Introduction to the Special Issue on the Biological and Social Determinants of Child Development

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The group of articles included in this special issue evolved from a workshop funded by the National Institutes of Health (Grant No. R25-HD38574) and entitled, “Biological and Social Determinants of Child Development,” with the goal of stimulating cross disciplinary communication and research collaboration in the field of child development. Children’s development is affected by physiological and genetic factors, as well as behavioral, social, and environmental experiences. Interactions of these can be studied at different levels of analyses which are reflected in the papers in this issue from this workshop. Through such communication and collaboration, our technical and theoretical understanding of the biological, emotional, cognitive, social, and health policy aspects of the child development field should be enhanced.

Although the articles in this issue seem diverse in terms of topic and discipline, there are a number of common themes. The theme of a critical period for brain development and the importance of specific environmental input during this period is seen in a number of the articles. Rosensweig provides a historical perspective reminding us of the critical importance of animal models in addressing questions regarding the influence of the environment on the developing organism. The classic rat studies described in this article from the Berkley group focused on the degree and timing of plasticity of brain and behavior through examination of enriched versus deprived environments on brain development. These studies highlight the potential for a critical period in brain development and also remind us of the potential for brain plasticity with careful retraining of new skills.

The importance of early brain development and enriched environments is supported in other articles in this issue describing findings from human studies. Molfese and his colleagues demonstrate longitudinal relations between the quality of the child’s caregiving environment and differences in brain wave responses to a speech discrimination task known to predict later cognitive and reading skills. Using the
event-related potentials technique, correct classification of a majority of children’s brain processing behavior was achieved from information regarding the quality of their home environment. As Stiles et al. do in their article, Molfese et al. highlight, through research findings, the importance of longitudinal studies for understanding how close the relation between developing behaviors and brain processing is.

A critical period for the strong influence of the environment is the focus of the article by Landry et al. They provide evidence that early childhood is a unique period, during which a broad constellation of behaviors reflecting responsive parenting influence later cognitive and social development. With longitudinal descriptive studies in combination with an experimentally controlled intervention, it becomes clear that parent behaviors that are supportive of, and adaptive to, the child’s developing skills result in better outcomes.

The potential for brain plasticity following specialized retraining is a theme found in Papanicolaou et al.’s compelling paper demonstrating different profiles of brain activation for normal readers versus those who have dyslexia and younger children at high risk for development of reading disabilities. Of particular importance for brain plasticity is the preliminary evidence described in this article for reversibility of the aberrant pattern of activity found in children with dyslexia, following effective training in phonological decoding. This finding echoes those described by Rosensweig using animal models that demonstrate the importance of recognizing the potential for ongoing plasticity of the human brain.

An enriched environment may include effective instruction for skills that need to be taught (e.g., reading), and this point is made by Foreman, Breier, and Fletcher. This article describes converging evidence for what the characteristics of effective reading instruction should include as well as insight into the importance of characteristics such as intensity, duration, and timing of interventions. An important theme of this article includes early identification of children at risk for reading failure using valid and reliable measurement techniques, so that interventions are more likely to prevent failure.

The themes of a critical period, brain plasticity, and parallel changes in developing behavior and brain structure and functioning also are found in Stiles et al.’s article. Their description of the relation of children’s performance on visuospatial tasks with the pattern of functional brain activation demonstrates how emerging processing efficiency corresponds with the development of functional specialization within the hemispheres. The importance of certain kinds of critical environmental input for normal brain development is highlighted in the description of how such input may inform researchers’ understanding of the proliferation and pruning of neural elements. The work of Ewing-Cobb, Barnes, and Fletcher encourages us to think about how these questions can be relevant to understanding skill deficits in children with early brain injury such as traumatic brain injury and spina bifida meningomyelocele. This article explains the critical need for assessment paradigms that are oriented toward the acquisition of skills—as opposed to
their recovery—to conduct theoretically driven examinations of brain–behavior relationships. The abnormal brain activation patterns seen for not only children with dyslexia but also young children at risk for reading problems—as described by Papanicolaou et al.—is an example of how the combination of sensitive behavioral measurement with imaging technology can provide important information that cannot be realized by the use of either technique alone. Several articles highlight the types of brain–behavior issues that can be addressed by utilizing state of the art technology, such as functional magnetic resonance imaging, evoked potentials, and magnetic source imaging.

As a number of articles in this issue describe potential interventions (e.g., Foreman et al., Landry et al., and Papanicolaou et al.), the article by Kraemer is relevant because it describes the numerous factors that allow the results of such studies to be generalized to larger populations. These factors include random assignment in clinical trials, careful sampling, and adequate power for clinically or policy significant effects to establish intervention effectiveness. However, these factors are necessary but not sufficient to establish effectiveness, and other issues need to be accounted for in determining policy significant effects. Just as many of the articles briefly described earlier emphasize the need for collaboration among various disciplines of scientists, Kraemer urges close collaboration among researchers and biostatisticians with clinicians, patient advocates, and policy makers to best understand the balance between efficacy and effectiveness of treatments.

Putting the described articles in a broad perspective, Power and Hertzman argue that researchers cannot understand the health status of a society without understanding the health-determining influences across the life course. They conceptualize life course relationships using three models—latency, pathway, and cumulative—that are not mutually exclusive. Through a review of a large number of longitudinal studies, this article highlights the compelling evidence for understanding how later socioeconomic, health, and educational outcomes have strong connections to early-life social origins. It is noted that the health status of adults is an important marker of a society’s health and well-being and that adult health status has a direct relation with socioeconomic status. That is, poor health increases from the highest to the lowest economic positions. This same socioeconomic gradient is evident in the cognitive and behavioral development of young children as manifested in the way the brain responds to variation in the quality of the early environment. Therefore, gradients for readiness in school can be viewed as a “health” indicator when taking a life course perspective. These authors urge us to acknowledge children’s early development as an important indicator of a society’s health and well being. Thus, investing in this period should not only improve outcomes for children in the short term but also become an investment in the health of the society over the long term. Enhancing caregivers’ quality of stimulation with young children should not only impact the children’s outcomes but can also have cross generational effects that lead to sustainable improvements in a society.