

## Preface

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ABBREVIATIONS. NBAS, Neonatal Behavioral Assessment Scale; NNNS, Neonatal Intensive Care Unit Network Neurobehavioral Scale.

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When I first began to work on the assessment of the neurobehavioral organization of the infant, I saw that an understanding of newborn behavior had 2 purposes: 1) to assess the functional integrity of the newborn and 2) as a clinician, to understand the newborn baby's contribution to the parent-infant system. Both of these were dreams. At the time, we did not recognize an infant's ability to make and respond to choices of stimuli from their environment. There was no concept of the newborn's capacity to shut out (or habituate) intrusive stimuli, to turn to and adapt to an interesting stimulus by maintaining state (controlling motor, autonomic reactions that might interfere), and to adapt his or her thresholds for taking in, digesting, and responding to environmental information. Because most investigations of the newborn's capacity had been conducted without regard for the "state of consciousness" of the baby, the results of auditory, visual, tactile, and kinesthetic stimulation were variable and yielded no significant, reliable results. The infant was viewed as passive, a kind of stimulus-response organism that was reflexively affected by stimuli but had no effect on its environment.

Yet, as a clinician, it was apparent to me as I examined newborns that they were far more competent than was thought and that the newborn influenced his parents' responses to him or her in a significant way. I could see that babies were so different from the very first and that parents shaped their behaviors to the baby. If there was aberrant behavior, the parent could begin to fail, not from lack of passion but because his or her sensitivity to the baby could not be realized. For example, a baby with hypersensitivity responds only to very mild stimuli and must shut out stimulation that might not overwhelm most infants. The threshold for responding to stimuli seemed to depend on mechanisms that were already operant at birth and influenced his or her capacity to demonstrate complex responsiveness to the environment. An anxious mother of a hypersensitive or hyposensitive baby might become more anxious and could easily try to reach her baby by extraordinarily increased techniques, which were

likely to fail. Only when she could observe that decreasing her efforts brought about success was it possible for her to change her techniques to reach such a baby. Mildly neurologically impaired neonates all too often set the stage for failure by their efforts to control input from a passionate, concerned parent.

This observation set the stage for my developing the Neonatal Behavioral Assessment Scale (NBAS). As a pediatrician, I could see that, unless I understood the neonate, my ability to model and lead a passionate parent to understand the newborn's responses was already impaired. I first needed to understand newborn behavior in order to communicate their individuality to their passionate parents. Could we reverse this by understanding the newborns' reactions better?

Since then, we have learned so much. My work with the NBAS was initially with Ed Tronick, PhD, and soon after its publication, Barry Lester, PhD, joined us in this collaborative effort. As Lester and Tronick discuss in the first article, "History and Description of the Neonatal Intensive Care Unit Network Neurobehavioral Scale" (NNNS), newborn babies are complex, responsive, and competent at birth. Their behavior is likely to shape caring parents' responses. Individual differences are likely to be reinforced from the beginning. In cross-cultural studies, we have found that the differences in newborn behavior are evident at birth, are valued, and often seem to shape cultural practices in handling and fostering the development of the newborn and, even later, the child. We learned a great deal about the effects of intrauterine experiences, and especially about the effects of exposure to toxic substances on the fetus, and hence on the neonate's behavior. We substantiated the importance of early recognition of central nervous system disorganization and impairment toward early intervention. In addition to identifying the effects of labor, delivery, and the events and medications involved with normal infants, the NBAS has been very successful in establishing these individual effects on behavior.

Our collaborative effort is now elaborated further by Lester and Tronick's realization of the NNNS as an "offspring" of the NBAS. The NNNS, with its more-complete analysis of neurobehavior, neurologic and stress responses, and regulatory capacities, as well as its more-standardized format and wider application to clinically normal and compromised infants of different gestational ages, offers us an important window into the newborn baby's organization and disorganization. It joins other siblings as

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well, one of which is the Assessment of Preterm Infant Behavior, which Lester, Tronick, and I developed with Heidi Als, PhD (Children's Hospital, Boston, MA) for the evaluation of the preterm infant's neurobehavioral organization. Another is the Clinical Neonatal Behavioral Assessment Scale, which aims to help practitioners establish a relationship with the parents through use of the infant's behavior during the newborn touchpoint. A third is the incorporation of newborn neurobehavior into the newborn well-child physical examination.

With these examinations in our clinical armory, our ability to evaluate and understand the newborn has dramatically enhanced our ability to play a more-effective role in early intervention and in the reorganization of parent-infant interactions. One of the most advantageous uses of the NBAS has been to train providers to achieve "best performance." In the process, providers must work with sensitivity and flexibility toward supporting the baby to achieve an optimal state for responding in his or her best way to each particular test of competence. However, achieving optimal performance is demanding of the examiner and takes extensive training. Also, in going after best performance, the behavior observed "in" the infant in fact more-accurately reflects the interaction of the examiner and the infant rather than only the infant's capacities. I believe that this effort is worth it. We have learned that this process can be a powerful one for demonstrating the baby's potential to parents. In turn, parents are likely to imitate the examiner and reproduce this process in fostering the best outcome for the baby. However, utilization of optimal performance is not desirable when one wants to assess the integrity of the infant to organize his or her own neurobehavior in a more-objective fashion (i.e., to assess what is "in" the infant) with a more-standardized examination (eg, the NNNS). Nor is NBAS' optimal-performance criteria appropriate for research studies, especially multisite studies, because of the training demands on the examiners, the data's reflection of the examiner-infant interaction, and attendant demands on reliability. Thus, Lester and Tronick did not make best performance one of the examination principles in the NNNS, which has a

much more-objective, straightforward, and rule-governed standardized format than the NBAS.

In efforts to understand longer-term prediction from infant neurobehavior to later developmental functioning, we have found that "recovery curves" of neurobehavior are more effective than a single assessment. In my work with Lester on the NBAS, we found that the items that showed optimal recovery could reflect the more-transient influences. The items that were below average and remained below average despite a nurturing environment might be reflecting more-permanent effects. The NBAS items that were below average but began to recover over this period might point to the design for early intervention. Longitudinal studies have not been carried out with the NNNS, but I expect that it will operate in the ways we have found already.

I have always worked with the hypothesis that the development of neurobehaviorally disordered infants is powerfully influenced by the nurturing environment. Our hypothesis is that the threatened nervous systems seem to be able to reorganize those neurobehavioral modalities that are easily overwhelmed. However, designing stimuli and modified caregiving in ways that are appropriate to these hypersensitive and hyperreactive systems requires that the systems be carefully evaluated and understood. This seems to me to be one of the most powerful potentials for this detailed exam, along with finer tuning to the integrity of the infant's own functioning.

## CONCLUSIONS

The NNNS joins the ranks of the NBAS and other scales based on the NBAS. Each serves a distinct and complementary purpose in expanding our understanding of newborn behavior and helping parents and providers to recognize the significance of these behaviors early so that we can institute appropriate interventions for parents and providers. As clinicians, we have the opportunity to utilize the newborn's behavior to help parents see the "real" baby, the baby at his or her most optimal, that they have and to optimize the infant's development. I am proud of the work that Lester and Tronick are doing to continue this effort in identifying threatened infants and their potential for recovery.

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