. Thus far, evidence of a right-frontal, left-occipital torque asymmetry in chimpanzees has challenged several recent claims that this asymmetry is a uniquely human trait. Further, evidence of individual differences in gray- and white-matter distribution and asymmetry has provided an empirical and theoretical foundation and justification for developing DTI for developmental and comparative studies in non-human primates.
- Attention problems in adolescents seem to be stable over time. Although some structural brain development research has indicated that frontal lobe development extends through the adolescent and young adult years, recent work suggests that behavioral measures associated with frontal lobe function (e.g., attention, executive function) may be quite stable during this time period. In a longitudinal study of 500 children (with equal numbers of males and females) that examined various areas within executive function (i.e., inhibition, working

memory, memory updating, and set shifting), researchers saw substantial stability in the relation of attention problems to later executive function and IQ during a 10-year timespan. Growth models also indicated that attention problems were quite stable in the seven-year-old to 17-year-old age range, and that the initial, early level of problems, rather than changes across time, predicted later executive function. Future studies to incorporate actual brain measurements with the behavioral data throughout this age range will be important for understanding the development of executive function abilities in adolescents.

Animal models are particularly important for researching how behavioral outcomes vary with environmental, genetic, and brain maturational factors. Important findings in this area supported by the Program include the following:

- Maternal behavior in the rat gives insight into nurturing. Among offspring of high- and low-nurturing (i.e., licking and grooming of the neonate) rat mothers, the effect of the post-weaning environment on juvenile offspring depended on the level of mother-infant interaction. Post-weaning isolation reduced exploratory behavior, maternal nurturing behaviors, and oxytocin receptor binding in the offspring of high-nurturing mothers; social enrichment enhanced exploration, maternal nurturing behavior, and oxytocin receptor binding of poorly nurtured offspring. These effects were also transmitted to the next generation. Thus, maternal nurturing and the neural mechanisms that regulate this behavior exhibited a high degree of plasticity in response to changes in environment, both within and beyond the postnatal period, and have implications for the transmission of behavioral response to novelty and maternal care across generations.
- Animal models suggest possible mechanisms for executive function in humans. Research comparing the performance of various cognitive tasks by monkeys and humans has generated results suggesting a new theoretical model of attention control based on competition between environmental constraints, levels of experience, and degree of cognitive control (executive function). For example, investigators are examining the processes by which monkeys and humans become aware of being unsure about an answer to a cognitive task. Species differences in the potency of executive control suggest a useful animal model for attention deficit disorders and for immature attention skills that might be present in normal development. Such findings show the time course and experiences necessary for an organism to emerge from being principally reactive, distractible, and associative to become increasingly purposive and effective in attention, executive functioning, and learning.

COLLABORATION AND DISSEMINATION

The Dev-CBNP Program has engaged in various collaboration and dissemination activities, including the development and dissemination of databases important to the research community and the hosting of scientific workshops whose products are shared broadly with the community. Some of these activities are described below.

- Pediatric MRI Study of Normal Brain Development Database. This contracted network includes six U.S. university research sites and a data processing center in Montreal, Canada. The goal of the initiative, developed through workshops followed by a trans-NIH Request for Proposals, is to produce a freely available database of structural MRI, DTI, and MRS

imaging data for a sample of typical children ranging in age from newborn to 18 years. Study leaders anticipate that many researchers will be able to use data from this sample as a comparison for atypical infant, child, and adolescent populations. The data, which include demographic, cognitive, and behavioral assessments for each child, are longitudinal and include several scans for each child taken over time. The sample was meticulously ascertained to represent the 2000 U.S. Census population distributions. Data from the first two visits of children, ages four and a half years to 20 years, were released and are available through the project Web site, <http://www.bic.mni.mcgill.ca/nihpd/info/>. Based on her experience overseeing NICHD interests in this important trans-NIH contract, the Dev-CBNP Program director is working on a volume that will describe how to read and interpret neuroimaging data to orient new researchers who are beginning data collection in this area (see Freund, *Child and Adolescent Neuroimaging: Understanding Methods and Results, Appendix C.*)

- Pediatric Brain Templates. The Imaging Research Center at the Cincinnati Children's Hospital Medical Center has collected brain imaging data from a large population of normal, healthy children. These data were used to construct pediatric brain templates, which can be used within Statistical Parametric Mapping for spatial normalization, tissue segmentation, and visualization of imaging study results. The data were processed and compiled in various ways to accommodate a wide range of possible research approaches. A toolbox is also available for creating a high-quality matched template for a pediatric sample based on the normal, healthy data. The templates are available free of charge to all interested parties for research purposes only through the Web site at <http://irc.cchmc.org/software/pedbrain.php>.
- Gene Regulation in Time and Space (GRiTS). GRiTS, funded by the NICHD and the National Institute of Mental Health (NIMH), is currently developing a set of new and innovative bioinformatics tools aimed at discovering the genetic regulatory networks at work in the developing rat cerebellum. GRiTS enables researchers to explore various gene-expression datasets and to compare the results of these explorations across different genetic models. The end result identifies sets of genes based on expression patterns and relationships among genes, cellular processes, and behavior during development. For more information, visit <http://grits.dglab.org/>.
- Brazilian National Seminar on Zero to Three-Year-Olds. The Dev-CBNP Program director was an invited speaker for this seminar, held in October 2007 at the Education Ministry of Brasilia, Brazil. The seminar was sponsored by the Brazilian National Confederation of the Commerce and promoted by the Education Committee of the Brazilian Chamber of Deputies. Her presentation on early brain development factors and the environmental influences leading to healthy outcomes during the newborn to three-year-old period was televised throughout Brazil; she also repeated the presentation in person to key members of the National Confederation of Commerce in Rio de Janeiro at the Confederation's request. The publication resulting from this seminar is listed in [Appendix C](#) of this report.

In addition, the Program has led or co-sponsored a number of workshops, including *Pediatric Functional Neuroimaging: A Trans-NIH Workshop*; *Reward Neurocircuitry in Adolescent Development and Decision Making*; and *Neuroimaging in Sleep Research*. For more information on these and other Branch-supported workshops, visit [Appendix F](#).

EARLY LEARNING AND SCHOOL READINESS (ELSR) PROGRAM

The ELSR Program supports research on the experiences children need from birth to eight years of age to prepare them to learn, read, and succeed in school. The Program supports research to identify early interactions with adults and peers in home, child care, and preschool settings that impact cognitive and social emotional development; this research includes studies of early childhood education teaching methods, curricula, and comprehensive interventions to prepare children from diverse backgrounds and environments for kindergarten and the early grades. Program research focuses on the development of cognition, emergent literacy, language, numeracy and mathematics, social and emotional competence, metacognition and self-regulation, motor development, and physical health. Supported studies employ cross-sectional and/or longitudinal research designed to specify cause-effect relationships between children's early experiences and the development of specific abilities and dispositions that lead to achievement, reading ability, social competence, and emotional well-being in kindergarten and early grades, as well as the mediating processes responsible for observed outcomes in learning and development.

In addition, the ELSR Program seeks to enhance knowledge about the preparation, training, and professional development of persons involved in the care and education of young children, the effectiveness of training strategies for promoting the positive modes of interaction identified by the research described above, and the causal linkages between adult behavior and school readiness outcomes for young children.

The ELSR Program was established in 2001 due, in part, to a Presidential emphasis on early childhood and development programs. It began with a single grant funded at \$500,000. In subsequent years, Requests for Applications (RFAs) for the two major projects (described later in this section) and the transfer of the Study of Early Child Care and Youth Development (SECCYD) significantly increased the size of the research portfolio. The Program's budget and portfolio increased from 36 grants at \$13.4 million in 2004, to 42 grants at \$16.5 million in 2007 (Figure 6). The majority of the grants supported during the reporting period were R01 research project grants (48 percent of the portfolio).

PROGRAM INITIATIVES

Since the ELSR Program was established, a majority of states have established pre-kindergarten programs, the Head Start Program has continued to serve children from disadvantaged backgrounds, and use of out-of-home child care services has continued to rise. Because the Program is housed in a science agency, it is able to support research that includes children from a variety of service settings and that longitudinally follows children as they enter and exit different service systems. In order to maximize the potential for this supported research to translate into tangible changes in parent, preschool, child care, pediatric primary care, and other service setting practices, the Program's research is closely coordinated with the efforts of agencies that oversee the management of service delivery programs, including the Head Start and Child Care Bureaus in the ACF within DHHS and the IES and the Office of Special Education and Rehabilitation

Services (OSERS) in ED. As noted below, two of the largest initiatives within the Program (School Readiness Consortium and Measurement Consortium) are co-funded by these agencies.

The following represent the largest program research initiatives within the ELSR Program portfolio:

- Study of Early Child Care and Youth Development (SECCYD). The NICHD SECCYD is the largest, longest running, and most comprehensive study of child care in the United States. At 10 locations across the United States, SECCYD researchers recruited families of 1,364 children through hospital visits with mothers shortly after the children's birth in 1991. Researchers measured the quality, quantity, and type of child care the children received from birth to 54 months of age. Child care was defined as regularly scheduled care by anyone other than the child's mother, for at least 10 hours per week, and included care by fathers, grandparents, and other relatives. The researchers then evaluated the children's academic achievement, cognitive (intellectual) functioning, and social development from kindergarten through age 16 years. Other factors, such as parenting quality and the quality of classroom instruction, were also measured and were taken into account to examine the association between early child care and children's subsequent development. The SECCYD Network sunset in 2008, and all of the data collected on children through age 16 years will be archived for secondary data analysis at the Inter-University Consortium for Political and Social Research (ICPSR) at the University of Michigan. A recently published Program Announcement (PA) will encourage such analyses. In addition, the NICHD competitively awarded one investigator-initiated R01 grant to continue following this sample through age 18 years to study early adult attachment relationships. More information about the SECCYD, including a list of publications, is available at <http://www.nichd.nih.gov/research/supported/seccyd.cfm>.
- Interagency School Readiness Consortium (ISRC). In 2003, the NICHD, the ACF, the ASPE, and OSERS released RFA HD-03-003 for the ISRC. A total of eight R01 research grants were awarded for five years; these grants were co-funded by the NICHD and partner agencies. The goal of the ISRC was to study the effectiveness of integrative early childhood interventions and programs, across a variety of early childhood settings, for promoting school readiness among children at risk for later school difficulties. Integrative programs included components intended to promote school readiness across multiple domains of cognitive and socio-emotional functioning. Research teams studied approximately 3,850 preschoolers, from diverse samples ranging from 19 percent to 29 percent Hispanic/Latino/English-language learning (ELL) students and from 25 percent to more than 50 percent African American students. ISRC investigators have published three papers and have 10 more in preparation. Results to date suggest that a variety of curriculum-based and teacher training interventions can positively impact both the cognitive and socio-emotional development of children who are in Head Start and other early care programs, but who remain otherwise at risk for social and achievement difficulties. Additional information on these research projects is available at <http://www.acf.hhs.gov/programs/opre/hs/interagency/index.html>. The funding period for the ISRC ended in fiscal year 2008; the RFA was reissued (HD-07-008) in August 2007 and was reviewed in summer 2008 for fiscal year 2009 funding. The new ISRC will focus on interventions that target ELL children, ages three years to five years, who are at risk for later school failure. This focus was chosen after consultation with agencies serving these populations and with the research community

because little is known about the most effective strategies for intervening with preschool-age ELL children, although existing research has documented that this population begins lagging behind in school readiness skills as early as 24 months of age. The new ISRC also represents an interagency effort: the ACF will fund a data coordinating center, which will support the network of grants funded by the NICHD through a cooperative agreement mechanism. Projects funded under the former ISRC were encouraged to seek new grants or competing continuations of existing projects through the investigator-initiated route.

- **Interagency School Readiness Measurement Consortium.** In 2005, the NICHD, the ACF, and OSERS jointly funded six R01 research grants, under RFA HD-04-026, comprising the Interagency School Readiness Measurement Initiative (ISRMI). These projects develop and test cognitive and socio-emotional outcome measures to assess critical school-readiness developmental domains, especially for children who are at risk for later school difficulties. These measures include assessments of children's school readiness across multiple domains of cognitive and socio-emotional functioning, including executive functioning, mathematical abilities, bilingual phonological development, and teacher ratings of socio-emotional functioning in the classroom. Results to date suggest that the measures developed are promising for examining cognitive and socio-emotional development of children otherwise at risk for social and achievement difficulties.
- **Family Life Project.** In 2007, researchers at the University of North Carolina, Chapel Hill, received a competing P01 research grant continuation to provide ongoing support for the Family Life Project, which received co-funding from the National Institute of Drug Abuse, the NIH National Center on Minority Health and Health Disparities, and the NIH OBSSR. The Family Life Project is the first and only large-scale study of the development of children from infancy through the early grades who live in rural poverty. The sample, 1,292 infants (followed since birth) and their mothers/families, has several compelling characteristics: it is representative of children in rural areas, collecting from six rural counties in North Carolina and Pennsylvania; the investigators have oversampled for lower socio-economic status because studying the impact of poverty is a key goal of the Project; and researchers have oversampled to achieve a sample that is more than 42 percent African American. In addition, the study has examined multiple levels of functioning, including child psychophysiology, child behavior and cognition (including extensive analysis of both executive functions and pre-literacy), parent-child and family interactions, family context and parent work, as well as community-level demography. While the longitudinal study continues, the investigators are also conducting ongoing cross-sectional analyses; analyses on the first three time points (age two months, six months, and 15 months) are complete. Despite the fact that the Project's major period of productivity will come when its investigators can analyze the entire dataset with all six time points, the researchers have already been quite productive, publishing 30 papers and having nearly as many in submission or revision. Additional information on the Family Life Project is available at <http://www.fpg.unc.edu/~flp/>.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Several findings from research supported by the ELSR Program are described below.

- Infants from rural low-income communities are exposed to numerous risk factors that affect their development. Findings from the Family Life Project demonstrate that infants growing up in rural low-income communities are exposed to numerous risks, including family social environments and parent health behaviors (e.g., smoking), that impact the development of both their cognitive skills and their hypothalamic-pituitary-adrenal axis stress-response system.
- Preschool interventions targeting both academic and social skills can have a significant short-term impact on the children's overall school readiness abilities. Findings from two ISRC studies support a causal relationship between preschool interventions that target executive function and academic and social-emotional skills and gains in overall school readiness skills among disadvantaged populations at high risk for school difficulties.
- Long-term longitudinal studies have established links between early child care experiences and later academic and behavioral outcomes. The NICHD SECCYD found that children who received higher quality child care before entering kindergarten had better vocabulary scores in the fifth grade than did children who received lower quality care. Further, the more time children spent in center-based care before kindergarten, the more likely their sixth grade teachers were to report such problem behaviors as “gets in many fights,” “disobedient at school,” and “argues a lot”; however, the increases in both vocabulary and problem behaviors were small, and parenting quality was a much more important predictor of child development than was type, quantity, or quality of child care. Another long-term longitudinal study found that children who attended programs encouraging a high level of parental involvement and providing intensive instruction in reading and math from pre-kindergarten through third grade showed higher educational attainment, lower rates of serious crime and incarceration, and lower rates of depressive symptoms at adulthood than did non-participants at adulthood.
- Quality of instruction in many elementary schools was objectively rated as poor, and children most in need were more likely to be in low-quality educational environments. Classroom observation data from the SECCYD revealed that classroom instruction was inconsistent and varied from classroom to classroom, and that teachers' instructional skills did not seem to be related to academic degrees or length of teaching experience. In addition, children who had poor test performance before entering kindergarten were significantly more likely to be in low-quality classroom environments in fifth grade.
- Not only are children who are overweight in early childhood at increased risk for obesity in preadolescence, but the physical activity level also drops between ages nine years and 15 years. Longitudinal Body Mass Index (BMI) data from the SECCYD revealed that children who were overweight as toddlers or preschoolers were more likely to be overweight or obese in early adolescence. Children who were overweight at least one time between ages two years and four and a half years were five times more likely to be overweight at age 12 years than were children who were never overweight during the same age range. A child who was overweight more often from ages seven years to 11 years was more likely than a child who was not overweight during those years to be overweight at age 12 years. Analyses of accelerometer (a device that measures movement) data from the SECCYD dataset showed that, at age nine years, children averaged roughly three hours of moderate to vigorous physical activity (MVPA) on weekdays and weekends. By age 15, however, they averaged

only 40 minutes of MVPA per weekday and 35 minutes per weekend, despite the recommendation that children engage in at least 60 minutes of MVPA per day.

COLLABORATION AND DISSEMINATION

The Program engaged in specific collaborative activities to build research in the ELSR area, and to disseminate those findings that could improve child care and educational practices. Several of these activities are described below.

- SECCYD Network findings. The SECCYD Network has been highly productive, in terms of publications both by Network researchers and by researchers outside of the Network who conduct secondary data analyses of SECCYD data. The NICHD has actively promoted the dissemination of SECCYD findings, including a number of news releases (see http://www.nichd.nih.gov/news/releases/obesity_risk_early_childhood.cfm, http://www.nichd.nih.gov/news/releases/child_care_linked_to_vocabulary_032607.cfm, and http://www.nichd.nih.gov/news/releases/july152008_physical_activity.cfm). A 2007 paper on the long-term association between early child care experiences and later achievement and behavior received a high degree of media coverage, including television, radio, and print stories. At the height of the media coverage, Google™ media documented 1,000 stories on the finding worldwide. The ELSR Program director participated in three on-camera television interviews and numerous radio and print interviews, including an hour-long segment of the nationally syndicated Diane Rehm Show on National Public Radio, in support of the news release. Likewise, a 2008 paper about youth physical activity published in *The Journal of the American Medical Association* was featured in the national news broadcasts of all three major television networks.
- SECCYD shared database. The data accumulated by the SECCYD Network during many years and multiple funding periods is one of the most detailed, well-documented datasets of young children's development over time in existence. Based on its potential value for continued analyses, data collected on the sample through age 16 years will be archived for secondary data analyses at the ICPSR at the University of Michigan (visit <http://www.icpsr.umich.edu/> for more information).
- SECCYD Data Advanced Training Institutes. Through a grant to the American Psychological Association, the program has held annual Advanced Training Institutes to instruct investigators on how to use the SECCYD dataset. Topics covered include the conceptual framework of the study, its methodological design, descriptions and psychometric properties of a large subset of variables included in the analytical datasets, and introduction to the raw datasets. Six such Institutes, held between 2002 and 2008, have trained more than 100 researchers. Visit http://www.apa.org/science/ati_ulsd.html for more information.
- School Readiness Updates. In order to keep the field abreast of the latest work being conducted by the ISRC and the ISRMI, the ELSR Program director organized and chaired sessions about both consortia at the 2007 Society for Research in Child Development biennial meeting, the 2007 American Educational Research Association annual conference, and the 2008 biennial Head Start Research Conference. The findings of one ISRC grantee were also the subject of an NICHD news release (<http://www.nichd.nih.gov/news/releases/nov19-08-New-Program.cfm>).

The ELSR Program also plays an active role in a number of interagency activities that serve to reach out to the research community, to other funding agencies, to the practice community, and to the public. The Program will continue its work with research, practice, and policy communities to generate research that can be readily translated into practice. Through a combination of grant support, conferences and workshops, and outreach to professional organizations, the Program director is forging relationships to foster awareness of both basic and translational research that can inform practices and that can promote the development of school readiness skills. One such activity is Good Start Grow Smart (GSGS). Launched as part of the President's Early Childhood Initiative in 2002, the GSGS consortium brings together federal research staff from DHHS and ED on a monthly basis to share information regarding ongoing efforts and to plan interagency collaborations. More information on this effort is available at <http://www.acf.hhs.gov/programs/ccb/initiatives/gsgs/fedpubs/GSGSBooklet.pdf>.

LANGUAGE, BILINGUALISM, AND BILITERACY (LBB) PROGRAM

The LBB Program supports and encourages research in three closely related and often integrated areas: language development and psycholinguistics, from infancy through early adulthood; bilingualism and/or second-language acquisition; and reading in bilingual and/or ELL children and youth. Of particular interest are developmental studies that identify and explicate the cognitive, linguistic, social, cultural, socio-environmental, geographic, environmental, instructional, and neurobiological factors related to language, bilingualism, and biliteracy. The Program, by virtue of its focus on bilingualism and ELLs' language and literacy, has a special interest in minority and language-minority populations, as well as in speakers of dialects of English within the United States that have implications for learning and reading.

Established in 2000, the LBB Program combined ongoing research in language development with projects from a then newly funded RFA on bilingual reading, while also providing a home for research on bilingual language development. Language development comprised one-half to two-thirds of the LBB Program grants and dollars in each of the four years of this reporting period as a result of a steady flow of investigator-initiated grants, which cover all areas of language development, but which have major concentrations in infancy and adult psycholinguistics. As of the end of 2007, bilingualism and biliteracy were addressed in 35 grants, or roughly one-third or more of the portfolio. Overall, in 2004, the LBB Program supported 43 grants, with an overall value of just more than \$16 million; by 2007, the Program supported 64 grants for a total of \$15.8 million. During the four-year period, two-thirds of funding went for R01 grants, and more than half of the training support was for F32 postdoctoral awards. During this same period, 5 percent of Program funding supported four P01s:

- Two in language development: Haskins Laboratories, *The Nature and Acquisition of the Speech Code and Reading*, which entered its 41st year of continuous support in 2007; and University of Chicago, *Environmental and Biological Variation and Language Growth*, which entered its second funding period with year six in 2008) and

- Two in biliteracy: University of Houston, *Oracy and Literacy Development in Spanish-Speaking Children*, funded from 2000 to 2004; and Center for Applied Linguistics, *Acquiring Literacy in English*, which entered its sixth year and second funding period in 2007.

PROGRAM INITIATIVES

Recent statistics related to language in the United States are definitive: one in five Americans speaks a language other than English at home; the language-minority proportion of the U.S. population has nearly doubled during the past decade; and the largest, most rapid growth within schools is in the number of ELL students. In 1992, only 15 percent of teachers had ELL students in their classrooms; by 2003 that proportion had increased to 43 percent, and it continues to grow. Based on these changing demographics, bilingualism/biliteracy has become an area of high research need and interest in the United States, along with a concomitant need to rapidly translate research findings to evidence-based instruction and intervention for the classroom and clinic. Thus, the Program seeks to maintain a Bilingual Language and Literacy Research Consortium through investigator-initiated grants, given the sunset of the Development of English Literacy in Spanish-Speaking Children (DELSS) Research Consortium in 2005.

In support of genetics work in language and language disorders, the Program led participation in an RFA on language phenotype assessment that was initiated by the National Institute on Deafness and Other Communication Disorders (NIDCD). This initiative grew out of a workshop, *The Relationship of Genes, Environment, and Developmental Language Disorders: Part II—Planning for the Future* (described in [Appendix F](#)). A jointly authored chapter from NIDCD and NICHD representatives at that workshop (Cooper & McCardle, 2004; see [Appendix C](#)) was included in the volume resulting from the workshop and served as a partial basis for the RFA. The two projects funded by the NICHD support the development of phenotype assessment tools in Spanish and in Hmong; both are ongoing.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Highlights from intervention and instruction-related research from the DELSS consortium and from other Program-supported research on bilingualism and biliteracy include the following:

- Reading in the first language can be an advantage for ELL students. Research showed that ELL students who were literate in their first language were likely to be advantaged in the acquisition of English literacy. Those instructed both in their native language (primarily Spanish in this body of research) and in English performed, on average, better on English reading measures than did those who were instructed only in English.
- Oral language ability is important to biliteracy development. Research indicated that, for most ELL students, word-level aspects of literacy, such as decoding or spelling, can be and often are developed to levels equal to those of their monolingual peers. Such similarities, however, were not present for second-language text-level skills, such as reading comprehension and writing. Skills for second-language learners on these measures often did not approach the levels achieved by monolingual students. Other findings suggested that,

although the effect of second-language oral proficiency on word-level skills was limited, having well-developed second-language oral proficiency was associated with well-developed reading comprehension skills. More specifically, the evidence showed that vocabulary knowledge, listening comprehension, syntactic skills, and the ability to handle metalinguistic aspects of language (such as providing definitions of words) were associated with reading comprehension.

- Home language use is important for maintenance of bilingualism and for the development of biliteracy. Achieving English proficiency did not require ELL students to use English instead of their first language in the home; however, those students not enrolled in bilingual programs required home support to become and remain proficient in their native languages. ELL students in bilingual programs were advantaged because these programs supported the development of native language skills in school-related topics. Ensuring such abilities in today's students is advantageous for a nation seeking to be globally competitive.
- Skills can transfer across languages. One difference between first- and second-language literacy development is that second-language learners have an additional set of intervening influences—those related to first-language literacy and oral proficiency. Studies showed that certain aspects of second-language literacy development are related to performance on similar constructs in the first language. This finding suggests that common underlying abilities play a significant role in both first- and second-language development; that certain error types can be understood in terms of differences between the first and second languages; that well-developed literacy skills in the first language can facilitate second-language literacy development; and that some cross-language influences are more likely to affect second-language literacy development than others, and to operate during some, but not all, stages of literacy development.
- Intervention in either of an ELL student's two languages can be successful in assisting struggling first grade ELL students. In experimental studies of the effectiveness of a supplemental, systematic, explicit reading and oral-language intervention presented in the language in which the student was being instructed (either Spanish or English), students showed gains in decoding and comprehension. Although children in the treatment groups outperformed children in the comparison groups, they still showed very low oral-language abilities, signaling a need for continued intervention and for additional attention to building oral vocabulary in the language of instruction.
- Bilingualism confers cognitive advantages in key areas that can affect learning. The cognitive effects of bilingualism are still being investigated, but research has already documented a cognitive advantage in attention and executive processing among bilinguals compared to monolinguals. A research team in Toronto, Canada, is examining the potential for this cognitive advantage to impact reading and mathematics performance in six-year-olds who are typically developing, and in those with attention deficit disorders.

Currently, little is known about language processing in American Sign Language (ASL)-English bilinguals. Speech-sign bilingualism is exceptional because distinct sensory-motor modalities allow for the simultaneous production and perception of two languages. With the spread of bilingual approaches to deaf/hearing-impaired education, the passage of the Americans with Disabilities Act and the resulting need for ASL-English interpreters, and the popularity of students taking ASL as a foreign language, the number of ASL-English bilinguals is increasing.

A better understanding of bimodal bilingualism will help clinicians and educators understand and assess linguistic and cognitive processing in these individuals. A full characterization of speech-sign bilingualism will also advance theoretical models of bilingualism in general. Researchers studying bimodal bilinguals have found the following:

- The bilingual cognitive advantage is not found in bimodal bilinguals, but is seemingly based on selection demands between similar modality languages. Bilinguals have been noted to outperform monolinguals on nonverbal executive function tasks, which require resolution of conflict from competing alternatives. It is thought that the regular use of two languages requires a mechanism to control attention and select the target language—an experience that enhances a general control mechanism—but it is not yet clear whether this selection stems from a general effect from bilingualism (the representation of two language systems) or from the conflict that arises from the need to select only one of the systems. Unimodal bilinguals (who know two spoken languages) cannot produce words in both of their languages at the same time. Bimodal bilinguals can produce words in each of their two languages at the same time because one is oral and one is manual; thus, they do not face the same necessity to select one language for production while inhibiting the other.
- Processing emotional expressions within a sign language context engages the left hemisphere for signers, but does so less strongly for hearing signers, although both sign language experience and deafness/hearing impairment seem to affect the neural organization for recognizing facial expressions. Researchers examined the neural activation of regions that support the recognition of linguistic and emotional facial expressions, comparing bimodal bilinguals, deaf/hearing-impaired signers, and hearing non-signers. The fMRI activation patterns of bimodal bilinguals were more like deaf/hearing-impaired signers, with no hemispheric asymmetry when recognizing emotional facial expressions in an ASL verb context, while hearing non-signers showed a right-hemisphere bias. All groups tended toward right-hemisphere asymmetry in the superior temporal sulcus for emotional facial expressions presented in isolation. These findings suggest that linguistic processing of sign language facial expressions reduces the general right-hemisphere preference for face processing, although it does not create a full shift to left-hemisphere processing. Hearing signers showed more posterior left-hemisphere activation for facial expressions, suggesting that their anterior regions may preferentially process auditory language input. In contrast, among deaf/hearing-impaired native signers, for whom auditory input has been absent/reduced since birth, these anterior regions are recruited for sign language processing.
- Acquisition of ASL from birth changes the neural organization for processing English in bimodal bilinguals. Researchers found greater activity in left inferior frontal gyrus (IFG) in bimodal bilinguals versus monolinguals and noted morphological differences in the right insular cortex—bimodal bilinguals showed bilateral activation within the insula and IFG, in contrast to the left-lateralized activation observed for the monolinguals. Further, the differences likely reflect a distinct neural organization within the insula and IFG for early bimodal bilinguals, a situation that may arise from use of multiple input/output channels for language. In addition, bimodal bilinguals showed more extensive activity than monolinguals in the bilateral superior temporal cortex, particularly within a region associated with speech reading. This difference may reflect increased attention to visual aspects of language (e.g., mouth movements) for bimodal bilinguals compared to monolinguals. When reading English, bimodal bilinguals displayed less robust activation within left superior-temporal

regions than did monolinguals, indicating that perhaps the superior temporal cortex is particularly sensitive to the early acquisition of a signed language. Thus, early and life-long experience with bimodal language processing seems to result in functional reorganization within perisylvian regions for spoken language processing.

Research on language development, supported by the LBB Program, has also produced some very interesting findings. One revealing area, which has implications for understanding language and learning and for facilitating instructional approaches, is the use of gesture with language. When people talk, they gesture. Research has shown that gesture and speech are integrated, and that gesture can convey related but additional information to that conveyed in speech. For example:

- Gesture signals readiness to learn, and adding gesture to instructions seems to make those instructions more effective. For many young children acquiring language, single word plus gesture seems to be a precursor of two-word utterances, meaning it is an indicator that the child is ready to enter the two-word stage.
- Gesture has also been examined for its potential role in teaching children new information. Children who received instruction with speech and gesture learned from the conversation, even when no objects or other visual aids were present; they were also more likely to offer explanations of how they would solve new problems. Telling children to gesture seemingly encouraged them to convey previously unexpressed, implicit ideas, which in turn, made them receptive to instruction that led to learning. For instance, when given explicit instruction about how to move their hands while solving a math problem, children were better able to retain the knowledge they gained.

COLLABORATION AND DISSEMINATION

The Program engaged in specific collaboration activities to build research in LBB research areas and to disseminate findings that could improve educational practices or advance the state of the science in these areas. Workshops and conferences are listed in [Appendix F](#). In addition, Program staff contributed to five thematic journal issues and an edited book, all of which highlight research needs in biliteracy (see [Appendix C](#)).

MATHEMATICS AND SCIENCE COGNITION AND LEARNING: DEVELOPMENT AND DISORDERS (MSCL) PROGRAM

The MSCL Program supports projects in both basic and intervention research within all aspects of mathematical thinking and problem solving, as well as in scientific reasoning, learning, and discovery, across all ages from infancy into early adulthood. Studies supported explore a variety of influences on atypical development in mathematics and science learning and cognition, including genetic and neurobiological substrates, and cognitive, linguistic, sociocultural, and instructional factors. Investigations of the individual differences, which may moderate

achievement in math and science, the delineation of skill sets needed to attain proficiency in these domains, the means to address the kinds of learning difficulties that frequently emerge in each of these areas, and the development of effective instructional methods for mitigating these difficulties are core areas of research focus.

Within mathematics, areas of focus within typical development include basic numerical representations and processing, arithmetic comprehension and procedural skills, proficiency with fractions and other types of rational numbers, algebraic problem solving, geometric thinking, concepts of probability and chance, and measurement concepts and skills. Although the Program supports all methodologies, it gives priority to longitudinal studies on the development of mathematical proficiency beginning either in the preschool period or in the early grades. The Program also funds studies exploring the nature and extent of specific mathematical learning disabilities (MLD), including diagnosis, classification, etiology, prevention, and treatment. Subject populations of interest include children with idiopathic MLD, those with co-morbid math and reading disabilities, and children with neurodevelopmental disorders for whom deficient math performance represents one of the primary cognitive sequelae. Epidemiological longitudinal studies are also needed to generate accurate estimates of the prevalence of MLD in mathematics. Of particular importance are studies of the effects of poverty on the failure to develop mathematical proficiency, and the identification of risk and protective factors within these contexts.

The area of science cognition and learning includes studies to improve understanding of the cognitive and developmental bases of scientific thinking and learning. Within this context, the Program encourages research on factors contributing to conceptual change, inductive and deductive reasoning, and the acquisition of scientific concepts, such as experimental control and falsifiability. Related topics of interest include causal thinking and inference, theory-evidence coordination, and reasoning about data. Another important area of focus is the investigation of developmental changes in naïve or intuitive thinking about the biological and physical worlds. The Program also supports studies that can inform the design of evidence-based instructional interventions for science learning.

The MSCL Program is the newest program in the CDB Branch, established in 2003 with the publication of an RFA on mathematical learning disabilities. Prior to the Program's establishment, the one mathematics grant the Branch supported in 2002 was housed in the Human Learning and Learning Disabilities Program (now the RWRLD Program, described in the next section). The MSCL Program is very active, supporting 15 grants in 2007. During the four-year reporting period, the Program supported more than \$7 million per year in math and science grants; the majority of grants were R01s, although a variety of grant types are also supported.

PROGRAM INITIATIVES

The Program currently includes the Mathematical Cognition and Specific Learning Disabilities Research Consortium (hereafter the Math Consortium), initially funded in 2003 through an

interagency partnership with OSERS at ED. This Consortium facilitates cross-project communication and collaboration, thereby enhancing the convergence of methods, measures, and findings to help build the knowledge base in this area and to eventually improve educational practice. Initially, five grants (one P01 and four R01s) were funded at an estimated cost of \$18 million for the five years; projects included studies of the neurobiological and genetic substrates of MLD, a longitudinal analysis of deficits in number-estimation competencies, studies of MLD subtypes, and classroom interventions for MLD in problem solving. The Math Consortium RFA was reissued in 2008, and five new R01 grants will be funded in fiscal year 2009. The Consortium includes grants from the RFA as well as investigator-initiated projects. Newly funded projects continue the Consortium's focus on the genetics and neurobiology of MLD, but add work on interventions, including a response-to-intervention approach for identifying and remediating MLD and identifying subtypes of MLD.

The Branch is building the science cognition and learning portion of the MSCL Program slowly, drawing researchers from various disciplines. Although no specific initiatives have been launched thus far, Program staff anticipate that the recent publication of the National Research Council's *Taking Science to School* (supported by the NICHD) will highlight the importance of research on how children develop an understanding of scientific concepts and the critical thinking necessary for mastery of scientific information.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Despite the relative youth of this Program within the Branch, its supported research has generated important findings about how children learn mathematics and about MLD. Several results are described below.

- Neuroimaging during math activities reveals differential activation and brain patterns reflective of maturation and learning. During learning of mental addition, children often use a variety of counting strategies; as they become more skilled, they shift from these inefficient strategies to increased use of memory retrieval. Researchers examined the neural bases of using these different strategies among children performing simple and complex addition tasks. The fMRI results for second and third graders suggest that rapid retrieval of simple arithmetic facts engages mechanisms of memory retrieval mediated by the medial temporal lobe. Parietal lobe regions, previously identified as involved in arithmetic fact retrieval and computation in adults, are engaged to a greater extent during simple arithmetic fact retrieval in children during more complex addition tasks. At the same time, frontal lobe regions which mediate counting-based strategies are not consistently engaged during complex addition trials, suggesting that the brain networks necessary for complex arithmetic fact retrieval are not yet mature in children at these ages.
- Neuroimaging reveals differential activation in children with MLD. Using magnetoencephalography to examine the latency of brain-area activation during performance of exact addition and estimation tasks, researchers found significant differences in the order of and degree to which different brain areas were involved, especially in the sequence of activation of frontal and parietal regions of brains of children with MLD. These children also showed increased reliance on a network of right-hemisphere parietal frontal areas for simple math calculations compared to controls.

- Evidence supports ways to predict which children may have difficulty learning math or who may develop MLD. Early number sense is an intuitive understanding of numbers, their magnitude, relationships, and how they are affected by operations. Researchers demonstrated that early number sense and growth trajectory in math achievement are good predictors for identifying kindergarten children at risk for math difficulties later in primary school. Number sense at age 14 years correlated with math achievement as far back as kindergarten, suggesting that number sense is a stable predictor of math learning success. The ability to predict math difficulty could significantly aid in identification, prevention, and early intervention for MLD. Many researchers now argue that number sense is a cross-species ability, as central to math as phonological awareness is to reading.
- Research shows links between numerical cognition and visual-spatial impairments. Research on the nature of visual-spatial and numerical cognitive deficits in children who have chromosome 22q11.2 deletion syndrome (which encompasses DiGeorge, Shprintzen, and Velocardiofacial syndromes) has demonstrated an association between atypical pattern development among the neural connections for numerical cognition in children with the deletion as well as visuospatial cognitive impairments that are a hallmark feature of the syndrome. This work has greatly increased the knowledge base about the cognitive phenotype for these children and could offer a neurocognitive explanation of the spatiotemporal and numerical impairments these individuals experience. Such knowledge could eventually lead to the development of targeted interventions for these syndromes.

Program-supported research has investigated the effectiveness of classroom and tutorial instruction in math, with a focus on elementary school children who struggle to learn math. These randomized trials have involved large samples of students at several sites. The researchers also studied basic mechanisms of math learning and MLD. Some key findings from these efforts are described below.

- Math interventions are effective both for children who have MLD and for children who have co-morbid math plus reading disabilities. Explicit tutoring enhances math calculations, word problems, and algebra outcomes for third-grade students who have math difficulties. Tutoring protocols proved transportable across sites proximal to and distal from the developers. Many of the gains in basic skills can be captured by interventions that focus on word problems, in which basic skill training in facts and procedures are embedded in the problem-solving intervention.
- When at-risk students receive two layers of prevention (e.g., scientifically validated classroom instruction and scientifically validated small-group tutoring as needed), math outcomes are better than when either form of prevention is provided in isolation.
- MLD are heterogeneous and may vary with each other and within subdomains of mathematics. Researchers investigating the classification of MLD have preliminary evidence that these disabilities may be represented as subtypes, which vary in cognitive strength and weakness, with links to deficient development in specific domains of math ability.
- Specific calculation difficulty (without concurrent difficulty with word problems) is associated with strength in language and weaknesses in attentive behavior and processing speed. Problem-solving difficulty (without concurrent difficulty with calculations) is associated with weak language abilities. Results suggest the potential utility of an MLD subtyping framework to distinguish between calculations versus word-problem disability;

this framework may help practitioners to better understand and eventually intervene with math difficulties, potentially reducing disparities in math learning.

- Severity of math difficulties is an important marker of disability. Evidence suggests that children who have severe math difficulties (i.e., below the 10th percentile on multiple measures of math ability) have more significant cognitive-processing difficulties than those who don't have the same degree of math difficulty. These students also have a qualitatively different pattern of abilities compared with children who are less impaired in math.

Although the Branch's portfolio in science cognition is limited, this research has revealed some important findings about how children understand scientific information. Researchers are also exploring how children develop causal reasoning and inferencing, with some striking results. A few key findings are described below.

- Children are sensitive to the fact that certain properties are more causally central to some domains than others (a concept called "causal relevance"). That is, if told that one of two people is a real expert on a novel tool or novel animal, while the other person is a fake, children infer appropriate expertise. For example, children think that an expert who talks about shape, size, and fragility of tools is more likely to be a legitimate expert than one who talks about color, number of parts, and patterns on the surface. By contrast, if exactly the same descriptions are given about a novel animal, children as young as five years of age prefer the expert who talks about color, number of parts, and surface patterns.
- Children have "causal powers"; that is, they expect that certain effects will follow from certain causes, even without information about how that outcome is possible. Researchers have shown that children, from about three years to eight years of age, can understand that only intentional agents could take a system from disorder to order, but that a wide variety of intentional and non-intentional agents could take a system from order to disorder. Younger children, however, were unable to explain why. Not until age seven years did children explicitly invoke goals and plans of intentional agents as the mechanism. Even at age one year, infants demonstrated expectations that only intentional agents can cause ordering events, with a strong preference for animate agents as causing disruptions of regular events.
- During the preschool period, children make inductions about the functions of unknown objects and later refine these assumptions, moving from abstract to concrete. In work on children's inferencing using both experimental situations and naturalistic interactions, researchers observed that patterns of questions asked by children ages three years to five years were about function for novel artifacts, but not for novel animals, indicating that they knew it made sense to ask about the functions of artifacts as a whole (e.g., knives are for cutting), but that it did not make sense to ask about animals as a whole (e.g., tigers are not for anything). A clear developmental trend suggested a general "basic level" of causal/functional interpretation (i.e., children first make inductions about the functions of unknown objects) that became more refined and specific with increased age (abstract to concrete). This finding contrasts with more traditional views and represents an important demonstration of the ways in which children most naturally process causal properties of artifacts, understand the nature of artifacts, and sharpen the causal attributions over time. Such work is foundational to how best to teach children science and how to facilitate development of scientific reasoning.

- How information is presented can enhance or hinder children’s learning of scientific concepts. In investigating intentional stance, researchers observed the impact of information presentation to kindergarten and second grade aged children and examined the causal understandings these children constructed. Using a series of researcher-developed storybooks depicting various natural phenomena, researchers found that providing explanations of natural systems in terms of intentional or “anthropomorphic” stances (e.g., the magnet “likes” the metal pieces and wants them to be closer), although a common technique in science textbooks, heavily impairs younger children’s understanding of the underlying causal chains conveyed in explanations relative to controls. Attributing intentionality to inanimate systems was not only useless for learning and memory, but also distorted and impaired understanding of underlying causal chains in comparison to traditional literal control formats; this distortion was especially true among younger children.

COLLABORATION AND DISSEMINATION

During the reporting period, the Program engaged in collaborative activities to stimulate additional research and to share findings. An edited volume was produced based on the first two annual meetings of the Math Consortium and on the productive work of its members (Berch & Mazzocco, 2007; see [Appendix C](#)). This volume constitutes the first comprehensive and multidisciplinary examination of the study of math difficulties and MLD and includes current theoretical conceptions and research methods, the latest empirical findings, and descriptions of research-based instructional interventions. The volume has served not only to help the public better understand the issues surrounding and underlying MLD, but also to highlight important research findings and needs in this area, which has received heightened national attention in recent years.

The previous Program director participated as an *ex-officio* member of the National Mathematics Advisory Panel, whose report is now publicly available at <http://www.ed.gov/about/bdscomm/list/mathpanel/index.html>. The recommendations of this Panel include topics for further research that are both relevant and appropriate for the MSCL Program. In addition, the NICHD is supporting the ongoing National Research Council study on early childhood mathematics that will synthesize past research on early childhood mathematics across various disciplines, and that will provide information to inform practice, policy, and additional research needs; more information on this study is available at <http://www8.nationalacademies.org/cp/projectview.aspx?key=48828>.

READING, WRITING, AND RELATED LEARNING DISABILITIES (RWRLD) PROGRAM

The RWRLD Program focuses on research and training initiatives to increase understanding of both normal and atypical development of reading and written language skills throughout the life course, as well as the development of prevention, remediation, and instructional approaches and methods to enhance these abilities. The Program includes work on reading and writing development, from preschool through adulthood, particularly multidisciplinary studies that integrate genetic, neurobiological, cognitive/behavioral, and intervention studies; it also emphasizes the development and validation of measurement tools to support such studies. The research in the RWRLD Program is complemented by related research supported by the ELSR Program, the LBB Program, and the PBHP Program (described later in this report) and has linkages with other Programs within the CDB Branch.

The RWRLD Program has maintained levels of funding close to those in place after the expansion in NIH funding during the late 1990s and early part of the 21st century. In fiscal year 2004, the RWRLD Program supported 37 research grants for a total of approximately \$22 million; by the end of fiscal year 2007, the Program supported 38 research grants for a total of approximately \$16 million.

The researchers supported under this Program focus on research samples ranging in age from preschool into adulthood. Many of the research projects (approximately 40 percent) make extensive use of longitudinal and cross-sectional designs. During the reporting period, the Program supported one program project (P01), which is unique both in terms of the project's area of science within the portfolio as well as its status in the field; this project represents the only animal model of dyslexia under investigation.

PROGRAM INITIATIVES

Within the reporting period, the following three major research consortia were active within the RWRLD Program:

- **Adolescent Literacy Research Consortium.** This Consortium is focused on understanding the development of literacy skills in adolescents, including those with learning difficulties, through research that examines instruction, intervention, and the contextual and environmental factors affecting adolescent learners. The consortium's genesis was a series of workshops, convened in 2002, that focused on the status of research in adolescent literacy. Those workshops, co-sponsored by various federal agencies and professional organizations, resulted in a research agenda (available at <http://www.nifl.gov/partnershipforreading/publications/adolescent.html>). Subsequently, the NICHD published RFA HD-03-023 and jointly funded four adolescent literacy research projects with the Office of Vocational and Adult Education (OVAE) and OSERS, both within ED, in fiscal years 2003 and 2004. Two additional investigator-initiated projects were added later, funded by the NICHD. Four of the R01 projects are still active, and the researchers are working on their final waves of data collection, corresponding analyses, and

manuscript preparation. Projects include investigations of the brain-behavior linkages in reading and reading disabilities among preadolescents and adolescents; the effectiveness of reading interventions; the relationship among expectancy values, motivation, engagement, and literacy achievement; and how differing levels of teacher support impact the effectiveness of a high-school literacy intervention.

- **Adult Literacy Research Consortium.** This Consortium consisted of six research project grants (R01) that addressed language and literacy skills during the late adolescent and adult periods, including investigation of how best to identify and intervene with low-literate individuals in these age groups and the development of effective, research-based assessment and intervention methods. The Consortium also emphasizes ways to increase functional English literacy among non-native speakers of English. In a workshop jointly sponsored by the NICHD, the National Institute for Literacy (NIFL), OVAE, and the Office of Elementary and Secondary Education at ED, expert panelists identified research needs and possible future directions for the adult and family literacy research field. The resulting summary, available at http://www.nichd.nih.gov/publications/pubs/upload/afl_workshop.pdf, served as the basis for the *Research on Adult and Family Literacy* RFA (HD-02-004). Beginning in 2002, the resultant Consortium was jointly funded by the NICHD, NIFL, and OVAE. Consortium investigators designed, developed, and implemented various interventions to increase the reading proficiency of low-literacy adults, and to better understand the interplay among decoding, vocabulary, fluency, and reading comprehension skills for this group. The projects primarily focus on learners who are reading at the third to eighth grade levels, with most falling in the low to moderate range of adult intermediate-learner reading. Investigators screened almost 73,000 participants and accrued a large (approximately 2,800 participants in total), ethnically diverse sample from across 16 states; the sample includes significant numbers of African American and Latino individuals, some of whom are non-native English speakers.
- **Learning Disabilities Research Centers (LDRC) Consortium.** This Consortium, initially established by an RFA issued in 1988 (HD-88-03), currently includes three new P50 grants (Florida State University, Kennedy Krieger Institute/John Hopkins University, and University of Houston) and one continuing grant (University of Colorado) from the third re-issuance of the RFA in 2005 (with fiscal year 2006 funding). The Consortium represents the only center program in the CDB Branch. The current LDRCs seek to develop new knowledge about the causes or origins and developmental course of learning disabilities, which affect oral language abilities related to reading and writing, basic reading skills, reading fluency, reading comprehension, and written expression. This focus includes the genetic and neurobiological contributions and responses-to-intervention characteristics of children, adolescents, and adults with learning disabilities. Teams across the four centers are conducting research on development and validation of classification systems and definitions for learning disabilities that impact reading, including oral language and writing skills as well as basic reading skills, reading fluency, and reading comprehension. LDRC investigators have been highly productive in their publications. Since fiscal year 2001, LDRC researchers have published more than 270 articles and chapters, particularly noteworthy given that three of the four funded sites changed in the current funding cycle. Historically, the LDRCs generated a crucial portion of the work cited in the *Report of the National Reading Panel: Teaching Children to Read* (2000) and provided key data that influenced the revision of the Individuals with Disabilities Education Act (IDEA) reauthorization in 2004; this legislation

now permits states to consider alternative approaches to classification of learning disabilities, including response to intervention, a topic being addressed by all four current LDRCs. In addition, an important aspect of these centers has been and continues to be the rich training opportunities they offer for both basic and translational research scientists, serving as a fertile training ground for predoctoral students, postdoctoral investigators, and early career investigators. For instance, the LDRC at the University of Colorado (now in its 19th year of funding) has trained approximately 50 current and previous graduate students and postdoctoral researchers since its inception. More than 40 individuals are currently supported at the funded centers, and these centers continue to attract young researchers to the field.

In addition to these Consortia, the RWRLD Program also supports research on written language development and disorders. The emphasis on written language development and disorders is relatively new for the RWRLD Program and focuses on the nature of normal and atypical development of orthographic processing, spelling, written composition, written expression, knowledge transformation, meta-cognitive skills, and compositional fluency. This programmatic focus includes an emphasis on the cognitive, behavioral, instructional, and neurobiological contributions to the development of these skills, and on the relationships among oral language, reading, and written language skills. To date, the Program has provided support primarily through the Small Business Innovative Research (SBIR) mechanism and through LDRC subprojects. To stimulate additional work in this area, which is poorly understood yet crucial to academic success, the Program is collaborating with NIFL to host an invitational workshop in 2009 to take stock of current and recent research in the field and to develop a research agenda; the workshop will also result in either a thematic journal issue or edited volume.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

The projects funded through the RWRLD Program continue to influence the field. Some of the recent findings include the following:

- Children learning to read need explicit, high-quality instruction. Peer-reviewed publications from previously funded LDRCs and R01 projects in the RWRLD Program formed a critical portion of the research included in the *Report of the National Reading Panel: Teaching Children to Read* and demonstrated that children who received explicit instruction in the various components of reading were more successful readers than those who did not receive explicit instruction. The National Research Council report, *Scientific Principles in Educational Research* (<http://books.nap.edu/openbook.php?isbn=030907570X>), also highlighted NICHD-supported research on the link between phonological awareness and reading as a “big idea” in science and provided an example of how scientific knowledge accrues vertically within a domain and is then horizontally integrated across disciplines to provide a comprehensive explanation of a scientific phenomenon, i.e., learning to read.
- Children at risk for reading difficulties can and should be identified early and receive effective remediation. The field has made significant progress in understanding the identification and classification of children with learning disabilities, and research has demonstrated the limitations of identifying reading disabilities solely by IQ-achievement

discrepancies. The body of work in this area directly influenced IDEA 2004, which permits states to consider alternative approaches to the identification of learning disabilities, including response to intervention (a topic being addressed by all four LDRCs). Educators can now target children for intervention prior to those students having failed to achieve for years; lengthy assessment procedures are no longer required for teachers to intervene and individualize instruction for struggling students. Classroom teachers, special educators, and allied professionals can now work as teams to ensure ongoing intervention and monitoring of children's progress in learning to read. The "wait to fail" model is finally being combated.

- Reading disability and co-morbid disorders are highly heritable. The co-morbidity of reading disability and attention deficit-hyperactivity disorder (ADHD) seem to be primarily explained via common genetic factors, with the important caveat that heritability is significantly higher for reading disabilities and inattention than for the ADHD dimension of hyperactivity-impulsivity described in the Diagnostic and Statistical Manual, Fourth Edition. One implication of this finding is that these common genetic factors may, in part, make learners more susceptible to deficits in processing speed (executive function).
- Genes alone are not the cause of reading disability. Using longitudinal studies of twin cohorts, researchers demonstrated that, although genes contribute significantly to the development of reading disabilities, particularly by impacting deficits in phonemic awareness and orthographic coding, their effects on behavioral performance on reading tasks are critically modulated by the child's environment. Interestingly, the same genetic and environmental influences seem to contribute to the development of reading difficulties for both sexes.
- Genetics and neuronal anomalies are implicated in reading disabilities. Researchers established *DCDC2* as a dyslexia susceptibility gene and demonstrated that it has a role in migration of neocortical neurons; this gene was later shown to possess a robust genetic association with dyslexia. There are now more than a dozen links between specific chromosomal sites and reading ability; much of this research was supported by the NICHD and replicated in laboratories around the world.
- The brain reflects changes in learning to read. Having revealed different neural signatures characteristic of successful readers and poor readers, researchers demonstrated that the functional brain metabolism of poor readers alters with successful reading remediation to more closely resemble that of skilled readers. In addition, as a novice reader progresses to more skilled status, diffuse activation patterns become more focused. This research, showing that the neural systems underlying disorders such as dyslexia are malleable and demonstrate considerable plasticity, has altered fundamental conceptions of the nature of a learning disability and the viability of education interventions.

COLLABORATION AND DISSEMINATION

The RWRLD Program recognizes the importance of moving toward evidence-based practice in reading instruction and remediation. It has engaged in various activities to reach out to the reading practice community. For example, the NICHD has an official, established partnership with the International Reading Association (IRA) that enables the Program and the Branch to work to bridge research and practice. The partnership was recently re-formalized for another six

years, and the collaborative planning process is underway for addressing the topic of *Measuring Classroom Instruction*. This effort will focus on the challenges of measuring behavioral interactions between teacher and learner, and the impact of such measurement on changes in learning over time. CDB Branch-supported researchers have participated in previous workshops co-sponsored by the IRA and NICHD and in symposia and panel presentations at IRA annual conferences, including organizing and moderating research symposia (at the IRA meeting) that primarily focused on the LDRC Consortium and the Adult and Adolescent Literacy Consortia.

In addition, the directors responsible for this Program during the reporting period co-authored book chapters and co-edited volumes presenting overviews of research findings as a means of both sharing findings and suggesting additional research areas (see [Appendix C](#)). The Adult Literacy Research Consortium is preparing manuscripts for a thematic section of an upcoming journal issue. Additionally, the Program director has presented scientific overviews at various national professional association meetings, such as the International Dyslexia Association, the IRA, the Learning Disabilities Association, and the American Education Research Association. Examples of other collaboration and dissemination activities include the following:

- Keynote address and Canadian Public Television interview. In 2005, the acting Program director presented a keynote address, *The Importance of Evidence-Based Practice in Reading Instruction*, to the British Columbia Branch of the International Dyslexia Association, Vancouver, Canada, in support of the Association's desire to move toward evidence-based reading instruction within the province. She was also interviewed and filmed by the British Columbia public television channel, Knowledge Network; film clips are available at http://www.knowledgenetwork.ca/dyslexia/base_loader.html within the *Diagnosis*, *Intervention*, and *Fact-or-Fiction* sections.
- *Partnership for Reading* and work with NIFL. The RWRLD Program director has worked collaboratively with NIFL—a partner on Adult Literacy Research Consortium projects, a partner in the upcoming Writing Research Workshop, and convener of the *Partnership for Reading*. Under the latter partnership, NIFL has played a primary role in disseminating literacy research findings to diverse communities. The CDB Branch staff has worked collaboratively with NIFL to provide substantive input on the development and revision of a number of NIFL publications, including:
 - o *What Content-Area Teachers Should Know About Adolescent Literacy*. This document serves as a resource for content-area instructors who may wish to consider supporting literacy development within the context of their classroom instruction. The publication provides background information about reading development and provides concrete suggestions for supporting the development of these skills to achieve the broader goal of content-area learning (http://www.nifl.gov/nifl/publications/adolescent_literacy07.pdf).
 - o *Teaching Adults to Read*. This document, based on the work of the Reading Research Working Group, provides evidence-based guidance for instructors and the research field about aspects of adult reading instruction (http://www.nifl.gov/partnershipforreading/publications/html/teach_adults/teach_adults.html).
 - o *Shining Stars*. This series of documents outlines ways for parents to support their children's acquisition and development of literacy-related skills. The series covers the

toddler years through third grade

(<http://www.nifl.gov/partnershipforreading/publications/k-3.html>).

- o *Health Literacy Curriculum*. NIFL is currently supporting online publication of a health literacy curriculum for adult intermediate learners created by one of the research teams composing the Adult Literacy Research Consortium. This product will be available free of charge to practitioners in 2009.

SOCIAL AND AFFECTIVE DEVELOPMENT/CHILD MALTREATMENT AND VIOLENCE (SAD/CMV) PROGRAM

The SAD/CMV Program supports research and research training relevant to normative social, affective, and personality development in children from the newborn period through adolescence. In addition, the Program focuses on the impact of specific physical and social environmental aspects on the health and psychological development of infants, children, and adolescents. Within this context, investigations of socio-cultural, familial, individual, and biological influences on development are of interest. The Program also supports studies of child developmental processes in high-risk settings (e.g., in violent or abusive environments, or in families experiencing stressors such as poverty, unemployment, or parental depression).

The SAD/CMV Program has been and continues to be one of the largest programs within the Branch. Overall, for the four-year reporting period, this Program invested approximately \$99 million in research, demonstrating that these areas of science are a significant priority for the Branch and for the NICHD. In 2004, the Program administered 67 research grants for a total budget of more than \$28 million. By the end of fiscal year 2007, the Program administered 70 grants for a total of more than \$25 million, reflecting a small decrease in the average award total costs, although the number of projects supported held relatively stable for the period. This Program also uses the K01, a career development mechanism specially designated for early career investigators who have made a commitment to focus their research endeavors on conducting high-quality, multidisciplinary, clinically relevant research on basic biological, behavioral, and social aspects of child and adolescent abuse and neglect. The K01 makes up 19 percent of the training and career development grants funded annually within this Program.

PROGRAM INITIATIVES

The SAD/CMV Program continues to have as its hallmark studies of child and family processes. Longitudinal or cross-sectional studies with a lifespan developmental focus constitute about one-third of the portfolio. These projects include studies of children in their broad ecological contexts, most often examining family dynamics and the impact of these interactions on psychosocial functioning and later development. Collectively, researchers funded through the SAD/CMV Program have authored a total of 310 scientific publications during the four-year reporting period. Important subareas of research within the Program include the following:

- **Intergenerational Research.** The Program supports four intergenerational studies, which examine a range of factors that influence the course of development. These include Economic Stress and Child Development across Three Generations, Intergenerational Transmission of Neglect and Abuse, Adjustment Problems and Substance Use in Three Generations, and Family Processes and Rural African American Children. Long-term studies such as these pose important questions about compelling public health problems, which may best be answered through systematic, prospective investigations.
- **Child Maltreatment.** The CDB Branch is actively involved in trans-NIH and trans-agency efforts to advance the science in the field of child abuse and neglect research. The Program director co-chairs the NIH Child Abuse and Neglect Working Group, which was established in response to a directive by the House Committee on Appropriations requesting that NIH report on current NIH efforts, accomplishments, and future plans for research on child abuse and neglect. Program efforts in this area include a PA on child abuse and neglect intervention research, which was developed in response to the 2005 Surgeon General's workshop on this topic. In addition, the Branch has worked with the Children's Bureau to support the continuance of the Fourth National Incidence Study of Child Abuse and Neglect (NIS-4). This effort supports NIS-4 supplemental studies, which seek to understand the definitions of child abuse and neglect used by reporting agencies, and their standards for reporting suspected maltreatment to Child Protective Services or to the NIS-4.
- **Children Exposed to Violence.** Research supported through this facet of the Program addresses the public health, justice, social services, and educational problems associated childhood exposure to violence. The CDB Branch funded eight grants through a multi-agency PA titled *Research on Children Exposed to Violence* (PAR-03-096), which closed in 2005, to develop new knowledge about the definition, identification, epidemiology, prevention, etiology, effects, early intervention, and mechanisms of violence exposure. Among these grants were three projects focused on the impact of political violence on children's development—a new area of investigation for this portfolio. Grantees meet annually to report on progress and exchange ideas, information, and resources. Two of the meetings were held in conjunction with national conferences to promote greater opportunities for dissemination of their research findings: the 2007 meeting was held in conjunction with the biennial Society for Research in Child Development meeting; the 2008 grantee meeting was held in conjunction with biennial meeting of the Society for Research on Adolescents.
- **The Development of Emotion.** The Program has long been the primary funder of basic research on the development of emotion in children and youth. It participated in the PA, *Basic and Translational Research on Emotion*, to support basic and translational research on the processes and mechanisms involved in the experience, expression, and regulation of emotion.

In 2006, the Program held a strategic planning meeting with an expert panel of five extramural scientists convened to assess the strengths of research within the Program and to recommend future directions. Reviewers noted that the Program supported a variety of projects, ranging from long-term intergenerational studies to SBIR projects, and agreed that the portfolio included a good balance of projects in affective development and violence. Research on child maltreatment was deemed a particular strength of the Program. The panel suggested two

additional areas to consider in future research, and the Program director is actively engaged in encouraging research in the following areas:

- **Media Research.** Members of the panel highlighted the need for more translational research to understand the positive uses of media and the new areas of media for which no empirical data exist. Specifically, they recommended research to address the following questions: What kinds of effects are new media having on child and adolescent development? What are the processes involved? What effect does creating new identities through the media have on the adolescent over time? Since receiving this recommendation, the Branch held a conference in 2006, *The Effects of Electronic Media on the Cognitive, Social, and Emotional Development of Children and Adolescents*. A summary of the meeting is available at: <http://www.nichd.nih.gov/about/meetings/2006/electronicmediaconf/workshopsummary.cfm>. The Branch's Program directors continue to represent the NICHD at meetings on this topic, most recently at a Congressional briefing intended to provide information about the Branch's leadership in this scientific area.
- **Political Violence.** Research in this area is now poised to go beyond questions about effects of political violence to include studying the processes of such violence. Important research questions to address include the following: What stereotypes play a role in this type of violence? How do stereotypes interact with ethnic identity to foster violent behavior? What is the extent to which exposure to political violence sets the stage for becoming more violent, and how do these processes operate? In 2009, grantees funded under the PA *Research on Children Exposed to Violence* will focus on these questions at a meeting, which will expand the possible participants to include representatives from federal agencies, such as the U.S. Department of State, and groups, such as the Fogarty International Center, which have a large international stake.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Although this Program is very productive, due to space limitations, only a sampling of findings from research in the four facets of this Program is included below.

- **Child-by-environment models** may be effective guides for investigating processes that precede psychosocial maladjustment. A longitudinal investigation explicated how the confluence of early behavioral dispositions, relational histories, and cognitive representations of the self and others contribute to internalizing problems, externalizing problems, and loneliness. Researchers found that, in a sample of school-age children, early aggressive behavior was directly related to maladjustment in fourth grade through subsequent relational stressors. Significant statistical associations emerged between chronic friendlessness and rejection. Self and peer beliefs partially mediated the relation between peer difficulties, internalizing problems, and loneliness.
- **Children's emotional responses and physiological reactivity to conflict** were examined as mediators and moderators in the associations between exposure to parental marital conflict and child adjustment and cognitive problems. Higher skin conductance level reactivity was a robust risk factor for various child outcomes. It also mediated boys' internalizing difficulties in the marital conflict-child functioning link and functioned as a vulnerability factor for girls'

externalizing, internalizing, and cognitive problems. Increased anger (for boys) and sadness (for girls) exacerbated adjustment difficulties related to marital conflict.

- Neglected children are at increased risk for depression. Detection and treatment of the long-term psychological sequelae of childhood neglect is extremely important. Research demonstrated that the onset of depression can begin in childhood for many neglected children. Significantly, such age-at-onset findings reinforce the need to intervene early in the lives of abused and neglected children, before depression symptoms cascade into other spheres of functioning.
- Adolescent perceptions mediate a substantial portion of the variance in the familial transmission of antisocial behavior. For instance, high-school students' perceptions of parenting behavior and disrupted parenting play a mediating role in the familial transmission of antisocial behavior across generations. This finding is consistent across parent and adolescent gender, suggesting a significant role for adolescent perceptions of parents' activities in the development and growth of antisocial behavior. The finding also demonstrates significant stability in antisocial tendencies during the course of adolescence.

COLLABORATION AND DISSEMINATION

In addition to its research initiatives, the Program works continuously to enhance collaboration with the research community, to provide information about additional research needs and findings upon which to build, and with the practice community and the public, to share research findings that can inform or improve practice. The Program director led two major Branch outreach efforts: the NCATE teacher education collaboration and the Summer Institute on Applied Research in Child and Adolescent Development, both described earlier in this report. In addition, she has engaged in various activities and contributed to publications to ensure that the findings of Program-funded research are disseminated broadly. Two Program workshops were held during the reporting period: *Teen Dating Violence: Developing a Research Agenda to Meet Practice Needs* and *Research Meets Policy: The 10th Anniversary of the Science and Ecology of Early Development Initiative*.

2006 marked the end of the Federal Child Neglect Consortium, formed in 2000 as a collaborative effort among federal agencies and grantees funded to promote collaboration among researchers from the child health, education, and juvenile justice fields in child neglect research field. Shortly thereafter, a group of the former grantees won a highly competitive R13 conference grant to continue the Consortium meetings and to further promote student development and scholarship in this area. The CDB Branch co-funds this series of scientific meetings that began in the 2007 and will continue through 2011. The collaboration, now called the Translational Research on Child Neglect Consortium, includes members of the original federal Consortium, invited guest speakers, federal partners, postdoctoral and minority fellows, and interested community partners. The goals of this effort are to advance translational science on this important public health issue and serve as a catalyst for continued research innovation. The group also provides mentoring opportunities for postdoctoral and minority fellows and new investigators.

In an unusual collaboration, the Program director also serves as a member of a scientific advisory panel for National Children's Museum's *Being Me: Inside and Out* exhibit. The exhibit will address issues of health and well-being by using child development as the focal point for its activities. The Museum's innovative approach to disseminating information on the factors promoting healthy development will allow parents, teachers, caregivers, and youth to understand these concepts through experiential learning opportunities—some of which are based on the science supported through the Branch's programs. For more information about the Museum, which will open in 2012, visit <http://www.ccm.org>.

PEDIATRIC BEHAVIOR AND HEALTH PROMOTION (PBHP) PROGRAM

The PBHP Program focuses on developmental and behavioral aspects of health risk behaviors and health promotion in individuals from infancy to young adulthood. The Program supports research and research training on biopsychosocial and developmental aspects of health behaviors with the goal of promoting healthier lifestyles and preventing injuries, diseases, and unhealthy conditions. The Program supports basic, clinical, and translational research studies, and studies utilizing secondary data analyses. Risk behaviors, such as substance use, early sexual activity, eating disorders, bullying and other antisocial behaviors, youth gambling, intentional and unintentional injuries, and youth suicide, are of central interest to this Program, as are research projects on the promotion of healthier lifestyles and prevention of diseases within the pediatric population. Health promotion topics of interest include obesity prevention, health literacy and communication, health practices and interventions, and positive youth development. Research on preventing risk behaviors is also critical because injuries are the leading cause of death in childhood and adolescence, and the causes of many adult deaths (i.e., heart attack, stroke, and cancer) have their origins in childhood behaviors, such as smoking, inadequate exercise, and improper nutrition.

In 2004, the PBHP Program supported 59 grants for a total of just more than \$12 million; by fiscal year 2007, the Program supported 68 grants for a total of just less than \$14 million. In light of the Program's focus on cross-cutting issues in pediatric health and behavior, the NICHD has signed on to a number of multi-Institute PAs as a way of encouraging investigator-initiated applications in areas of chronic illness, parenting and health outcomes in children, pain, sleep, health literacy, and improving diet and physical activity.

PROGRAM INITIATIVES

Through several multi-Institute PAs and RFAs, the Program has supported work in three key areas: health risk behaviors, health promotion, and health literacy. The Program also supports efforts on various health issues that cut across health risk prevention and health promotion, such as precursors of risky sexual behavior, mechanisms of health risk behavior change, maintenance of behavior change, chronic kidney disease in children, sleep disorders, and pain.

Childhood overweight and obesity are occurring in epidemic numbers both nationally and globally and are tied to topics related to health risk and health promotion. From 1970 to 2004, the prevalence of overweight almost tripled among U.S. preschoolers and adolescents and quadrupled among children ages six years to 11 years. Currently, about 25 million U.S. children and adolescents are overweight or obese, and the rates are higher for individuals from families of low socioeconomic status and from minority populations. Through various PAs and investigator-initiated applications, the PBHP Program has supported 21 research projects dealing with physical activity and nutrition/eating behaviors that relate to obesity prevention, examining the impact of family and peer support, developmental and social contexts, school-based interventions, which include the use of media and literacy, motivation, and use of various behavioral approaches to influence motivation in physical activity, food choices, and media use. The PBHP Program director is a member of the recently formed NICHD Obesity Research Strategic Core and has collaborated with the U.S. Department of Agriculture Center for Nutrition Policy and Promotion on the development of My Pyramid for preschoolers (visit <http://www.mypyramid.gov/preschoolers/index.html> for more information on this effort).

Health Literacy was an important focus for the DHHS even before it published its framework for disease prevention and health promotion, *Healthy People 2010*. In this framework, the DHHS defines “health literacy” 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.” Low or limited health literacy is linked with adverse outcomes, such as poor self-management of chronic diseases, fewer healthy behaviors, higher rates of hospitalization, and overall poor health. To attain health literacy, individuals and family members must be able to communicate with health professionals, understand health information and how to use health-related materials, comprehend basic health concepts and vocabulary, and utilize this information to inform health decision making and to motivate behavior (i.e., making and keeping appointments, adhering to treatment regimens, etc.). The PBHP Program director has represented the NICHD in these efforts. In June 2004, the NICHD, the Agency for Healthcare Research Quality, and multiple NIH Institutes and Offices co-sponsored *Understanding and Promoting Health Literacy* (PAR-04-116/117) to support research on this topic. Since then, the NICHD has funded six projects on health literacy; these efforts are ongoing.

SELECTED FINDINGS FROM PROGRAM-SUPPORTED RESEARCH

Within the context of risk prevention and health promotion, work supported by the PBHP Program has revealed some important and exciting findings during the four-year reporting period. Some of these findings are described below.

- Computer-based interventions can influence parental use of safety measures for young children. Although often preventable, injuries are the leading cause of death for children and adolescents. The Program supported a randomized study of families who presented with children at pediatric emergency departments to compare a tailored intervention—presented by computer—on use of car safety seats, smoke alarms, and safe poison storage to a generic printed report on child health that included advice about child development, sleep,

neighborhood safety, and dog bites. Follow-up data on parental safety knowledge, beliefs, and practices collected by telephone interview at two weeks to four weeks and at four months post-intervention revealed that intervention families who read the report and discussed it with others described greater readiness to adopt car seat and smoke alarm recommendations. Other results varied by income level; low-income parents were more likely than control parents to practice safe poison storage, while higher-income intervention parents were more likely than controls to report correct child safety seat use. Parental anxiety and reason for the hospital visit were not significantly linked to the outcomes, and there were no interactive effects. Although research on the use of computer-kiosk interventions is still in its infancy, the results of this study indicate that, in a highly vulnerable population with limited education and income, use of computer technology may be useful for promoting injury prevention in emergency departments and other child health care settings.

- Student participation in after-school care and parental involvement both positively affect social and academic functioning and physical health. In a Program-supported study assessing patterns and trajectories of social and academic functioning, physical health and individual differences in adjustment associated with participation in after-school programs. Among public school students, ages four years to eight years, researchers compared participation in after-school programs with parent care, combined parent/self-sibling care, and combined other-adult/self-sibling care. Children in after-school programs had significantly higher academic performance and motivational attributes at the end of the academic year; differences were especially notable for those rated as “highly engaged.” In addition, children in such programs were less likely to be obese at followup and showed increased rates of peer acceptance over time. In examining the other categories of after-school care, researchers found that, for children living in high-crime areas, moderate and high amounts of self care were linked to increased aggression and decreased academic performance, and that academic outcomes were more favorable if self care was combined with some after-school program participation. Mobility and neighborhood crime were significantly related to aggression in boys, but not in girls; boys who moved into high-crime neighborhoods exhibited high aggression, based on teacher and parent reports. For all children, greater amounts of organized activity participation led to increased levels of positive adjustment; further, parental support and encouragement played a positive role in children’s activity enrollment, attendance, and engagement. This study, significant because it is one of the first to examine the ecology of after-school care arrangements and the association with social and academic development over time, demonstrates that after-school programs have a buffering effect on multiple outcomes, including childhood obesity and related social consequences (peer acceptance) and childhood aggression.
- Chronic Kidney Disease in Children (CKiD) study investigators found that although a significant proportion of children with chronic kidney disease have elevated blood pressure, about one-third do not receive antihypertensive medication, suggesting an under-diagnosed disorder and an opportunity to improve treatment. Further, the use of 24-hour ambulatory blood-pressure monitoring revealed cases of hypertension that were missed by casual blood pressure monitoring. These researchers also developed a new methodology for determining glomerular filtration rates from iohexol plasma disappearance and will be doing additional tests on this methodology as the jointly funded CKiD study continues.
- Parent training can increase communication between parent and child and can enhance prevention of early sexual behavior, but the outcome is mediated by the parent-child

relationship. Increased sexual activity among young adolescents and consistent parental underestimation of children's risk of sexual behavior increases the need for evidence-based efforts in this area. To address this topic, researchers conducted an efficacy study of an audio-presented intervention (delivered via CD-ROM) to parents of fifth and sixth graders for improving communication as a way to prevent sexual activity. The intervention, designed as an easily accessible, culturally sensitive, low-cost educational product for parents, included dramatic role-model stories to help parents recognize "teachable moments" for sharing their values, expectations, and household rules with their children. Parents in the intervention group reported significantly greater communication with their children about targeted risk behaviors, higher self efficacy for discussing pubertal development and sexuality, and greater perceived influence over youths' behaviors at followup. However, family rules and support partially mediated the relationship between the intervention and the behavioral outcome and helped explain the mechanism of action for the intervention.

COLLABORATION AND DISSEMINATION

In an effort to disseminate Program-supported research results and to encourage collaboration, the PBHP Program participated in several workshops on such topics as health disparities and the impact of substance use (tobacco and alcohol). Examples include the following:

- *The Connection between Parents and Their Children* Plenary Address. The PBHP Program director was invited to deliver the plenary session at the DHHS Office of Adolescent Pregnancy Programs Care Conference, held February 2, 2007, in New Orleans. The presentation focused on parental attachment to their infants and on the role of attachment in subsequent growth, development, and behavior of children and adolescents.
- Behavior Change Consortium. In 2005, this predecessor of the Health Maintenance Center (HMC) published a special supplement to the *Annals of Behavioral Medicine* (vol. 29). This supplement included original articles about measuring tobacco-dependence treatment outcomes, screening in physical activity interventions, motivational interviewing in community-based research, implementation and evaluation of treatment fidelity for retaining study participants, and designing and planning health behavior change interventions. The publication was a pivotal achievement for the Consortium, which is now encompassed by the HMC.

FUTURE DIRECTIONS FOR THE BRANCH

In 2005, the NICHD modified its process for drafting reports to the NACHHD Council by adding a review of the Branch portfolio by a panel of experts, including not only one or more members of the NACHHD Council, but also those with expertise in research areas within the portfolio and public representatives with an interest in the research portfolio. In keeping with this process, the CDB Branch convened its expert panel (see [Appendix D](#) for participant list) on July 8, 2008, to review and discuss Branch activities and possible future research directions. The

panel included a member of the NACHHD Council, two representatives from relevant professional associations, plus individuals with expertise in developmental, cognitive, and neuro- and biopsychology, demography, pediatrics, neuroimaging, genetics, human development, and linguistics.

The panel made numerous suggestions, including a continued emphasis on supporting research that delves into the rich array of behaviors children produce, and that directly measures such behaviors using new methods and innovative approaches to continuously move the field forward. Understanding the important impact of behavior and its multiple influences and contexts on child health and development has broad implications on public health, education, national policies, and the economy. The panel's recommendations for future research directions are consolidated into four themes, which are described in the remaining sections of the report.

COGNITION, LEARNING, AND LEARNING DISABILITIES

The CDB Branch has a long history of supporting research on learning, cognition, learning disabilities, such as dyslexia and mathematics disorders, and special areas of development, including bilingualism. Such topics are inter-related and stem from research on fundamental aspects of human development; more recently, this research has involved an integration of the cognitive, neural, and genetic aspects of learning in reading, mathematics, and language. Within the context of this central theme and based on panel recommendations, the Branch will consider the following activities:

- Conduct further research on early cognition and learning in infancy; school readiness across domains; learning and learning disabilities in preschool- and school-aged children; bilingualism and language development; and the role of social and emotional development (e.g., motivation and engagement, aggression, bullying, etc.).
- Continue to build research programs in mathematics and science cognition and learning, with renewed emphasis on the learning of scientific concepts, a relatively under-represented, yet highly important area; give high priority to projects and efforts on early math and science learning.
- Support efforts on how best to present scientific concepts to diverse populations, taking into account cultural, linguistic, and socioeconomic differences that may require tailored approaches.
- Examine the nature and impact of co-morbid conditions, as well as the role of executive functions (i.e., self-regulation, working memory, etc.) in cognition and learning. These efforts should include basic research on the behavioral, genetic, and neural bases of learning and learning disabilities, as well as of language/bilingualism. They should also include work on the impact of interventions, such as medication for ADHD, on co-morbid learning disabilities. Developmental perspectives should also be considered.
- Support applied research, ranging from intervention efficacy studies to health literacy interventions, that utilizes what is learned about the development of science concepts, including concepts related to health, in children and youth.
- Develop and support research on the role of play and its importance in cognitive and social and emotional development.

- Develop and support research on the definition, measurement, and study of how children and youth develop scientific reasoning and critical thinking skills.

SOCIAL-EMOTIONAL BEHAVIORAL INTERVENTIONS

Historically, the CDB Branch has supported work on behavioral health and behavioral interventions. Because, in today's world, various stressors—such as bereavement and divorce—that children are regularly subjected to impact health and are potentially amenable to behavioral intervention, the panel recommended that the Branch continue its strong support for risk reduction and health promotion, while explicitly focusing on areas that can reduce stressors and interrupt and remediate their effects. In light of the panel's response, the Branch will consider the following activities:

- Enhance support for research on the impact of bereavement, disaster, and traumatic events (both natural and manmade) on children and families.
- Increase research efforts on exposure to violence, including the impact of individual and family violence, as well as political violence.
- Study ways to further reduce risk, including studies of multiple risk factors, in adolescence. Such research should incorporate measures of physiological responses to stress and interventions to reduce either the responses or the stresses themselves.
- Support research on common adjustment problems of children and youth that do not necessarily result in mental illness or a diagnosable condition, but that nonetheless have major impacts on learning, behavior, and adjustment. These types of subjects fall squarely within the mission of both the NICHD and the CDB Branch.
- Increase research on the impact of media on children's social and emotional development, on family interactions, and on children and youth's interpersonal interactions as well as on various areas of learning.

GENETICS AND EPIGENETICS

Research integrating or focusing on genetics and epigenetics is well poised for major growth in next five to ten years. All areas of child development research, including reading and writing, math and science cognition and learning, language, and cognitive development, could benefit from an infusion of this type of work. Within this context, the Branch will consider the following activities:

- Enhance support for studies to move beyond gene-environment interactions by studying entire pedigrees (i.e., families). The field needs preliminary work on behavioral phenotyping, and pedigree studies are a cost-effective approach to such phenotyping because they offer more genetic power and define phenotype more narrowly.
- Combine epigenetics with animal model research to encourage rapid advances. To effectively link the brain, behavior, and genes, research in which behavior is clearly understood to be the phenotypic variable holds specific promise. Including environmental factors also enhances such research because comprehensive explanations for variation in the

phenotypic presentation of different disorders can be modeled. In addition, by requesting developmental studies that include epigenetic and other approaches (i.e., chromatin remodeling and additional studies of DNA methylation), the Branch can further enhance animal model and genetic/epigenetic research.

BRAIN IMAGING AND BRAIN DEVELOPMENT

The CDB Branch has supported ground-breaking imaging research projects for decades, and the panel commended the Branch for its role in defining and establishing this scientific area. In addition, the Branch may consider the following activities:

- Establish a training workshop to assist researchers in learning how best to access and use the brain-development neuroimaging database; existing training efforts, such as the Applied Research in Child and Adolescent Development Institute (described earlier) provide ideal models for these types of training activities.
- Support imaging projects in which large multi-modal datasets are collected, and encourage projects and researchers to share and make use of these datasets, which provide unique opportunities for data mining and hypothesis testing. Such resources would not only benefit newly funded projects, but would also position the field for seminal discoveries.
- Enhance neurocognitive data by integrating multi-modal imaging data. Although considerable work has been done with structural imaging data, less has been published to describe how brain morphology and functional brain changes relate to behavior or cognition and learning in normal or abnormal brain development. Integrating imaging data into such neurocognitive projects could be very fruitful, and quickly.
- Encourage data sharing. As new large datasets are developed, continued vigilance is important to ensure that they are shared to maximize analyses opportunities and federal investment.

OTHER POSSIBLE ACTIVITIES

In addition, the panel emphasized the following general points with regard to ongoing and future research supported by the CDB Branch:

- Research on child development should address the settings and contexts in which children grow and develop. Such research will require the inclusion of children from diverse backgrounds and cultures, children living in poverty, and children from different family structures and should address potential gender differences.
- Multi-level descriptive studies are critical to fully understanding how children develop, what factors influence that development, and how influences may be carried across generations to impact both health and development.
- Studying development realistically must involve studying changes over time. Although these investigations are resource intensive, such longitudinal studies are necessary for studying many aspects of child development. The National Children's Study may present opportunities for adjunct studies, but is limited by its breadth of scope and cost; further, it

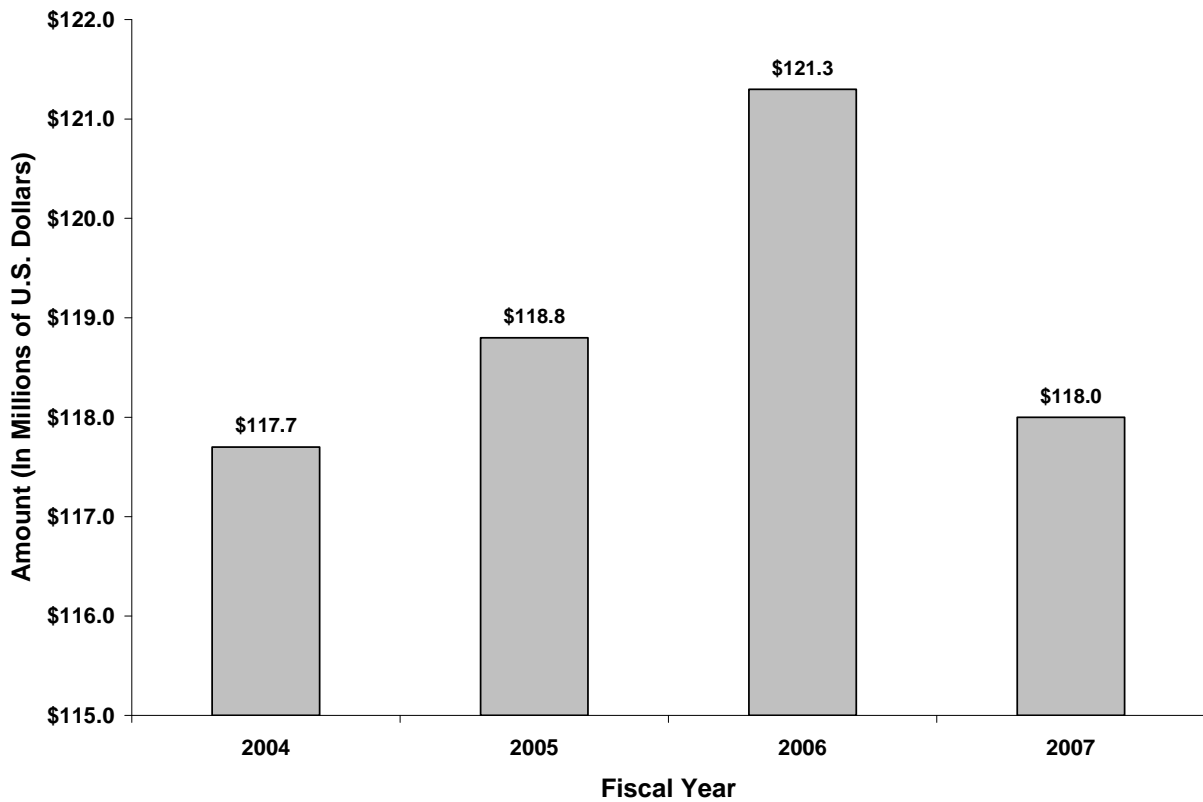
does not replace the need for targeted longitudinal studies on specific aspects of child and adolescent development.

- When possible, studies should consider international perspectives to build on work in other cultures and countries, including the impact of war, violence, famine, etc., on children's development.
- Measurement and the development of valid, replicable measurement methods are ongoing challenges for studies of child development and behavior. The need for new or more-reliable, better-validated measures is constant. The Branch, and possibly the Institute, should examine mechanisms for supporting work specific to measurement and the development of innovative methods to enhance the science of child development.
- Continued and enhanced coordination with relevant funding agencies, such as ED and ACF, should be a routine part of all Branch activities. Regularly scheduled sessions to convene relevant agencies could help to ensure that basic research findings influence the funding of more applied work, and that basic research needs are clearly defined and addressed. Similarly, communication with professional associations and advocacy organizations should continue to be a regular part of the Branch's efforts.
- Continued and enhanced dissemination efforts to provide the findings of NICHD-supported research to other researchers, practitioners in clinics, school and other settings, and the public (such as parents). As an example, lay language booklets to disseminate information about child care research could help parents in their decision making about whether to place their children in child care, at what ages, and what to look for in choosing quality child care.

FIGURES AND TABLES

Please Note: The numbers and amounts presented in these figures and tables represent unofficial figures prepared by the NICHD Referral and Program Analysis Branch. Some of the amounts may differ from those reported by the NIH Research, Condition, Disease, and Categorization Process, which provides the only official amounts for the NIH. Please visit <http://report.nih.gov/rcdc> to view official numbers and amounts for specific disease categories. All figures shown are in U.S. dollars unless otherwise indicated.

FIGURE 1: BRANCH RESEARCH FUNDING, FISCAL YEAR 2004 THROUGH FISCAL YEAR 2007



Note: Excludes training and career development funding

FIGURE 2: BRANCH FUNDING IN CURRENT AND CONSTANT DOLLARS, FISCAL YEAR 2000 THROUGH FISCAL YEAR 2007

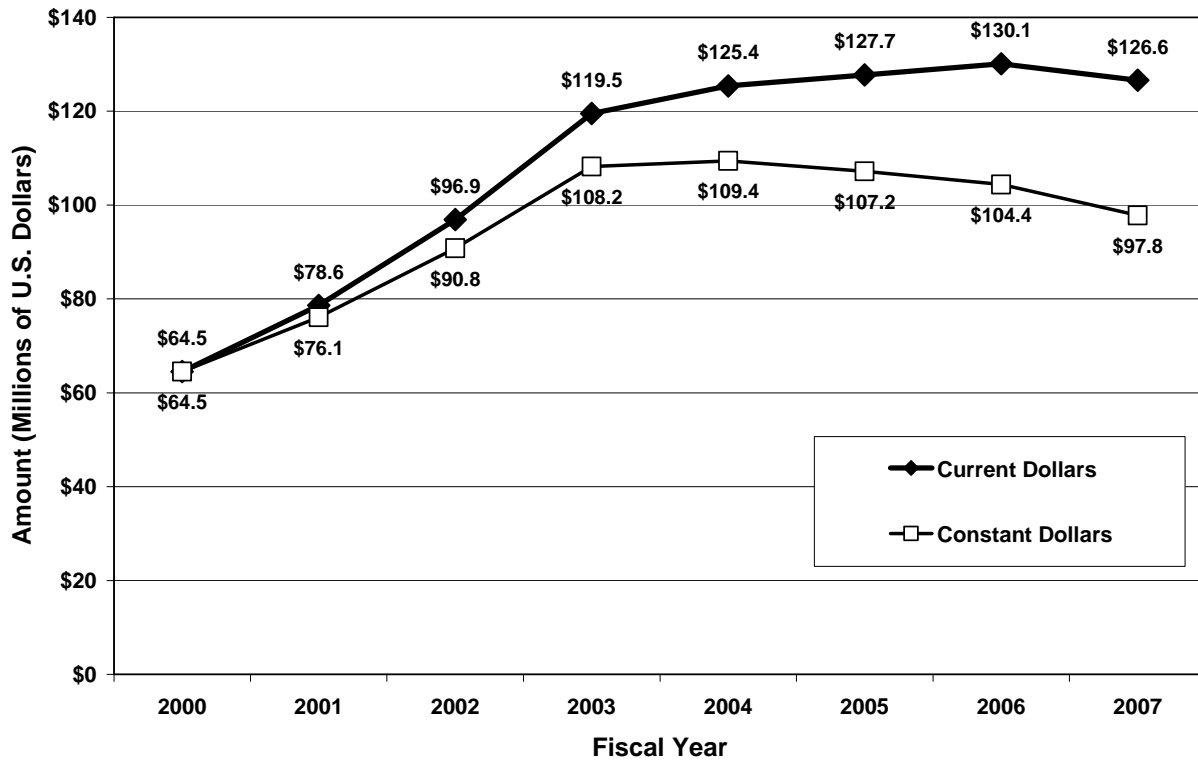
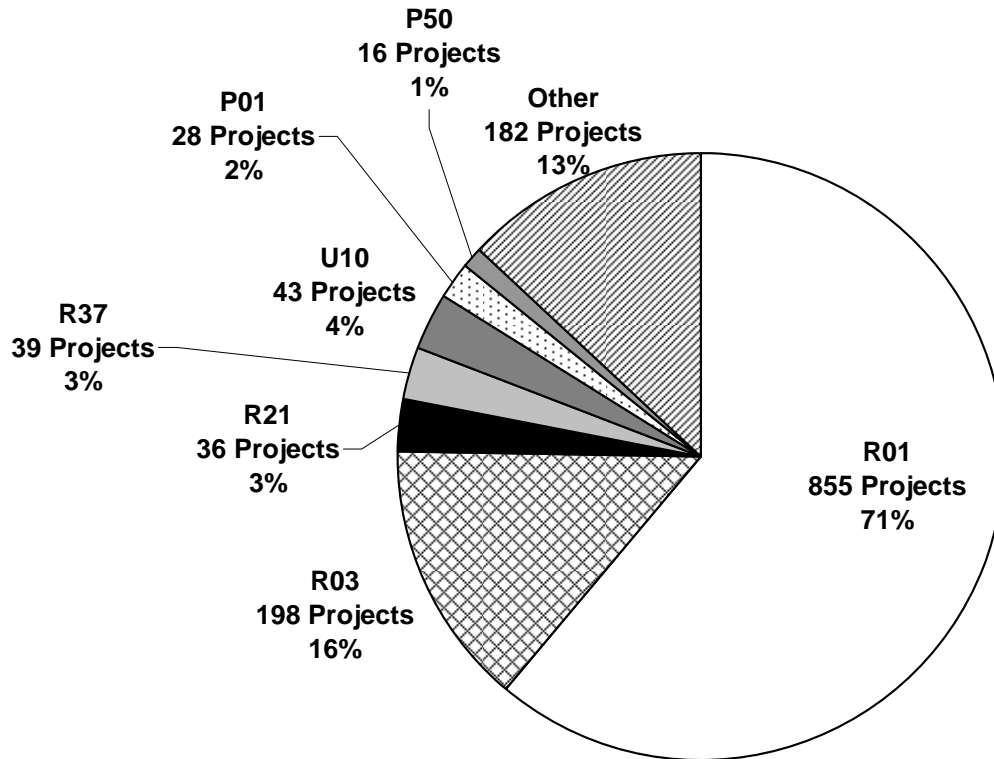


FIGURE 3: BRANCH RESEARCH GRANTS, FISCAL YEAR 2004 THROUGH FISCAL YEAR 2007



Note: The “Other” category includes the following research grant types: N01, N02, R13, R15, R24, R41, R42, R43, R44, U01, Y01, and DP1.

FIGURE 4: BRANCH RESEARCH GRANTS AND TRAINING GRANTS, FISCAL YEAR 2004 THROUGH FISCAL YEAR 2007

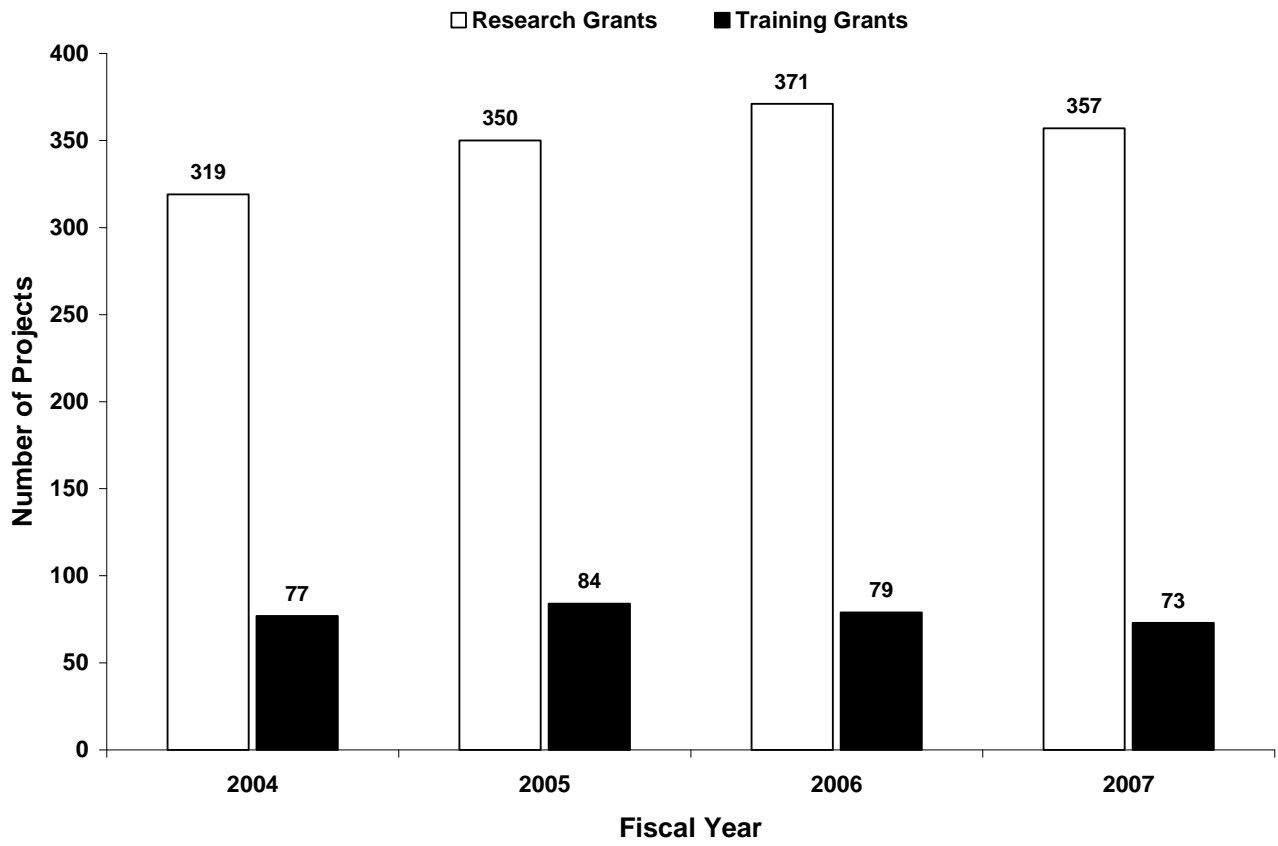
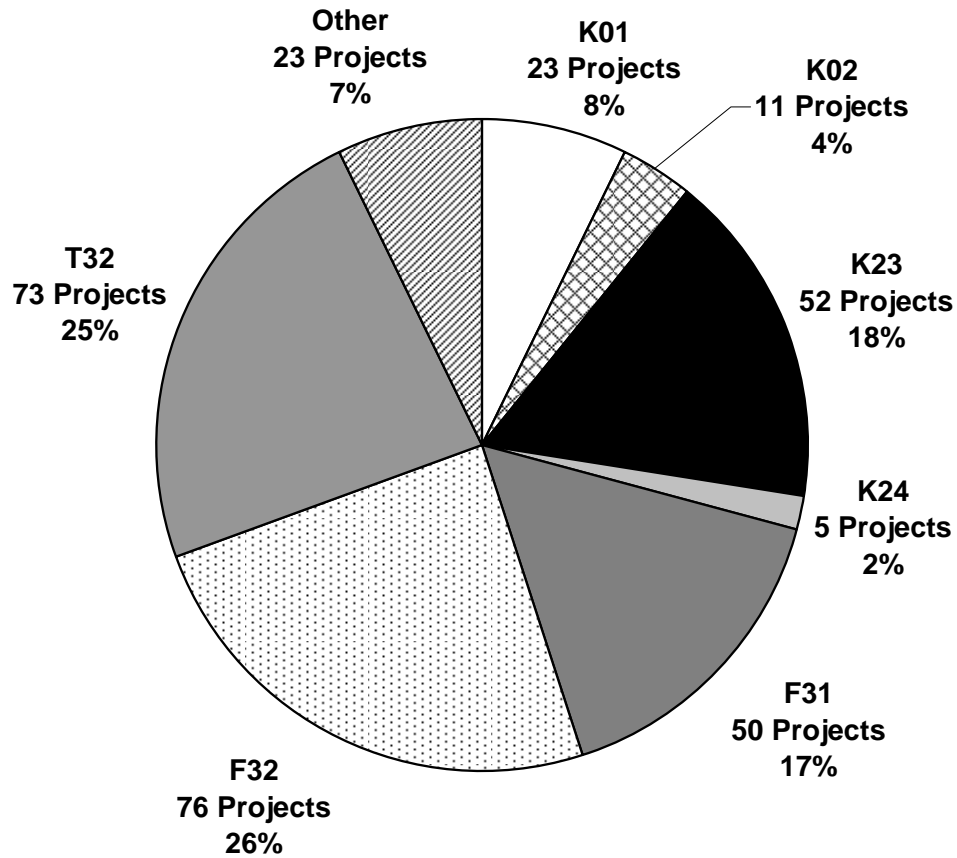
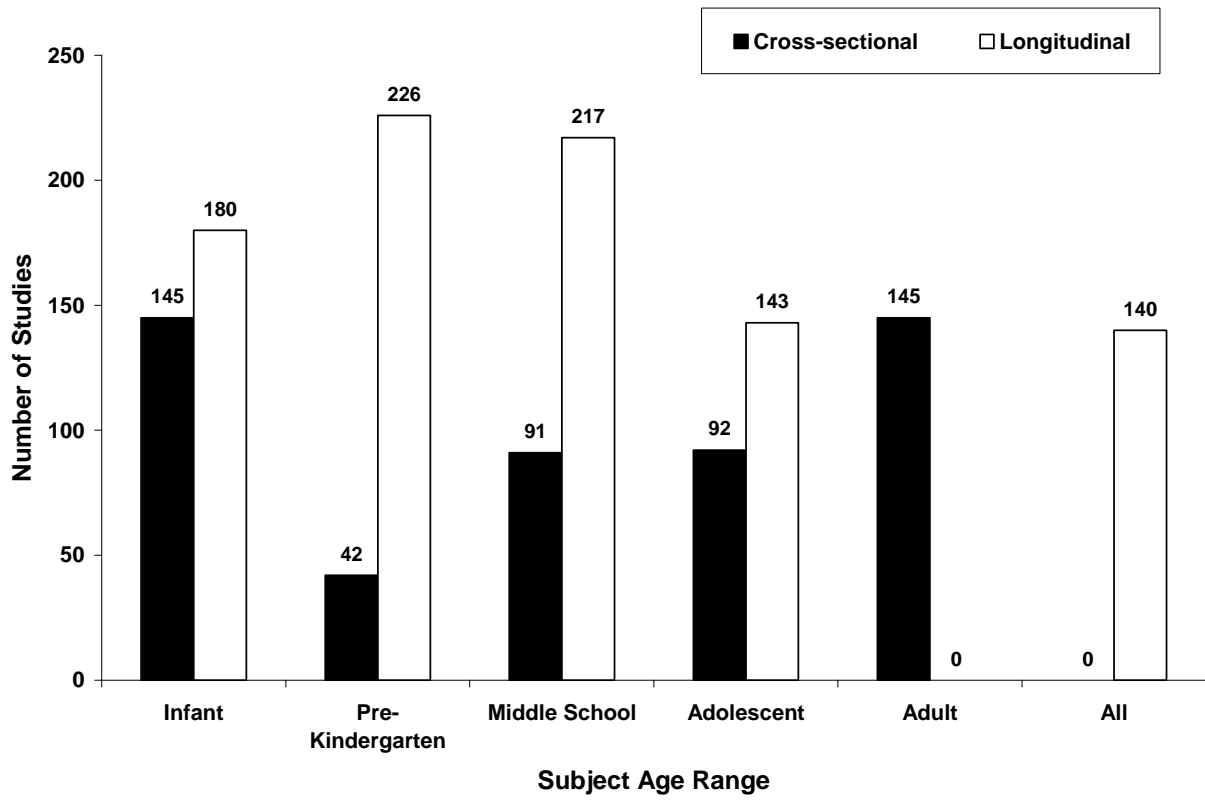


FIGURE 5: BRANCH TRAINING AND CAREER DEVELOPMENT GRANTS, FISCAL YEAR 2004 THROUGH FISCAL YEAR 2007



Note: The “Other” category includes the following types of training and career development grants: T15, K08, K99, and F33.

FIGURE 6: BRANCH-SUPPORTED TYPES OF STUDIES AND SUBJECT AGES, FISCAL YEAR 2004 THROUGH FISCAL YEAR 2007



APPENDIX A: CDB BRANCH PERSONNEL

Peggy McCardle, Ph.D., M.P.H., is the chief of CDB Branch and directs the Language, Bilingualism, and Biliteracy Program. Dr. McCardle holds a bachelor's degree in French, a Ph.D. in linguistics, and a master's degree in public health. She has been a classroom teacher and a speech-language pathologist and has held university faculty positions at South Carolina State College, the University of Mississippi, the University of Maryland, and the Uniformed Services University of the Health Sciences; she also held hospital-based clinical positions at Womack Army Community Hospital, Fort Bragg, North Carolina, and at Walter Reed Army Medical Center, Washington, D.C. Her publications address various aspects of public health and developmental psycholinguistics (e.g., language development, bilingualism, and reading). She was the NICHD liaison to the National Reading Panel, currently serves as liaison to the National Institute for Literacy, and leads and/or serves on various interagency working groups. She co-edited *The Voice of Evidence in Reading Research* (2004, Brookes Publishing), which presents information about reading research and its findings for educators, administrators, and others concerned with getting research results into the classroom; and *Childhood Bilingualism* (2006, Multilingual Matters), which addresses research issues in the development of bilingual language abilities; as well as various thematic journal issues on these and related topics.

James A. Griffin, Ph.D., is the deputy chief of the CDB Branch and directs the Early Learning and School Readiness Program. Dr. Griffin holds a B.A. *summa cum laude* in psychology from the University of Cincinnati and a Ph.D. with honors in child clinical psychology from the University of Rochester. He completed a postdoctoral fellowship in psychiatric epidemiology at the Johns Hopkins University School of Public Health. Prior to his position at the NICHD, Dr. Griffin was a senior research analyst in the Institute of Education Sciences (IES) at the U.S. Department of Education. He previously served as the assistant director for Social, Behavioral, and Education Sciences in the White House Office of Science and Technology Policy. Dr. Griffin's career has focused on research and evaluation efforts related to service systems and early intervention programs designed to enhance the development and school readiness of children from at-risk and disadvantaged backgrounds. These efforts include several large-scale evaluations of the Head Start program (while with the Administration on Children, Youth, and Families, now the Administration for Children and Families) and research on preschool curricula involving geographically diverse child care, Head Start, and state pre-kindergarten programs (while with IES). Dr. Griffin currently serves as the science officer for the 15-year longitudinal NICHD Study of Early Child Care and Youth Development, as well as the program officer for the Interagency School Readiness Consortium and the Interagency Consortium on Measures.

Lisa Freund, Ph.D., is the associate chief for neurobiological research in the CDB Branch and directs the Developmental Cognitive Psychology, Behavioral Neuroscience, and Psychobiology Program. Dr. Freund received her Ph.D. from the University of Maryland in applied developmental psychology and was an associate professor of psychiatry at the Johns Hopkins University School of Medicine and Kennedy Krieger Institute. Dr. Freund is a developmental psychologist and cognitive neuroscientist who is known for her neuroimaging studies of children from different clinical populations; she was an NICHD-supported scientist for several years. She has extensive training and experience in the fields of developmental neuroscience,

developmental psychology, learning disorders, and behavioral and molecular genetics. As part of the CDB Branch, Dr. Freund is responsible for a multi-faceted research and training program that promotes basic and applied topics to gain a deeper understanding of the linkages among genes, the developing brain, and behavior.

Fuambai Ahmadu, Ph.D., is the program specialist for the CDB Branch. Dr. Ahmadu received her doctorate in social anthropology from the Department of Anthropology at London School of Economics in September 2005 and completed a National Institute of Mental Health-sponsored postdoctoral fellowship at the Department of Human Development of the University of Chicago in January 2008. She continued as an associate in that department until June 2008. Dr. Ahmadu conducted research for five years in The Gambia as a consultant for the United Nations Children's Fund (UNICEF) and an anthropologist at the Medical Research Council laboratories in Fajara. Her research has focused on socio-cultural constructs of gender and health, as well as health-seeking behavior both in West Africa and, more recently, among African women immigrants in the Washington, D.C., metropolitan area.

Lynne Haverkos, M.D., M.P.H., directs the Pediatric Behavior and Health Promotion Program in the CDB Branch. She received her medical degree from the Medical College of Ohio and her master's in public health from the Graduate School of Public Health in Pittsburgh, Pennsylvania. She completed a fellowship in ambulatory pediatrics at the Children's Hospital of Pittsburgh and developed expertise in adolescent health, anticipatory guidance, obesity, and attention deficit-hyperactivity disorder as a practicing pediatrician. Dr. Haverkos is a board-certified pediatrician and a Fellow of the American Academy of Pediatrics. Her portfolio of grants focuses on health risk behaviors, health promotion, disease and injury prevention, development of infants born at risk, and medical adherence. She has participated in a number of interagency committees including the Surgeon General's Obesity and Inactivity Federal Planning Committee, the Surgeon General's Children's Mental Health Federal Planning Committee, the Interagency Committee on Emergency Medical Services for Children Research, the Interagency Coordinating Committee on Fetal Alcohol Syndrome, the trans-NIH Working Group on Chronic Fatigue Syndrome, and the trans-NIH Sleep Research Coordinating Committee. She served as a federal expert to the Science and Program Review Subcommittee of the Centers for Disease Control and Prevention's Advisory Committee for Injury Prevention and Control, as an active member of the Behavior Change Consortium, and as a representative to the Department's Interagency Committee on Smoking and Health. She participates actively in the Chronic Kidney Disease in Children Advisory Committee and the Health Maintenance Consortium.

Valerie Maholmes, Ph.D., C.A.S., directs the Social and Affective Development/Child Maltreatment and Violence Program in the CDB Branch. Dr. Maholmes holds a Ph.D. in educational psychology from Howard University and a six-year degree with advanced study in school psychology, with a concentration in neuropsychological and psychosocial assessments, from Fairfield University. Prior to her position at NICHD, Dr. Maholmes was a Fellow with the Society for Research in Child Development and the American Association for the Advancement of Sciences. Her research and clinical work has focused on the psychosocial, cultural, and environmental factors that influence the children's learning and development, particularly low-income minority children. She held a faculty position at the Yale University Child Study Center, where she served in numerous capacities, including the director of research and policy for the

school development program, the Irving B. Harris Assistant Professor of Child Psychiatry, and the endowed professorial chair for social policy. Dr. Maholmes served two terms as a member of the New Haven Board of Education, for which she was vice president/secretary and chair of the curriculum committee. She also served a term as the president of the Board of Directors for the Arnold Gesell Institute of Human Development.

Kathy Mann Koepke, Ph.D., directs the Mathematics and Science Cognition and Learning: Development and Disorders Program in the CDB Branch. Dr. Mann Koepke completed her Ph.D. at the University of North Carolina, Chapel Hill, in applied physiological psychology (cognitive neuroscience) and her National Research Service Award postdoctoral fellowship at the University of Iowa College of Medicine in the Department of Pediatrics. Dr. Mann Koepke served NIH first at the National Institute on Aging in the Behavior and Social Research Branch, then at the National Institute of Nursing Research, where she was the director of the Neuroscience Program. Prior to joining the NIH, she held several faculty appointments, including more than a decade as faculty in neurology at Washington University-St. Louis School of Medicine.

Brett Miller, Ph.D., directs the Reading, Writing, and Related Learning Disabilities Program in the CDB Branch. Dr. Miller completed his Ph.D. at the University of Massachusetts at Amherst in cognitive psychology and a postdoctoral fellowship at Haskins Laboratories in reading research. Dr. Miller's research program focuses on developing and supporting research and training initiatives to increase knowledge relevant to the development of reading and written-language abilities for learners with and without disabilities. This program supports research that includes work with diverse groups and includes a range of ages across the lifespan. Before joining the NICHD, Dr. Miller held the position of associate research scientist at the IES at the U.S. Department of Education. In this capacity, he served as program official for the National Center for the Study of Adult Learning and Literacy, the Mathematics and Science Education Research Program, and co-program officer for the Cognition and Student Learning Program.

Tiffany Ray is the CDB Branch secretary, assigned through the Division of Extramural Activities and Support (DEAS). She attended Prince George's Community College. Ms. Ray is co-chair of Workshop Support Group within DEAS and provides conference, meeting, and workshop planning services for the Branch. She also manages travel planning for the Branch and mentors other DEAS personnel in travel and workshop organization, while also providing technical and administrative support to the CDB Branch personnel, including work on the use of electronic technology for Web conferences and virtual meetings.

Wanda Hawkes is also assigned to the CDB Branch through DEAS. She attended Howard University in Washington, D.C. Currently she provides administrative, general office and technical support, travel planning, and literature and citation research (using PubMed). Ms. Hawkes also serves the Branch as a conference and workshop planner and manages Center for Information Technology Web conference accounts for the Branch. She, too, is assisting with work on new Web conference applications.

APPENDIX B: BRANCH-SUPPORTED RESEARCH CONSORTIA AND NETWORKS*

- NICHD Study of Early Child Care and Youth Development (SECCYD) Network, 1991-2009
- Learning Disability Research Centers' Consortium, 1998-present
- Bilingualism/Biliteracy Research Consortium, 2005 to present; previously the Development of English Literacy in Spanish Speaking Children (DELSS) Consortium, 2000-2005
 - o DELSS co-funded by the Institute of Education Sciences (IES) at U.S. Department of Education (ED)
- Adult Literacy Research Consortium, 2002-2008
 - o Co-funded by National Institute for Literacy and Office of Vocational and Adult Education (OVAE) at ED
- Adolescent Literacy Research Consortium, 2003-2008
 - o Co-funded by Office of Special Education and Rehabilitation Services (OSERS) and OVAE at ED
- Brain Development Cooperative Group, 2000-present
 - o Co-funded by the National Institute of Mental Health (NIMH), National Institute of Neurological Disorders and Stroke, National Institute on Drug Abuse (NIDA), and the NIH Neuroscience Blueprint
- Health Maintenance Consortium (HMC), 2003-present
 - o Co-funded by National Cancer Institute, National Heart, Lung, and Blood Institute, National Institute on Aging, National Institute on Alcoholism and Alcohol Abuse, NIDA, National Institute of Diabetes and Digestive and Kidney Diseases, NIMH, and the National Institute of Nursing Research
- Interagency School Readiness Consortium (ISRC), 2003-present
 - o Co-funded by the Agency for Children and Families (ACF)/Head Start and the Office of the Assistant Secretary for Planning and Evaluation (ASPE) at the U.S. Department of Health and Human Services (DHHS), and IES and OSERS at ED
- Interagency School Readiness Measurement Consortium (ISRMC), 2003-present
 - o Co-funded by ACF/Head Start and ASPE at DHHS, and IES and OSERS at ED
- Mathematical Cognition and Math Disability Consortium, 2003-present
 - o Co-funded (2003-2007) by OSERS at ED

* If no co-funding agency or organization is listed, the Consortium or Network is funded entirely by the NICHD.

APPENDIX C: BRANCH PUBLICATIONS 2004-2008

BOOKS

- Berch, D., & Mazzocco, M. (2007). *Why Is Math So Difficult for Some Children?* Baltimore, MD: Brookes Publishing, Inc.
- Colombo, J., McCardle, P., & Freund, L. (2008). *Infant Pathways to Language: Methods, Models, and Research Directions*. New York, NY: Lawrence Erlbaum Associates, Taylor & Francis Group.
- McCardle, P., & Chhabra, V. (2004). *The Voice of Evidence in Reading Research*. Baltimore, MD: Paul Brookes.
- McCardle, P., & Hoff, E. (2006). *Childhood Bilingualism: Research on Infancy through School Age*. Clevedon, United Kingdom: Multilingual Matters.

BOOK CHAPTERS

- Freund, L. (2008). Developmental foundations for successful cognition and learning. In J.A. Olivieri (Ed.), *Healthy Development from One to Three* (pp. 191-206). Brasilia: Brasilia Press.
- Freund, L. (2008). Neuroimaging resources for investigating language-brain development in infancy. In J. Colombo, P. McCardle, & L. Freund (Eds.), *Infant Pathways to Language: Methods, Models, and Research Directions*. New York, NY: Lawrence Erlbaum Associates, Taylor & Francis Group.
- Hoff, E., & McCardle, P. (2006). Introduction. In P. McCardle & E. Hoff (Eds.), *Childhood Bilingualism: Research on Infancy through School Age*. Clevedon, United Kingdom: Multilingual Matters.
- McCardle, P. (2006). Foreword. In D. August and T. Shanahan (Eds.), *Developing Literacy in Second-Language Learners: Report of the National Literacy Panel for Minority Language Children and Youth*. Mahwah, NJ: Lawrence Erlbaum Associates.
- McCardle, P. (2006). Preface. In G. Rosen (Ed.), *The Dyslexic Brain: New Pathways to Neuroscience Discovery*. Mahwah, NJ: Lawrence Erlbaum Associates.
- McCardle, P., & Cooper, J. (2004). Next steps in the study of genetics and language disorders. In M. Rice & S. Warren (Eds.), *Developmental Language Disorders: From Phenotypes to Etiologies* (pp. 373-380). Mahwah, NJ: Lawrence Erlbaum Associates.
- McCardle, P., & Miller, B. (2009). Why we need evidence-based practice in reading and where to find that evidence. In S. Rosenfield & V. Berninger (Eds.), *Implementing Evidence-Based Academic Interventions in School Settings* (pp. 19-48). England, United Kingdom: Oxford University Press.

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- McCardle, P., Freund, L., & Marcus, G. (2008). Pathways to infant language research. In J. Colombo, P. McCardle, & L. Freund. (Eds.), *Infant Pathways to Language: Methods, Models, and Research Directions* (pp. 297-304). New York, NY: Lawrence Erlbaum Associates, Taylor & Francis Group.
- McCardle, P., Keller-Allen, C., & Shuy, T. (2008). Learning disability identification: How does it apply to English-language learners? In E. Grigorenko (Ed.), *Educating Individuals with Disabilities: IDEIA 2004 and Beyond* (pp. 143-170). New York, NY: Springer Publishing Co.

THEMATIC JOURNAL ISSUES

- Journal of American Indian Education*, Special Issue: Improving Academic Performance Among American Indian, Alaska Native, and Native Hawaiian Students: Report of a National Colloquium, Part I: Programs & Practices. W. Demmert & P. McCardle, editors. Tempe, AZ: Arizona State University, Center for Indian Education. Vol. 45, Issue 2, 2006.
- Journal of American Indian Education*, Special Issue: Improving Academic Performance Among American Indian, Alaska Native, and Native Hawaiian Students: Report of a National Colloquium, Part II: The Research. W. Demmert & P. McCardle, editors. Tempe, AZ: Arizona State University, Center for Indian Education. Vol. 45, Issue 3, 2006.
- Language, Speech, and Hearing Services in the Schools*, Special Issue: Research on Bilingual Literacy Development in Spanish-Speaking Children. P. McCardle & S. Nixon, editors. Rockville, MD: American Speech-Language-Hearing Association. Vol. 38, 2007.
- Learning Disabilities Research and Practice*, Special Issue: Learning Disabilities in English-Language Learners: Research Issues and Future Directions. P. McCardle, J. Mele-McCarthy, K. Leos, & L. Cutting, editors. Hoboken, NJ: Blackwell-Wiley Publishers. Vol. 20, Issue 1, 2005.
- Perspectives: The International Dyslexia Association*, Special Issue: English Learners. P. McCardle, editor. Spring, 2005.
- Scientific Studies of Reading*, Special Issue: Reading Comprehension Assessment. T. Shuy, P. McCardle, & E. Albro, guest editors. Mahwah, NJ: Lawrence Erlbaum Associates. Vol. 10, No. 3, 2006.
- Topics in Language Disorders*, Special Issue: English-Language Learners: Development & Intervention. P. McCardle & C. Leung, editors. Philadelphia, PA: Lippincott Williams & Wilkins. Vol. 26, Issue 4, 2006.

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- Almli, C.R., Rivkin, M.J., McKinstry, R.C., & the Brain Development Cooperative Group. (2007). The NIH MRI Study of Normal Brain Development: Infants, Toddlers, and Preschoolers. *Neuroimage*, 35(1), 308-325.
- Bloch, M., Haverkos, L., & Jobe, J.B. (2008). Tobacco use and secondhand smoke exposure of children and youth with serious chronic illness: Establishing an agenda for research and action. *Journal of Pediatric Psychology*, 33(2), 111-112.
- Demmert, W., McCardle, P., & Leos, K. (2006). Conclusions and commentary. *Journal of American Indian Education*, 45(2), 77-88.
- Demmert, W., McCardle, P., Mele-McCarthy, J., & Leos, K. (2006). Preparing Native American children for academic success: A blueprint for research. *Journal of American Indian Education*, 45(3), 92-106.
- Evans, A.C., & Brain Development Cooperative Group. (2006). The NIH MRI Study of Normal Brain Development. *Neuroimage*, 30, 184-202.
- Garcia, G., McCardle, P., & Nixon, S. (2007). Prologue. *Language, Speech, and Hearing Services in the Schools*, 38, 1-3.
- Illes, J., Kirschen, M., Edwards, E., Freund, L., Stanford, L.R., Choo, M., & Working Group on Incidental Findings in Brain Imaging Research. (2006). Incidental findings in brain imaging research. *Science*, 311, 783-784.
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- McCardle, P., & Chhabra, V. (2005). Motivation and commitment in the interest of science and our children. *Phi Delta Kappan*, 86(6), 448-451.
- McCardle, P., & Chhabra, V. (2006). Commentary. *Journal of Elementary Education*, 107(2), 1.
- McCardle, P., & Demmert, W. (2006). Introduction. *Journal of American Indian Education*, 45(2), 1-5.
- McCardle, P., & Demmert, W. (2006). Introduction. *Journal of American Indian Education*, 45(3), 1-4.
- McCardle, P., & Leung, C. (2006). Foreword. *Topics in Language Disorders*, 26(4), 302-304.
- McCardle, P., Cooper, J., & Freund, L. (2005). Language and genetics: Needs and opportunities. *Journal of Applied Psycholinguistics*, 26(1), 129-135.
- McCardle, P., Mele-McCarthy, J., & Leos, K. (2005). English-language learners and learning disability: A research agenda and implications for practice. *Learning Disabilities Research & Practice*, 20(1), 57-68.
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- Nixon, S., & McCardle, P. (2007). Epilogue: Commentary and Next Steps. *Language, Speech, and Hearing Services in the Schools*, 38.

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APPENDIX D: EXPERT PANEL MEMBERS

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* Denotes NACHHD Council member

**APPENDIX E: CDB BRANCH FUNDING INITIATIVES, FISCAL YEAR 2004
THROUGH FISCAL YEAR 2007**

Title	Activity Code	Announcement Number
Behavioral and Social Research on Disasters and Health	R01 R21 R03	PA-07-141 PA-06-452 PA-06-453
Behavioral and Social Science Research on Understanding and Reducing Health Disparities	R01 R21	PAR-07-379 PAR-07-380
Brain Disorders in the Developing World: Research Across the Lifespan	R01 R21	PAR-08-112 PAR-08-113
Chronic Illness Self-Management in Children and Adolescents	R01 R03 R21	PA-07-097 PA-07-098 PA-07-099
Community Participation in Research	R01	PAR-08-074
Community Participation Research Targeting the Medically Underserved	R01 R21	PAR-08-075 PAR-08-076
Improving Diet and Physical Activity Assessment	R01 R21	PAR-07-259 PAR-06-103
Interagency School Readiness Consortium	U01	RFA-HD-07-008
Learning Disabilities: Multidisciplinary Research Centers	P50 P50	RFA-HD-04-027 RFA-HD-00-003
Limited Competition: Continuation of the Chronic Renal Insufficiency Cohort Study	U01	RFA-DK-07-502
Mathematical Cognition and Specific Learning Disabilities	R01	RFA-HD-07-005
Mechanisms, Models, Measurement, and Management in Pain Research	R01 R21 R03	PA-07-282 PA-06-542 PA-06-543
Methodology and Measurement in the Behavioral and Social Sciences	R21	PA-06-343
Neurotechnology Research, Development, and Enhancement (Small Business Innovative Research)	R43/R44	PA-07-389
Parenting Capacities and Health Outcomes in Youths and Adolescents	R01 R21	PA-07-061 PA-06-530
Reducing Health Disparities Among Minority and Underserved Children	R21 R01	PA-07-391 PA-07-392
Research in Adolescent Literacy	R01	RFA-HD-03-112
Research on Adult and Family Literacy	R01	RFA-HD-02-004
Research on Emergency Medical Services for Children	R01	PA-07-269
Research on Ethical Issues in Human Subjects Research	R01 R03 R21	PA-07-277 PA-06-367 PA-06-368

Title	Activity Code	Announcement Number
Research on Interventions for Child Abuse and Neglect	R01	PA-07-437
Research on Sleep and Sleep Disorders	R01 R21	PA-07-140 PA-06-238
School-based Interventions to Prevent Obesity	R01 R03	PA-07-180 PA-06-417
Secondary Data Analyses Based on the NICHD Study of Early Child Care and Youth Development	R03	PA-06-284
The Influence of Religiosity and Spirituality on Health Risk Behaviors in Children and Adolescents	R01 R03 R21	PA-07-181 PA-06-402 PA-06-403
The Science and Ecology of Early Development (SEED)	R03 R01	PA-08-06 PA-08-069
Translational Research in Eating Disorders	R01	PA-07-285
Typical/Disordered Language: Phenotype Assessment Tools	R21	RFA-DC-05-001
Understanding and Promoting Health Literacy	R03 R01	PAR-07-019 PAR-07-020
Understanding Mechanisms of Health Risk Behavior Change in Children and Adolescents	R01/R21	PA-04-121

APPENDIX F: BRANCH-SPONSORED/CO-SPONSORED WORKSHOPS AND CONFERENCES

DEVELOPMENTAL COGNITIVE PSYCHOLOGY, BEHAVIORAL NEUROSCIENCE, AND PSYCHOBIOLOGY (DEV-CBNP) PROGRAM

- *Pediatric Functional Neuroimaging: A Trans-NIH Workshop.* The purpose of this trans-NIH co-sponsored workshop, held May 24-26, 2004, was to foster translational research involving pediatric functional brain development using functional neuroimaging to study both normal brain development and developmental deviations across a variety of disorders. Speakers at this conference concentrated on design and analysis issues for pediatric development studies, domains and key paradigms with high clinical relevance, advances in functional Magnetic Resonance Imaging (MRI) and integration of imaging across modalities, and data sharing. A summary and a selection of the workshop presentation are available at http://www.ninds.nih.gov/news_and_events/proceedings/PediatricFunctionalNeuroimagingWorkshopSummary.htm.
- *Reward Neurocircuitry in Adolescent Development and Decision Making.* This trans-NIH co-sponsored workshop arose from the idea that improved understanding of reward neurocircuitry in adolescent development and decision making may offer opportunities for prevention of and early intervention for illness. To assess the state of knowledge and research needs, this interdisciplinary workshop was held on January 20, 2006. Attendees included preclinical and clinical researchers, neurobiological and behavioral scientists, pediatricians, and developmental psychologists. Questions of interest included the following: What is known about the functional neuroanatomy and neurochemistry of reward neurocircuitry in humans? What is known about changes in reward/decision-making circuitry over the course of adolescence? How are developmental changes in reward circuitry impacted by puberty? What are the major methodological considerations in designing research to address these questions? A summary of the major themes discussed at the meeting is available at <http://www.nimh.nih.gov/research-funding/scientific-meetings/2006/reward-neurocircuitry-in-adolescent-development-and-decision-making.shtml>.
- *Neuroimaging in Sleep Research.* This trans-NIH workshop, held March 29-30, 2006, convened a group of experts in neuroimaging and sleep disorders to assess the current state of knowledge, identify gaps in understanding how neuroimaging can be best utilized to identify and test critical hypotheses for advancing sleep research across the lifespan, and provide recommendations for future collaborative and interdisciplinary research opportunities. A summary of the topics discussed at the workshop is available at <http://www.nhlbi.nih.gov/meetings/workshops/neuroimaging.pdf>.

EARLY LEARNING AND SCHOOL READINESS (ELSR) PROGRAM

- *The Use of Effect Size Measures in Research on Young Children and Their Families.* The ELSR Program director attended and chaired a session on Program research at this meeting, which was funded by multiple federal agencies and was held on March 5, 2007, in Washington, D.C. Presentations by experts in the fields of methodology, statistics, epidemiology, economics, and evaluation provided foundational understanding of effect sizes including their purpose, calculation, and interpretation, critically examined the factors affecting the interpretation of effect sizes, and made recommendations about the use of effect sizes in policy-relevant research with children and families. Additional information on this meeting is available at http://www.acf.hhs.gov/programs/opre/other_resrch/effect_sizes/index.html#overview.
- *Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) First-Release Conference.* This conference, sponsored by the NICHD, the NIH Office of Behavioral and Social Science Research (OBSSR), and the National Center for Education Statistics in the U.S. Department of Education (ED), was held May 8-10, 2007, on the NIH campus. A total of 18 researchers presented findings from secondary data analyses of the ECLS-B dataset through age 24 months. More information on this conference is available at <http://www.nichd.nih.gov/about/meetings/2007/050807.cfm>. Presenters from this meeting have submitted their conference papers for publication.
- *Intervening Early: Progress and Opportunities in Child Service Settings.* This conference, sponsored by multiple agencies in September 2007, aimed to review existing prevention programs for children, ages birth to five years, and their families that are designed to improve child, parent, and family outcomes in a variety of domains (e.g., social and emotional development, mental health, education, parenting, substance use, family functioning), with a particular focus on programs delivered within child service settings. Additional information about this conference is available at <http://www.drugabuse.gov/whatsnew/meetings/childservice/>.
- *Language and Literacy Development in Young Language-Minority Children: Research, Policy, and Practice.* This workshop, sponsored by multiple agencies in April 2008, convened researchers, policy makers, and practitioners to discuss the implications of recent research on program approaches for English-language learning students. Additional information on this workshop is available at <http://researchconnections.org/Discover?displayPage=meetings%5Cell%5Cindex.jsp>. In addition, the Administration for Children and Families (ACF) plans to publish a summary of the workshop proceedings.

LANGUAGE, BILINGUALISM, AND BILITERACY (LBB) PROGRAM

- *The Relationship of Genes, Environment, and Developmental Language Disorders: Part II—Planning for the Future.* This workshop, held in September 2003, and co-sponsored by the Merrill Advanced Studies Center and the National Institute on Deafness and Other Communication Disorders (NIDCD), included NICHD participation and resulted in both a

Request for Applications (RFA) and a jointly authored chapter by the NIDCD and NICHD representatives at that workshop; the chapter was included in a volume that resulted from the workshop and served as a partial basis for the RFA.

- *Identification of Learning Disabilities in English-Language Learning Students.* Two consecutive conferences were held in October 2004 (Santa Fe, New Mexico) and March 2005 (Washington, D.C.). One or both of these workshops were jointly sponsored by several agencies and organizations, including: the NICHD and the NIH OBSSR; multiple offices of ED; the National Institute for Literacy (NIFL); the Bureau of Indian Affairs; Western Washington University; the International Reading Association (IRA); Educational Testing Services; the American Speech-Language-Hearing Association (ASHA); the Administration for Native Americans; the American Indian Higher Education Consortium; the Council of Chief State School Officers; the National Congress of the American Indian; the National Indian Education Association; the National Indian School Boards Association; the Northwest Regional Educational Laboratory; the Santa Fe Indian School; and the RAND Corporation. Two thematic journal issues were produced based on these conferences, the latter of which focused more specifically on the identification of learning disabilities in Native American (e.g., American Indian, Alaska Native, and Native Hawaiian) students.
- *Childhood Bilingualism: Current Status and Future Directions.* To take stock of the work in bilingualism and to promote synergy across various disciplines and spur high-quality research in this area, the NICHD organized a workshop, held in April 2004, on bilingual development. This event was co-sponsored by Office of English Language Acquisition (OELA) and the Office of Special Education and Rehabilitation Services at ED, with support from NIFL, the American Federation of Teachers, the IRA, and ASHA. Leading researchers in the fields of language development (including cross-linguistic work), bilingual development, and adult bilingualism convened for this event. A summary document is available at http://www.nichd.nih.gov/publications/pubs/upload/Childhood-Bilingualism_2005.pdf. A resulting volume on this workshop is also available. To date, this work has stimulated additional research on language and cognitive development in bilinguals.
- *Infant Pathways to Language: Methods, Models, and Research Directions.* Because of the CDB Branch's efforts on early cognitive and language development, the LBB and Dev-CBNP Program directors joined with colleagues at the University of Kansas to organize a workshop on this topic. The workshop, co-sponsored by the Merrill Center for Advanced Studies and the NICHD, took place in September 2005. Goals for the event included taking stock of the current state of the field, examining existing paradigms and methods, and looking at potentially innovative approaches, as well as at establishing a research agenda for the study of infant language and cognition. In the resulting volume, *Infant Pathways to Language*, the final chapter (McCardle, Freund, & Marcus, 2008) describes important areas related to possible future work; such areas include: development of innovative methods, measures, and approaches to offer potential for examining new questions and old, but unanswered, questions by approaching them in new ways. Additional topics include the role of social cognition in language development, the roles of statistical learning and rules and how these might interact, what aspects of language are heritable versus what aspects are most significantly impacted by context and experience, and how best to move beyond or enhance the use of paradigms, such as the preferential-looking paradigm. Program staff anticipate

that this volume will stimulate innovative and creative research applications in the area of infant language and cognition.

- *English-Language Learners: Research Findings, Next Steps, and Implications for Practice.* The NICHD and the IRA held a research agenda-building conference in October 2006, as part of the NICHD-IRA Partnership. The OELA at ED, NIFL, Teachers of English for Speakers of Other Languages, and the National Association of Bilingual Education were also partners in this effort. A brief summary is included in an IRA publication available at http://www.reading.org/publications/reading_today/samples/RTY-0706-brainstorming.html. In addition, the IRA is preparing a research synthesis on English-language learner instruction for potential journal publication. A companion document, *Tapestry for Teachers of English-Language Learners*, was also developed for teachers and is posted on the Teachers of English to Speakers of Other Languages, Inc., Web site at http://www.tesol.org/s_tesol/cat_tapestry.asp?CID=1585&DID=8732.

SOCIAL AND AFFECTIVE DEVELOPMENT/CHILD MALTREATMENT AND VIOLENCE (SAD/CMV) PROGRAM

- *Making Prevention of Child Maltreatment a National Priority—Implementing Innovations of a Public Health Approach, Surgeon General’s Workshop.* The intent of this 2005 workshop was to generate ideas for eliminating obstacles to change, and identifying opportunities for advancing innovations in science, service delivery, care coordination, and prevention. A summary of this event is available at <http://www.surgeongeneral.gov/topics/childmaltreatment/index.html>.
- *The Effects of Electronic Media on the Cognitive, Social, and Emotional Development of Children and Adolescents.* This 2006 workshop was jointly funded by the NICHD, the Kaiser Family Foundation, and the NIH OBSSR. It focused on media use in home, school, and social environment; media influences on social, emotional, and cognitive development with emphasis on content and context; and research methodology and theory. More information about the meeting is available at <http://www.nichd.nih.gov/about/meetings/2006/electronicmediaconf.cfm>.
- *Teen Dating Violence: Developing a Research Agenda to Meet Practice Needs.* This scientific workshop, co-sponsored by the U.S. Department of Health and Human Services and the U.S. Department of Justice, sought to bridge the gap between research and practice in the area of teen dating violence. Federal agencies need to collaborate in pursuit of research and service programs that address this critically important topic and shed light on not only the etiologies, but also on the impacts of teen dating violence. The Branch co-funded this meeting, and the Program’s director is actively involved in the federal interagency workgroup, which coordinates these efforts. For more information on this workshop, visit <http://www.ojp.usdoj.gov/nij/topics/crime/violence-against-women/workshops/teen-dating-violence-agenda.htm>.
- *Research Meets Policy: The 10th Anniversary of the Science and Ecology of Early Development (SEED) Initiative.* The Program Announcement for the SEED initiative, jointly developed and overseen by CDB Branch and the NICHD Demographic and Behavioral Sciences (DBS) Branch in collaboration with the National Institute of Drug Abuse, was re-

issued in 2008. Because the annual grantee meeting marked the 10th anniversary of this important initiative, the CDB and DBS Branches, which co-sponsored this meeting, invited federal agencies and organizations involved in the early conceptualization of SEED to participate and provide commentary. Participants, including representatives from Office of the Assistant Secretary for Planning and Evaluation, ACF, the Children's Bureau, and Child Trends, Inc. (a D.C.-based independent non-partisan children and family research center), discussed findings from SEED research that could inform policies and influence design of service delivery programs to have an impact on child development.

PEDIATRIC BEHAVIOR AND HEALTH PROMOTION (PBHP) PROGRAM

- *Health Literacy Research.* In December 2008, the NICHD and the OBSSR coordinated a one-day workshop for health literacy grantees to discuss lessons learned and to be learned in the field of health literacy. Topics included methodology and measurement of health literacy, actionable research, special populations, and quantitative literacy. This meeting immediately preceded the *NIH Summit: The Science of Eliminating Health Disparities* (December 16-18, 2008), sponsored by the National Center for Minority Health and Health Disparities, which also included health literacy presentations. Visit <http://www.blsmmeetings.net/2008healthdisparitiessummit/> for more information.
- *State-of-the-Science Conference on Tobacco Control.* The PBHP Program director participated with other members of the NIH Tobacco and Nicotine Research Interest Group in planning this conference, held June 12-14, 2006, on the NIH main campus. The conference recognized the serious public health problem resulting from tobacco use in the United States, as well as the national quality-of-care problem, which is created by adult smokers who have the desire to quit smoking, but who are not participating in effective intervention programs. The need for smoking prevention programs for youth and the need to understand net population harms related to the use of smokeless tobacco were important conclusions reached by the participants.
- *Improving Educational Outcomes for Students with Intellectual and Behavioral Disabilities Due to Prenatal Alcohol Exposure.* The Education Work Group of the Interagency Coordinating Committee on Fetal Alcohol Syndrome sponsored this symposium, held July 12-13, 2007, in Rockville, Maryland. The PBHP Program director served on the planning committee for this symposium and was a facilitator for several break-out group sessions during the event. The meeting focused on identifying ways to improve educational outcomes on a multitude of levels, including family, school, medical, community, and national levels, for students with fetal alcohol exposure.
- *Adolescent Susceptibility to Substance Abuse: Neural and Social Underpinnings of Reward Behaviors.* The CDB Branch provided technical support and co-funding for this seminar, conducted by the National Research Council and the Institute of Medicine's Board on Children, Youth, and Families. A summary of the seminar, held November 12, 2007, in Washington, D.C., is available at http://www7.nationalacademies.org/bocyf/11_12_2007.html.