VI. SENSITIVE PERIODS

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This chapter reviews sensitive periods in human brain development based on the literature on children raised in institutions. Sensitive experiences occur when experiences are uniquely influential for the development of neural circuitry. Because in humans, we make inferences about sensitive periods from evaluations of complex behaviors, we underestimate the occurrence of sensitive periods at the level of neural circuitry. Although we are most interested in complex behaviors, such as IQ or attachment or externalizing problems, many different sensitive periods at the level of circuits probably underlie these complex behaviors. Results from a number of studies suggest that across most, but not all, domains of development, institutional rearing limited to the first 4–6 months of life is associated with no significant increase risk for long-term adverse effects relative to noninstitutionalized children. Beyond that, evidence for sensitive periods is less compelling, meaning that “the earlier the better” rule for enhanced caregiving is a reasonable conclusion at the current state of the science.

A longstanding controversy in psychology concerns the degree to which experiences in the early years are uniquely important in human development or merely equivalent to experiences during subsequent epochs of development. The “early experience hypothesis” holds that the first 3 years or so constitute a relatively more important period in development because of the profound changes in brain development known to occur during that time (Sheridan & Nelson, 2009). Once the neuronal “foundation” is constructed in particular ways, subsequent revisions are more difficult to achieve. In keeping with this assertion, a large literature has documented strong relationships between early adverse caregiving experiences and subsequent maladaptation. If early experiences are, in fact, more important, then a number of related questions become apparent: To what degree, under what circumstances, and for whom?

Still, O’Connor and Parfitt (2009) have pointed out that the number of studies evaluating the “early experience hypothesis” are limited. Because of the continuity of most caregiving environments, what is needed to properly evaluate the importance of early experience are studies in which young
children experience a significant change in their caregiving circumstances. Following such a change, children’s functioning in the new environment can be compared to functioning in the original environment. For this reason, intervention studies of young children who were reared for varying periods of time in institutions characterized by social or material privation have attracted great interest. Timing of interventions designed to change young children’s trajectories may reveal important differences in outcomes. An important question concerns when and if it is ever too late for remediation to occur and whether timing may differ across different developmental domains.

Sensitive periods in brain development are of great interest in the psychology of early experience. It is well established that the human brain is capable of adapting to different inputs and experiences. Still, there are constraints on plasticity, often described in terms of sensitive or critical periods. Knudsen (2004) has defined sensitive periods as “when the effects of experience are particularly strong on a limited period in development” (p. 1412). In contrast, he defined critical periods as when particular experiences are “vital for normal development and lead to permanent alteration” in neural circuitry (p. 1412). Because there is to date little evidence of critical periods in human brain development, at least beyond perceptual development, we focus in this chapter on sensitive periods. From the standpoint of brain development, one important question is the time during which a sensitive period remains “open” to change and adaptability versus when it closes and becomes relatively impervious to the effects of subsequent experiences.

Studies of children raised in institutions appear to provide a unique opportunity to study sensitive periods in brain development. Institutionalized children are often raised in conditions of social and material privation. For those who later experience a dramatically different environment, the change can be studied as an “intervention” effect. Because these changes in the caregiving environment often occur at different ages, this provides a test of the sensitive period hypothesis. On the other hand, we must be cautious about inferring sensitive periods in brain development from studies of the brain and behavioral characteristics of children raised in institutions for several reasons.

Although we make inferences from children’s skills and behaviors about sensitive periods in development, Knudsen (2004) has emphasized that sensitive periods are actually properties of neural circuits. This assertion is extremely important in understanding the limitations of the inferences we make about sensitive periods regarding various behaviors. To understand these limitations, it may be useful to review what sensitive periods means at the level of the neural circuit.

Knudsen (2004) pointed out that before a circuit has ever been highly activated strongly, it is in a state that favors change. That is, excitatory synapses are weak and inhibitory influences are limited. Intense and repeated activation of a circuit, however, alters these conditions dramatically. The
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Synapse consolidates based upon the input received, and the sensitive period for that circuit closes (Knudsen, 2004).

Absence of or reductions in activation of a circuit (compared to what occurs in more typical development) may lead initially to prolongation of the sensitive period. In fact, circuits seem to anticipate certain levels and types of input. Furthermore, even when a sensitive period ends, there may remain some capacity for change, but more energy is required for the circuit to revert to less stable connectivity. Further, the degree of plasticity varies depending upon the circuitry involved. A synapse likely has more flexibility and responsivity to experiences that occur earlier and loses this flexibility to adapt as time passes.

Knudsen’s (2004) reminder has profound implications for our understanding of the development of children with histories of institutional rearing. Within the multiple hierarchies of circuits involved in producing behaviors of interest, many sensitive periods may occur. Thus, complex behaviors such as IQ, attachment, and psychopathology probably reflect the distal effects of multiply interacting sensitive periods of underlying neural circuitry. In fact, the human brain is designed so that higher level circuits may compensate to varying degrees for abnormalities in lower level circuits. As a result, higher level circuits may compensate to a degree for abnormal processing at lower levels. Thus, analyzing complex behaviors probably underestimates the effects of sensitive periods and certainly complicates the interpretation of studies aiming to determine something about sensitive periods for behavior (Knudsen, 2004).

Circuits vary from those that are unaffected by experience to those that continue to remain open to the effects of experience more or less indefinitely. This raises problems for interpreting results of investigations of children’s behaviors when most investigations are relatively short term. Only with long-term longitudinal investigations can we determine whether additional learning and modification in behaviors of interest are possible.

Furthermore, the preinstitutional experience—which for many children means prenatal experience—is far from typical. In Romania, for example, before child welfare reforms occurred, most institutionalized children were abandoned at birth and spent time in a maternity hospital before being transferred to an institution. Many had mothers who received limited prenatal care, suffered from poor nutrition, and may have been exposed to nicotine, alcohol, or other substances. Any of these factors is known to increase risk for adverse outcomes, and because they most often co-occurred, cumulative risk was likely to be even greater. So, unlike animal research in which a particular perturbation in caregiving may be timed precisely to study its effects, institutional rearing is experienced mostly following abnormal preinstitutional experiences.
Comparison Groups

This problem of equating for prenatal adversity makes the choice of comparison groups for postinstitutionalized children a vital concern (Chapter IX). Comparing children raised in institutions to children born and raised in families comparable to the adoptive families does not provide a test of postnatal sensitive periods, although it may provide some index of optimal developmental benchmarks. Comparing children raised in institutions with children who would have been institutionalized were it not for some event external to the child (e.g., a change in government policies that commits to foster care or opens up the opportunity for adoption), provides the best available comparison group, although they will be hard to find. Comparing earlier versus later adopted children represents an approximation, but it may also involve selection bias (Chapter VII and IX).

An ideal study of sensitive periods of institutional rearing of children would begin with comprehensive assessments of a large number of children during their institutional stay (if not before) and follow them longitudinally in more optimal caregiving environments. The intervention group would vary systematically in the age at which they received enhanced caregiving, and the control group would continue to receive routine institutional care for many years. Ideally, the study would also systematically vary the age of entry into institutional care. Finally, it would include children destined for institutional care who are placed in optimal environments at birth. For ethical and logistical reasons, no such ideal study will ever be conducted in humans, so the best that can be done is to consider studies that have some of the aforementioned features and to assess what we know about timing effects of enhanced environments from the pattern of their results.

Timing of Interventions and Outcomes in Children

What evidence exists for effects of timing of intervention on the behaviors of interest in children reared in institutions? Three different types of interventions with longitudinal designs have been examined. These studies also have used several different designs to assess the effects of timing.

First, there are studies of international adoption. The English and Romanian Adoptees Study (ERA), for example, followed children adopted out of Romanian institutions before 6 months of age, between 6 and 24 months of age, and between 24 and 42 months of age and compared their development to children adopted within the United Kingdom prior to 6 months of age. The children have been followed from infancy into adolescence, making it the longest longitudinal investigation since Tizard’s study of children in London residential nurseries (Hodges & Tizard, 1989). This study has the advantage of assessing the effects of the greatest contrast in caregiving environments.
Children were removed from institutional care in Romania in the early 1990s, before any reforms had been instituted there, and then placed in advantaged homes with adoptive parents in the United Kingdom. Other studies of children adopted out of institutions also have made important contributions (e.g., LeMare & Audet, 2006; Morison & Ellwood, 2000; Tarullo, Bruce, & Gunnar, 2007; Verhulst, Althaus, & Versluis-Den Bieman, 1990; Vorria et al., 2003).

A second intervention that has been studied is foster care. The Bucharest Early Intervention Project (BEIP), for example, comprehensively assessed young children before randomly assigning them to care as usual or to foster care (Zeanah et al., 2003). This study has the advantages of assessments of the children’s baseline functioning even prior to randomization, so that assessments at outcome may be compared to preintervention. Because of the randomization of children, this study is able to establish causal links between the intervention and various outcomes.

Finally, another type of intervention enhances care within institutions. The St. Petersburg-USA Orphanage Research Project, for example, compared usual care in one Russian Baby Home to structural changes in staffing in another Baby Home to training only of caregivers in a third Baby Home (The St. Petersburg-USA Orphanage Research Team, 2008). This study highlights enhancing institutional caregiving environments rather than transitioning children out of the institution to a richer family environment.

A broad range of outcomes has been examined in these studies, and for the most part, large effects have been demonstrated for all three types of interventions (Nelson, Furtado, Fox, & Zeanah, 2009; Rutter et al., 2007c; The St. Petersburg-USA Orphanage Study Team, 2008). Within these different interventions, the relation of timing to outcomes has been approached in different ways and yielded different results for different outcomes.

No Effects of Intervention

In the BEIP, some outcomes showed no evidence of response to the intervention. There were no differences in head circumference in care as usual and foster care children and also no effects of externalizing psychiatric disorders (e.g., attention-deficit/hyperactivity disorder [ADHD] and Oppositional Defiant Disorder). For purposes of this discussion, two possibilities must be considered to explain the lack of response. The first is that the intervention, in this case high-quality foster care, was simply ineffective to increase head circumference or to reduce signs of ADHD. In other words, a more intense or specific intervention might have succeeded where the actual intervention failed. Another possibility, however, is that the sensitive periods relevant to these two outcomes may have closed, rendering the potentially effective intervention unhelpful because it was provided too late, as the earliest age
of placement in foster care was 6 months and the average was 22 months. It is important to note that in the ERA study, children adopted prior to 6 months of age had no increase in signs of inattention/overactivity (Rutter et al., 2009). The difference in results between the two studies could be either because the adoptive family environments in the ERA study were superior to the foster family environments in BEIP or because the sensitive period for inattention/overactivity is earlier than when the BEIP intervention was implemented.

Effects of Interventions but No Effects of Timing

There are also outcomes for which significant treatment effects were evident but no timing effects could be identified. In the BEIP, for example, internalizing disorders were reduced (Zeanah et al., 2009), emotional responsiveness was enhanced (Ghera, Marshall, Fox, Zeanah, & Nelson, 2009), and the amplitude and latencies of several event-related potentials (ERPs) components (P1, N170, and P400) were increased (Moulson, Fox, Zeanah, & Nelson, 2009), but there were no effects of timing on these outcomes. One interpretation of these results is that within the age range of the sample when the intervention began, that is, between 6 and 31 months, the sensitive periods underlying these behaviors remained sufficiently open to allow for some or even complete recovery.

Correlational Findings

There are also a number of findings from studies of children raised in institutions indicating that duration of deprivation, usually defined as time living in institutions and indexed by age at adoption, is correlated with various outcomes. For example, in the ERA study, several major variables were linearly related to time raised in institutions when the children were 6 years old, including IQ, signs of quasi-autism, inattention/overactivity, and disinhibited attachment (indiscriminate behavior) (Rutter et al., 2007a, 2007b; Stevens et al., 2008). Similarly, Bruce, Tarullo, and Gunnar (2009), studying internationally adopted children, found that age at adoption and length of institutionalization were correlated with disinhibited approach to unfamiliar adults. In the BEIP, the younger the child was placed with a foster family, the greater their EEG power at 42 months and the more it approached the level of EEG power in never institutionalized children (Marshall et al., 2008). Also, in the same study, the probability of a child developing a typical attachment with a parent increased the younger the child was removed from an institution and placed with that parent (Smyke, Zeanah, Fox, Nelson, & Guthrie, 2010).

These findings suggest increasing difficulty with recovery as the child becomes older, but they are not especially illuminating about sensitive peri-
ods. There are probably several reasons for this pattern of findings. As has been demonstrated in animal models (Knudsen, 2004), there may be sensitive periods that prolong their opening due to sensory deprivation, there may be compensatory processes that mask closing of sensitive periods, and there may be compensation at higher levels of brain functioning.

**Age Cut Points**

A number of investigations have detected age cut points after which recovery from early adversity becomes significantly more difficult. These cut points appear to represent behavioral sensitive periods. On the other hand, it is necessary that multiple cut points be examined to determine that a function is not linear. As an example, Smyke et al. (2010) examined organized versus atypical attachment classifications in children removed from Romanian institutions and placed in foster homes. In keeping with findings from other domains of development, children placed in foster care prior to 24 months were more likely to have organized than atypical attachments. Initially, this suggested a sensitive period of 24 months. On the other hand, children placed less than 30 months, less than 28 months, less than 26 months, less than 22 months, less than 20 months, and less than 18 months were all more likely to be organized than atypical. This indicates a more linear function rather than a true cut point.

In the Romanian Adoption Project, children were studied who had been adopted out of Romanian institutions by Canadian families. Two groups were compared, an early-adopted group (prior to 4 months) and a later adopted group of children. Across a range of outcomes, the early-adopted group was developing more favorably than the later adopted group (Ames, 1997) and comparable to nonadopted Canadian children.

Similarly, across a range of what they describe as deprivation specific outcomes, the ERA group has found that children adopted before six months of age appear very much like children who had never experienced institutional deprivation. Specifically, this group has reported that IQ (Beckett et al., 2006), executive function (Colvert et al., 2008), quasi-autism (Rutter et al., 2007), and inattention/overactivity (Stevens et al., 2008) all were indistinguishable between Romanian children adopted out of institutions prior to 6 months and nondeprived children adopted prior to 6 months within the United Kingdom. In addition to these specific domains, findings were similar for a construct the investigators termed pervasive impairment (Kreppner et al., 2007b).

In a recent meta-analysis of adoption studies, Van den Dries, Juffer, Van IJzendoorn, and Bakermans-Kranenburg (2008) found that children adopted prior to 12 months of age were as likely to be securely attached as nonadopted children. This suggests broad protection with regard to secure attachment for
children adopted in the first year of life, although protection is incomplete (O’Connor et al., 2003). Both longitudinal studies of internationally adopted children and a meta-analysis converge on the finding that children adopted before 12 months have more advantaged outcomes than children adopted after 12 months of age (Juffer & Van IJzendoorn, 2009).

In the BEIP, investigators found timing effects for the intervention on a number of outcomes, including IQ, language, EEG power and coherence, and security of attachment. Examining children removed from institutions and placed in foster care between 7 and 33 months, investigators found that for IQ (Nelson et al., 2007), EEG power (Vanderwort, Nelson, Zeanah, Marshall, & Fox, 2009) and EEG coherence (Marshall et al., 2008), and security of attachment (Smyke et al., 2010), children placed in foster care prior to 24 months of age were significantly advantaged compared to those placed after 24 months. For language, in contrast, those placed prior to 15 months, had normal expressive and receptive language scores with delays evident for those placed after 15 months of age (Windsor et al., 2011).

Many of the studies cited above have been limited by relatively small sample sizes and/or restricted ranges of the timing variable. Consequently, some studies may have conducted linear correlations without the ability to examine an extensive scatter plot and others simply dichotomized or trichotomized the independent variable. Thus, the form of the function relating time in the institution/age at adoption and outcome was not comprehensively examined. Nevertheless, a few studies have looked at the form of this relation and have observed a step function in which persistent deficits or problems in postinstitutionalized children do not occur in those adopted before a certain age, do occur after that age, and tend not to increase in frequency or severity with prolonged exposure to the institution after that age. Further, this step function tends to occur in postinstitutionalized children who are assessed at somewhat older ages.

Specifically, the ERA group reports no effects of institutionalization on children adopted before 6 months into the United Kingdom from the 1990s Romanian orphanages that were globally and severely depriving. However, while a linear relation between age at adoption and deficiencies was found in assessments made at age of 6 months (see above), assessments on these children at age 11 and 15 years revealed a step function at age 6 months in which exposure to these orphanages was associated with deficiencies or higher frequency of problems on a variety of mental and behavioral measures and longer exposure was not associated with progressively worse outcomes (Rutter et al., 2007b). The step function also has been observed for postinstitutionalized adopted children coming from orphanages that may be more deficient with respect to social-emotional aspects rather than the global deficiencies in 1990s Romanian orphanages. For example, higher rates of clinical and borderline scores on the Child Behavior Problem Checklist were
observed only for children adopted at 18 months or older and only when assessed in children 12 years of age or older (Merz & McCall, 2010), and a similar step function was observed for children adopted from unspecified orphanages around the world (Gunnar, Van Dulman, & the International Adoption Project Team, 2007). However, a study of adoptees from 1990s Romanian orphanages found child behavior checklist (CBCL) clinical and borderline rates to increase above-expected levels for children adopted after 6 months, a result more consistent with the ERA study of similar children. While rates did not increase with longer exposures to the institutions for the social-emotional depriving group or those from unspecified orphanages, they did so for the 1990s Romanian children (Groza reference), a result contrary to that found by the ERA group. Finally, recent analyses of the social-emotional institutional group reveal a similar step function at 18 months for parent-reported executive functioning with no increases at older ages of adoption (Merz & McCall, 2011).

These results are somewhat more consistent with a sensitive period notion, but they also introduce some possible parameters. First, they are consistent with a behavioral sensitive period spanning approximately the first 18 months of life for a variety of characteristics, although if children depart the depriving environment before 6 months of age, there seems to be no lasting consequences. Second, one cannot completely rule out an interpretation based on the length of exposure to the depriving environment rather than specific ages, although there may be no additional effects after 18 months of exposure. There are too few children available for study who enter the orphanages at 18 months to confirm that it is the specific ages and not the length of exposure that is associated with persistent deleterious effects. Third, children exposed to global and severe orphanages may be adversely affected at earlier ages and/or with less exposure and may have higher rates of problems than children exposed to orphanages primarily socially-emotionally deficient. However, the similarity in step function and in behavioral domains affected for all of these groups suggests that deficiencies in social-emotional interactions with caregivers are a potential common underlying factor (the social-emotional environment of the 1990s Romanian orphanages was even more severely depriving than in the contemporary St. Petersburg orphanages).

**SUBSEQUENT EXPERIENCES**

**Compensatory Processes**

A further question is the degree to which abnormal input from adverse early experiences can be overcome by subsequent interventions and whether
there is a point at which it is too late to reverse or even to compensate for abnormal circuit formation.

Despite the clear evidence for the effects of timing of family placement on IQ demonstrated in the BEIP, a subsequent follow-up demonstrated unexpected results. That is, when children were 8 years old, the gap in IQs between the care as usual (institutionalized) and the foster care groups decreased sufficiently in intent-to-treat analyses that they were no longer significantly different (Fox et al., 2011). Interestingly, this was not because of decreases in the IQs of children in the foster care group, but rather, because of increases in the scores of the care as usual group. This may be because most of the children in the care as usual group were no longer institutionalized at age 8 years, having been returned to their parents, adopted domestically, or placed in government foster care that did not exist at the time the study began. Importantly, for the children in the care as usual group who were actually still institutionalized at 8 years of age, their IQs were significantly lower than children in the foster care group. Further, those in high-quality BEIP foster care had higher IQs than all other children (Fox et al., in press). Furthermore, timing of placement was no longer related to IQ when the children were 8 years old (Fox et al., 2009). These findings are compatible with compensatory processes that allow for alternative pathways to behaviors as complex and important as intelligence. For species as sophisticated as human beings, it makes sense that alternative pathways to complex behaviors would be available.

If compensatory interventions can be effective, a question we may reasonably ask is at what cost? That is, Knudsen, Heckman, Cameron, and Shonkoff (2006) have emphasized that early experience is so important not because it creates the only pathways to adaptive outcomes but because it creates the most efficient pathway to adaptive outcomes. Subsequent compensatory processes are necessarily more expensive in terms of energy required to achieve desired outcomes because of the hierarchical way in which the brain is organized and develops. At the level of policy, they require more resources to attempt to change their developmental trajectories. Increasingly, this is recognized as less effective and far more expensive (Knudsen et al., 2006).

Sleeper Effects and Expertise

Developmental investigators describe outcomes that emerge far distal to experiences as “sleeper effects.” That is, some experiences may serve to establish neural substrates for capacities that emerge at a much later point in development. For example, Maurer, Mondloch, and Lewis (2007) studied children born with large central, bilateral cataracts that blocked all patterned input to their retinas. The children had the cataracts removed, anywhere from 1 month to 1 year of age, and they were given compensatory lenses.
The children showed rapid “recovery of function” and for many years seemed function normally. But, when tested at a later age, they show deficits on aspects of visual processing (high-frequency contrast sensitivity and holistic face processing) that emerge much later in normal development.

As noted above, some apparent consequences of early institutionalization do not become apparent until many years after the children have been adopted out of the institution and reared in highly advantaged families, although this may depend on the severity of the early experience. While children adopted from the global and severely depriving 1990s Romanian orphanages displayed behavioral problems and other deficiencies at early ages and shortly after most catch-up growth had occurred (e.g., by age 6 years), children from less severely depriving orphanages deficient primarily in psychosocial aspects of care did not display high rates of clinical and borderline behavior problems or parent-reported executive function deficiencies until approximately 12 years of age and older (Merz & McCall, 2010, 2011). Such sleeper effects suggest that the early institutional experience does not simply produce learned behaviors that are adaptive in the institution but not adaptive to family life and behavior outside the institution; rather, a deficient early experience produces or fails to develop certain rather basic skills, functions, or dispositions, which become more important in tasks that typically emerge later in development perhaps under additional environmental influences (e.g., the demands and stresses of adolescence).

**Disordered Development or Expertise?**

Does it make sense to distinguish between sensitive periods for typical and for disordered behavior? Maurer et al.’s (2007) results also have implications for the capacity to develop “expertise.” For example, they found early deprivation of visual input constrained the individual’s capacity for becoming a visual/face-processing expert. This raises questions about the kinds of expertise that may be constrained by the social deprivation inherent in many institutional-rearing environments.

In much of the literature on institutional effects, attention has been focused not on “expertise” but on the probability of highly disordered or clinical-level problems. But questions about the development of expertise are also interesting. For example, examining IQ as a function of duration of institutional care, there is a clear increased frequency of IQ’s that are two standard deviations below the mean associated with increased time in institutional care. What is also striking, however, is the loss of children with above average and higher IQs as time in institution increases (Loman, Wiik, Frenn, Pollak, & Gunnar, 2009).

There are few studies to date that have examined children following institutional rearing on tasks and at an age when typically developing kids
are reaching their full level of “expertise.” The child’s emotional, social, and academic life becomes far more complex in adolescence, requiring really sophisticated, integrated, and well-regulated skills to navigate. This might well be a time when early experiences of profound deprivation restrict the competencies and expertise of adolescents in a similar sleeper effect to that described by Maurer et al. (2007) for vision and for behavior problems and executive functioning in postinstitutionalized children found by Merz and McCall (2010, 2011). If so, some aspects of functioning might be relatively intact and only more subtle features seriously compromised? If the focus were on early indicators of competence, we might detect early indicators of subsequent maladaptation. In other words, it is possible that different answers may emerge when examining sensitive periods for competence rather than sensitive periods for disordered functioning? This indicates a novel line of inquiry that could be pursued within extant longitudinal studies.

**Preliminary Conclusions and Future Directions**

Investigations are currently underway that may help to answer many of the questions raised in this chapter. At this point, the following preliminary conclusions summarize what we know related to sensitive periods in development with regard to young children raised in institutions.

1. Our ability to understand sensitive periods at the level of neural circuitry in humans is limited and likely will be for the foreseeable future because of a combination of ethical concerns about manipulating adverse environments as well as technical limitations in our ability to study brain function with the necessary temporal and spatial resolution.

2. Because we make inferences about sensitive periods from evaluations of complex behaviors, we underestimate the occurrence of sensitive periods at the level of neural circuitry. This means that although we are interested in complex behaviors, many sensitive periods at the level of circuits probably underlie these behaviors.

3. For many behaviors, there is no evidence of timing of advantaged environments on child outcomes. This does not necessarily indicate absence of sensitive period effects, but it does make conclusions impossible until we are better able to study brain processes underlying the relevant behaviors.

4. Results from a number of studies suggest that across most, but not all, domains of development, institutional rearing that is limited to the first 4–6 months of life is associated with no increase in the rate of long-term adverse effects relative to noninstitutionalized
children. Exceptions to this rule seem to be more related to the social/emotional rather than cognitive domain.

5. With the above exceptions, exposure to deficient institutional environments in the first 18–24 months of life is associated with poorer development and higher rates of problems than would be expected, although the ages at which exposure occurs has not been separated from the length of exposure. Further, it is likely that sensitive period results will depend on preinstitutional factors, the nature and severity of the institutional environment, the age at assessment, and the domain of development and measurements used. For example, current studies show age-at-adoption cutoffs (after which deficiencies are reported) to be 6, 12, or 18 months (parent-rated behavior problems, security of attachment), 15 months (expressive and receptive language), 18 months (parent-reported executive functioning), and 24 months (IQ, security of attachment; EEG coherence).

6. Sensitive periods for expertise should be considered as well as sensitive periods for maladaptive behaviors.

7. The literature informing discussion of sensitive periods is compromised by methodological limitations. Sampling, measures, design, and data analytic variability complicate interpretation of what findings do exist. Drawing conclusions from single study is risky because of design limitations inherent in this kind of research. Nevertheless, extant data could probably be more intentionally mined for hypotheses relevant to timing effects and sensitive periods.

8. Taken all together, research findings applied to clinical and policy recommendations suggest “the earlier the better” rule for enhanced caregiving is a reasonable conclusion. Efforts to be more specific are premature, given the state of the science.

With renewed interest in the study of institutional rearing that we have witnessed in the past decade, we may better understand the effects of adverse caregiving environments in young children, and some of the individual differences that help explain variable outcomes, including timing of interventions.

REFERENCES


