Chapter 5

Thinking Developmentally

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."

– R. Buckminster Fuller

For many pediatricians, "thinking developmentally" is intuitive. Cognitive frameworks used by pediatricians everyday include acknowledging the significant influences of the social milieu and past experiences on current behaviors; understanding the cumulative process of development and long-term consequences of early disruptions; recognizing that maladaptive behaviors are often maintained because they were actually adaptive at some point in the past; and generally thinking longitudinally over time. But for some health care professionals, unfamiliarity with recent advances in the basic developmental sciences, coupled with the time constraints of a busy clinical practice, limit consideration to the patient's current condition, often with little thought given to how they arrived at the current state or what that journey might mean for the future. This myopic vision not only is detrimental to patient care; it limits the way research is framed, trainees are instructed, and policy is crafted.

This chapter will briefly review the evolution of 3 models used to frame human health. This review is not intended to be comprehensive or all-inclusive because many other models of health have been proposed.[1–4] But many of their salient features align with one or more of the following 3 models: the biomedical (BM) model, the biopsychosocial (BPS) model, and

This chapter was originally published in slightly different form as Garner AS. Thinking developmentally: the next evolution in models of health. *J Dev Behav Pediatr.* 2016;37(7):579–584.
Copyright 2016 Wolters Kluwer Health. Reprinted courtesy of Wolters Kluwer Health and the Society for Developmental and Behavioral Pediatrics.

the ecobiodevelopmental (EBD) model. By beginning with the BM model, the subsequent BPS and EBD models are understood as attempts to reconcile and integrate the BM model with subsequent advances in scientific knowledge, initially in the psychosocial sciences but more recently in the developmental sciences. In doing so, the BPS and EBD models not only redefine how to train for and practice medicine; they broaden the concept of "health" from simply the absence of disease to a dynamic spectrum that ranges from the presence of disease to the presence of wellness (Box 5-1).

Evolving Models of Disease, Health, and Wellness

Following advances in biology and other physical sciences at the end of the 19th century, much of Western medicine adopted a BM model of disease.[5] The BM model was grounded in biological reductionism, as advances in

Box 5-1. Evolving Models of Disease, Health, and Wellness

Biomedical Model of Disease (mid-19th century)

- Embraced biological reductionism (a single, organic etiology) and mind-body dualism (psychosocial vs organic etiologies; "problems of living" vs "problems of life").
- The practice of medicine demands an understanding of human biology and the physical sciences.
- Health is simply the absence of disease.

Biopsychosocial Model of Health (1977)

- Grounded in social-cognitive theory, refuted mind-body dualism, and embraced a broader vision of health.
- The practice of medicine demands an understanding of the nexus among human biology, psychology, and sociology.
- Health is the product of many factors and more than the absence of an objective disease state.

Ecobiodevelopmental Model of Disease and Wellness (2012)

- Driven by advances in basic developmental science (eg, epigenetics, developmental neuroscience), replaces mind-body dualism with adaptive versus maladaptive responses to experience, and acknowledges the developmental origins of disease and wellness.
- The practice of medicine demands an understanding of how the ecology (eg, the physical, nutritional, and psychosocial milieu) and biology (eg, genome, brain) interact in a dynamic and cumulative manner over time.
- Health is a dynamic continuum between disease and wellness, and early experiences play a pivotal role because the foundations for disease and wellness are built over time.

microbiology and Mendelian genetics suggested that one physical etiology (eg, a single germ, a single gene) could account for a diseased state. The BM also embraced a mind-body dualism, differentiating disorders of *living* (due to poor mental health, psychosocial circumstances, or poor character) from disorders of *life* (due to physical health and biology). The BM model of disease, therefore, demanded that health care professionals be well versed in human biology, including anatomy, physiology, histology, immunology, and microbiology. The vestiges of this BM model of disease are still seen in contemporary medical school curricula, with their emphasis on the physical sciences over the social sciences (eg, psychology, sociology, epidemiology, public health). According to the BM model, health is simply the absence of a diseased state.

In the 1970s, George Engel published a series papers outlining the need for a new medical model.[6–8] As a psychiatrist, Engel was steeped in social-cognitive theory and took exception to the concepts of biological reductionism and mind-body dualism. He argued that the BM model was "no longer adequate for the scientific tasks and social responsibilities of either medicine or psychiatry" because "it leaves no room within its framework for the social, psychological, and behavioral dimensions of disease."[8] As Engel stated, "We are now faced with the necessity and the challenge to broaden the approach to disease to include the psychosocial without sacrificing the enormous advantages of the biomedical approach."[8]

Engel proposed a BPS model that acknowledged the contributions of biology and physical science but also embraced the significant effect of nonorganic influences on health. The Engel BPS model presaged the contemporary appreciation for the social determinants of health and suggested that the practice of medicine demanded an understanding of the nexus among human biology, psychology, and sociology. In rejecting the extreme biological reductionism of the BM model, the BPS model embraced a systems approach (multifactorial etiologies) and suggested that health was more than the absence of a physical or objective diseased state.

In 2012, the American Academy of Pediatrics released a policy statement[9] and technical report[10] on toxic stress that endorsed an EBD model of disease and wellness. Integrating elements of several previous models, including the ecodevelopmental[3,11,12] and biodevelopmental[4] models, the EBD model affirms the BPS model's emphasis on the psychosocial determinants of health, but it does so at the molecular and cellular levels. According to the EBD model, the salient features of the early developmental milieu (ie, physical, nutritional, and psychosocial) are biologically embedded and influence the subsequent trajectory of development.[10] Recent advances in basic developmental sciences like epigenetics and neuroscience have begun to elucidate how the ecology gets under the skin[13,14] and influences genomic function, physiology,

brain connectivity, learning, behavior, and, ultimately, life course trajectories (Figure 5-1).[2,15,16] Consequently, the EBD model argues that the practice of medicine requires an understanding of how the ecology and biology interact in a dynamic but cumulative manner over time. In the EBD model, health is a continuum between disease and wellness, and early experiences play a pivotal role because the foundations for both are built over time (see Box 5-1).

Advantages of the Ecobiodevelopmental Model

The EBD model builds and improves on the BM and BPS models. Like the BM model, the EBD model is grounded in contemporary basic science (eg, epigenetics, neuroscience). Like the BPS model, the EBD model affirms the biological significance of the salient features of the ecology, including

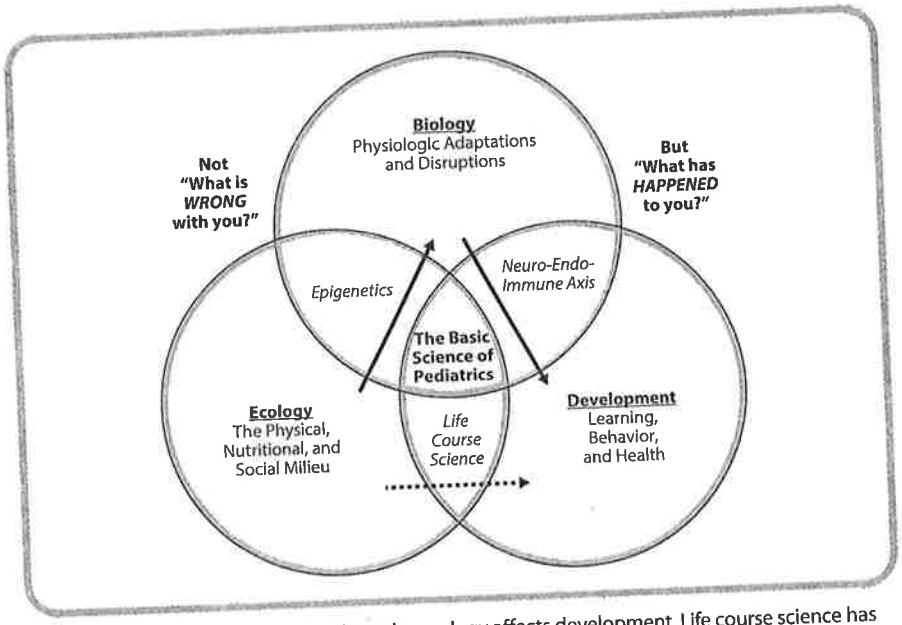

Figure 5-1. The emerging model of how the ecology affects development. Life course science has repeatedly demonstrated strong associations (dotted arrow) between the early childhood ecology and developmental outcomes in learning, behavior, and health. Through epigenetic mechanisms (solid arrow), the early childhood ecology is biologically embedded, leading to changes in the way the genetic blueprint is used. Developmental neuroscience helps us to understand how those biological changes (adaptive and disruptive) lead to alterations in brain structure and function. But the biological changes in response to the environment extend beyond the nervous system and include alterations to endocrine and immune function as well. Adaptive and disruptive changes in this neuro-endo-immune axis drive lifelong outcomes in learning, behavior, and health (solid arrow). In the center of this Venn diagram is what Dr Julius Richmond called the "basic science of pediatrics": the basic science of child development. One important implication of this emerging model is that asking patients, "What is wrong with you?" is not as salient as asking, "What has happened to you?"

the psychosocial milieu. What sets the EBD model apart is that it adds the dimension of time, forcing health care professionals to think developmentally (Figure 5-2).

The EBD model acknowledges that development is the product of an ongoing, dynamic, but cumulative dance between nurture (the environmental milieu or ecology) and nature (biology).[9,17] The advances in epigenetics and developmental neuroscience discussed in the previous 2 chapters demonstrate that experiences with the physical, nutritional, and psychosocial ecology lead to changes in genomic function, physiology, and brain connectivity.[16] At the highest level, the output of all of these ecologically induced changes is behavior, which, in turn, shapes the individual's next experience with the ecology. This ongoing and dynamic dance between ecology and biology is depicted in Figure 5-2A.

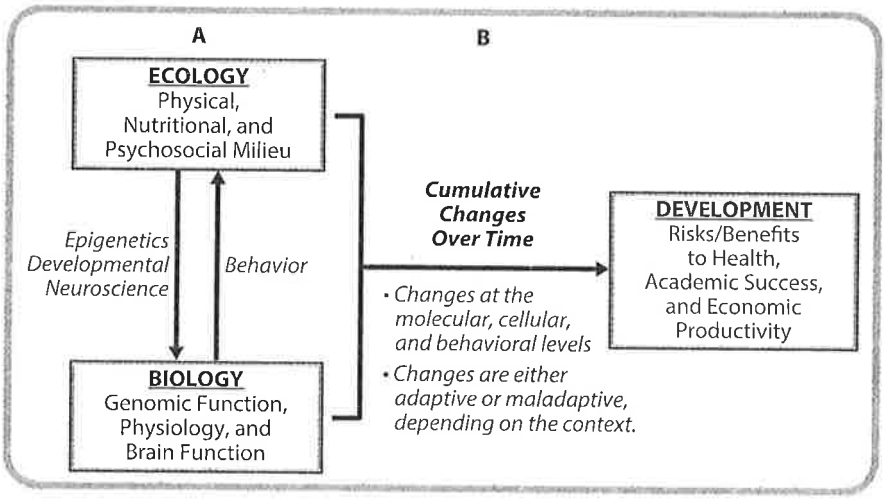

Figure 5-2. The ecobiodevelopmental (EBD) model of disease and wellness. The ecology becomes biology, and together they drive the development of disease and wellness across the life span.
A. There is an ongoing, dynamic dance between the ecology and biology. The biomedical model focused primarily on the biology. The biopsychosocial model acknowledged the psychosocial components of the ecology, but recent advances in epigenetics and developmental neuroscience have revealed molecular and cellular mechanisms that allow the ecology to become biologically embedded. Conversely, the highest-level output of biology is behavior, which shapes the individual's next experience with the ecology.
B. Cumulative changes over time drive development and lead to risks and benefits to health, academic success, and economic productivity. The dynamic dance between the ecology and biology lead to changes at the molecular (eg, DNA methylation), cellular (eg, brain connectivity), and behavioral levels (eg, behavioral allostasis). Although these changes might be adaptive initially (eg, the physiologic stress response), they might prove to be maladaptive over time (eg, toxic stress) or in different contexts (eg, post-traumatic stress). The EBD model adds this dimension of time and forces health care professionals to think developmentally.

The EBD model asserts that, over time, the accumulation of changes at the molecular, cellular, and behavioral levels in response to the ecology can be adaptive or maladaptive, depending on the subsequent context (Figure 5-2B). For example, significant adversity early in life can lead to changes in methylation patterns (eg, the glucocorticoid receptor gene),[18] brain connectivity (eg, a reduced capacity for the prefrontal cortex to suppress the amygdala),[19] and coping behaviors (eg, behavioral allostasis manifest as smoking, overeating, promiscuity, or substance abuse)[20,21] that might be somewhat adaptive and beneficial initially but prove to be maladaptive or harmful over time. These adaptive and maladaptive changes due to the ecology represent benefits and risks to not only health but academic success and future economic productivity (see Figure 5-2).[10]

The EBD model also

1. Eliminates mind-body dualism. The dichotomy of disorders of *living* versus disorders of *life* is replaced with the dichotomy of *adaptive* versus *maladaptive* changes at the molecular, cellular, and behavioral levels in response to experiences with the ecology. Those changes caused by the psychosocial features of the ecology are, therefore, every bit as biological as the changes caused by physiological factors such as poor nutrition or lead poisoning.
2. Incorporates potentially transformational advances in epigenetics and developmental neuroscience. Plasticity, the ability of genomic and brain function to be altered by experiences with the ecology, is a powerful resource, but it cuts both ways. Early experiences can set a strong or weak foundation for future learning, health, and economic success.[22]
3. Is congruent with the burgeoning literature on gene and environmental interactions,[23] including intriguing evidence that a biological sensitivity to context can be a benefit in nurturing environments but a risk in adverse environments.[24–29]
4. Highlights the pivotal role of the early childhood ecology. In the absence of safe, stable, and nurturing relationships, significant adversity in childhood can lead to toxic stress responses. Frequent, prolonged, or overexposure to the mediators of the physiologic stress response triggers changes at the molecular, cellular, and behavioral levels that may prove to be unhealthy over time. Conversely, the presence of safe, stable, and nurturing relationships (with parents, caregivers, extended family, teachers, and coaches) buffers adversity, triggering a positive stress response that is infrequent or brief, leads to healthy adaptations to future adversity, and builds competence and confidence. Significant adversity in childhood can indeed be toxic, but safe, stable, and nurturing relationships are the antidote.[30]

5. Incorporates recent epidemiologic studies that suggest many chronic diseases are actually adult-*manifest* diseases with origins in childhood. The Adverse Childhood Experiences (ACE) Study,[20,21] the data supporting the so-called Barker or fetal origins hypothesis,[31,32] and the burgeoning field of study loosely referred to as the developmental origins of health and disease[33–36] all force health care professionals to begin considering distal or remote etiologies. The history of the ACE Study is a cautionary tale for non-pediatric health care professionals, as an internist discovered that significant adversity in childhood was preventing many of his adult patients who were morbidly obese from maintaining their weight loss.[21] By understanding the remote or distal causes of maladaptations, and by uncovering the adversities that may have led to behavioral allostasis, health care professionals are in a better position to form strong therapeutic relationships, empower patients with a deeper understanding as to why they may feel stuck in unhealthy behaviors, and support patients in developing ways first to heal and then to cope more adaptively moving forward. With regard to this last point and the need to build wellness moving forward, motivational interviewing and cognitive behavioral strategies may prove useful.
6. Forces health care professionals to think developmentally. Although trauma-informed care also encourages health care professionals to change their approach from "What is wrong with you?" to "What has happened to you?"[37] an emphasis on the *risks* to health must be balanced with the *benefits* to health that come from strong social supports (eg, family), mindfulness (eg, emotional intelligence), healthy adaptations to previous adversity (eg, exercise, journaling, artistic pursuits), and other sources of resilience. The EBD model embraces reactive, trauma-informed care *and* proactive, resilience-informed care under the broader umbrella of development-informed care.
7. Challenges the medical community to accept a broader vision and mission, because thinking developmentally demands that one also think ecologically. As discussed earlier in this chapter, the accumulation of changes due to experiences with the environment shapes who we are at the molecular, cellular, and behavioral levels. To address the biology underlying disparities and to optimize adult outcomes, not just in health but in academic achievement and economic productivity, medicine must accept an expanded vision that acknowledges the social determinants of health and the developmental origins of disease and wellness. The mission, therefore, expands from "How do we cure the sick?" to include "How do we build the well?"

Implications for the Health Care System

Meeting this expanded mission and vision will demand dramatic changes in the health care system. The EBD model's emphasis on the development of wellness was mirrored in the efforts of the original Patient Protection and Affordable Care Act (ACA) to support prevention services. Similarly, the EBD model's emphasis on optimizing the ecology was mirrored in the focus of the original ACA on measuring and improving population-level health. But change is hard, and skeptics will continue to argue that the social determinants of health and other factors of the ecology that build disease instead of wellness are beyond the scope of medicine. Yet even the skeptics will concede that, while our current system is well prepared to cure the sick, the system is simply unsustainable economically. In addition, our overall health, by any number of measures, is poor relative to our economic peers.[38] For every dollar that economically advanced countries spend on medical care, they spend 2 dollars on the social services that promote healthy ecologies.[39] In the United States, for every dollar we spend on medical care, we spend 90 cents on social services.[39] The EBD model predicts that the way to build wellness and to decrease health care expenditures over the long term is to promote healthier ecologies.[10]

But this dichotomy between social services and medical expenditures is grounded in mind-body dualism and the artificial dichotomy between disorders of *living* and disorders of *life*. From an economic standpoint, investments in social services and health care are complementary investments in human capital. That is not to say that physicians are now social workers, but that physicians and social workers are now working toward the same end: child, family, and community wellness. The same could be said for early intervention specialists, home visitors, legal advocates, educators, and job-training professionals. The EBD model supports the concept of community-based, family-centered medical homes, where a team of professionals is led by a physician and focuses not only on curing the sick but on building the well.

For many health care centers, however, this transition from curing the sick to building the well will require a significant redistribution of resources. Does the community need more medical specialists or more home visitors and community health workers? Does the community need another magnetic resonance imaging scanner or another well-located primary care clinic? More importantly, this transition to a well-care system will require a fundamental shift in the relationship between tertiary care centers and primary care physicians. In the sick-care system, one of the principal roles of primary care physicians is to feed the centers with sick patients in need of high-tech, expensive, tertiary care. In a well-care system, tertiary care centers must empower primary care physicians with the tools needed to improve the lives of children,

their families, and their communities. Resources like community health workers, home visiting programs,[30] medicolegal partnerships,[40] and Health Leads[41] allow academic health care centers to begin changing the directionality from "feed us the sick" to "let us help you keep people well" outside the tertiary care center.

If changing this directionality sounds naive, consider the example of episode-based payments for asthma. Under this model, if a child presents to the emergency department of a tertiary care center with an asthma exacerbation, the tertiary care center payment for that visit may cover the patient's asthma care for the next 30 days. If, after discharge, the patient is subsequently readmitted to the intensive care unit during those next 30 days, the tertiary care center would get no additional payment. Hence, tertiary care centers are now incentivized to ensure compliance with the treatment plan and adequate follow-up with the primary care physician. But the primary care physician will likely point out that to prevent readmissions, a home visit is needed to ensure that the home space is being adequately maintained by the landlord (eg, absence of mold or cockroaches). If it is not, the family may need the assistance of a medicolegal partnership to minimize the risk of a subsequent readmission. This example demonstrates the need for tertiary care centers to seek bidirectionality in their relationships with primary care physicians and the communities they serve. To promote wellness, health care centers need to carefully consider ways to assist primary care physicians and other local resources (eg, food pantries, domestic violence or homeless shelters, Head Start, neighborhood resource centers) in keeping children, their families, and their communities well.

Implications for Medical Practice and Training

Transitioning to a well-care system will also require changes in the way that physicians practice medicine. As described in the EBD model, physicians must begin to think developmentally and ecologically. Thinking developmentally forces physicians to acknowledge the significant biological consequences of previous experiences, both good and bad. When thinking developmentally, the most important question for physicians to consider is not "What is *wrong* with this patient?" but "What has *happened* to this patient?"[37] When thinking developmentally, physicians will be challenged to ask themselves, "How can I *better understand* this patient?" instead of "How can I *fix* this patient?" Thinking developmentally acknowledges that the patient's current health status is the product of their previous experiences. Thinking developmentally encourages physicians to "go upstream" and consider the distal or remote etiologies (eg, the link between significant adversity in childhood and adult

obesity). But to assess the patient's history and ecology in a safe, nonjudgmental, and respectful manner, physicians must redouble their efforts to form therapeutic relationships and to always be mindful of their own vicarious trauma on hearing the patient's experiences. If the physician's orientation is, "I must fix this," they are likely to face rising levels of frustration and burnout. But if the physician's orientation is, "I must understand this patient," they are more likely to practice active listening, form that foundational therapeutic relationship, and protect themselves from the frustration of not being able to fix the patient's experience.

The EBD model will also challenge physicians to think ecologically, not only about etiologies but also interventions and treatments. Thinking ecologically will encourage physicians to adopt a public health approach to complex issues (eg, obesity) and to capitalize on individual, family, and community strengths and assets. For example, if a child has an identified learning disability, efforts might be made to strengthen that child's social-emotional skills to empower the child to successfully engage assistance when needed. If a family is struggling due to maternal depression, efforts might be made to garner additional supports from the extended family or a faith community. Similarly, communities could work to ensure that although its children may live in poverty, they will not be impoverished socially, emotionally, or intellectually.

To prepare the next generation of health care professionals for this emerging well-care system, undergraduate medical education will need to embrace the EBD model of disease and wellness. All physicians will need to start thinking developmentally and ecologically. As the leaders of teams of health care professionals, the next generation of physicians must also develop the skills needed to collaborate with a wide range of professionals outside the traditional purview of medicine. Perhaps most importantly, to prepare the next generation of pediatricians, pediatric residency programs will need to expand the time allotted for developmental and behavioral pediatrics, both to reassert that child development is the basic science of pediatrics[42] and to operationalize the broad implications of the EBD model.

Conclusions From Part 1

To transition from a health care system that reactively cures the sick to one that proactively builds the well, a different model of health is needed. The EBD model of disease and wellness is grounded in contemporary advances in developmental science (chapters 1–4), builds on previous models of health (Chapter 5), eliminates mind-body dualism (the idea that mental health and physical health are somehow distinct), and challenges health care professionals to think developmentally. Thinking developmentally acknowledges the ongoing but

cumulative dance over time between the salient features of the ecology and the biological machinery that is adapting, for better or worse, to that ecology. Thinking developmentally also means thinking ecologically because the accumulation of experiences with the environment shapes who we are at the molecular, cellular, and behavioral levels.

Part 2 of this book will build on these foundational principles and expand the discussion of the implications of the EBD model to children (Chapter 6), their families (Chapter 7), their communities (Chapter 8), the future practice of pediatrics (Chapter 9), and public policy (Chapter 10). The emerging developmental science discussed in this and the previous 4 chapters is solid. The question to be addressed in the second half of this book is what we, as pediatricians, parents, and citizens, can do to translate this emerging science into healthy children, nurturing families, and caring communities. As pediatricians, that's what we do: translate the latest science into practice and policy. That has been, and hopefully will remain, the pediatric way.

References

1. Halfon N, Hochstein M. Life course health development: an integrated framework for developing health, policy, and research. *Milbank Q.* 2002;80(3):433–479
2. Hertzman C, Power C. Health and human development: understandings from life-course research. *Dev Neuropsychol.* 2003;24(2-3):719–744
3. Bronfenbrenner U, ed. *Making Human Beings Human: Bioecological Perspectives on Human Development.* Thousand Oaks, CA: Sage Publications; 2005
4. Shonkoff JP. Building a new biodevelopmental framework to guide the future of early childhood policy. *Child Dev.* 2010;81(1):357–367
5. Annandale E. *The Sociology of Health and Medicine: A Critical Introduction.* 2nd ed. Malden, MA: Polity Press; 2014
6. Engel GL. The biopsychosocial model and the education of health professionals. *Gen Hosp Psychiatry.* 1979;1(2):156–165
7. Engel GL. The biopsychosocial model and the education of health professionals. *Ann N Y Acad Sci.* 1978;310:169–187
8. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science.* 1977;196(4286):129–136
9. American Academy of Pediatrics Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. Policy statement: early childhood adversity, toxic stress, and the role of the pediatrician: translating developmental science into lifelong health. *Pediatrics.* 2012;129(1):e224–e231
10. Shonkoff JP, Garner AS; American Academy of Pediatrics Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. Technical report: the lifelong effects of early childhood adversity and toxic stress. *Pediatrics.* 2012;129(1):e232–e246
11. Moen P, Elder GH, Lüscher K, eds. *Examining Lives in Context: Perspectives on the Ecology of Human Development.* Washington, DC: American Psychological Association; 1995

12. Bronfenbrenner U. *The Ecology of Human Development: Experiments by Nature and Design.* Cambridge, MA: Harvard University Press; 1979
13. Hertzman C. The biological embedding of early experience and its effects on health in adulthood. *Ann N Y Acad Sci.* 1999;896:85–95
14. Hertzman C, Boyce T. How experience gets under the skin to create gradients in developmental health. *Annu Rev Public Health.* 2010;31:329–347
15. Royal Society of Canada and the Canadian Academy of Health Sciences. *Early Child Development: Adverse Experiences and Developmental Health.* Ottawa, ON: Royal Society of Canada; 2012
16. Shonkoff JP, Boyce WT, McEwen BS. Neuroscience, molecular biology, and the childhood roots of health disparities: building a new framework for health promotion and disease prevention. *JAMA.* 2009;301(21):2252–2259
17. Hertzman C, Power C, Matthews S, Manor O. Using an interactive framework of society and lifecourse to explain self-rated health in early adulthood. *Soc Sci Med.* 2001;53(12):1575–1585
18. Oberlander TF, Weinberg J, Papsdorf M, Grunau R, Misri S, Devlin AM. Prenatal exposure to maternal depression, neonatal methylation of human glucocorticoid receptor gene (NR3C1) and infant cortisol stress responses. *Epigenetics.* 2008;3(2):97–106
19. Kim P, Evans GW, Angstadt M, et al. Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood. *Proc Natl Acad Sci U S A.* 2013;110(46):18442–18447
20. Anda RF, Felitti VJ, Bremner JD, et al. The enduring effects of abuse and related adverse experiences in childhood. A convergence of evidence from neurobiology and epidemiology. *Eur Arch Psychiatry Clin Neurosci.* 2006;256(3):174–186
21. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *Am J Prev Med.* 1998;14(4):245–258
22. National Research Council, Institute of Medicine. *From Neurons to Neighborhoods: The Science of Early Child Development.* Committee on Integrating the Science of Early Childhood Development. Shonkoff JP, Phillips DA, eds. Washington, DC: National Academy Press; 2000
23. Simons RL, Beach SR, Barr AB. Differential susceptibility to context: a promising model of the interplay of genes and the social environment. *Adv Group Process.* 2012;29
24. Ellis BJ, Essex MJ, Boyce WT. Biological sensitivity to context: II. Empirical explorations of an evolutionary-developmental theory. *Dev Psychopathol.* 2005;17(2):303–328
25. Boyce WT, Ellis BJ. Biological sensitivity to context: I. An evolutionary-developmental theory of the origins and functions of stress reactivity. *Dev Psychopathol.* 2005;17(2):271–301
26. Obradović J, Bush NR, Stamperdahl J, Adler NE, Boyce WT. Biological sensitivity to context: the interactive effects of stress reactivity and family adversity on socioemotional behavior and school readiness. *Child Dev.* 2010;81(1):270–289
27. Obradović J, Boyce WT. Individual differences in behavioral, physiological, and genetic sensitivities to contexts: implications for development and adaptation. *Dev Neurosci.* 2009;31(4):300–308
28. Blair C, Raver CC. Child development in the context of adversity: experiential canalization of brain and behavior. *Am Psychol.* 2012;67(4):309–318
29. Blair C. Stress and the development of self-regulation in context. *Child Dev Perspect.* 2010;4(3):181–188
30. Garner AS. Home visiting and the biology of toxic stress: opportunities to address early childhood adversity. *Pediatrics.* 2013;132(Suppl 2):S65–S73

31. Barker DJ. Fetal origins of cardiovascular disease. *Ann Med.* 1999;31(Suppl 1):3–6
32. Barker DJ. Fetal origins of coronary heart disease. *BMJ.* 1995;311(6998):171–174
33. Barker D, Barker M, Fleming T, Lampl M. Developmental biology: support mothers to secure future public health. *Nature.* 2013;504(7479):209–211
34. Barker DJ. The origins of the developmental origins theory. *J Intern Med.* 2007;261(5): 412–417
35. Gluckman PD, Hanson MA, Buklijas T. A conceptual framework for the developmental origins of health and disease. *J Dev Orig Health Dis.* 2010;1(1):6–18
36. Walker CL, Ho SM. Developmental reprogramming of cancer susceptibility. *Nat Rev Cancer.* 2012;12(7):479–486
37. Bloom SL. The sanctuary model: developing generic inpatient programs for the treatment of psychological trauma. In: Williams MB, Sommer JF, eds. *Handbook of Post-Traumatic Therapy.* Westport, CT: Greenwood Publishing; 1994:474–449
38. National Research Council, Institute of Medicine. *US Health in International Perspective: Shorter Lives, Poorer Health.* Washington, DC: National Academies Press; 2013
39. Bradley EH, Elkins BR, Herrin J, Elbel B. Health and social services expenditures: associations with health outcomes. *BMJ Qual Saf.* 2011;20(10):826–831
40. Sege R, Preer G, Morton SJ, et al. Medical-legal strategies to improve infant health care: a randomized trial. *Pediatrics.* 2015;136(1):97–106
41. Onie RD. Creating a new model to help health care providers write prescriptions for health. *Health Aff (Millwood).* 2012;31(12):2795–2796
42. Richmond JB. Child development: a basic science for pediatrics. *Pediatrics.* 1967;39(5): 649–658