A Promising Opportunity for Developmental and Behavioral Pediatrics at the Interface of Neuroscience, Psychology, and Social Policy: Remarks on Receiving the 2005 C. Anderson Aldrich Award

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I am deeply grateful to the American Academy of Pediatrics for this wonderful award and truly humbled by the distinguished list of previous recipients. I view this recognition less as a personal accolade and more as an opportunity to reflect on how the evolution of my own career might contribute to the ongoing process of defining both the science and the practice of pediatrics.

Twenty years ago, I was the director of a division of developmental and behavioral pediatrics in a university hospital. Ten years ago, I changed my work address but not my core interests and accepted a position as dean of a graduate school for social policy and management. Five years ago, I participated in a press conference at the National Academy of Sciences to announce the release of a new report from the Institute of Medicine and National Research Council entitled, From Neurons to Neighborhoods: The Science of Early Childhood Development. And, 3 years later, I had the pleasure of joining 11 distinguished neuroscientists, developmental psychologists, economists, and communications researchers to launch the National Scientific Council on the Developing Child.

The mission of the National Scientific Council is to build informed, bipartisan leadership in both the public and the private sectors to close the gap between what we know and what we do to create a strong foundation for successful learning, adaptive behavior, and sound physical and mental health beginning in the earliest years of life. Central to this concept is the ongoing generation, analysis, and integration of established knowledge and the critical task of educating policy-makers, business executives, and civic leaders about the rapidly growing science of early childhood development and its underlying neurobiology. My personal commitment to this effort is deeply grounded in a recognition that the promotion of healthy development requires far more than access to hospitals and clinical offices. To this end, I have worked hard to strengthen my ability to serve as a knowledge broker on behalf of young children and their families in the complex world of social policy.

The list of previous Aldrich Award honorees provides an instructive historical record of the multilaceted incorporation of developmental knowledge into pediatric practice and public policy. Four decades ago, Julius Richmond (1967) laid...
down the gauntlet by identifying child development as the basic science of pediatrics. Over the ensuing years, the fundamental importance of relationships for both understanding and facilitating healthy adaptation has been underscored by honoring the work of Erik Erikson, Sally Provence, John Kennel, Marshal Klaus, and Mary Ainsworth, among others. Award presentations to Benjamin Spock and Berry Brazelton highlighted the importance of translating the science of development into the art of child rearing. Honors for Leo Kanner, Gunnar Dybwad, and Allen Crocker affirmed the critical importance of viewing the health and development of children within a broad community and societal context.

BUILDING A BROADER AND DEEPER SCIENCE OF DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

As we reflect on the contributions of 4 decades of Aldrich awardees in the context of contemporary medicine, it is clear that the time has come to reenergize Richmond’s notion of child development as a basic science of pediatrics. Although the study of the developing child remains central to the promotion of children’s health, its underlying scientific foundations and its interdisciplinary roots are increasingly complex. From its early origins in the descriptive work of Arnold Gesell, among others, the knowledge base for child development has now moved far beyond the domain of psychology and into the realms of neuroscience, molecular biology, genomics, and a broad range of social and behavioral sciences, and the implications of this growth in knowledge are compelling. Stated simply, development in the pediatric setting. And, tributes to the seminal thinking of Morris Green and Robert Haggerty affirmed the critical importance of viewing the health and development of children within a broad community and societal context.

Brains, Skills, and Health Are Built Over Time

The early years of life matter because the interactive influences of both early experience and gene expression affect the architecture of the brain, the emergence of capabilities, and the development of the immune system. As these complex systems mature, they establish either a sturdy or a fragile foundation for all the developmental achievements and physical and mental health that follow.

Social, Emotional, and Cognitive Development Are Highly Interrelated

Although each of these domains can be studied individually in a laboratory or described separately in its own chapter in a textbook, the brain is a highly integrated organ, and its multiple functions cannot be isolated from each other in vivo. Emotional well-being and social competence provide a strong foundation for emerging cognitive abilities, and all are important prerequisites for success in school, in the workplace, and in the community. Therefore, if we really want to build a strong platform for healthy development and effective learning in the early childhood years, then we must pay as much attention to children’s emotional well-being and social capacities as we do to their cognitive abilities and early literacy skills.

Brain Architecture and Human Capabilities Are Built in a Hierarchical, “Bottom-up” Sequence

The neural circuits that process basic information are wired earlier than those that process more complex information. Higher circuits build on lower circuits, skills beget skills, and the development of higher-level abilities is more difficult if lower-level circuits are not wired properly.

Brain Plasticity and the Ability to Change Behavior Decrease Over Time

Brain circuits stabilize with age, making them increasingly more difficult to alter. Thus, although the window of opportunity for adaptive development remains open for many years, the costs of remediation grow with increasing age. Stated simply, it is more efficient, both biologically and economically, to get things right the first time than to try to fix them later.

Relationships Are the “Active Ingredients” of Early Experience

Nurturing and responsive interactions build healthy brain architecture that provides a strong foundation for later learning, behavior, and health. Recurrent and excessive stress in the absence of protective relationships results in persistent activation of the body’s stress-management systems, which includes the continuous elevation of serum cortisol. These increased hormone levels undermine the immune response and disrupt brain architecture by impairing cell growth and interfering with the formation of healthy neural circuits.

The Dynamics of Stress in the Developing Child Offer a Promising Model for Thinking About Causal Mechanisms That Mediate Differences in Learning, Behavior, and Physical and Mental Health

The higher prevalence of developmental problems, school difficulties, and poor health outcomes among children who live in disadvantaged environments has been well documented for decades. That robust cor-
relation needs no further confirmation. What is needed, however, is greater understanding of how the adverse experiences associated with poverty, abuse, neglect, racial/ethnic discrimination, and exposure to family violence, among others, can lead to a lifetime of illness and diminished capabilities. Research on the biology of stress in the early years of life offers a promising avenue of investigation to elucidate this phenomenon.

The National Scientific Council on the Developing Child (2005) has proposed a simple taxonomy for addressing the experience of adversity in young children, based on 3 categories: positive, tolerable, and toxic stress.

“Positive stress” is characterized physiologically by moderate, short-lived stress responses such as brief increases in heart rate or mild changes in stress hormone levels. Precipitants include the challenges of meeting new people, dealing with frustration, mastering separation, getting an immunization, and accepting adult limiting, among many others. The key feature of positive stress is that it is an important and necessary aspect of healthy development. Its defining characteristic is that it occurs in the context of stable and supportive relationships.

“Tolerable stress” refers to stress responses that could potentially disrupt brain architecture but are buffered by supportive relationships that create safe environments that facilitate adaptive coping. Precipitants include the death or serious illness of a loved one, a frightening injury, serious family conflict, a natural disaster, terrorism, and homelessness. The defining characteristic of tolerable stress is that it generally occurs within a time-limited period, during which protective relationships help to bring the body’s stress-management systems back to baseline, which then gives the brain time to recover and thereby reverse potentially damaging effects.

“Toxic stress” refers to strong, frequent, and/or prolonged activation of the body’s stress-management systems in the absence of the buffering protection of adult support. Precipitants include extreme poverty, recurrent physical and/or emotional abuse, chronic neglect, severe maternal depression, parental substance abuse, and family violence. The defining characteristic of toxic stress is that it disrupts brain architecture and leads to stress-management systems that establish relatively lower thresholds for responsiveness that persist throughout life, thereby increasing the risk of stress-related physical and mental illness well into the adult years.

The primary prevention of toxic stress in early childhood and the provision of immediate intervention when it is detected at any age present a critical challenge to the practice of pediatrics. In many respects, the primary care setting is the most natural place to coordinate such critical work. On the other hand, fully effective prevention and treatment require resources and expertise that exceed the capacity of all but a few medical facilities, even at the tertiary care level. Thus, although the nature of the problem lies at the intellectual center of developmental and behavioral pediatrics, the key to its solution rests in the broader domain of social policy.

**USING KNOWLEDGE TO INFORM CONSTRUCTIVE CHANGE IN BOTH POLICY AND PRACTICE**

The recent reauthorization of 2 federal laws illustrates how the gap can be narrowed between what we know and what we do to promote healthy child development. The first example was illustrated by the renewal of the Child Abuse Prevention and Treatment Act as the Keeping Children and Families Safe Act of 2003 (Pub L 108–36). This legislation requires states to establish “provisions and procedures for referral of a child under the age of 3 who is involved in a substantiated case of child abuse or neglect to early intervention services funded under Part C of the Individuals with Disabilities Education Act.” The second example can be found in the reauthorization of the Individuals with Disabilities Education Act of 2004 (Pub L 108–446), which included a similar provision. Both of these changes in federal law were based on an explicit recommendation included in From Neurons to Neighborhoods.

Before the enactment of this new policy mandate, a pilot project was conducted in Massachusetts to test and study its implementation. During a 2-year period, 218 children under 3 years of age with newly opened child protection cases were successfully referred to local early intervention programs and received developmental evaluations. Examination of the assessment data found that 51% of the children had documented delays or diagnosed conditions that met eligibility criteria for Individuals with Disabilities Education Act-Part C services (Massachusetts Early Childhood Linkage Initiative, unpublished data). These findings indicate the extent to which skull radiographs and skeletal surveys are necessary but clearly not sufficient to complete the clinical assessment of a young child who has been abused or neglected. The data also send a clear message that foster care placements for maltreated children without the inclusion of sophisticated developmental and behavioral services are seriously shortchanging many of the most vulnerable of our youngest children.

These study findings, in conjunction with the new federal requirement for linkage between the child welfare and early intervention systems, underscore the need to rethink traditional approaches to child protective services. The old way, for example, focuses largely on documenting bodily injury, assessing the risk of recurrent harm, and making decisions about legal custody in the service of assuring the child’s physical safety. In contrast, contemporary neurobiology and social science tell us that child maltreatment should be evaluated and treated...
primarily as a health and development emergency in the context of a family relationship crisis, which requires sophisticated expertise in both early childhood and adult mental health. Thus, regularized referrals of suspected cases of abuse or neglect from the child welfare system to the early intervention system provide a promising step forward toward policies and practices that are grounded in state-of-the-art developmental knowledge. The absence of new funding to support the implementation of this new legislation, however, presents a formidable obstacle. The resolution of this dilemma is not simply a social service concern or a political problem. It is a core challenge to the practice of 21st-century developmental and behavioral pediatrics.

SCIENCE POINTS TOWARD A MULTIPRONGED APPROACH TO HEALTH PROMOTION AND DISEASE PREVENTION

Universal access to prenatal care and primary health services assures the detection of threats to health that can benefit from early diagnosis and preventive intervention. Targeted services for children experiencing toxic stress is essential to reduce disruptions of the developing nervous and immune systems that can lead to lifelong problems in learning, behavior, and both physical and mental health. Science tells us that a combination of both is essential and that services for vulnerable, young children can have positive impacts on brain development that generate a significant return on investment over a lifetime. But, science also tells us that targeted interventions that work require the quality and sustainability that come from low staff turnover and well-trained personnel with expertise that matches the needs of the children and families they are asked to serve.

Finally, if we really want to promote better health and developmental outcomes for all children, then we must apply the science of early childhood and early brain development to a much broader range of policies that affect the causes and consequences of toxic stress. Beyond the needs of children involved in the child welfare system, this includes those who live in families receiving public assistance (particularly where mothers are facing time limits for support), as well as children whose parents are enrolled in substance abuse and/or mental health programs or are homeless. The need for a stronger child-focused lens in these disparate domains of contemporary social policy is essential to the promotion of child health. The responsibility to influence such policies is fundamental to the effective practice of pediatrics and critical to the evolving professional identity of developmental and behavioral pediatricians.8,9

PERSISTENT CHALLENGES FACING DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

The rich and rapidly growing science of human health and development points toward 3 core challenges for developmental and behavioral pediatricians.

Closing the Gap Between What We Know and What We Do by Rethinking the Balance Between Individual and Shared Responsibility for Child Well-being

There is a compelling need to address the striking paradox of a strong and expanding science base yet persistently inadequate and ineffective societal investments in the healthy development of children and their families, particularly for those who are the most vulnerable. This indeniable gap calls out for new, bipartisan strategies to build broad-based public will that recognizes the complementary (not mutually exclusive) responsibilities of family, community, school, workplace, and government to promote the health and development of all children. As the one profession that is (or should be) involved in the life of every young child and his or her family, pediatrics should be at the forefront of that campaign, and developmental and behavioral pediatricians should be positioned prominently at the helm.

Searching for New Partners and a More Powerful Message

There is a clear imperative for pediatricians to build creative, new alliances with a broader array of leaders in both the public and private sectors. Beyond the need for fresh messengers, however, there is also a need for more effective messages to create a greater sense of urgency about the imperative of reducing significant inequalities in health and development, beginning in the earliest years of life. The well-being of young children is not only a compelling moral responsibility. It also benefits all of society by providing a solid foundation for responsible citizenship, economic productivity, strong communities, sustainable democracy, and future prosperity.

Expanding the Boundaries of Developmental and Behavioral Pediatrics Beyond the Clinical Setting

The challenge is clear, and the stakes are high. The number of children whose lives are threatened by social and economic adversity is unacceptably large, and the knowledge that could be used to promote their healthy development is exploding. The time has come to broaden and deepen the scientific foundations of developmental and behavioral pediatrics and to enlarge its field of active engagement. Central to this task is the need for stronger impact in the public policy arena that is grounded in science and avoids ideological advocacy. The maturing discipline of developmental and behavioral pediatrics can best address this critical opportunity by establishing a unique niche as a trusted knowledge broker at the interface of science, policy, and practice.10
No other group is positioned to play a comparable role. No other group could have as much influence.

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BELIEVABILITY OF RELATIVE RISKS AND ODDS RATIOS IN ABSTRACTS: CROSS SECTIONAL STUDY

“Objective: To compare the distribution of P values in abstracts of randomized controlled trials with that in observational studies, and to check P values between 0.04 and 0.06.

Design: Cross sectional study of all 260 abstracts in PubMed of articles published in 2003 that contained ‘relative risk’ or ‘odds ratio’ and reported results from a randomized trial, and random samples of 130 abstracts from cohort studies and 130 from case-control studies. P values were noted or calculated if unreported.

Main outcome measures: Prevalence of significant P values in abstracts and distribution of P values between 0.04 and 0.06.

Results: The first result in the abstract was statistically significant in 70% of the trials, 84% of cohort studies, and 84% of case-control studies. Although many of these results were derived from subgroup or secondary analyses, or biased selection of results, they were presented without reservations in 98% of the trials. P values were more extreme in observational studies (P<0.001) and in cohort studies than in case-control studies (P=0.04). The distribution of P values around P=0.05 was extremely skewed. Only five trials had 0.05≤P≤0.06, whereas 29 trials had 0.04<P<0.05. I could check the calculations for 27 of these trials. One of four non-significant results was significant. Four of the 23 significant results were wrong, five were doubtful, and four could be discussed. Nine cohort studies and eight case-control studies reported P values between 0.04 and 0.06, but in all 17 cases P<0.05. Because the analyses had been adjusted for confounders, these results could not be checked.

Conclusions: Significant results in abstracts are common but should generally be disbelieved.”

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Noted by JFL, MD
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