

12 Behavioral Assessment

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The newborn infant is truly amazing, and awareness of the infant's capabilities and interactive behaviors has evolved over the past 25 years. Born at term or preterm, the infant has a unique repertoire of behaviors that caregivers can observe to better understand what the infant is trying to accomplish. The infant's behaviors are a window for understanding the developing brain. Assessing the infant's neurologic status and cognitive abilities requires evaluating how the infant responds and interacts with the environment.

The womb is a dynamic, sensory-rich environment. The neonate who is delivered early *experiences a very different sensory environment* in the task-driven, high-tech world of the neonatal intensive care unit (NICU). To best respond to an infant as caregivers or parents, we must first understand the unique behavioral strategies the infant uses to cope with the NICU experience. At this point in development, the preterm infant "expects" a sensory experience that is different from the actual experiences in the NICU. This mismatch in neurobiological sensory expectations in the context of the developing brain is important to long-term developmental outcomes.^{1,2}

Behavioral assessment provides information about the infant's neurologic well-being and

allows caregivers to design individualized, developmental care plans for hospitalized infants. Studies by Als and associates and by Buehler and colleagues show that appropriate, individualized developmental care of preterm infants decreases the length of hospitalization.^{3,4} A meta-analysis of individualized developmental assessment and care demonstrated a statistically significant impact on the requirement for supplemental oxygen and on neurodevelopmental outcome at 9 and 12 months, but not at two years.⁵ Another study indicated an enhancement of developmental outcomes when the infant's behavioral and physiologic cues were supported in the nursery.^{6,7} McNulty and colleagues report individualized developmental care had enhanced neuropsychological and electrophysiological effects into school age, which were evaluated at eight years corrected age.⁸ Although the latest Cochrane Review related to the integration of developmental care states there is not yet enough evidence to support change of practice, it also states there is no evidence to support that these interventions have negative effects.⁹ In fact, there appears to be growing evidence for many of the interventions included in what is defined as developmentally supportive care. What are

more difficult to sort out are the cumulative effects of this type of care on infant and family outcomes. An integrative review examining the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) was published in *Pediatrics* in 2013 and found no differences in outcomes; however, many inaccuracies have been noted in how the review of the research was conducted.¹⁰

Parents and professionals have long searched for accurate indicators of competence, developmental delay, or disability in infants. Predicting neurodevelopment delays is complex and challenging. Untimely and/or inappropriate predictions sometimes have caused both infants and families more harm than benefit. Each approach to assessing the newborn represents the need to determine early which infants are progressing normally and which will benefit from special interventions and follow-up. The infant's developmental trajectory is influenced by evolving relationships. Parents are the infant's ideal nurturer and coregulator, enhancing the infant's competence and ability to build trust within the relationship. Parents and infants benefit from the parent's awareness and responsiveness to the infant's behavioral capabilities and temperament. Parental ability to interpret the infant's behavioral cues has been shown to strengthen parent-infant interaction during the first year of life.^{6,11-13} When parents can interpret their infant's cues and respond appropriately, the infant is better able to self-regulate and respond appropriately to the physical and social environment.¹⁴ Providing infants with this foundation for trusting interactions increases their learning and ability to respond to new situations.

The assessment of behavioral organization complements and elaborates on the neurologic assessment. The neurologic examination assesses the function of the central nervous

system and includes assessment of muscles and reflexes within the context of the infant's state of consciousness, while the behavioral examination relies on describing the infant's observable behavior. This behavior pattern is thought to be a reflection of the infant's underlying neurologic status. A critical window of incredible brain growth and differentiation happens between 24 and 40 weeks postmenstrual age. How the caregiver interacts with the infant during this critical window influences brain development and function.¹⁴

The findings of a newborn behavioral assessment must be understood in context of several considerations. First, an important foundation for presenting the assessment findings is the acknowledgment that developmental behavior and function are not determined solely by the circumstances at birth. The human brain demonstrates a fascinating capacity to adapt and adjust to difficulties and conditions. Moreover, a child's development is a complex, dynamic process with many influences that occur over time in addition to the structural and functional changes within the infant's central nervous system.

The process of infant behavioral assessment has shifted to embrace a range of competencies, rather than deficiencies. A priority for health professionals is to offer helpful and accurate information that can facilitate parent-infant attachment. Assessment of the infant's environment and of family and social interaction must also be included to assess the capacities and needs of infants who may be considered at risk during the perinatal period. The assessment needs to be repeated at different time intervals to determine the infant's current level of behavioral functioning while identifying strengths and vulnerabilities.

APPROACH TO BEHAVIORAL ASSESSMENT

Identifying conditions of risk, describing behavior patterns, and estimating developmental function are all important aspects of the behavioral assessment. Creditable evaluation relies primarily on the examiner's astute, accurate observational skills. The examiner must observe the infant's ability to organize, recognize signs of disorganization or stress, and modify the interaction based on the infant's behavioral response.

It is important to follow the basic principles of physical examination when assessing the infant's behavior. Perinatal history will provide important information on factors that will affect the infant's ability to interact with the environment. Matters such as time elapsed since birth, type of labor and delivery, and drugs taken during pregnancy and delivery by the mother must be considered. Gestational age as well as postnatal age and medical status will have a significant impact on both the behavioral findings and the infant's ability to tolerate the examination. An infant with respiratory distress will exhibit different behaviors than one who is not in distress. Caregiving and activity before the examination must also be considered. Research with preterm infants has demonstrated that the sequence of care and the clustering of caregiving interventions can affect the infant's responsiveness and capabilities.^{15,16}

The environment is an important consideration that may affect the outcome of the examination. A warm, quiet, softly lit room provides the best environment in which to observe the infant's responses to stimuli and ability to regulate state. Performing the examination in the presence of the infant's parents or caregivers provides a valuable opportunity for the parent to better understand the infant's behavior and competencies. Other supports that might be needed for some infants to perform at their best include swaddling

and containment. These postural supports encourage a tucked, neutral position. The use of rest periods allows the infant to regain energy and focus during the examination. Another strategy to reduce the effects of the sensory environment is to reduce the sounds and activity in the infant's immediate environment to thereby decrease the stressful stimuli for the infant. These infants are easily stressed. There is often little leeway for the young, small, physiologically compromised infant. The infant who surpasses autonomic regulation thresholds experiences behaviors such as desaturations or bradycardia.

The infant's state of consciousness, or "state," is another important consideration.¹⁷ State depends on a variety of factors, such as time of last feeding, recent events (e.g., blood tests or circumcision), and the infant's individual sleep-wake cycle. It is important to be aware of these other factors and consider them in relationship to performance during the examination. The response to stimuli and behavioral cues will vary according to the infant's state. Preterm infants exhibit subtle behaviors that are more difficult to identify than term infants. The examiner needs to be flexible to obtain the most valid outcomes and conclusions. It is important to remember while caring for these vulnerable infants that there is only a small window of leeway for state organization; infants can quickly go from being actively engaged in the interaction to being disorganized and stressed to the point of fatigue. Thus, caregivers are always balancing the need for assessing the infant's competence with the knowledge that the NICU sensory experiences may be impinging on the infant's ability to demonstrate appropriate behavioral responses.

In many intensive care nurseries and follow-up clinics, neurobehavioral assessment is an essential part of the comprehensive care

TABLE 12-1 ▲ Neonatal Behavioral States

State	Characteristics
Deep sleep	No eye movements No activity Regular breathing
Light sleep	Low levels of activity Rapid eye movement possible
Drowsiness	Variable activity levels Dull, heavy-lidded eyes that open and close
Quiet alert	Wide, bright eyes Attention focused on stimulus
Active alert	Increased motor activity Periods of fussiness Irregular respirations
Crying	Increased motor activity Color changes

of the high-risk newborn. Evaluating behavior is a useful concept because it facilitates understanding the infant's ability to cope with his experiences. Evaluation also helps to provide an understanding of the infant's interactional capacities, including alerting and orienting to caregivers' faces and objects in the environment. Examples of behavioral assessment of three different infants (well newborn, well preterm infant, and sick preterm infant) are found at the end of this chapter with the descriptions of the instruments that can be used for behavior assessment. These examples demonstrate the necessity of the examiner understanding infant behaviors and being trained to assess them. This understanding is necessary for developing a rapport with the infant and administering a developmental assessment.

Behavioral assessment is intended to identify an infant's current level of balance and smooth, integrated functioning. In other words, it is designed to identify in what situations and with what supports the infant exhibits organized behavior. It is also the purpose of the assessment to describe the threshold of disorganization indicated in the infant's

behaviors of defense and avoidance. The degree and kinds of stress and the intensity of frustration or defense that the infant experiences can be indicators of the degree of energy the infant has available. The behavioral assessment must also determine if there is any leeway in the infant's responses. For example, if the infant can tolerate being moved from the examiner's shoulder (where he is flexed, tucked, and resting calmly) to her lap without an onslaught of disorganized behaviors (such as extended arms and hands, grimaces, and fussiness), then he is organized, even if he is working hard to achieve that organization. If disorganization is unavoidable, even when sensitive handling is provided, the infant needs a great deal more facilitation before, during, and even after caregiving, with minimal activity during handling.

It is the intent of the behavioral assessment to describe the degree of competence and organization in the infant's behavioral repertoire, as well as when and how behaviors reflect disorganization or stressful reactions. Are there changes in the infant's color, breathing, or movement patterns as he is moved? Or can he be moved from one place to another with minimal adjustments and limited cost to his behavioral systems? What strategies does the caregiver need to employ to help the infant function smoothly? The behavioral assessment provides the data that can answer all of these questions. The next several sections outline parameters often included in a behavioral assessment. It is important to note that not all parameters are included in all behavioral assessments. Use of some parameters is dependent on the status of the infant. At times, a chosen tool may bring each parameter used together in a meaningful way. For reliable administration, a thorough understanding of the elements is needed. Once each parameter is discussed, then several different behavioral

assessments are described with how they might be best used in the clinical setting.

IDENTIFYING STATES OF CONSCIOUSNESS

State refers to the level of consciousness exhibited by the infant (Table 12-1). This is determined by the level of arousal and ability to respond to stimuli. The infant's behavior, function, and reaction to the environment will depend upon which baseline state he is in, ranging from deep sleep to vigorous crying. Healthy infants can use state to exert control over environmental input, but this ability is limited in the preterm or sick infant. Often the preterm infant is awake with eyes closed; this can be mistaken for sleep. Premature and critically ill infants often have difficulty achieving the entire range of states; for example, a defined state of deep sleep or robust crying. Behavioral assessment begins with evaluating the infant's ability to control his state, move smoothly from one state to another, and maintain alertness.^{18–20}

State is determined by observing an infant's level of arousal and accompanying behaviors or cues. Several scoring systems have been developed for identifying infant states. Brazelton's system is the most widely used and easiest to follow, particularly for the term infant.¹⁸ For the preterm infant, more definitive state definitions may be useful, such as those developed by Als, Holditch-Davis, and Anderson.^{18,21–23} The Anderson Behavioral State Scale (ABSS) has been used often in nursing research because it is easily learned and provides interrater reliability.²² The ABSS was devised by Gene Anderson specifically for use with preterm infants. It is based on the works of Parmelee and Stern, and Burroughs and coworkers.^{24,25} The underlying theoretical framework for this state scale is different from that of other scales. Most other state scales are nominal in nature: the coding is a categorical

representation of clusters of behavioral states. These state scales, then, have been designed to capture the *qualitatively* different aspect of behavioral clusters. The ABSS was designed with consideration for the linear relationships between the states, heart rate, and energy consumption. Thus, the differences are *quantitative* or ordinal in nature.²¹ The ABSS is particularly useful for preterm infants because it breaks down the typical 5 or 6 states into 12 states. This delineation more closely captures the behavioral states exhibited by preterm infants because differentiating sleep-wake states is more difficult in these subjects. For example, the ABSS has four measures of sleep, five measures of awake, and three measures of crying, allowing a more sensitive indication of infant behavioral state.

Interobserver reliability with the ABSS has been easier to establish than with other scales. ABSS scores range from 1 to 12. The infant's sleep is categorized within scores of 1 to 4; the behavior observed with infant's eyes closed (sleep) is used to differentiate the actual score itself. Scores of 1 or 2 are quiet sleep states and represent no body movement; these are considered optimal for recovery and/or growth because of decreased energy expenditures. Scores of 3 or 4 are more active sleep states, with beginning awareness of the environment. Apnea due to disorganized breathing is most likely to be seen in state 3 or 4. Drowsiness with eyes open and closed at times is a score of 5. Scores of 6 or 7 are the alert states considered optimal for perception, interaction, and learning. Increasing activity with a degree of alertness are scores of 8 or 9. Scores of 10 to 12 represent increasing levels of agitation and crying. The examiner assigns a state based on ease of identification (that the infant clearly exhibits that state). This may be more difficult in the preterm or ill infant, whose states may be more fleeting.²³

SLEEP STATES

Deep sleep is characterized by closed eyes with no eye movements, regular breathing, and no spontaneous activity. There is a delayed response to external stimuli and then only a brief arousal, followed by a return to deep sleep. Isolated sucking movements or startles may be noted. Preterm infants may demonstrate a difference between very deep sleep, still sleep, and deep sleep with startles or muscle twitching.²³

Light sleep consists of low levels of activity, with greater variability in response to external stimuli (Figure 12-1). Rapid eye movement may be observed. Preterm infants may exhibit irregular respirations. Infants in light sleep may startle or make brief fussing or crying noises. Parents may need support in delaying response to these brief episodes during the light sleep phase. Active sleep and lower-level alert states are seen more often in preterm infants than in term infants who spend more time in deep sleep and quiet alert states.^{21,23}

TRANSITIONAL STATE

Drowsiness is characterized by a variable activity level, with smooth movements and occasional mild startles (Figure 12-2). The eyes open and close and appear dull and heavy-lidded. The infant will react to stimuli, but the response is often delayed, or he may startle easily. From the drowsy state, the infant may either return to a sleep state or move to a more alert state. Caregivers may arouse an infant to a quiet alert state by providing an auditory or visual stimulus. Nonnutritive sucking has also been found to be effective in calming and bringing an infant to an alert state.^{21,25,26}

AWAKE STATES

Quiet alert refers to the state in which the infant interacts most with the environment. He exhibits a brightening and widening of the eyes and an alert appearance (Figure 12-3). Attention is focused on available stimuli,

whether visual or auditory (Figure 12-4). A minimal amount of motor activity is noted, and respirations are regular. This state provides the greatest opportunity for infant interaction with caregivers. Term newborns commonly experience a period of quiet alertness in the first few hours after birth, providing an opportunity for parents to interact with their infant.

Preterm infants may have difficulty maintaining a quiet alert state for long. Their alert periods may be brief and fleeting. They may become “*hyperalert*,” with an inability to decrease or end fixation on a stimulus (Figure 12-5). Preterm infants may also appear awake and alert but be unable to involve themselves in interaction.^{11,23,27,28} During these periods, they are often noted to use gaze aversion to manage the overwhelming stimuli in the NICU environment.^{28–30}

The *active alert* state is characterized by increased motor activity, with heightened sensitivity to stimuli. The infant may have periods of fussiness, yet is consolable. Although open, the eyes are less bright and attentive than in the quiet alert state. Respirations are irregular. The term infant may be able to use self-consoling techniques to return himself to a quiet alert state (Figure 12-6). The preterm infant will usually become distressed and unable to organize himself. Interventions such as waiting for the infant to settle, swaddling, containing, and reducing other environmental stimuli can be provided by caregivers to help the infant return to a quiet alert state.²³

Crying is accompanied by increased motor activity and color changes. The infant is very responsive to unpleasant stimuli, both internal and external. Some infants are able to console themselves and return to a lower state, whereas others need help from caregivers. Preterm infants may exhibit a very weak cry, or their cry is not audible due to intubation.

FIGURES 12-1 through 12-9 ▲ Progression of infant through states of light sleep to crying; demonstrating time-out signals with visual stimuli.

FIGURE 12-1 ▲ Light sleep.



FIGURE 12-2 ▲ Drowsy.



FIGURE 12-3 ▲ Quiet alert.



FIGURE 12-4 ▲ Signs of attentiveness.



FIGURE 12-5 ▲ Hyperalert response to stimulus.



FIGURE 12-6 ▲ Self-consoling behavior; hand-to-mouth movements.



They demonstrate color changes, alterations in motor activity, and other signs of stress, such as cry-face, apnea, vomiting, or decreased oxygen saturation.^{21,23} The infant may also extend and straighten his extremities, then lie still, remaining extended without the capacity to return to a neutral, flexed posture as he loses his energy, becomes flaccid, and appears depleted. The question the examiner must ask when these behaviors are observed is, “What does it take from the environment or caregiver to settle the infant and help him to recover and return to a modulated, interactive state?” Awareness of the infant’s behavior and the reciprocity of the caregiver to support the infant are core components of individualized, developmentally supportive care practices.

MAINTENANCE OF STATE

Although the states can be distinguished from one another, the infant makes frequent transitions among them. He may change from one state to another several times in the course of the examination. The term infant should display smooth transitions between states and move from sleep to drowsy to wakefulness instead of moving from sleep to robust agitation. Excessive lethargy or irritability is abnormal. The preterm or neurologically impaired infant may exhibit sudden changes between sleep and awake states, but abrupt state changes in the seemingly healthy term infant are a cause for concern.^{21,23}

The ability to maintain an alert state with interaction varies among infants. Some have difficulty becoming alert initially and then struggle to maintain this state for any length of time. They may need facilitation from a caregiver to sustain alertness. Others have trouble filtering out noxious stimuli and progress rapidly to active alert or crying, becoming disorganized. Swaddling or a quiet, darkened environment may help these infants remain alert and focus on a single stimulus.

The examiner should acknowledge the amount of time the infant spends in the quiet alert state or focusing on a stimulus and reinforce the infant’s attempts to build positive trusting interactions. Infants who have difficulty remaining alert can be frustrating for caregivers and parents. The examiner may spend time with parents exploring opportunities to support the infant to maintain an interactive alert state. The examiner reflects on and asks him- or herself, “When does the infant look most comfortable?” or “What supports are necessary to enable the infant to be successful?” The examiner then incorporates these answers that are individualized to this particular infant into the interaction with the infant.

Preterm infants have brief periods of alertness, and may have difficulty maintaining this state. Brazelton describes the “cost of attention” as the amount of energy the infant must expend to maintain an interaction.³¹ This cost of attention varies, depending on the health and maturity of the infant. Premature or sick infants show fatigue or stress sooner than do healthy term infants.^{29,30} The caregiver’s supportive response to the infant’s distress is imperative to building a trusting relationship.

Signs of stress or fatigue include color changes, irregular respirations, apnea, changes in tone, irritability or lethargy, and vomiting. The infant may change states rapidly from crying to sleep or become hyperalert. The examiner must be able to recognize these signs of stress and fatigue and support the infant or discontinue the examination when appropriate. After the infant has had a period of rest, the examiner may be able to begin again. The cost to the infant or the amount of energy he expends during the examination should be noted.^{22,31} The preterm or ill infant may require completion of the examination in pieces, which is not optimal; yet completion

in one time period may be too much for these infants.

ORGANIZATION

Organization reflects the infant's ability to integrate physiologic and behavioral systems in response to the environment without disruption in state or physiologic functions.^{11,32} Physiologic functions include such parameters as heart rate, respiratory rate, oxygen consumption, and digestion. The behavioral system includes state (attention and self-regulation) and motor activity (tone, movements, and posture).

The organized, robust infant maintains stable vital signs, smooth state transitions, and even movements when interacting with the environment. The infant is able to self-console or be consoled easily and can habituate to or block out overwhelming stimuli. The disorganized infant will react to the environment with sudden state changes and will exhibit frantic, jittery movements, color changes, and irregular respirations. Some infants will respond with hypotonia. The ability to maintain organization depends on the infant's maturity level and overall well-being. Individual temperament may also play a role in organizational ability.

In evaluating organization of motor behavior, the examiner assesses the infant's movement patterns, energy level, and tone. Hand-to-mouth maneuvers in an attempt to self-console are purposeful movements achieved by the mature, well-organized infant (see Figure 12-6). When a cloth is placed over the face of a term neonate, he will attempt to remove it by arching, rooting, and swiping at the cloth covering his eyes/face. As during most assessments of behavioral maturity, the preterm infant may have a diffused or delayed response.

FIGURE 12-7 ▲ Sign of overstimulation in response to stimulus.



FIGURE 12-8 ▲ Sign of overstimulation in response to stimulus.



FIGURE 12-9 ▲ Crying as a response to continued stimulus.



TABLE 12-2 ▲ Signs of Overstimulation (Time-Out)

Gaze aversion
Frowning
Sneezing
Yawning
Hiccuping
Vomiting
Mottled skin
Irregular respirations
Apnea
Increased oxygen requirement
Heart rate changes
Finger splaying
Arching
Stiffening
Fussing, crying

Infants who are easily overwhelmed will benefit from care designed to enhance their organizational ability. Clustering care to allow for uninterrupted sleep, arousing the infant slowly, and introducing one stimulus at a time are all interventions that support the infant in being more successful or competent. However, it is important to consider those caregiving tasks that are clustered together and their overall effect on the infant. There is always a cost/benefit ratio to consider.^{15,16} Providing postural support to encourage the infant to stretch and squirm to help steady breathing yet return to a neutral, tucked posture is essential for the infant to develop productive coping mechanisms. Being aware of and modifying sensory input is important so as not to increase stress for the infant. Some infants, however, can tolerate help in modulating their behavior during the examination. Quietly speaking to the infant in a way that provides comfort while you interact can be a supportive intervention.

RECOGNIZING THE SENSORY THRESHOLD

Sensory threshold refers to the level of tolerance for stimuli within which the

TABLE 12-3 ▲ Signs of Approach (Attention)

Quiet alert state
Focused gaze
Dilated pupils
Regular respirations
Regular heart rate
Rhythmic sucking
Reaching or grasping
Hand-to-mouth movements

infant can respond appropriately. When he reaches or exceeds his threshold, the infant becomes overstimulated and exhibits signs of stress and fatigue (Table 12-2). Preterm and neurologically impaired infants may have low thresholds, compared to healthy term newborns. What would normally be considered routine care (e.g., talking to the infant during feeding) may be overstimulating to an infant with a low sensory threshold. These infants might do better when presented with a single stimulus or modified, muted sensory inputs such as providing a comforting quiet voice or briefly catching the infant with eye contact.

The mature newborn has a unique ability to regulate physiologic and emotional response to a variety of stimuli. It is his way of learning to control the effects of the surrounding environment. Evaluating these reactions to the environment allows the examiner to design a plan of care that is unique to that infant.³¹⁻³⁴ Knowledge of these reactions also facilitates parent competence and involvement.^{13,35} Infants who are easily overwhelmed may require more frequent breaks during caregiving to adapt and regulate responses.

OBSERVING BEHAVIORAL CUES

An infant's behavior indicates his physical, psychological, and social needs. Caregivers who respond appropriately to these cues develop reciprocal relationships with the newborn. Responding to an infant's behavioral cues

also reinforces behavioral organization.^{11,23,36} This reciprocity helps to build trust, which is an essential component of emotional development and a key component in the foundation of secure attachment.³⁷ The infant relies on individualization, responsiveness, and respectfulness, and should be integrated into each interaction.³⁸

Signs of approach (or attention) indicate that the infant is ready to interact with the caregiver or the environment. Approach behaviors include an alert, focused gaze; regular breathing; and dilated pupils. The infant may also exhibit grasping, sucking, or hand-to-mouth movements (Table 12-3; see Figure 12-6).^{22,23}

Avoidance behaviors (time-out signals) indicate that the infant is becoming tired, overstimulated, or stressed and needs a break from the stimulus or interaction. Avoidance behaviors include averting the gaze, frowning, sneezing, yawning, vomiting, and hiccupping. The infant may also display finger splaying, arching, stiffening, or crying (Figures 12-7 through 12-9; see Table 12-2). Color changes, apnea, irregular breathing, and decreased oxygen saturation also indicate the infant's need for time-out.^{21,23,36} A state change may be an avoidance behavior, as demonstrated by the infant who withdraws or shuts down entirely by falling asleep during repeated or prolonged painful procedures. It is important to remember that while some infants may muster up the energy to protest to a noxious stimulus, they seldom have the autonomic stability to sustain the response. Nurses must use these cues in planning routine care if they are to best support the infant and decrease energy consumption.^{29,30}

Reflective strategies can help caregivers better understand their own perceptions of the infant's experience and can be used to strengthen the critical thinking skills needed

for comprehensive assessments of vulnerable infants.³⁹ Reflection provides an opportunity to shift the focus of learning to include self-knowledge as a component of competency.⁴⁰ Schön provides a framework for reflection where the knowledge or act of knowing comes from within the practitioner.⁴¹ Reflection can also be defined as a process to creating meaning from our experiences to guide our decision making—to take the next steps of action.³⁹ This mindful awareness of the infant's behavior prepares the caregiver to sustain responsive and respectful interactions. Reflection is a key element of individualized developmental care practices and can be defined as the caregiver's recollection or memory of the interaction, journaling, or talking things through with another person.^{42,43} These insights or newly gained knowledge through reflecting on the infant's behavior can be utilized for future interactions to be more supportive of infants' strengths and challenges.^{44,45}

HABITUATION

The infant's ability to decrease his response to a repeated stimulus is referred to as *habituation*. When a stimulus is repeated, the infant's initial response to it will gradually disappear. Habituation provides a defense mechanism for shutting out overwhelming or disturbing stimuli. For example, health care providers often habituate to the noxious noise of the NICU.

Habituation is best assessed when the infant is asleep or in a drowsy alert state.^{18,32} The stimulus can involve the visual, auditory, or tactile senses. Visual habituation can be easily assessed by shining a light briefly into the infant's eyes from 10 to 12 inches away. Repeat the stimulus every five seconds to a maximum of ten times or until the infant ceases to respond (whichever comes first). Note the presence of startles, facial grimaces, blinking,

and respiratory changes. If habituation occurs, responses will become delayed and eventually disappear. Infants who are able to habituate successfully usually do so within five to nine flashes.

The infant's ability to habituate to an auditory stimulus can be tested in the same manner, but using an object that makes a noise (e.g., a bell or rattle). Holding the object 10–15 inches from the baby, shake it for about one second. Reactions may include startles, facial grimaces, and respiratory changes. Note the infant's ability to decrease his reactions as the stimulus is repeated. As they do with visual habituation, most term infants decrease their reaction after five to nine repetitions.

Habituation to tactile stimulation can be determined by pressing the sole of the foot with a smooth object. Repeat the stimulus every five seconds. The infant may begin with a generalized body response, pulling both feet away. The response will gradually decrease to only the involved foot or will disappear altogether.

The ability to habituate varies among infants. Some (including those who are preterm) have difficulty tuning out noxious stimuli.⁴⁶ They are easily distracted and then become irritable and disorganized, displaying signs of stress and fatigue. The premature infant's brain development is influenced by random frequent sensory stimulation. Their inability to cope with environmental sights and sounds may make interactions and feeding difficult. These infants may need to be fed in a quiet, darkened room or presented with one stimulus at a time during their quiet alert state. Work with parents to reinforce identification of and response to their infant's behavior. This can facilitate a positive relationship between the infant and the family, supporting parent competence.

RESPONSE TO STIMULI

VISUAL STIMULI

The newborn has the ability to focus on and react to a variety of stimuli in the environment. The examiner should observe and record the infant's response to visual and auditory stimuli. For optimal evaluation, responses should be assessed with the infant in the quiet alert state.

Two tests for visual response can be performed with the newborn. The first is a response to light. When a light is directed toward the infant's eyes, an appropriate response is for him to grimace and close his eyelids. This response will lessen with habituation. The second test evaluates the ability to fixate on an object and track it. Term infants are able to fixate briefly on an object (a face or a mobile, for example). The newborn's visual field is fairly narrow, with the ability to focus on objects at a distance of about 10 to 12 inches. Objects closer or farther away will be ignored because newborns have decreased visual acuity that improves with maturation. The term newborn is able to follow or track an object horizontally about 60 degrees and vertically about 30 degrees, often with some head movement.^{18,21}

The pupillary reflex develops at approximately 30 weeks gestational age. Without this reflex, premature infants have a limited ability to maintain protective lid tightening and therefore should be protected from bright lights and visual stimulation.⁴⁷ As the pupillary reflex matures, preterm infants beyond 30 weeks gestational age demonstrate both response to light and ability to fixate on simple patterns.⁴⁸ Preterm infants may take longer to fixate on an object, and they have less visual acuity than term newborns, which accounts for this variability in response. It is important to continue monitoring light levels, protecting the infant's eyes from direct light. In

the preterm infant, closed eyelids provide less protection from bright lights than they do in more mature term infants. Behavior responses to visual stimuli should be evaluated for signs of stress and fatigue.⁴⁷ An eye examination for the preterm infant is a very noxious procedure that the infant may need supportive interventions to manage.

AUDITORY STIMULI

When in the alert state, newborns will respond to an auditory stimulus with brightening of the eyes and face and turning of the head in search of the sound. A rattle, bell, or music box will work well as an auditory stimulus. Keep in mind that a newborn may tune out a noxious auditory stimulus. With the baby's head in midline, initiate the stimulus 6–12 inches away from his ear, out of his visual range. He should alert and turn toward the sound; continue by alternating the stimulus on each side with sounds of varying rhythm and intensity.

Preterm infants begin to orient to a soft sound source around 28 weeks gestational age, but often demonstrate sensitivity to noise and physiologic instability in the presence of loud noise. The use of soft voice and rhythmic cyclical auditory stimulation can be introduced based on the infant's behavioral response.⁴⁹ Careful attention must be paid to limiting environmental noise because it has the ability to interfere with the responses to the behavioral examination. White and associates provide design guidelines for limiting noise.⁵⁰

EVALUATING CONSOLABILITY

Infants' abilities to quiet when in a crying state vary. The well-organized infant demonstrates observable activities to self-console during the course of examination. These include bringing the hands to the mouth; sucking on the fist or tongue; and using environmental stimuli (visual or auditory),

such as a soft human voice, to self-console (see Figure 12-6).¹⁸ Infants who make limited attempts or who show decreased ability to self-console may be more irritable or sensitive to stimuli.^{18,51}

Most infants will respond to consoling attempts by caregivers. Irritable infants may be easily disturbed by stimuli from the environment and may be slower to respond (or may not respond at all) to attempts to console them. The examiner should try interventions that can lead to consoling the infant, such as talking softly; providing hand containment or placing your hand over the infant's stomach; flexing his extremities near the trunk to prevent startle activity; holding; rocking; or offering nonnutritive sucking. Decreasing such environmental stimuli as light, noise, and sudden movement may also be helpful. A common mistake is trying several interventions at the same time (e.g., rocking, talking softly, *and* offering a pacifier).⁵² A combination of activities may overstimulate some infants. Therefore, limit the interventions to one at a time before using them as a group. If one intervention fails, try a different one, and note which interventions work for this particular infant so they can be used again in the future.

IDENTIFYING TEMPERAMENT

Some babies seem more difficult; others appear to be easier to care for. Infant temperament has been defined as the infant's behavioral style. It is how he behaves in relationship to the environment and caregiving interaction.⁵³ The developing relationship between the infant and mother is affected by how the child's temperament is exhibited and perceived. The infant is neurobiologically connected to his parents. When there is synchrony within this dyad, there is said to be "goodness of fit." When synchrony is lacking, the infant is perceived

as difficult and/or demanding by the mother (primary caregiver), and the asynchrony of the relationship predisposes the infant to long-term negative outcomes. Because she is the primary caregiver, the mother's perceptions of infant temperament are important. Maternal perceptions and beliefs about the attributes of the infant affect how she cares for her infant and the symbiotic relationship that will support the infant's cognitive development. Thus, infant temperament has been measured by asking mothers about their infants. How do they perceive the infant? Is he calm or demanding? How easily is he consoled or is he inconsolable? Understanding these dimensions can help the mother acquire realistic expectations for the child's behavior and perceive that he has met them. Consider using reflective strategies, such as journaling or talking about the interaction with their infant, to support the parents in exploring their perceptions and better understanding their infant's behavior.

As stated above, *temperament* refers to the way an individual interacts with his environment. Chess and Thomas describe nine behaviors that define variations in temperament.⁵³ A description of each behavior follows:

Activity level refers to motor activity such as playing, dressing, eating, crawling, and walking. Sleep-wake cycles and their durations are also used in scoring activity level. Some infants are very active, with short sleep cycles; others are less robust.

Rhythmicity refers to the regularity of functions such as hunger, sleep-wake patterns, and elimination.

Approach or *withdrawal* describes the individual's reaction to a new stimulus such as food, a new toy, or a new person. Approach responses are positive; withdrawal responses are negative reactions to the new situation.

Adaptability is the individual's response to new situations once the initial response has

passed. Adaptability examines the ability to adjust to the new situation or environment.

Threshold of responsiveness refers to the amount of stimulation required to generate a response, either positive or negative.

Quality of mood describes the overall mood of the individual or the amount of pleasant, friendly, happy behavior versus unpleasant, unfriendly, or fussy behavior.

Intensity of reaction is the level of energy in a response, whether positive or negative.

Distractibility is the ability of extraneous stimuli to interfere with the individual's current behavior.

Attention span or *persistence* refers to the length of time an individual will pursue a specific activity, especially when obstacles interfere with it.

Based on these behaviors, three categories of temperament can be defined and frequently identified in the newborn:

1. The "easy" baby demonstrates regularity, positive approaches to new situations, adaptability to change, and an overall positive mood.
2. The "difficult" baby has an irregular schedule, trouble adapting to new situations, a low threshold for stimuli, and intense, often negative moods.
3. The "slow-to-warm" infant is characterized by mild intensity, positive or negative moods, and slow adaptation to new situations and people. These infants need repeated, slow exposure to a situation before they will respond positively.

Understanding and supporting an infant to best optimize his temperament can help parents create an environment that will maximize their child's positive characteristics and minimize frustration.⁵⁴ Parents of a slow-to-warm child can allow extra time for him to adapt to new situations. The infant with a low sensory threshold may be easier to care

for if activity is limited to a stimulus or two at a time.

TERM NEWBORN BEHAVIORAL ASSESSMENT

Perhaps the best-known tool for behavioral assessment of the term infant is the Neonatal Behavioral Assessment Scale (NBAS) developed by Brazelton.³¹ The tool was designed for use with healthy newborns from about 36 to 44 weeks gestation. A complete behavioral assessment using the NBAS takes about 30 minutes and is best administered by a trained examiner. However, even limited aspects of the examination performed by an untrained examiner can be used to provide helpful information about the infant's neurobehavioral status.^{18,48} There are also several studies in which the NBAS has been done in the presence of families to encourage them to see the vast capabilities of their infant.^{17,55} The NBAS assesses the newborn's response to 28 behavioral items, each scored on a nine-point scale, and 18 elicited responses, each scored on a four-point continuum. These items provide information about the newborn's ability to respond and adapt to his environment. Such items as reflexes, state regulation, orientation to visual and auditory stimuli, habituation, motor performance, and interaction with caregivers are assessed. The examination is usually done in one sitting, and items are most often presented in the same order to all infants.

The focus is assessment of the infant and intervention with the family.¹⁸ The parents and nurse work together, using a nonjudgmental approach, to observe and understand the unique behaviors of the infant. Specific items selected from the NBAS by the nurse create opportunities to emphasize the infant's capabilities and to facilitate reciprocal interaction between parents and their infant.

Nurses trained in the NBAS can use this assessment in any setting where nurses see newborn babies in the first months of life. The model is based on the assumption that the parents and newborn are dynamically inseparable and that the family and infant require individualized attention. The nurse selects the behaviors and interactions with the infant that she feels will have the most positive impact on establishing a parental-infant bond. During the examination, the nurse identifies infant strengths and builds on these successful strategies the infant is demonstrating. She can also identify the infant's efforts to comfort and self-console as well as how the infant copes with the demands of the experience. The nurse facilitates/guides parents to be most responsive to their infant. Anticipated areas of concern are addressed, and parents are encouraged to understand and communicate with their infant in ways that promote understanding of his behavioral needs and communications.

The NBAS focuses on motor responses and maturity, interactive skills, visual and auditory orientation, management of sleep-wake cycles, and physiologic integrity and reflexes.¹⁹ Self-quieting activity is highlighted, and parents learn how their infant can calm himself by bringing hands to mouth, sucking, looking, and changing his position. If a baby cannot quiet himself, the nurse points out cues that signal stress or disorganization. Parents can then be aware of when their infant is stressed and modulate their reactions to him. Parents can be shown how to watch for stress cues and how to intervene without either overwhelming the infant with too much stimulation or failing to offer enough intervention to soothe him.

The examination is structured with a preferred order of presentation of items. The infant's state plays a major role in the evaluation; therefore, observing the state of consciousness becomes the starting point. This

sample evaluation using the NBAS describes some of the major responses of a healthy term newborn, but space does not permit description of the entire examination.

Initially, the examiner evaluates state of consciousness by observing respirations, eye movements, startles, and body movements. A specific scoring system is utilized to describe the initial state and the predominant states throughout the examination. The range and variety of state changes are noted. Once state is observed, habituation is evaluated. Habituation is the degree to which the nervous system reduces or inhibits responsiveness to a repeated stimulus until shutdown. Typically the examination begins with the infant asleep or in a drowsy state. A flashlight is passed across the sleeping infant's closed eyes ten times, and the degree of response and response decrement is noted. The assessment is repeated with a rattle and then a bell to note the infant's ability to shut out sound after repeated presentations. A typical response would be a startle or dramatic movement to the first stimulus, followed by decreasing reactions to each of the remaining nine presentations. A range of responses is possible, but overall, one would like to see the infant react strongly at first and then show a reduction of reaction over time. Next, the supine sleeping infant is uncovered slowly and the response to this change is noted. One may see no change, postural changes, color or breathing changes, or state changes. Next, a series of reflexes is evaluated with the infant still in a supine position. First the reflexes of the hands and feet are evaluated, including plantar grasp, Babinski, heel prick, ankle clonus, passive tone in legs and arms, rooting response, sucking reflex, and glabella reflex. Each item is presented in a specific pattern with a watchful eye for change and variable responses.

Because the infant is supine, he can be undressed gently prior to the palmar grasp and pull-to-sit reflexes are tested. The infant is then picked up with his head facing away from the examiner, and standing and stepping reflexes are tested. The infant is then placed prone on the bed to evaluate the crawling reflex. Next, the infant is picked up to evaluate incurvation. The infant is placed prone over the examiner's hand and raised in the air, and the examiner skillfully strokes along the right and left of the spine to evaluate for hip swing. The infant is then moved through space in a brisk manner, initially in an upright position, then in the horizontal position, and tonic deviation of head and eyes, and nystagmus are assessed by eliciting the infant's vestibular reaction and neurobiological capacities. These maneuvers also allow for observation of the degree and type of balance, and differentiation between relative extensor and flexor tone and posture. The infant is then held close to the examiner's body to evaluate cuddliness. A cloth is placed over the baby's eyes to evaluate his attempts to remove it by swiping with the arms in a defensive movement pattern. Tonic neck reflex and Moro reflex are then tested.

By this time in the examination, the examiner can begin to define what is necessary to help this infant stay in a calm, alert state. When the infant does alert, the social interactive package can be administered. To set the stage for administration of these items, evaluate state, check room temperature and lighting, and have a comfortable chair available. Gently move the infant to the examiner's lap, providing postural supports. Ideally, this change will not disrupt the alertness that has been achieved by the infant. The examiner then presents a red ball, a rattle, and the examiner's face alone, voice alone, and the two together. The responses that are evaluated are

the degree of visual fixation, gazing, and any avoidance reactions, such as turning away, or nonresponsiveness. In addition, the examiner may see the degree of recognition of voice and sound in the infant's turning with head and/or eyes to "see" the sound off to the side of each ear.

Throughout the administration of these items, the examiner is vigilant in watching for state changes (i.e., change in the quality of alertness, becoming fussy, or crying). All state changes (if they last at least 15 seconds each) are recorded. The lability of crying and alertness is scored along with irritability. The degree of excitation and ease in consoling the infant are important (self-quieting and consolability). As crying or fussiness develops, the examiner does not immediately stop the cry, but gives the infant a chance to self-quiet, then offers a specific sequence of supports to see what level of support quiets the infant. The examiner watches for any attempts or strategies used by the infant to organize himself and quiet himself (such as hands to mouth, bracing a foot, or sucking). The buildup to a full, intense cry state becomes important so that the examiner can see the degree of self-quieting, as well as what it takes to calm the infant. If, at any time, any physiologic instability is observed, the examiner terminates the examination.

Throughout the examination, the examiner is scoring the infant's best performance. The examination moves from presentation of simple to more vigorous stimuli. A typical term newborn may show a variety of responses, from smooth responses that appear to come steadily and without cost or effort to vigorous activity levels with intense upset, demonstrating a need to be comforted. Some infants are more difficult to comfort than others. They may need specific levels of stimulation to elicit

their ability to use the comforting resources available to them. "Normal" encompasses a wide range, and all of these responses can fall within normal limits.

CASE ASSESSMENT OF A FULL-TERM INFANT

Jenna is a normal three-day-old newborn. Her mother, Helena, had recovered from her delivery and was eager to get to know her baby, but had been told that babies do not see well for the first few weeks. Helena had many questions when the nurse came in to discuss Jenna with her. The nurse noted that Jenna's mother had already learned several things about Jenna: how she liked to suck on her fist, what made her cry, and even how to calm her successfully. When the nurse pointed out Jenna's alertness and explained that Jenna could see her mother even at this early stage, Helena seemed skeptical. The nurse suggested that because Jenna was awake now, Helena should hold her in front of her and move her face out of Jenna's vision, call her name, and talk to her. As soon as Jenna heard her mother's voice, her eyes shifted in the direction of her mother's face. Encouraged to keep talking, Helena was extremely pleased as Jenna continued to look and search until she found her mother's face and voice. As Jenna gazed at her mother, the nurse pointed out that if she kept Jenna's face within ten inches of her own face, Jenna could focus and look (Figure 12-10). Helena and Jenna sat gazing at each other, enthralled, for several minutes. After these minutes, her nurse, who had remained quiet while letting them get to know each other, explained that Jenna could indeed see and even hear and look for her mother's voice and face. She suggested that this be a game they could play. Helena was absolutely amazed and proud at the same time, marveling at her baby's capacity to interact at such a young age (Figure 12-11).

FIGURE 12-10 ▲ Jenna gazes at her mother's face.**FIGURE 12-11 ▲ Jenna gazes at her father's face in full alert state.**

PRETERM INFANT BEHAVIOR ASSESSMENT

Als and associates developed an instrument for assessing the preterm infant. Their assessment of preterm infant behavior (APIB) examines the interplay of behaviors within five behavioral parameters (subsystems): *autonomic*, which refers to physiologically related changes such as pulse, respiration, skin color, and visceral responses; *state*, or state of consciousness on the continuum of sleep to wakefulness up to robust crying; *motor*, which assesses tone, posture, and movement patterns; *attention/interaction*, or the ability to attend and respond to the environment; and *self-regulatory*, the infants' efforts to cope with their experiences along with their ability to maintain state and self-console.^{27,48} These parameters can be used to assess preterm infants' current level of functioning as well as their ability to cope with the physical and social environment. It is important to note that the APIB is a dynamic, interactive examination that is provided by an examiner who is mindful of an infant's breathing/autonomic stability and thus, the infant is facilitated to exhibit best performance. Once an infant's coping ability and organization are assessed, a plan of care that individualizes interactions for that infant can be developed.^{27,47,48}

The assessment seeks to describe the unique way in which each individual infant interacts, copes with, and integrates experience from the world around him. The interplay of behaviors is evaluated along with the degree of organization rather than maturation of the central nervous system as the focus because in this model the preterm infant is seen as being in continuous interaction with the environment. The degree of facilitation by the examiner is also integrated into the scoring.

This assessment is intended to identify an infant's current level of balanced and smooth integrated functioning (competence). In other words, identifying in which situations and with what supports the infant appears to function smoothly and is relaxed and comfortable enables the caretaker to promote modulated, organized behavior. It is also the purpose of the assessment to enable the examiner to describe the threshold of disorganization indicated in the infant's behaviors of defense and avoidance. The degree and kind of stress and intensity of frustration or defense that the infant experiences can be indicators of the degree of energy the infant has available. The assessment will show if there is any leeway in the infant's responses. For example, can the

infant tolerate being turned over to supine from prone (where he is flexed, tucked, and resting calmly) without demonstrating disorganized behaviors such as extended arms and hands, grimaces, and fussiness, or does the infant lose his energy and become depleted with vestibular input of changing positions? What is the relationship between the infant's breathing and movement patterns? Does the infant stretch and squirm in an attempt to steady breathing? Does the infant pause in breathing, holding his breath as he stretches and squirms? If the infant cannot display organized behavior when being handled sensitively, he may require greater facilitation before, during, and after caregiving interactions. As with the NBAS, training is required to become proficient at administering the APIB examination. However, an awareness of various behavior dynamics will increase the untrained examiner's ability to assess the infant's well-being and provide appropriate interventions. Training in the APIB is available by contacting Heidelise Als, PhD, Neurobehavioral Infant and Child Studies, Children's Hospital, 320 Longwood Avenue, Boston, Massachusetts 02115.

CASE ASSESSMENT OF A HEALTHY PRETERM INFANT

Assessing the organizational function of a healthy preterm newborn follows much the same approach as examining the term infant, yet responses may be very different. In the following example, Alejandra represents a healthy, preterm newborn of an appropriate weight for gestational age when the infant was delivered at 33 weeks and who is now 36 weeks postmenstrual age (PMA). The infant is doing well with minimal respiratory support, is breastfed every 2–4 hours, and is bedded in a bassinet.

As the examiner begins the evaluation of this infant, she is positioned supine and loosely swaddled to support flexed, midline postures.

Her hips and legs are tucked in close, and she is surrounded by rolled blankets to provide additional postural support. One of the infant's hands is placed on top of her face, and the other arm is extended along the side of her body. Alejandra is breathing regularly and has stable oxygen saturation levels. Her face is pink, and she is in a deep sleep. Her nicely flexed body position, regular breathing, and good color indicate organized sleep. The examination begins by assessing the habituation responses with passing a flashlight across the infant's eyes, which yields an intense startle at the first shine, followed by brief squirming and the infant returning to sleep. The second and third flashes trigger a slightly delayed but less intense response. The fourth flash yields a cycle of activity starting with the startle, and then all arms and legs extend, followed by a brief stoppage and then a recycling of less intense movements. The next flash yields a facial movement only, and then stillness. The infant's breathing is regular, but the face is now paled around her eyes and nose. The next two flashes produce no response. Thus, Alejandra had some difficulty inhibiting the motor arousal with one cycle of response, but was able to eventually settle into sleep and shut out the remaining light stimuli. Using a rattle as an auditory sound stimulus, the examiner repeats a similar sequence of ten trials. The first response shows a movement, with subsequent responses subsiding, and eventually the infant successfully inhibits the motor response. The second auditory stimulus of a bell produces no response, and the infant remains asleep. This means that the sequence can end because the infant has shut down successfully. These are appropriate habituation responses for a healthy, preterm newborn.

The next part of the assessment evaluates movement, posture, and tone. The examiner begins by placing Alejandra on her back. As

she is touched, her color changes across her face, her hands become blue, and her trunk appears mottled. She makes jerky arm and leg movements in all directions; she awakens and squirms. The examiner places her hand on the soles of Alejandra's feet and contains them, allowing the leg movements to slow, which softens the arm movements. As the examiner bends over the infant and talks quietly, her eyes open and she fixates on the examiner's face.

Now that Alejandra is calmer and is able to use motor inhibition to quiet her state and movement pattern, the examiner touches the sole of the infant's foot and begins a series of reflexive tests. As Alejandra's feet are touched, she once again becomes active with uncontrolled activity of arms, legs, and trunk, resulting in prolonged tremors. The infant also begins breathing irregularly, and her color changes, so that face and body appear very pale. She does not fuss or cry, but it is clear that the examiner's tactile stimulation has aroused the motor system beyond the infant's capacity to regain any control on her own. As Alejandra is placed on her abdomen, she squirms and attempts to regain control. By pressing her feet against the bottom wall of the incubator and putting her hands to her face, the infant is able to inhibit the squirming and motor movements. Her color and breathing once again come under control.

The examiner wraps Alejandra and lifts her to assess social skills. The examiner places Alejandra on her lap with her face about 12 inches away from infant. The infant opens her eyes wide and actively avoids looking at the examiner, turning her gaze away. The examiner speaks softly and now keeps her face unavailable and out of the infant's visual field. The baby seems to relax, and her hands open and close rhythmically, her face softens, her mouth begins to purse, and eventually the infant turns her head in the direction of

the voice. As Alejandra continues to focus, looking and staying alert, her arms, hands, and head lift toward the examiner in a generalized approach movement. At the height of this approach, she yawns and sneezes and then settles into a drowsy state. Then the examiner presents the rattle to the infant and sees a different response. She startles, frowns, and her face becomes pale. The examiner presents the sound again, but more softly, and the infant turns to the left, in the direction of the sound. Alejandra appears more relaxed and with great effort shifts her eyes to search in the direction of the rattle. Even though her movements remain smooth, she becomes paler and frowns again, indicating the cost of this maneuver to her nervous system.

These responses indicate that although Alejandra can process and respond to the information, it is very taxing for her. Being held wrapped and being placed on the examiner's lap help her to respond. She can show her ability to be selective, choosing the animate social voice to turn to and avoiding the more difficult inanimate auditory stimulus of the rattle. The infant's responses give the overall impression of a well-organized, healthy preterm newborn. Alejandra is capable of communicating within a range of behaviors in which she can function smoothly without stress to her systems. Her sleep is stable, and her ability to process both visual and auditory stimuli indicates that she can handle stimuli without becoming upset or irritable. With the onset of a stimulus that is too loud, the infant's autonomic system is taxed, and she becomes pale, but the assistance of being wrapped and supported on the examiner's lap, along with a slower presentation of the stimulus, affords Alejandra an opportunity to smoothly regulate her motor and autonomic systems. This infant is able to avoid overwhelming input with some

degree of specificity by rejecting taxing and costly stimulation.

If Alejandra is given a supportive environment, several developmental achievements can be predicted for the next two to three months. First, her intense sensitivity to activity will lessen, and her autonomic nervous system will mature to a degree so that sleeping and wakefulness will become more regular. Alejandra is available to alert and interact with her caregivers yet is easily taxed and moves past her threshold for stimulation as she closes her eyes and withdraws from the interaction. She demonstrates the capacity for consistent modulation of the ability to self-regulate as seen with her alertness and interactiveness when the stimulation is appropriate. The facilitation and timing of the stimulus by the examiner is pivotal to eliciting the infant's best performance. As Alejandra's organization increases, the examiner should see arousal of her motor system after tactile stimulation lessens. Alejandra has demonstrated that she can modulate her arousal when the examiner provides containment (putting her hands on the infant's feet, wrapping her, and letting her press her feet against a surface). Alejandra

FIGURE 12-12 ▲ Containment helps the preterm infant to stay organized.

Alejandra, as her mother holds her close and contains her, curls her fingers around her mother's finger, holds on, and can suck on her hand and "hold" her mother's face.



has also shown that her movements become smoother when motor arousal is diminished. Additional signs of motor organization include the ability to bring fingers to mouth and to fold hands under chin and keep them together. The infant is also demonstrating the ability to make a transition from one state to another without becoming upset. Figures 12-12 through 12-18 show Alejandra in an organized state and a disorganized state, with some instances of infant cues.

CASE ASSESSMENTS OF IMMATURE PRETERM INFANTS

Some infants can show a range of immature or highly sensitive reactions to interactions and environmental stimuli. At one extreme of the continuum of preterm functioning is Iain, a hyperreactive infant who reacts to all stimuli, lacking any ability to shut them out and protect himself. This infant appears to be "at the mercy of the stimuli," and his autonomic system pays a severe cost in stress.^{52,56,57} He overreacts to sound or to being touched with a series of startles and limb extensions, followed by uncontrollable flailing, arching, and squirming. Soon Iain is in a challenging cycle that goes on until he either stops breathing or drops his oxygen saturation level or heart rate.

FIGURE 12-13 ▲ Alert state.

Alejandra focuses and scans the outer edges of her mother's face with a clear calm alert state.



FIGURE 12-14 ▲ Organized preterm infant.

Alejandra can sustain looking at her mother while being talked to. Her mother holds her hands and contains her entire body. Alejandra focuses only on her mother's face.



This is costly to him because it uses energy and delays his ability to consolidate the regulation of his motor and state systems.^{52,56,57} Iain's high reactivity interferes with his growth and may lead to failure to thrive.

Unlike Iain, the hyperreactive preterm infant, Lucas is a lethargic, withdrawn, or depleted infant who lies still and does not respond to stimuli.^{52,56,57} This preterm

FIGURE 12-15 ▲ Disorganized preterm infant.

Alejandra squirms on the bed and has difficulty tucking and calming on her own. She shows her stress by extending her arms and fingers in jerky movements over and over.

**FIGURE 12-16 ▲ Disorganized preterm infant.**

Alejandra tries to suck on her fingers. She cannot do so and becomes upset and splays her fingers.



newborn appears to want to preserve his fragile autonomic regulation. Because Lucas is past his thresholds and is depleted, he has little energy for interaction. He will not respond and does not put any energy into attempted interactions. Lucas does not develop or activate new pathways or take in new information. Therefore, he develops a rigid or minimal range of responses. Autonomic behaviors such as heart rate and oxygen saturation will often fluctuate. This infant's presentation is very concerning, and his developmental trajectory is guarded.

Some premature infants exhibit a combination of these two types of response patterns, demonstrating an overreactive range of sensitivity at times and later becoming unavailable if overwhelmed by the constant sensory stimuli within the environment. In some disorganized infants, the pattern of protest takes the form of resistant squirms, turning away, pushing away, and avoidance behaviors while being held. These behaviors can be channeled into a more modulated level of interaction if the caregiver slowly introduces caregiving activities, allowing the infant time

FIGURE 12-17 ▲ Disorganized preterm infant unable to cope with outside stimulation.

Alejandra fusses diffusely (disorganized state) when her head is stroked and waves her arms and extends her fingers.



FIGURE 12-18 ▲ Preterm infant signals “time out.”

Alejandra turns away from her mother’s face and extends her fingers in a “time-out” gesture, indicating that she is overwhelmed.



to ease into them.⁵⁸ For example, the caregiver can pause to allow the infant the opportunity to steady breathing or regain energy during an interaction.

An appropriate behavioral assessment describes the infant’s abilities to utilize intervention support and delineates the types of facilitation necessary to ensure smooth functioning. If the infant is supported to actively participate in the interaction despite a taxing sensory environment, the caregiver can articulate the infant’s neurobehavioral agenda and emerging competence. Recognizing the infant’s efforts to cope with stress and regain modulation leads to the infant’s evolving behavioral agenda.^{21,59}

The ability to understand and reveal the infant’s full range of responses becomes essential when parents of a newborn infant begin to read his behaviors as meaningful communications. The nurse’s role is to help parents become attuned to the infant’s responses and facilitate their developing relationship. If parents can interpret the behaviors and understand the infant’s messages, they can use strategies such as reciprocity to enhance the infant’s competence. When

parents and caregivers can support the infant based on his behavioral cues, the infant is more successful and competent and can improve his overall level of functioning while his caregivers continue to develop their understanding of his unique individuality as he develops.

OTHER EMERGING INFANT ASSESSMENT TOOLS

There are several other infant assessment tools available. One recent systematic review completed by Noble and Boyd found 27 different infant assessment instruments available in the literature for use in the newborn period (up to four months corrected age).⁶⁰ However, they chose only eight assessment instruments to include in their review; those that had good reliability in prediction, discrimination, and evaluation of change.⁶⁰ The Brazelton and APIB as described above were among those chosen. Other instruments found to be of high quality included the Test of Infant Motor Performance (TIMP),⁶¹ the NICU Network Neurobehavioral Scale (NNS),¹⁹ Prechtl’s Assessment of General Movements (GMs),⁶² Neurobehavioral Assessment of the Preterm Infant (NAPI),⁶³

Dubowitz neurologic assessment of the preterm and full-term infant (Dubowitz),⁶⁴ and Neuromotor Behavioral Assessment (NMBA).⁶⁵ The GMs and Dubowitz are well-known and described as primarily neurologic system assessments rather than behavioral assessments and as such are discussed elsewhere in this text. Each of the others is appraised below with some of the unique examination characteristics, psychometric properties, and clinical utility that might be of interest to those considering use of these assessments. These descriptions are in no way exhaustive but are to be considered as an introduction to the different options available for discriminating infant behaviors.

Each of the instruments chosen in the review by Noble and Boyd were found to have adequate content validity,⁶⁰ however, the TIMP created by Campbell was found to be the only one suitable to be used as an outcome measure. This could be important if the instrument is being used to demonstrate effectiveness of previously delivered interventions. The TIMP is a standardized instrument for assessing neuromotor development in infants between 34 weeks PMA and 4 months postterm.⁶⁶ The TIMP includes 13 observation and 28 elicited items. The TIMP is an age-sensitive measure of motor performance and can differentiate for high and low risk of poor infant motor outcomes and has excellent psychometric properties.⁶⁴ Reliable administration of the TIMP requires extensive training. Primarily physical or occupational therapists become reliable in the scoring when used for prediction or outcome measures. The NAPI has some similarities to the TIMP; however, it was developed only for use with preterm infants, while the TIMP can be used across infant groups. This makes the TIMP useful for comparison across populations.⁶⁶ The NAPI was designed to measure the progression of

neurobehavioral performance in the preterm infant 32 weeks PMA to term.⁶³ Training to administer the NAPI is fairly extensive but not as formalized as with some of the other assessment tools. The NMBA has less utility since its scoring is only reliable from 30 to 36 weeks PMA and it was developed to identify preterm infants at risk for developmental delays. Interestingly, no formal training is required for the NMBA as opposed to extensive training required for other instruments. Only the TIMP and the NAPI have published preterm norms, and these two instruments may be better suited for clinical utility than other well-designed infant assessments available.

Another tool, developed by Lester and Tronick, for use with the preterm population is the NNNS.¹⁹ In the NNNS, the baseline state is a key concept because some items can be administered only if the infant is able to reach a predetermined state. This decreases the variability of examination results based on the individual examiner's abilities to elicit the indicated behaviors from the infant. During the NNNS, the order of the items is more structured, and the emphasis to bring out the "best" in the infant is less apparent. This shortens the examination time and makes scoring less complex. Yet the examiner is expected to read the infant's states and behaviors and develop a rapport with him throughout the examination. The NNNS expands the scoring of the NBAS and was specifically designed for the more vulnerable preterm and/or drug-exposed infant. The NNNS can be used with these high-risk infants 32–44 weeks PMA and is easily administered in the NICU. Noble and Boyd reported findings from their review that support the use of the NNNS and APIB for use in research because of their strong psychometric qualities.⁶⁰

SUMMARY

An infant's behavioral patterns may be subtle and difficult to elicit and interpret, yet observing behavior is an integral part of a comprehensive newborn examination. The behavioral assessment allows the examiner an opportunity to evaluate aspects of the infant's neurologic status, and it helps establish guidelines for individualized developmental care of both term and preterm infants. Behavioral assessments can also be used to encourage parents to identify and respond to their newborn's cues and signals. Behavioral assessment provides an opportunity to consider the infant as a whole individual—an approach that enhances infant competencies and support of the infant/parent relationship.

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