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*Neonatal
Behavioral
Assessment
Scale* 3rd Edition

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FOREWORD

It is more than 20 years since we published the first edition of the *Neonatal Behavioral Assessment Scale* (NBAS), and its continued widespread use is testament to the need that people have for it. As Berry Brazelton notes in his Introduction, at that time many people felt that assessment of the newborn infant's behaviour was not possible, relying entirely on a detailed neurological examination. In some neonatal units one can still have the feeling that behaviour is not regarded as an important part of assessment, and it was because of this attitude, more prevalent at that time, that the late Dr Ronald Mac Keith was so keen to get this volume into our series of *Clinics in Developmental Medicine*. He personally spent two days with Dr Brazelton going over the manuscript in great detail to satisfy himself that it met the standards that he aimed for in the Press which now bears his name.

This new edition is substantially changed from our last revision in 1984. Then the Scale was still widely seen as a research instrument, and of course it continues to be used in this way today. With the many environmental dangers that the fetus can now be exposed to *in utero*, the need for such an instrument to look sensitively at the newborn infant's functioning has become even more important in recent years, and research has demonstrated the Scale's effectiveness.

At the same time, the NBAS has influenced a generation of clinicians in their approach to the examination and assessment of the newborn infant, and in helping the family understand the subtle ways in which the infant is 'prepared' to interact with the world into which she has emerged. This edition therefore is greatly expanded with accounts of the Scale's use clinically. The authors describe a flexible application of the Scale so that it not only reflects the interaction between the examiner and the infant but also allows the whole family to be involved and participate in the study of the infant. It informs my own approach to newborn infants, and I hope that other clinicians will find it of equal value.

The authors have continued to refine the Scale, and this new edition will allow users to update their practice in assessing behaviour of the neonate.

MARTIN BAX, DM, FRCP

1 INTRODUCTION

T. Berry Brazelton

The Neonatal Behavioral Assessment Scale (NBAS) has been in use for over 20 years now. It seems to have survived the test of time and today is in common use as a research instrument in many settings across the world. Items and concepts from the original Scale have been incorporated into other assessments of competence in the newborn infant (e.g. Dubowitz and Dubowitz 1981, Als *et al.* 1982*b*, Amiel-Tison and Grenier 1986, Komer and Thom 1990). The Scale is also increasingly being used as a clinical tool with parents (Nugent and Brazelton 1989).

The NBAS was originally designed to document the neonate's contribution to the parent-infant system. At the time of its conception (1955), detailed knowledge of babies' abilities was limited, and their development was understood largely as the result of environmental (parental) nurturing. As a clinician, I could see that babies made a major contribution to their own development. If infants had processing problems, such as pervasive developmental disorder (PDD) or autism, we tended to blame the victim—the parent—and in the process we ignored the infant's contribution to the failure in their interaction. Infants with problems such as PDD or autism were already from the beginning transmitting negative signals to parents. We needed to understand the infant in order to be able to understand the parent's failure in a more dynamic way. My goal in developing the NBAS was to assess the baby's contributions to the failures that resulted, when parents were presented with a difficult or deviant infant. If we could understand the reasons behind the infant's deviant behavior, perhaps we could in turn lead parents to a better understanding of their role. This then could lead to a more optimal outcome.

At the time when the NBAS was first published (Brazelton 1973), the neonate was still thought of as a passive recipient of environmental stimuli. Assessment was confined to Apgar scores, pediatric examinations of physical competence and neurological evaluations. The Graham Scale (Graham *et al.* 1956), since revised as the Graham-Rosenblith Scale (Rosenblith 1961), seemed to outline behavioral differences among neonates as they responded to stimuli. The newborn infant's ability to shut out or handle stimuli by changing state to an habituated or sleep state was a revelation to me (Brazelton 1961). The baby's marvelous capacity to control levels of stimulation by the use of state (from sleep to alertness) also impressed me. An infant who had too low a threshold for the intake of stimuli (hypersensitivity), or too disorganized a response to stimuli, was at the mercy of environment. This infant would be difficult for her caretaker as well, and might be at risk of neglect or abuse from an intolerant social environment. I hoped that a neonatal examination could help us predict this possibility.

Most studies of infancy at that time (e.g. Gesell *et al.* 1943, Mahler *et al.* 1975,

Thomas and Chess 1977) started examining infants at 3 months of age. Yet it seemed obvious to me that babies were endowed with unique behaviors at birth. In order to understand and to participate in their adjustment to their new world, we needed to understand their organization as early as possible.

The concept that the baby could indeed see, hear and respond differentially to positive and negative stimuli was slowly gaining ground in the mid-1950s. Wolff (1959) and later Prechtl and Beintema (1968) described 'states' of consciousness in newborn infants. Identifying an infant's state is basic to performing a reliable neurological examination. Prechtl's work, based on the tradition of André-Thomas *et al.* (1960), recognized the influence of states of consciousness on motor and reflex performance. This led me to realize that 'state' was a critical matrix on which to base all reactions—sensory as well as motor (Brazelton 1961). With that as a first concept, I began to recognize that the clinician's sensitivity toward providing a containing and facilitating envelope would assist the baby toward optimal performance. I remember Sally Provence as she interacted with a newborn infant. They were like ballet dancers in a *pas de deux*. The baby responded with an alert state and dramatic responses. I remember saying, 'Sally, it's almost as if you got inside that baby.' I saw the baby quite differently from that time. I already felt that this was what parents tried to do in order to understand their infants better. Could we devise an assessment which reproduced the neonate's response to their parent's best efforts? The concept of 'best performance' was born.

I began to work toward attempting to understand the neonate's capacity to reduce interfering motor activity and to control her states in order to respond with socially interactive behaviors. The realization of this ability to monitor, utilize and control states of consciousness has become the most important insight into the human neonate's marvelous capacities. A frail newborn infant has severely diminished capacity in this area and without it has less opportunity to respond appropriately to environmental cues.

The most recent conceptual breakthrough from empirical work with such neonates, using the NBAS, has been the concept of a lowered threshold for taking in, utilizing and responding to stimuli. Many at-risk neonates have such a low threshold, coupled with an inability to habituate to meaningless or repeated stimuli, that they are easily overwhelmed. They are likely to become disorganized, to stop breathing, or to become active or to start crying in order to shut out these overwhelming stimuli. Such reactions preclude the ability to focus on environmental cues. Hence, the opportunity to take in and learn from the environment is seriously endangered. We have learned that these infants can accept reduced stimuli, but with only one modality at a time—touch, or visual, or auditory, or kinesthetic, but not two simultaneously. Respecting this need for reduced input, the baby will learn over time to handle more complex stimuli, and will organize her* CNS to interact with a more and more complex environment. We have found that parents of such a baby can model on our cues as we use the NBAS in a way that is sensitive to her needs, and can provide her with a sensitive environment for future organization. The many research efforts which have been carried out since have clarified many of these questions.

*The female pronoun is used for convenience throughout to represent both male and female children and adults.

The neonate's behavior cannot be assumed to be purely of genetic origin, although genetic endowments do lead to important differences in neonatal behavior. Such factors as intrauterine nutrition, maternal infection (Scrimshaw *et al.* 1959, Klein *et al.* 1971, Lester and Brazelton 1982, Oyemade *et al.* 1994b) and drug abuse (Chasnoff *et al.* 1987, Coles *et al.* 1992, Dreher *et al.* 1994, Van Barr 1995) will also be relevant. Perinatal events, such as maternal medication and anesthesia, and episodes of hypoxia, further influence her reactions (Brazelton and Robey 1965, Sepkoski *et al.* 1992, Tronick *et al.* 1994). Infant behavior at birth is phenotypic, not genotypic. There is evidence that experiences involving the pregnant mother may also be shaping the neonate's learning *in utero* (Fifer and Moon 1994).

The effects of maternal abuse of substances such as alcohol, heroin, methadone, cocaine and crack are being studied in many centers, using the NBAS as an instrument for assessment (see review by Beeghly and Tronick 1994). The repeated use of the assessment over time (the first few months) to monitor the baby's withdrawal and reorganization can provide a window into the reorganization of the CNS which has been influenced by intrauterine exposure. We have already learned a lot from studying frail infants such as preterm or small for gestational age (SGA) babies. While some genetically determined disorders may permanently affect the CNS, the disorganizing effects of immaturity or of cocaine or marijuana may be temporary, and many will improve over time. Planning for early intervention to assist the baby's recovery can be effected from understanding the plasticity and the potential for recovery of the nervous system in a nurturing environment (Dixon 1994).

Another use of early evaluation of infant behavior is that of cross-cultural studies. Differences in groups of neonates, such as those described by Geber and Dean (1957), Cravioto *et al.* (1966) and Brazelton (1972), and more recently by Chisholm (1989), Rosser and Randolph (1989) and Keefer *et al.* (1991), identify the kind of neonatal behavior which may contribute to the perpetuation of child-rearing practices which preserve cross-cultural differences among adults. If we are to understand the ultimate effect of child-rearing practices in a particular group of children, we must start by studying infants, and as soon after delivery as possible. The culture is sensitive to these differences and is prepared to nurture them appropriately. There are now three volumes of cross-cultural studies which have used the NBAS and provide a rich source of hypotheses on the origins of individual differences in neonatal behavior (Nugent *et al.* 1989, 1991, 1995a).

This edition of the manual retains at its core the standard administration and scoring guidelines necessary for using the NBAS as a research instrument. New administration guidelines as well as clarifications of scoring criteria have been added. Many item descriptions in the Scale have been revised in response to examiner questioning and feedback. This active collaboration between trainers and examiners has led to a number of changes made in this edition. Individual Scale items have been re-written and clarified. The supplementary items, which have proved invaluable to both researchers and clinicians, have also been substantially revised. Examiner training is still seen as a key component of the NBAS philosophy. We insist that whoever uses the Scale in

research settings be trained to reliability. The same 90 per cent inter-rater reliability standard applies, and we advise researchers to return for a reliability re-check at least every two to three years.

Clinical use of the NBAS

While the NBAS has so far been used primarily as a research instrument, it can be, and has been, adapted for clinical use. In this new edition of the manual, we will present a range of approaches and a series of guidelines for adapting the Scale to clinical practice. I have always believed that a version of the Scale for application by *clinicians* during each examination of a newborn infant would be highly desirable. We have, however, resisted shortening it too much as there is the danger that it could lose the organizational integrity that one can observe in a longer examination.

A trained clinician can utilize the behavioral organization of the newborn infant to gain insights into the intrauterine experience and the perinatal events which may have influenced the baby's CNS organization. In addition, a clinician gains insight which may help in understanding the baby's temperament as she handles the baby to produce 'best performance'. In this way, the clinician gains insight into the practices which will be necessary for parents as they interact with the infant. To aid this process of understanding, we have been using supplementary items which, among other things, score the cost of bringing the baby to her optimal performance. The organization and disorganization which is experienced as she is examined can lead to a better understanding of the baby as a person. In turn, this can be shared with new parents to give them a window into their baby's adjustment to the new environment. Sharing these concepts with them presents a powerful means of capturing the baby for them and of enabling the observer to participate in the process of early attachment. Parents are bound to be appreciative and will see the clinician as part of a future support system. This may be the most important use of the NBAS. Clinicians who have been trained to understand the concepts underlying the Scale can adapt it to facilitate parents' understanding of their baby. One of our present goals is to develop a more flexible clinical assessment for use with parents.

The NBAS was designed to assist clinicians in their own assessment of all newborn infants and to share the knowledge gained with the parents. In contrast to the classic medical model of assessment, the efforts of the clinician to assist the baby toward best performance do not emphasize the pathology, but rather the strengths of the infant as she organizes to react to the clinician's sensitive handling. The emphasis, then, is on the baby's capacity to organize herself in spite of interfering variables. This can be shared first with concerned parents. Then, they will be ready to accept and work with any neurological or autonomic deficits.

In my own clinical work with families present, I often utilize an adapted version of the Scale. I try to start the assessment by respecting the status of the baby. I am not tied to any rigid use of the items but follow the baby's behavior in order to demonstrate as many reactions as possible to the parents. Aware of their reactions, I store them up for discussion later. My goal is to demonstrate as many of the concepts behind the Scale as possible. If the baby is asleep, I demonstrate the capacity to ignore responses to light and

to the rattle and bell. If she is awake or wakening, I start with the alert responses. Demonstrating their baby's ability to turn to a rattle and to the voice is always exciting for parents. As she awakens, one often must rock her or try the reflexes to bring her to an optimal state of alertness. Walking, crawling and the pull-to-sit responses are interesting for parents and they serve to awaken the baby. As a newborn baby awakens, she will often begin to startle and to cry. If this happens I use a graded approach to settling her down. After I have commented on all of these, I am ready to demonstrate rooting and sucking reflexes. Then, as she becomes alert, I often swaddle her so her motor behavior cannot interfere with visual and auditory behavior. When she is propped at a 30° angle in my hands, she is likely to follow the red ball and my face, then my voice and face. After we have shared the concepts of state changes, of temperament and of her threshold for responses I finish by inviting the parents to call their infant's name. As the baby turns to them, they automatically take her away from me to cuddle her, with 'You know us already!' This clinical version of the NBAS can be adapted to the baby and to the parents to allow them to follow the baby's behavioral responses. Meanwhile, the clinician and the parents have shared insights into the baby's behaviors and her ability to organize herself as she responds to her world. This is the time to share the observations, to discuss the baby's style or temperament, and to use the NBAS to predict the best ways to handle and look after the baby. In order to utilize these responses for diagnostic purposes and for parental attachment, clinicians need to be trained in the concepts and administration of the NBAS. Reliability training provides a firm base for sharing the baby's best performance, and for interpreting any deficit behavior for intervention.

The most significant change in this new edition of the manual has been the inclusion of additional material on using the Scale with families, to enable clinicians more easily to adapt the Scale to their own practice. The more detailed guidelines for administration in this edition will also make it easier for the clinician to use the manual as a resource for clinical practice. This edition includes a new chapter on the clinical uses of the Scale and goes on to discuss the issues involved in conducting the Scale with families. Clinicians need to remember that the NBAS is an individualized examination and each application of it is modified in some way as you tailor it to the needs of the individual infant and her family. These needs will shape the examination and dictate the kinds of adaptations you will make.

In adapting the Scale to clinical settings, examiner flexibility and hence examiner training is even more critical. To do this successfully, you should be familiar with the principles of infant development as well as the theoretical basis for the Scale. In conducting a clinical examination, the decision making process is never arbitrary. Scale adaptations, what to omit and what to emphasize must be based on informed observations. In adapting the Scale, examiners may omit some items if they consider that their addition would be counterproductive and could overwhelm the infant's system. You may modify or shorten a particular sequence if you judge that the infant is too stressed.

I have always felt that an examination of a baby who is 'at risk', that is shared with parents, is of particular importance. I need first to assess the baby by myself in order to evaluate her strengths and the areas that may need intervention. Then, I am ready to

share the behavior with the parents. I can demonstrate her strengths to capture their interest. Then I am prepared to demonstrate the areas which need attention and intervention. 'You can see how great she is and how hard she works to perform for us. Now we need to share the areas in which you will need to help her.' Implicit in this model is the assumption that we (the parents and I) will be sharing in her progress over time. Repeated sessions will serve to reinforce them and their efforts toward her recovery from stress.

2

THE STANDARD ADMINISTRATION OF THE NBAS

Background and conceptual base

The NBAS is based on the assumption that the newborn infant is both competent and complexly organized (Brazelton 1973). In developing the Scale, we were impressed by the newborn infant's ability to interact with the environment and by her capacity to deal selectively with environmental stimuli. In addition, we could see that she was a social organism and seemed to be predisposed to interact with her caregiver from the beginning and to be able to elicit the kind of caregiving necessary for her adaptation.

We wanted a scale that could yield a comprehensive profile of neonatal functioning by describing the full range of neonatal behavior including competencies and strengths as well as identifying areas of difficulty or deviation. Specifically, the goal of the NBAS was to identify and describe individual differences in neonatal behavior (Brazelton 1973). The Scale describes therefore the current status of the individual infant's autonomic, motor, state and social-attentional systems as they interact with each other and become integrated during the neonatal period. By conducting repeated examinations over the first ten days of life, we were able to observe four dimensions of functioning in neonatal behavior: Physiologic, Motor, State and Attentional/Interactional (Als *et al.* 1982a). These serial observations revealed how the systems were being integrated over time and how they were being affected by environmental factors. Furthermore, this integrative task seemed to proceed in a hierarchical fashion, with autonomic regulation preceding motor organization, followed by the task of state regulation and finally social interactive tasks.

Serial examinations using the NBAS enable the examiner to monitor and evaluate progress in these dimensions over time (Lester 1984). Autonomic stability is exemplified by the presence or absence of tremulousness and startles or the lability of skin colour. Motor organization is determined by the status of the infant's tone, motor maturity and activity level, and the level of integrated motor movements such as hand-to-mouth activities or defensive movements. The reflexes are examined as a component of the infant's motor organization and CNS status. State Organization is assessed by examining the lability of states, the level of irritability, peak of excitement, capacity for shutting out negative stimuli while asleep, rapidity of build-up and consolability and self-quieting capacities. The quality of the infant's attention/interactive capacities is observed in her degree of alertness and her response to animate and inanimate visual and auditory stimuli. The major task of the neonate is to integrate these four dimensions of functioning.

The NBAS, therefore, was conceptualized not as a series of discrete stimulus-response presentations simply to assess the baby in isolation but rather as an interactive

assessment, in which the examiner plays a major role in facilitating the performance and organizational skills of the infant (Brazelton 1973).

We considered the assessment in the neonatal period as providing only one glimpse into the continuum of the infant's adjustment to labor, delivery, and her new environment. As such, it was expected to reflect her inborn characteristics and the behavioral responses that had already been shaped by the intrauterine environment. We believed that repeated examinations would best demonstrate the infant's coping capacities as she began to integrate and profit developmentally from the environmental stimulation. Serial examinations would better reflect the interaction between the infant's inborn characteristics and the environmental influences over the first weeks of life.

Content of the NBAS

The NBAS assesses the newborn infant's behavioral repertoire on 28 behavioral items, each scored on a 9-point scale. The Scale also includes an assessment of the infant's neurological status on 18 reflex items, each scored on a 4-point scale. The reflex items will identify gross neurologic abnormalities through deviant scores or patterns of scores, but they are not designed to provide a neurological diagnosis. In the second edition of the NBAS manual (Brazelton 1984), a set of Supplementary items was added in an attempt to better capture the range and quality of the behavior of frail, high-risk infants. These seven items attempt to summarize the quality of the baby's responsiveness and the amount of input she needs from the examiner to organize her responses. The usefulness of these items has been confirmed by recent studies of high-risk infants (*e.g.* Dreher *et al.* 1994) and they have been retained in this edition with some minor modifications in the scoring descriptors. The behavioral, supplementary and reflex items are listed in Table 2.1. Scoring criteria are described in detail in Chapter 3.

Training of examiners

Under ideal circumstances, an examiner should be proficient in her knowledge of neonates and their behavior before coming for training to administer the NBAS. Paradoxically, however, many observers who did not know neonates well have had their interest and skills awakened by learning to administer the Scale. The neonatal clinician sees and assesses these behaviors unconsciously as part of any clinical evaluation. Recording them reliably is a next step. We cannot convey this clinical expertise in a manual. There is no substitute for experience in observing and handling babies. These guidelines will help define some of the steps to training to reliability after this clinical experience has been amassed.

The role of the examiner: NBAS vs traditional scales

The NBAS was developed as an empirical instrument to assess the behavior of the neonate within the dynamic context of the infant-caregiver relationship. It is precisely the interactive character of the Scale which distinguishes it from other assessments. Nowhere is this shift of emphasis more apparent than in the training of the examiner for the administration of the Scale.

TABLE 2.1
Behavioral, supplementary and reflex items on the revised NBAS

<i>Behavioral items</i>	<i>Supplementary items</i>
Response Decrement to Light	Quality of Alertness
Response Decrement to Rattle	Cost of Attention
Response Decrement to Bell	Examiner Facilitation
Response Decrement to Tactile Stimulation of the Foot	General Irritability
Orientation Inanimate Visual	Robustness and Endurance
Orientation Inanimate Auditory	State Regulation
Orientation Inanimate Visual and Auditory	Examiner's Emotional Response
Orientation Animate Visual	
Orientation Animate Auditory	
Orientation Animate Visual and Auditory	
Alertness	<i>Reflex items</i>
General Tonus	Plantar Grasp
Motor Maturity	Babinski
Pull-to-Sit	Ankle Clonus
Defensive Movements	Rooting
Activity Level	Sucking
Peak of Excitement	Glabella
Rapidity of Build-up	Passive Movements—Arms
Irritability	Passive Movements—Legs
Lability of States	Palmar Grasp
Cuddliness	Placing
Consolability	Standing
Self-quieting	Walking
Hand-to-Mouth	Crawling
Tremulousness	Incurvation (Gallant Response)
Startles	Tonic Deviation of Head and Eyes
Lability of Skin Color	Nystagmus
Smiles	Tonic Neck Reflex
	Moro

The differing assumptions underlying traditional infant tests and the NBAS are reflected in the guidelines presented for examiner training. While the essential aim of traditional infant tests is to document the infant's motor and sensory responses to standard stimuli, the NBAS views infant development in terms of the integration of competencies. The traditional objectivity of the examiner has given way to a more flexible and exacting approach as she assumes an interactive role, much like that of a parent, in the attempt to draw out the full richness of the infant's repertoire of behavior. Flexibility, vigilance and sensitivity become key ingredients for the successful administration of the Scale.

The screening and training to reliability of examiners on the NBAS has therefore become an issue of importance for many reasons. First, since the field of neonatal assessment is a relatively new area of investigation, few health professionals—doctors, nurses, psychologists, physical or occupational therapists—have been used to record behaviors of the newborn infant. Second, medical professionals are trained to search for abnormalities. The aim of the Scale is to provide a profile of the infant's overall level of organization, documenting and integrating both positive and negative characteristics of

behavior. Hence it reflects a radical departure from conventional pathological medical assessment. Third, researchers and clinicians have been trained to maintain objectivity in an interaction, so that the interactive thrust of the Scale constitutes a novel approach to clinical assessment.

Key concepts in examiner training

Two initial concepts are important: 'best performance' and 'examiner flexibility'. The ability of the infant to produce 'best performance' is, in turn, linked with the examiner's ability to elicit it by providing optimal conditions. This is dependent on the examiner's flexibility, *i.e.* the ability to vary or change procedures and to modulate input in response to the baby's cues as the examination proceeds. The Scale has no overall fixed order of administration and so places greater demands on the examiner to adapt her procedure to the responses and cues of the infant. Such flexibility reflects both the examiner's understanding of the baby's behavioral repertoire and the development of sharp observational skills.

Training on the Scale focuses on achieving examiner reliability, *i.e.* reliability in scoring and competence in administration. Scoring reliability means that two observers can achieve an inter-observer agreement level of at least 90 per cent by being able accurately to observe the same behavior and score it within one point. The scoring criteria in the Manual are well defined so that when an inexperienced trainee has administered and scored the examination with 20-25 babies, she should not have much difficulty in reaching the 90 per cent inter-scorer reliability criterion.

Competence in administration refers not merely to the examiner's knowledge of administrative procedures, but also to her ease in handling the infant and ability to understand and respond to behavioral cues throughout the assessment. This kind of competence reflects the examiner's ability to vary or change procedures or modulate input in response to such cues.

Examiner training procedures

There are two major phases in the reliability training of examiners using the NBAS: (a) the training phase, and (b) the reliability phase.

The initial phase involves familiarization with the test items and with the administrative and scoring procedures. Prospective examiners should also have an adequate background in theories of child development in order to interpret the infant's behavior.

Trainees should view the training film, study the scoring criteria in the manual, and then attend an orientation session at a training center or observe a demonstration examination by a trained examiner.

A pivotal concept in the development of the trainee's observational skills is the ability to recognize the baby's 'states of consciousness', since these mediate the baby's behavior. It is important that the examiner be able to recognize and discriminate these states as the baby moves from sleep to wakefulness, and that she be able to note the frequency and pattern of such changes.

The examiner must also be comfortable and confident in handling the newborn

infant. Examiners who have experience with the routine care of infants (diapering, feeding, bathing, etc.) will more easily learn the appropriate handling techniques for administering the Scale. Since newborn infants are social beings who quickly learn to judge the safeness of a situation from the examiner's facial expression and voice, as well as from the way they are handled, the aim of this phase of training is to help the examiner feel comfortable in handling the baby, so as to elicit the infant's best performance. Awkwardness or lack of ease in handling the infant may well affect performance. Familiarity with the routine of the neonatal care facility will also help the examiner's confidence.

Finally, the trainee should administer and score the Scale with around 20 to 25 babies. The figure is arbitrary, but it is recommended that the trainee continue to practise until feeling comfortable with every aspect of the administration and scoring.

The reliability training session

When the training phase is completed, it is essential that a further session be scheduled to establish examiner reliability. This is particularly important when the trainee intends using the Scale in teaching or research.

The reliability session begins with a discussion of any unresolved difficulties in administration or scoring that may have arisen during training. This is followed by a demonstration examination by the trainer. The examination is observed and scored jointly by both trainer and trainees. The rationale for allocating specific scores is discussed, while different administrative styles are considered. It is important at this time to identify the items which show disagreement in scoring and to discover the reason for the lack of agreement.

During this session the trainee administers the Scale to at least two babies, and afterwards the trainer and trainee both score the examination independently. The purpose is to bring the trainee to the 90 per cent level of agreement. On the 20 elicited response items, scoring reliability is based on there being no disagreements on any of the items. A one-point difference is permissible on the standard 28 nine-point behavioral items, and a difference of two points on more than two items is considered unreliable.

While clinical experience in handling newborn infants gives the prospective examiner a distinct advantage in learning the NBAS, the training program does provide neophyte examiners with an opportunity to learn how to handle babies as they learn the mechanics of the Scale. For examiners who are new to this area of work, it should be pointed out that some people may need to do more than the recommended 25 examinations before coming for the final training session. Experienced clinicians on the other hand need much less.

We believe that competence in working with term, low-risk infants is necessary before beginning to work with high-risk infants. Only when trainees have achieved the necessary level of reliability and competency in examining the former and understand the wide range of individual differences among them will they be able to move into the more complex and demanding area of working with high-risk infants, including the examination of drug-exposed infants.

Examiner certification lasts for three years and must be renewed at that time if the examiner wishes to use the Scale in research settings. We have found that examiners' scoring tends to 'drift' over time, *i.e.* their scores tend to vary in a systematic direction, especially if they continue to work in different cultural settings or with specific populations. For example, researchers who work predominantly with high-risk infants who have low arousal levels may, over time, tend to 'over-score' the normal term baby because their understanding of baseline functioning may have changed. We recommend that during a research project with specific populations, examiners should assess a healthy term infant after every five research examinations. This helps prevent the kind of slippage described above. In the long term this kind of scoring slippage is addressed through the re-certification process.*

The administration of the NBAS

The NBAS is appropriate for use without adaptation for term infants, and can be applied until the end of the second month of life. With the addition of the Supplementary items it can also be used for apparently healthy preterm infants (<37 completed weeks of gestation), and for them, depending on the degree of immaturity, its application is still possible at 48 weeks post-conceptual age. It will be obvious that the NBAS should not be attempted for infants requiring neonatal intensive care with multichannel monitoring, oxygen therapy and intravenous or gavage feedings. A baby who is either immature or recovering from illness may become over-stressed by the examination.

The NBAS is a structured examination with a preferred but not invariable order of administration. This preferred order must always be modified in response to the baby's 'availability' (state), and for that reason examiner flexibility is a critical ingredient in its successful use. Good observation and handling skills are needed, and the ability to carefully monitor the infant's state throughout is prerequisite to a reliable examination.

The 28 behavioral items and 18 reflex items are administered in a particular sequence and can be grouped into 'packages' which follow an established order. This packaging of items makes the administration sequence simpler to remember; the items are also placed in clusters because they fit together conceptually, *e.g.* all the items in the Habituation Package are designed to evaluate the infant's capacity to 'shut out' negative stimuli. They are administered in sequence. The items measuring the infant's visual and auditory capacities are grouped together in the Orientation Package and are administered together. The other items in the Scale are clustered in terms of their level of stimulation intensity and are administered with increasing levels of stimulation.

The packages are as follows. (1) The Habituation Package, which includes the Response Decrement items. This package should come first and is only omitted if the infant is not in the appropriate sleep states. (2) The Motor-Oral Package. This package of minimally intrusive items includes the reflexes of the feet and the rooting, sucking and glabella items. (3) The Truncal Package, including all the moderately stimulating items,

*For information on NBAS training, contact the Brazelton Center for Infants and Parents, The Children's Hospital, 1295 Boylston Street, Boston, MA 02215, USA.

Undressing and handling, including the Tonic Deviation of Head and Eyes. (4) The Vestibular Package, which includes the maximal handling and stimulating items, the Defensive, TNR* and Moro. (5) The fifth package, the Social-Interactive Package, includes all the Orientation items and is tied to the baby's state of consciousness. It can be administered only when the infant is in an appropriate alert state and as such is a movable package. The assessment of consolability or self-quieting may also interrupt the standard sequence if the baby comes to a crying state. When these have been administered, you return to the original sequence of administration. As a general guide to new examiners, it is advisable to memorize the overall schema of the examination. This schema, illustrated in Figure 2.1, presents a modal sequence for the Scale and will act as an anchor when the sequence needs to be modified in response to the infant's state changes, for example when the baby cries or becomes alert. With practice, you will know the examination well and be able to modify the sequence when the baby's state demands it. Rigidly adhering to any sequence can make for an examination that is contrary to the concept of 'best performance'.

It is also important to point out that the examination sequence is not composed of a series of discrete items, set out in an arbitrary sequence, but has an inherent organizing thread. The order of items is organized according to their level of intensity or degree of stimulation. The initial items do not involve any handling of the baby, but as the examination progresses the items become more stimulating, beginning with minimally intrusive tactile items and ending with the more massive vestibular items, such as the Moro.

State observations

Since an infant's reactions will be state-related, it is extremely important that observations on her state should be considered as a starting point from which all other observations are made.

Initial state

In the two minutes before stimulation is begun, an assessment of the infant's state is made by observing her spontaneous behavior, respirations (assessed from the movement of the gown or covering sheet), eye movements, startles and responses to concurrent spontaneous events in the environment. States are scored according to the criteria set out below. The infant's state when you begin administration of the items is recorded as 'initial state'. If her state within the two-minute observation period is changeable, you should try to begin the examination when she is in State 2 (see below).

Predominant states

At the end of the examination period, the examiner should record the two, or at the most three, predominant states (excluding the decrement items) within which the infant has performed. Since the most important influence on the infant's scores will be her

*In this manual the asymmetric tonic neck reflex will be referred to as the tonic neck reflex (TNR).

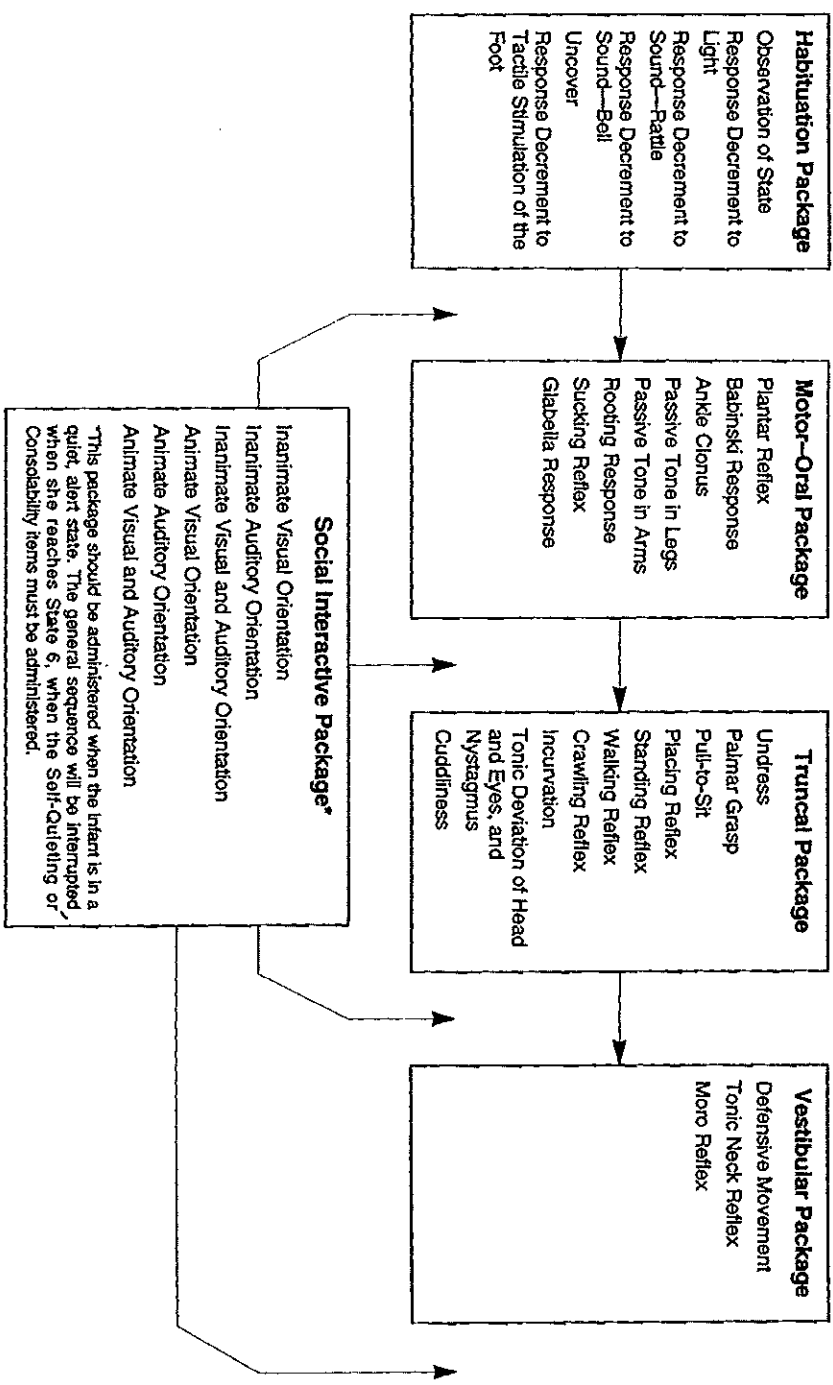


Fig. 2.1. Modal sequence of administration of the NBAS.

available states, it is important to have an idea of the range and variety of states in this period and the amount of time spent in each one. The duration of each of the states is an important component to consider when scoring. We have found that we can often differentiate groups of babies by how they use states, and which ones predominate.

State definitions for scoring initial and predominant states

SLEEP STATES

State 1: Deep sleep with regular breathing, eyes closed, no spontaneous activity except startles or jerky movements at quite regular intervals; external stimuli produce startles with some delay; suppression of startles is rapid, and state changes are less likely than from other states. No eye movements (Fig. 2.2).

State 2: Light sleep with eyes closed; rapid eye movements can often be observed under closed lids; low activity level, with random movements and startles or startle equivalents; movements are likely to be smoother and more monitored than in State 1; responds to internal and external stimuli with startle equivalents, often with a resulting change of state. Respirations are irregular, sucking movements occur off and on (Fig. 2.3). Eye opening may occur briefly at intervals.

AWAKE STATES

State 3: Drowsy or semi-dozing; eyes may be open but dull and heavy-lidded, or closed, eyelids fluttering; activity level variable, with interspersed, mild startles from time to time; reactive to sensory stimuli, but response often delayed; state change after stimulation frequently noted. Movements are usually smooth. Dazed look when the infant is not processing information and is not fully alert (Fig. 2.4).

State 4: Alert, with bright look; seems to focus invested attention on source of stimulation, such as an object to be sucked, or a visual or auditory stimulus; impinging stimuli may break through, but with some delay in response. Motor activity is at a minimum. There is a kind of glazed look which can be easily broken through in this state (Fig. 2.5).

State 5: Eyes open; considerable motor activity, with thrusting movements of the extremities, and even a few spontaneous startles; reactive to external stimulation with increase in startles or motor activity, but discrete reactions difficult to distinguish because of general activity level. Brief fussy vocalizations occur in this state (Fig. 2.6).

State 6: Crying; characterized by intense crying which is difficult to break through with stimulation (Fig. 2.7); motor activity is high.

Testing conditions

To ensure optimal conditions for the examination, it is recommended that the infant be tested midway between feedings, in a quiet, semi-darkened room with a temperature of 22–27°C (72–80°F).

The third day of the infant's life has long been regarded as the optimal day for conducting the first examination of the neonate on the NBAS (Brazelton 1984). However, we have learned that it is possible to examine the infant any time after delivery, as

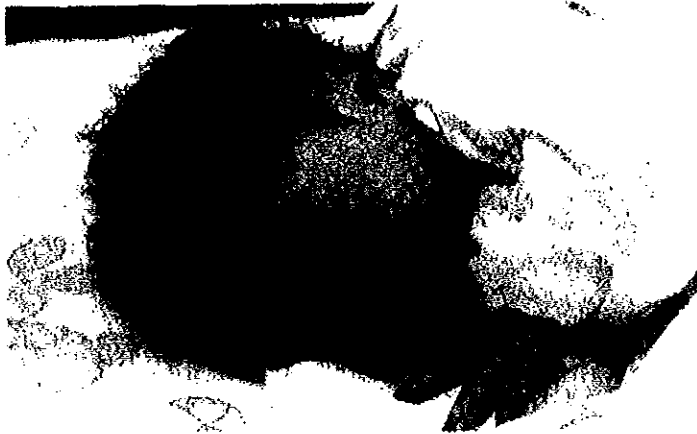


FIG. 2.2.
DEEP SLEEP
(STATE 1).



FIG. 2.3.
LIGHT SLEEP
(STATE 2).



FIG. 2.4.
DROWSY
(STATE 3).



FIG. 2.5.
ALERT
(STATE 4).

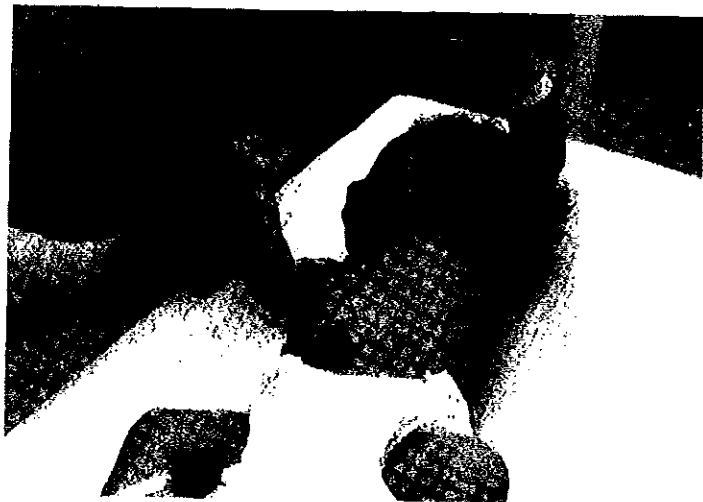


FIG. 2.6.
CONSIDERABLE
MOTOR ACTIVITY
(STATE 5).



FIG. 2.7.
CRYING
(STATE 6).

long as it is midway between feedings and the infant has recovered from any painful medical procedure or any other environmental influences that may interfere with her ability to respond to the items of the Scale. More and more, with policies of early discharge, the first day of life is often the only opportunity clinicians or researchers have to perform a comprehensive examination. If the infant is examined on the first day of life and the Scale reveals some concerns about the infant, then it is particularly important to examine the infant a second time, before or after discharge. The environmental conditions in which the first examination is administered and its timing become even more critical if it is going to yield valid findings. Results of studies using the NBAS, conducted on the first day of life, demonstrate that the day 1 examination can identify individual differences and can capture the full range of the infant's behavioral repertoire (e.g. Sepkoski *et al.* 1992). It should be pointed out that in these studies, the day 1 results were merely the first in a series of NBAS examinations conducted over the first month. By examining the infant more than once, the researcher or clinician can better understand the pattern of adaptation over time.

Administration of NBAS Items

The Habituation Package

Every examination ideally begins with a two-minute observation of the baby in a sleep state. These observations become the baseline from which to assess the baby's capacity to shut out negative stimuli. If the baby is sucking on a pacifier it is best to remove it at this time. To have to begin the examination with a crying infant or with an infant in an alert state compromises the organization of the examination and valuable information on the infant's coping capacities is lost. It is therefore not advisable to handle or transfer the infant from the bassinet to an examination table as this may involve a state change and make the Habituation items difficult to assess. When the Habituation items must be omitted, the organization of the examination will be changed and the infant's responses are modified accordingly. The scoring of certain items such as Irritability, Rapidity of Build-Up and Lability of State will be affected because these items are based on the assumption that the examination begins with the Habituation items. The criteria for scoring will be described in the next chapter. We recommend that if the baby is not in a sleep state, the examination be delayed if possible, until she assumes a sleep state.

ELICITING THE FIRST RESPONSE TO THE RESPONSE DECREMENT STIMULI

States 1 or 2 are the optimal states for the administration of the Habituation items, but they can also be attempted in State 3 to see if the responses will decrease. If the baby is in a deep sleep state, then it may be difficult to break through and to elicit a first response. This is the guiding rule: if the baby does not respond to the first presentation of the light, rattle, bell or heel-stick, wait for five seconds and present the same stimulus a second time. If after that there is still no response, loosen the blankets or clothing or shake the crib or move the infant's position a little in order to bring her to a more testable state. Then administer the same stimulus again, and a fourth time if there is no response after the third. The point at which the baby first responds in this sequence

becomes the 'first response', and the examiner continues from there and scores it accordingly. If the infant still does not respond after these four presentations, then the examiner must move on to the next stimulus in the sequence.

RESPONSE DECREMENT TO LIGHT

For this item, shine the light directly into the infant's eyes for one to two seconds and observe the response (Fig. 2.8). When she has settled and after the response disappears, wait five seconds and present the stimulus again. If no decrement is observed, re-present the stimulus up to as many as ten times. If decrement is observed on the tenth stimulus, present one more time to confirm that decrement has occurred. The minimum response for this item is a tightening of the eyes or a furling of the brow, so that an eye-blink or a change of breathing is not considered adequate as a response. Conversely, response decrement is defined as the absence of body movement, but may include eye-blinks or changes in breathing.

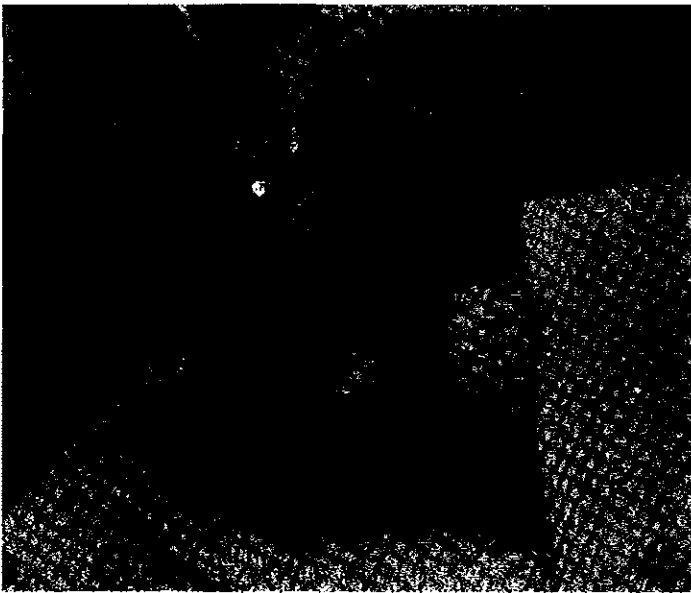


FIG. 2.8.
RESPONSE
DECREMENT TO
LIGHT.

RESPONSE DECREMENT TO SOUND—RATTLE

This item is designed to assess the infant's ability to shut out negative auditory stimuli. The infant must be in a sleeping state for the valid administration of the stimulus. To administer this item, shake the rattle about 25–30cm (10–12 inches) from the baby's ear, using a brisk repetitive staccato shaking movement lasting about one second.

RESPONSE DECREMENT TO SOUND—BELL

This item is administered as above. Hold the bell about 25–30cm (10–12 inches) from the baby's ear (Fig. 2.9), and ring it for about 1 second, making sure not to vary the intensity of the stimulus as you proceed.



FIG. 2.9.
RESPONSE
DECREMENT TO
BELL.

If during the presentation of any of the individual stimuli the infant continues to respond, the question becomes how long to wait before discontinuing and moving on to the next item. This kind of response pattern may be especially noticeable in the case of an at-risk infant, when a pattern of recycling takes place following the presentation of the stimulus. If the movement continues for up to 60 seconds or if at any time the infant changes to a higher state during this time, the examiner should go on to the next stimulus in the package.

UNCOVER

Uncover the infant before going on to the next response decrement item. Observe the infant's response to being uncovered, *i.e.* postural change, colour change, state change, etc.

RESPONSE DECREMENT TO TACTILE STIMULATION OF THE FOOT

Try not to disturb the infant's state before administering this, the so-called 'pin-prick'

item, since she should be asleep to elicit a valid response. Press the heel gently but firmly with a sterile stick or with a light pin-prick. Apply the stimulus only five times, to the same foot, in contrast with the ten stimuli required for the sensory items.

Try to ensure that all the stimuli are presented in a standard fashion. Maintain the same intensity of stimulation for all the presentations, even when the baby begins to become aroused. If she becomes alert and active, the stimulus must be discontinued.

The Motor-Oral Package

It is helpful to position oneself directly at the base of the bassinet to begin the examination of the reflexes of the feet. The infant should be supine, and to assess symmetrical responses the head must be in midline. When one finds an asymmetry on one side, the head should be turned to the other side to see if the TNR has not influenced the lateralization of the responses.

PLANTAR GRASP

This item is administered by pressing the thumb on the balls of the infant's feet and observing the flexion of the toes (Fig. 2.10). Both feet must be observed separately.



FIG. 2.10.
PLANTAR GRASP.

BABINSKI RESPONSE

The Babinski response is elicited by moving one's finger from the toe to the heel or from the heel to the toe along the outside of the sole (Fig. 2.11). There is dorsiflexion of the big toe, with spreading of the other toes. The infant's state is not important for this item.



FIG. 2.11.
BABINSKI
RESPONSE.

ANKLE CLONUS

First, break the tone of the leg at the knee. The Ankle Clonus is then administered by pressing the sole of the foot abruptly against the leg with the thumb or the finger(s). This will produce a dorsiflexion of the foot and a resistant beat or beats.

PASSIVE TONE IN LEGS

Hold both legs around the ankles and lower leg. Extend and pull the legs rhythmically back and forth once or twice through their full range of movement before releasing them, observing signs of recoil. Avoid jerky or rapid movements.

PASSIVE TONE IN ARMS

Extend and pull the arms alongside the trunk, holding them for one or two seconds, then release them. One is looking for the quality of '*élasticité*' (André-Thomas' phrase) in the tone.

ROOTING RESPONSE

A Rooting response is elicited by gently stimulating the perioral skin at the corners of the mouth (Fig. 2.12a). It is best elicited when the infant is in an alert state and with the head in midline. Hold the arms against the infant's chest and watch for the head turning to the stimulated side. Note the opening of the mouth (Fig. 2.12b).



FIG. 2.12a,b.
ROOTING
RESPONSE.

SUCKING REFLEX

This is best elicited when the infant is in States 4 or 5. Place the index finger (well washed or gloved) in the infant's mouth, with the pad toward the palate. Record the strength and rhythmicity of the suck. This can be elicited even when wearing a rubber glove. Some infants may clench the finger, and in such cases it is helpful to stimulate the sucking response by stimulating the roof of the mouth with movement of the finger. Three components of the suck are examined: the pressure in the front of the mouth, the

pull on the back of the tongue, and the suction from the esophagus. The latency before all three components come together is a measure of maturity and CNS adequacy.

GLABELLA REFLEX

The Glabella reflex is given now, although it can be administered at any time during the examination. Give the infant a sharp tap on the forehead (glabella), and observe whether she briefly closes her eyes tightly.

The Truncal Package

UNDRESSING

Undressing the infant gently is the first item in this package and is followed by the Palmar Grasp and Pull-to-Sit items. Take time after the Undressing to observe the infant's state change.

PALMAR GRASP

Palmar Grasp should be elicited by placing the index finger into the infant's hands and gently pressing the palmar surface. Her fingers should flex around your finger (Fig. 2.13). Avoid stimulating the back of the infant's hand during this maneuver.



FIG. 2.13.
PALMAR GRASP.

PULL-TO-SIT

Next, place your thumb in the infant's palm, grasp her hands and forearms at the wrist, and slowly pull her up to a seated position for the Pull-to-Sit item (Fig. 2.14). If there is no attempt to raise the head and you deem it necessary to provide support to the head

during this maneuver, the item is scored accordingly (score 1 or 2). If the infant brings her head through midline, then wait to see if there is any further effort to bring the head back up to midline. The arms are held in a moderately extended position as shoulder and head control are evaluated. If the infant is able to maintain head control without apparent stress, she can be left in that position for as much as ten seconds or even up to one minute.



FIG. 2.14a-d.
PULL-TO-SIT.

PLACING REFLEX

Pick the infant up, with her head facing away from you and her head and trunk supported against your body. Stand at the base of the bassinet to administer the Placing reflex. The baby is held with one hand around the chest so that both feet are hanging free. Then lift her so that the dorsal part of her foot is placed under the protruding edge of the bassinet (or any other moderately hard surface with an edge), while keeping the other foot tucked up. Make sure her foot is relaxed. Observe whether the foot lifts; the toes should fan and the foot move in a downward movement to be placed on the surface. This should be done separately for each foot.

STANDING REFLEX

Next hold the baby with both of your hands under her arms and allow her feet to touch the surface of the bassinet to evaluate the Standing reflex. Keep her in an upright position and observe whether she is able to support her weight by extending her legs (Fig. 2.15).



FIG. 2.15.
STANDING
REFLEX.

STEPPING OR WALKING REFLEX

Move on smoothly into the evaluation of the Stepping or Walking reflex. Place the infant's feet firmly on the surface and tilt her trunk forward to stimulate the stepping movements (Fig. 2.16).



FIG. 2.16*a, b*.
STEPPING OR
WALKING
REFLEX.

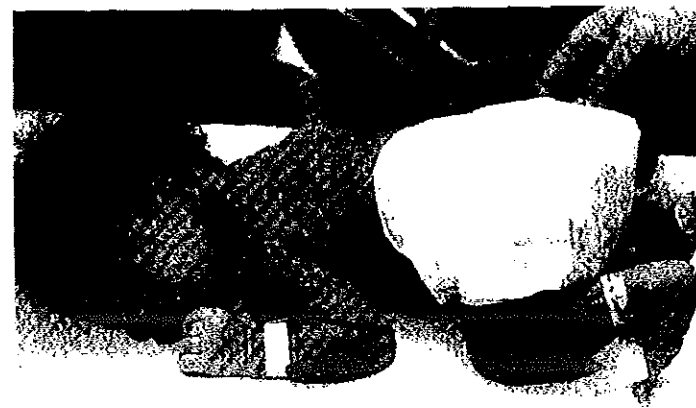


FIG. 2.17a-c.
CRAWLING
REFLEX.

CRAWLING REFLEX

Now place the infant on her stomach with her head in midline in order to observe the Crawling reflex (Fig. 2.17). Make sure her arms are not underneath her trunk. Observe her for about 30 seconds to see whether she crawls spontaneously. Watch for the ability to lift the head up and to turn it to one side. The feet and arms should move in a crawling motion. If she does not crawl spontaneously, then you can press your thumbs up against the soles of her feet to stimulate this response.

INCURVATION (GALLANT RESPONSE)

Pick the infant up and place her body supine across your hand with her limbs hanging free. Before eliciting the Incurvation response, take time to assess the quality of tone by observing the curvature of the back, the degree of head-lifting, the flexion of the limbs, and the relation of the head to the trunk. This evaluation can contribute to the assessment of general motor tone. Now, with the index finger of the other hand, scratch the trunk with the fingernail or knuckle in a downward movement, from just below the shoulder toward the buttocks, in a line at about 1 cm ($1/2$ inch) from the spine. If it is difficult to elicit a response in this way, it is possible to tap along the same line with quick, deep tapping movements in order to observe the swing or the curving of the trunk.

TONIC DEVIATION OF HEAD AND EYES, AND NYSTAGMUS

There are two ways to administer this item. Hold the infant upright, with your hands under both arms. Facing her, slowly rotate her through about 90° in one direction and then in the other. Be sure her head is not restricted so that it is free to turn in the direction of the spin. An alternative approach is to hold the infant in the *en face* position at a 45° angle, supporting her in your arms with both hands. In order to observe the eye component of the response the infant's eyes must be open and you must watch their position during the spin and at the end of the spin. The eyes and head should go ahead of you, the eyes turned into the movement of the spin. As they catch the light you will note a slow nystagmus of each eye. This compensatory movement is due to a combination of a vestibular response and visual stimulation by the light as the eyes pass it.

CUDDLINESS

The last item in this package is Cuddliness, although it can be inserted at the end of any package as long as the infant is in a quiet alert state. This behavior is assessed in both horizontal and vertical positions. In each position you should observe whether the infant actively molds into your body. On the shoulder, she may pick her head up to look around, moving forward to nestle her head in the crook of your neck (Fig. 2.18). Be sure not to facilitate the infant's response until it becomes clear that she does not spontaneously or actively cuddle.

At this point in the examination many infants are alert so that it is often an ideal time to administer the Orientation items. However, if the baby is not yet alert, then you should move on to administer the final package. This more stimulating package of Vestibular



FIG. 2.18.
CUDDLINESS.

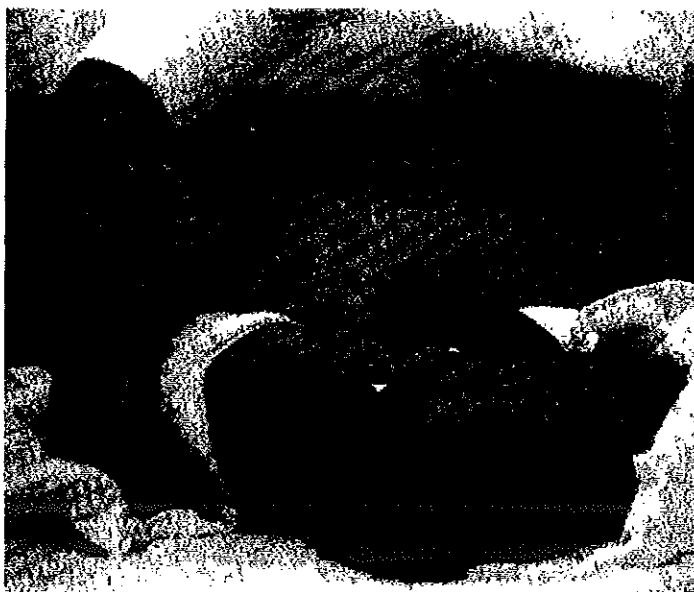


FIG. 2.19.
DEFENSIVE
MOVEMENT.

items may serve to arouse the infant and bring her to a more alert state for the Orientation items.

The Vestibular Package

DEFENSIVE MOVEMENT

In order to assess Defensive Movement, the infant should be in an alert state for optimal results. Place her in a supine position, with her hands by her side. Hold a cloth over her eyes, but do not occlude her nose (Fig. 2.19). Release her hands. The cloth should be kept in position for 30 seconds unless it appears to become too stressful for the infant. Otherwise, remove your hand only after her swipes are likely to remove it. Typically, she will toss her head upward, then from side to side. If this does not succeed, she may move her arms up on each side in a batting movement. Finally, she may bring her hand up to the cloth and try to remove it.

TONIC NECK REFLEX

The TNR is elicited with the baby still in supine. Holding one hand across her chest, with the other hand turn her head slowly first to one side and then to the other. Use the infant's rooting reflex to assist in turning the head. Hold the head for a moment in the extreme position on each side in order to assess the quality of the response. The arm on the side to which the face is turned will extend, and the other arm will flex; the legs behave likewise. The full fencer-like position is not always present in the newborn infant, but you should observe an increase in extensor tone on the face side and an increase in flexor tone on the occipital side.

MORO REFLEX

The final item in this package is the Moro. There are many ways to elicit this. One way is to pick the baby up and hold her suspended midway between the horizontal and vertical, with one hand supporting the trunk and the other supporting the head. The head is maintained in midline in flexion onto the chest and then released abruptly and dropped back about 8 cm (3 inches) into the examiner's hand. The examiner should hold the trunk constant, for best results. The hand should remain in this position to protect the head. The Moro reflex can also be elicited in the supine symmetrical position, by striking the surface or the side of the bassinet.

The Social Interactive Package

When you decide to administer the Orientation items, you must first 'set the stage' to ensure that the infant is given the best opportunity to demonstrate the full range of her social interactive repertoire. Not only is it important that she be in the appropriate state, but the setting must also be controlled to facilitate her performance. Room temperature, lighting and timing of the examination are all important in preparing a setting that will ensure 'best performance'. You (the examiner) should also have a comfortable chair. It is more difficult to administer the Orientation items while the infant is in the bassinet or on an examination table. Moving the infant must be done gently or it may disrupt her

state and it will no longer be possible to elicit the Orientation responses. A footstool can be helpful so that you can use your knees to support the infant, leaving both your hands free to hold the rattle and the ball. In general, all the Orientation items can be administered from a seated position, although for some infants the animate items are best performed while you are standing. If you have to provide constant vestibular stimulation to maintain the baby in a testable state (gently rocking her or jogging her up and down), you may have to remain standing to do so. In general, the inanimate items are best administered from a seated position.

The Orientation package should be attempted no more than twice during each examination.

- *Facilitating techniques and the 'fragile' (frail) infant.* Before you begin this package, you should know what kind of facilitating techniques you will need to use to bring the best out of the baby. Over the course of the examination, you will already have made a judgement about the kind of support the infant may need to maintain herself in a quiet alert state. Some infants need little support to maintain their alertness, while others may need to be swaddled or you may need to hold their arms. You may need to give them a pacifier or use different levels of vestibular stimulation to help them stay in a testable state. In other words, the kind of support you provide must be responsive to each individual baby's needs. Tremors, startles, colour change, gaze aversion, heightened activity levels, changes in respiration, fussing or crying all are signs of stress which must be acknowledged and dealt with. It is important to moderate the mode of your presentation and the intensity of the stimulus you offer in response to the baby's own behavior. Some frail infants can respond to only one modality at a time—touch, voice or merely looking at the examiner's face. In order to be responsive to such infants, present only one modality at a time and reduce that to a level at which you can elicit a response.

- *The threshold test.* Examiners should learn how to present various stimuli and to be able to modify or change the intensity of each stimulus in response to the baby. This is particularly important in the examination of the at-risk baby who may have a low threshold for stimulation. To begin with, you must try to identify the infant's threshold for responding to see what level of stimulation is appropriate. If you judge that the infant is somewhat frail and could easily be overstimulated, then it is best to begin with the least stimulating of the Orientation items, such as the animate or inanimate visual items. Start with the least intense level of stimulation. By observing the baby's response you will be able to determine the pace and direction of the rest of this package. If, on the other hand, the infant is difficult to rouse then it is better to rock her gently and present the inanimate auditory stimulus first to see if you can rouse her. Some babies are best engaged by using your voice and face as a stimulus.

There is no set order of administration of the Orientation items, although animate and inanimate items should be presented as separate sub-packages.

- *The Orientation items with a 'difficult' or frail baby.* Learning to handle a 'difficult' or fussy baby while maintaining a smooth flow in the Orientation package of items is one of the most challenging tasks for the new examiner. Since the goal of the examination is to bring out the infant's best performance, you will have to learn a repertoire of

techniques that will allow you to facilitate this. You must learn to use different handling or facilitating techniques to reduce the baby's crying, as you will to arouse her if she is in a drowsy or sleeping state. These strategies may be as subtle as a change of voice if your normal tone of voice does not elicit any response for the animate auditory item. It may mean a change in the volume of the rattle if you see that this is overstimulating for the infant. It may mean having to swaddle her if you find that her arms are interfering with her ability to respond to the Orientation stimuli. For some very frail infants, it may mean swaddling them and using the pacifier in order to provide them with the kind of support they need to be quiet enough to respond to the stimuli. When you have helped the infant reach a suitable state, then you can begin to evaluate her social capacities.

INANIMATE VISUAL ORIENTATION—RED BALL

This item measures the infant's ability to track an object visually. This item is best done on the examiner's lap, with the addition of a footstool for the feet, so that the baby is supported on your lap at a 45° angle and both your hands are free to present the stimulus. If the baby is very active or fussy, then you can hold the ball with one hand and restrain the baby's hands or arms with the other. The ball is held about 25–30 cm (10–12 inches) from the baby's eyes at midline (Fig. 2.20). It may be helpful to shake the ball to get the baby focused on the stimulus. Then move the ball slowly and smoothly to the left or to the right. Try not to go beyond the baby's range of vision and to draw her along with the stimulus in a smooth arc. Do not duplicate the presentation of stimuli, so that if she follows with head and eyes for 60° once, then move on to examine vertical head and eye following. If she succeeds with this, move on to see if she can follow for a 180° arc.

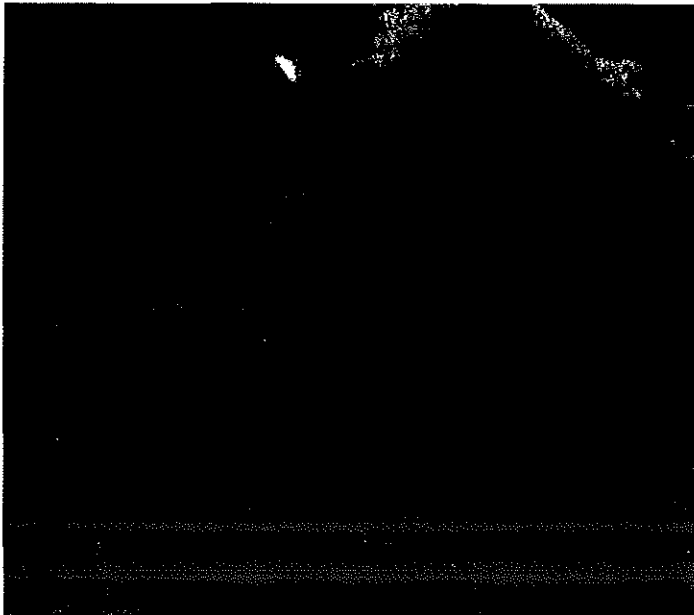


FIG. 2.20.
INANIMATE
VISUAL
ORIENTATION.

Avoid talking to the baby during this presentation and try to keep your face out of her line of vision.

INANIMATE AUDITORY ORIENTATION

For this item, shake the rattle gently about 15–23 cm (6–9 inches) from the infant's ear at right angles, out of her range of vision (Fig. 2.21). Begin with her head in midline and present a continuous soft rhythmic sound. Unlike the presentation of the rattle in the Response Decrement Package, where it is a negative disturbing stimulus, here it is presented as an attractive eliciting stimulus. For that reason it is better to begin with a soft sound and to increase the sound level only if the baby does not brighten. Try to find her threshold for responding and then present the stimulus at that level. If she winces, startles or turns her head away, this means that the presentation is overstimulating and should be adjusted. If she does turn to and find the stimulus, then this item should be done alternately, twice on each side.

INANIMATE VISUAL AND AUDITORY ORIENTATION

This item involves using the rattle as both a visual and auditory stimulus. Gently shake the rattle as in the previous item and move it slowly and smoothly across the baby's line of vision, making sure to stay in pace with her tracking.

ANIMATE VISUAL ORIENTATION

The animate visual item can be performed with the examiner in either a standing or sitting position, but it is important that the infant has maximal head and body support. The ease with which you hold the infant and the degree to which the infant feels secure will influence these responses. Holding the baby in the *en face* position at a 45° angle and about 30–45 cm (12–18 inches) away, move slowly in a horizontal arc, keeping the baby in the face-to-face position throughout (Fig. 2.22). The baby's task is not to find you but rather to track your face. If she does follow horizontally with coordinated head and eyes movements, then present your face for vertical following and finally for the 180° horizontal and vertical tracking.

ANIMATE AUDITORY ORIENTATION

Speak softly into the baby's ear with your face out of her line of vision to elicit this response. You may have to vary the level, pitch and pattern of your voice to obtain her attention and to prevent her from habituating to your voice. Usually, a soft, high-pitched voice is the most potent stimulus for this item. If the baby does locate the source of your voice and turns her head to find it, then repeat the stimulus so that it is presented twice on each side.

ANIMATE VISUAL AND AUDITORY ORIENTATION

Finally, using the same technique as that for Animate Visual item, add your voice (Fig. 2.23). While people's voices and their vocal or facial expressions are quite individual, each examiner searches for the level of stimulation that elicits the baby's attention.



FIG. 2.21a-c.
INANIMATE
AUDITORY
ORIENTATION.

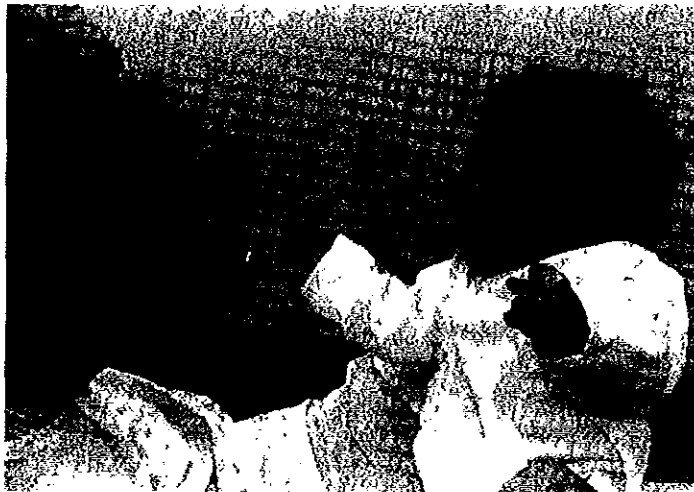


FIG. 2.22.
ANIMATE VISUAL
ORIENTATION.



FIG. 2.23.
ANIMATE VISUAL
AND AUDITORY
ORIENTATION.

Additional guidelines on the examination of a crying or fussy baby

Crying is normal in the newborn infant and is an integral component of the baby's repertoire. During the course of the NBAS examination, you have an opportunity to observe and score how much the infant cries (Lability of State, Irritability), how much stimulation it takes to bring her into a crying state (Rapidly of Build-up, Peak of Excitement), and how easy it is to console her, or for her to console herself (Consolability, Self-Quieting). Without an opportunity to observe crying, important information will be missing from the examination. As the examination proceeds, you should not rush to console the baby immediately when she begins to fuss. Continue with your administration until she goes into a full-blown State 6. When she has been in this state for 15 seconds, then begin the consoling maneuvers. Make sure to give her a chance to self-console. Administer the Consolability item twice at most during the examination and assign her the best score of these two trials. When you have evaluated this item and the infant continues to cry, use whatever maneuver is most effective in bringing her to a testable state in order to continue with the sequence of the examination.

During the examination it is important for examiners to distinguish between a fussy State 5 cry and a full-blown State 6 cry. This means that as the examination proceeds and the baby fusses, trainees must learn to continue with the items, allowing the maneuvers themselves to bring the infant to a full State 6. Only then can consolability be administered. The first cry is an important juncture in the examination since it reveals how much stimulation along the continuum it took to bring the baby to a crying state (the Rapidly of Build-up item). Examining a baby who cries throughout the examination is a challenging task for the beginner. Do not 'shut off' crying when you first meet it but wait until you can understand what it means to the baby. Very often crying can serve a cathartic purpose for her. It can act as a behavioral organizer and is often followed by well-organized behavior—a baby's best performance often follows a crying episode.

There may be times when crying is a sign of serious distress if it is accompanied by other signs of physiological instability. You may have to terminate the examination. In general, however, you should examine your feelings about and then try to empathize with the crying since it does provide an important window into the newborn infant's behavioral organization.

CONSOLABILITY

This is measured only after the infant has been in a crying state (State 6) for at least 15 seconds. During this 15 second period you have an opportunity to see if she can self-quiet. If she continues to cry, begin with the face alone, and if that fails, move on to the face and voice (Fig. 2.24a). If she still cannot be consoled, move on to placing your hand on her belly. This is followed by restraining both arms, then picking up and holding, holding and rocking, dressing the infant, and finally, if she still cannot be consoled, use a pacifier in addition to holding and rocking her. For each maneuver, allow the baby enough time to succeed in response to that particular consoling intervention. The administration of the Consolability maneuvers is cumulative, *i.e.* picking up and holding the infant includes restraining arm movements and using one's face and voice (Fig. 2.24b).

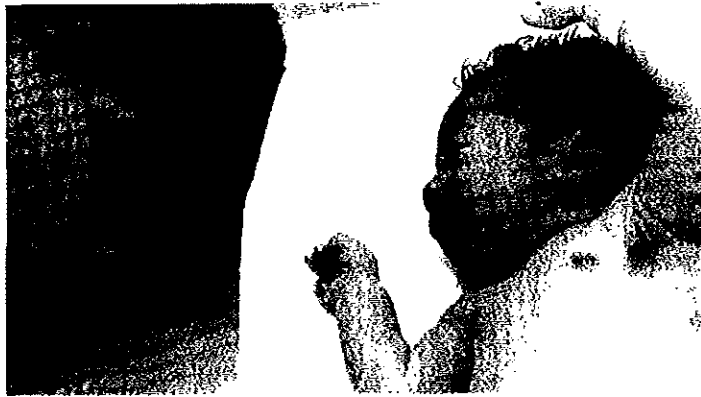


FIG. 2.24a,b.
CONSOLABILITY.

Guidelines for administering the reflex items

Administering these items correctly takes practice. For each reflex, the manual provides a recommended state for optimal results. If the infant is not in the recommended state during the regular sequence of the examination, you should continue with the sequence but may return at the end of the examination to try to elicit these reflexes again. Some examiners have a tendency to spend too much time waiting for the infant to be in the correct state before trying to elicit a particular reflex. Even if the baby is in a drowsy state at the initial foot reflex items, for example, you should attempt to elicit them and continue with the set sequence. Otherwise, the infant may be exhausted by the prolonged efforts to elicit the reflexes. The examination of the infant's behavioral responses takes precedence unless you suspect there may be brain damage.

The same guidelines apply to motor items. If the infant is in a sleep state for the Pull-to-Sit maneuver—the recommended states are 4 and 5—it may be difficult to get an accurate assessment of shoulder and neck tone at that particular moment in the examination. If she remains in a sleep state during your attempt to administer the item, you should note this and may have to come back to administer it again when the examination proper is complete. On the other hand, it may be that the item itself will bring the infant to a more alert and testable state. It is important to remember that the order of item presentation plays an important role in arousing the infant and in maintaining the integrity of the examination. Prechtl's *Neurological Examination of the Full-term Newborn Infant* provides reliable information on the correct elicitation of the reflexes and serves as a resource on reflex behaviors (Prechtl 1977).

Testing procedures

While the order of testing has been described above, a few points about administration can be added here.

The initial portion of the examination measuring response decrement has a fixed order, and scores may be recorded after each item. If the infant becomes alert during this period, the response decrement items are discontinued and you move on to the next set of items. If this occurs, you cannot assess response decrement at a later stage of the examination but should score these items as NA. If the infant becomes upset and begins to cry, you should wait 15 seconds before intervening with the consoling items. This allows the infant an opportunity to console herself. If no self-quieting occurs, you then proceed to administer the series of maneuvers designed to comfort the infant, as described above. If it is necessary to console the infant during this part of the examination, the response decrement items are deleted and you proceed to the next set of items. It is not necessary to go through these graded steps for consoling each time the infant cries during the course of the examination, but it should be tried twice and the best performance scored. Otherwise, you should attempt to preserve a flow in the administration of the items.

If the infant comes to an alert state during any of the various sets of maneuvers during the examination, you should attempt to administer the animate and inanimate visual and auditory items. We suggest that you pick up and hold the baby at this juncture

in order to interact with her in the *en face* position. Whether sitting or standing, it is particularly important that you feel comfortable when entering into interaction with the infant, since these maneuvers are at the heart of the examination. If she changes state and is no longer in a quiet alert state despite your facilitating efforts, you should move on to the next item and return to the orientation items later in the examination.

Throughout the examination, you watch for the various strategies the baby may use to organize herself (e.g. hand-to-mouth movements, postural change, sucking, etc.). You will also score the number of tremors, startles or skin color changes, which reflect the baby's response to stress. All the state changes that take place from the initial period of observation until the end of the examination are also documented. While there is no fixed order of item administration, the examination is structured in such a way that the items become progressively more stimulating as it progresses. This in turn allows you to group the items according to their level of intensity and thus preserve continuity and ensure a smooth flow in the presentation of items. The infant is first exposed to repeated distal, visual and auditory stimuli during the response decrement items, then the stimulation is increased when you uncover the infant and administer the pin-prick. The next level of stimulation consists of various tactile maneuvers where you test the various foot reflexes and rooting and sucking. The increasing degree of stimulation may bring the baby to an alert state by this time, so that the interactive cluster of items may then be assessed. If she does not become alert, the level of stimulation increases and the maneuvers become more invasive with increasing vestibular stimulation as you elicit the hand grasp, pull-to-sit, placing, stepping, crawling, incurvation and tonic deviation of the head and eyes items. Finally, the last cluster of items involving massive vestibular stimulation are administered: the defensive, TNR and Moro.

3

MANUAL FOR SCORING THE NBAS ITEMS*

Response Decrement to Light, Rattle and Bell (states 1, 2, 3)

One of the most impressive mechanisms in the neonate is the capacity to decrease responses to repeated disturbing stimuli. In these tests, an attempt is made to measure the decrement which occurs in a sleeping state or in a transitional drowsy state, after the infant has responded to a bright light, and to the sound of a rattle and a bell.

SCORING:

- 1 No shutdown observed and item has to be discontinued because baby moves into a crying state or exhibits signs of physiological stress, *e.g.* apnea, startles, tremors, severe cyanosis.
- 2 No shutdown observed, with a gradual increase in level of responsivity over the 10 trials. Startles may be present after the final trial.
- 3 No complete shutdown observed over 10 trials. Diminution in responses does occur at some time during the 10 trials, but global responses return and are still present after the final trial.
- 4 No complete shutdown observed over 10 trials. Body movements are still present but there has been a decrease in the level of responsiveness over the 10 trials, with a gradual diminution from global to more minimal levels of responsiveness. Body movements may be delayed, and the infant is able to shut out completely at least once during the sequence, but is unable to reach criterion by shutting out twice in succession.
- 5 Shutdown of body movements; some diminution of blinks and respiratory changes after 9-10 presentations of the stimuli.
- 6 Shutdown of body movements; some diminution in blinks and respiratory changes after 7-8 presentations of the stimuli.
- 7 Shutdown of body movements; some diminution in blinks and respiratory changes after 5-6 presentations of the stimuli.
- 8 Shutdown of body movements; some diminution in blinks and respiratory changes after 3-4 presentations of the stimuli.
- 9 Shutdown of body movements; some diminution in blinks and respiratory changes after 1-2 presentations of the stimuli.

Response Decrement to Tactile Stimulation of the Foot (states 1, 2, 3)

SCORING:

- 1 No shutdown and item has to be discontinued because infant moves into crying state or exhibits signs of physiological stress, *e.g.* apnea, startles, tremors or severe cyanosis.
- 2 No shutdown and response generalized to whole body and increases over trials.
- 3 No shutdown over the 5 trials; body movements still present.

*The standard Scoring Form for NBAS examinations is reproduced as Appendix 1, p. 123.

- 4 No shutdown after 5 trials but decrease in responsivity over the 5 trials is observed with a gradual diminution from generalized body movements to minimal levels of responsivity.
- 5 Response localized to stimulated leg after 5 trials. No movement observed in rest of the body.
- 6 Response localized to stimulated foot after 5 trials. No movement observed in rest of the body.
- 7 Complete shutdown after 5 trials.
- 8 Complete shutdown after 3-4 trials.
- 9 Complete shutdown 1-2 trials.

Orientation Inanimate and Animate Visual (and Visual-Auditory) (alert states)

Since most neonates will demonstrate some ability to fixate on a visual object and follow it horizontally for brief excursions, these items are a measure of that ability. They are highly state-related, and under optimal conditions (a quiet, semi-dark room), they are repeatable; following with the eyes is also accompanied by head turning and following. Vertical following seems of an even higher order, and many babies will stretch their necks to follow up and down.

The infant may respond with (a) alerting (decrease in random activity, focusing on the object when it is in her line of vision, slow regular respirations, and following in smooth arcs when the object moves), and (b) brightening (change in facial expression, widening of eyes and brighter look, uneven respiration, with an associated decrease in random activity).

SCORING:

- 1 Does not focus or follow stimulus.
- 2 Stills with stimulus and brightens.
- 3 Stills, focuses on stimulus when presented, little spontaneous interest, brief following.
- 4 Stills, focuses on stimulus, follows for 30° arc, jerky movements.
- 5 Focuses and follows with eyes horizontally for at least a 30° arc. Smooth movement, loses stimulus but finds it again.
- 6 Follows for two 30° arcs with eyes and head. Eye movements are smooth.
- 7 Follows with eyes and head at least 60° horizontally, maybe briefly vertically, partly continuous movement, loses stimulus occasionally, head turns to follow.
- 8 Follows with eyes and head 60° horizontally and 30° vertically.
- 9 Focuses on stimulus and follows with smooth continuous head movement horizontally and vertically, and follows in a circular path for a 180° arc.

Orientation Inanimate and Animate Auditory (alert states)

This is a measure of the infant's response to the rattle stimulus when in an alert state. Brightening of face and eyes can be seen, and they are evidence of attention to the stimulus. If an observable response does not occur on the first presentation, it may be repeated later in the examination.

SCORING:

- 1 No reaction.
- 2 Respiratory change or blink only.

- 3 General quieting as well as blinking and respiratory changes or head may turn to stimulus, but eyes remain closed.
- 4 Stills, brightens, no attempt to search for source.
- 5 Shifting of eyes to sound; stills and brightens.
- 6 Alerting and shifting of eyes, head turns to source.
- 7 Alerting, head turns to source, searches for, finds and looks at stimulus (at least once).
- 8 Alerting, head turns, eyes search and find stimulus repeatedly (3 out of 4 times).
- 9 Alerting prolonged and consistent, head turns, eyes search for and find stimulus every time (4 times out of 4).

Alertness (alert states)

This is a summary score which assesses the best periods of alertness as shown by the infant's responsiveness to the examiner within these best periods. It assesses both the duration of focused alertness (as opposed to 'blank stare' alertness) and the baby's ability to respond with a relatively short latency to visual and auditory stimuli. The periods of alertness can occur at any time during the examination period. Often they are elicited while the examiner holds the infant. Since neonatal behavior is as variable as babies are, and babies are alert for such a short period, one must assume that any period of alertness in a 30 minute examination may be taken as an index of the infant's capacity for responsiveness. Alerting is defined as brightening and widening of the eyes, while orienting is used to describe the response of turning toward the direction of stimulation. Delay refers to the amount of time it takes for the baby to alert to the stimulus.

SCORING:

- 1 Inattentive—rarely or never responds to stimulation.
- 2 When alert, responsiveness very brief and always delayed. Not specific to stimuli.
- 3 When alert, responsiveness brief and often delayed and quality of alertness variable. Responsiveness specific to stimuli.
- 4 When alert, responsiveness brief but not delayed. Quality of alertness variable.
- 5 When alert, responsiveness of moderate duration. Responsiveness may be delayed and variable and takes considerable time to engage the infant's alertness.
- 6 When alert, responsiveness of moderate duration, not delayed and not variable and can be achieved with minimal examiner effort.
- 7 When alert, responsiveness of generally sustained duration. Still some delay and variability. Examiner support may be necessary to elicit this level of responsiveness.
- 8 When alert, responsiveness is sustained. No delay or variability, and minimal examiner support necessary to initiate Orientation responses.
- 9 Always alert for most of the examination. Orientation cues are clear and alertness predictable, no examiner facilitation necessary.

General Tone (states 4, 5)

This scores the motor tone of the baby in her most characteristic states of responsiveness. Since this is a summary assessment, it should include the overall tone as the infant responds to being handled. This should be assessed in states 4 and 5 and not in state 6.

Strictly, tone means the resistance of parts of the body to passive movement. In the child even more than in the adult the posture reflects tone to a large extent. Positioning the baby allows gravity to impose a passive force on her body. The 'floppy baby' will therefore be like a rag doll in both ventral and supine suspension. When the tone is increased the baby holds limbs in flexed postures, and it is in attempting to break these postures either with gravity or by passive movement that the observer notes increased tone.

Tone is scored by a summary assessment of the motor responses observed when the baby is at rest and is confirmed by handling and testing her motor resistance when handled. Tone is assessed in such maneuvers as spontaneous activity, Pull-to-Sit, holding the infant over one's hand horizontally, prone placement, cuddling and so on. This should be an overall assessment of body tone as the infant reacts to all of these in awake states.

SCORING:

- 1 Flaccid, limp like a rag doll, no resistance when limbs are moved, complete head lag in Pull-to-Sit.
- 2 Little response felt as infant is moved, but less than 25% of the time.
- 3 Flaccid, limp most of the time, but is responsive about 25% of the time with some tone.
- 4 Some tone half the time, responds to being handled with average tone less than half the time.
- 5 Tone average when handled, lies with relaxed tone at rest.
- 6 Responsive with good tone as infant is handled approximately 75% of the time, may be on the hypertonic side up to 25% of the time, variable tone in resting.
- 7 Is on the hypertonic side approximately 50% of the time.
- 8 When handled infant is responsive, with hypertonicity about 75% of the time.
- 9 Hypertonic at rest (in flexion) and hypertonic all the time.

Motor Maturity (states 4, 5)

This is a summary assessment of motor responses—spontaneous and elicited—assessed throughout the examination in states 4 and 5, not in state 6. Arm movements have been found to be easier to score than leg movements. This item assesses (a) smoothness vs. jerkiness, which reflects the balanced flexor and extensors vs. the unbalanced cogwheel movement of the arms, and (b) freedom of arcs of movement (45° to 90°) vs. restricted arcs (45° or less) (arms and legs in flexion). The short-gestation baby has unlimited freedom of movement (floppy) in lateral, sagittal and cephalad areas, but the movements are jerky and cog-like, overshooting their marks. The very mature infant has freedom of movement in all directions associated with a smooth, balanced performance (not floppy). The average newborn infant is somewhat limited in arcs of movement—especially those above the head, and somewhat in the lateral plane beyond a 45° angle.

To score this item, one must first consider whether the baby's movements are smooth, jerky or consisting of overshooting movements. Jerky movements must be differentiated from tremors. Jerky movements are of low frequency and high amplitude

and involve all of the extremities, whereas tremors are high-frequency, low-amplitude movements and may involve only part of the extremities. Overshooting must also be differentiated from smooth unrestricted movements. Overshooting is characterized by abruptness and lack of modulation (*i.e.* lack of limitation and control), and is often seen in the preterm infant.

In judging the degree of the arcs, 0° means that the arms are extended directly up and the legs are straight out. 90° is scored if one observes the angle as complete between the trunk to full extension at the extremities (*i.e.* flat on the table). 45° means that each extremity is moved halfway out in each direction.

SCORING:

- 1 Cogwheel-like jerkiness, overshooting of legs and arms in all directions.
- 2 Jerky movements predominate with mild overshooting.
- 3 Jerky movements predominate, with no overshooting.
- 4 Jerky movements half the time, smooth movements half the time.
- 5 Smooth movements predominate (about 75% of the time), some jerkiness may be observed.
- 6 Smooth movements throughout, arcs predominantly 45°. There are no 90° angles. Jerkiness is no longer observed.
- 7 Smooth movements throughout, 90° arcs observed 25% of the time. No jerkiness observed.
- 8 Smooth movements throughout, 90° arcs observed 75% of the time. No jerkiness observed.
- 9 Smooth movements throughout, unrestricted smooth arcs of 90° or more, all of the time. No jerkiness observed.

Pull-to-Sit (states 3, 4, 5)

This is a measure of the tone of the shoulder girdle muscles, and of the muscular resistance to stretching the neck and lower musculature, as the infant is pulled to a seated position.

It is a measure of traction, head control and the strength of neck muscles. Head control is a joint function of the strength of the neck muscles and the activity of the labyrinth, while the traction response examines the infant's arm flexion and resistance.

SCORING:

- 1 Head flops back completely, with no attempt to bring it up. No shoulder and neck tone observed.
- 2 Futile attempts to bring head forward to midline, but very slight shoulder tone increase is felt.
- 3 Increase in shoulder tone felt and infant is able to bring head forward through midline. Head remains forward, resting on chest, but infant is unable to bring it back to midline.
- 4 Some shoulder and arm tone increase is felt as infant is pulled to sit. Infant brings head through midline. Infant makes further attempts to bring head back up to midline, although does not succeed.
- 5 Head and shoulder tone increase is felt as infant is pulled to sit. Infant brings head through and then successfully brings it back to midline. Can maintain it there for at least 1-2 seconds.

- 6 Head and shoulder tone increase, and infant brings head to midline twice and can keep it in position at midline for 2 seconds or more.
- 7 There is still some head-lag as infant is pulled to sit. However, head can now be maintained at midline for a total of 10 seconds. When the head falls the infant repeatedly rights it.
- 8 No head-lag observed as infant is pulled to sit. Infant can maintain head at midline for 10 seconds.
- 9 No head-lag, shoulder girdle and tone increase as infant is pulled to sit. Can maintain head at midline for 60 seconds.

Defensive Movement (states 3, 4, 5)

This maneuver measures the infant's response to interference with visual functioning, head restraint and breathing. The baby's efforts to remove the cloth demonstrate the salience of the visual system for the human newborn infant (Als and Duffy 1983), while the response to partial occlusion of the respiratory airway reflects the strength and robustness of the newborn infant's ability to defend against interference with breathing (Thoman 1975).

SCORING:

- 1 No response.
- 2 General quieting.
- 3 Non-specific motor responses with long latency.
- 4 Non-specific motor responses with short latency.
- 5 Rooting and lateral head turning.
- 6 All the above and neck stretching.
- 7 More than one non-directed swipe of arms in upper quadrant area of the body.
- 8 More than one directed swipe of arms in the upper quadrant but directed at the cloth.
- 9 Successful removal of the cloth with swipes.

Activity (states 4, 5)

This is a summary of the activity seen during the entire observation, especially during the alert states. The activity consists of two kinds: (a) spontaneous, which measures the baseline activity that one sees during the course of the examination; (b) elicited, or activity in response to the stimulation of handling as well as during the visual and auditory stimuli used by the examiner.

A further dimension must be reflected by the inaccessibility of the baby's activity (*e.g.* an overactive child). In these babies the activity is not interfered with by the observer's maneuvers.

A summary judgment may be made initially by comparing the baby's activity level to that seen in a range of healthy term babies.

Amount of activity is graded: much = 75% or more of the time; moderate = 50% of the time; slight = 25% of the time. After stimulation which triggers activity, the amount of activity which persists can be assessed: much—builds up first, perpetuates itself for a period after activity is initiated; average—no build-up, and at least three cycles of activity which is decreasing all the time; little—two or three cycles of

activity which die out quickly. Continuous activity is an unusual and excessive amount to be judged on whether the baby can or cannot be consoled.

SCORING:

Score spontaneous and elicited activity separately on a four-point scale: 0 = none; 1 = slight; 2 = moderate; 3 = much. Then add up the two scores.

- 1 Total score = 0.
- 2 Total score = 1.
- 3 Total score = 2.
- 4 Total score = 3.
- 5 Total score = 4.
- 6 Total score = 5.
- 7 Total score = 6.
- 8 Continuous but consolable movement.
- 9 Continuous, unconsolable movement.

There may be a more marked difference between spontaneous and elicited activities than the scoring reflects. Then, the baby will be scored midway between them, but you should be alert to the fact that this reflects a kind of uncoordination, such as is seen in metabolic imbalance or CNS irritation. A note should be made about this.

Peak of Excitement (all states)

This is a measure of the overall amount of motor and crying activity observed during the course of the whole examination. The examiner observes the infant's peaks of excitement and notes how she returns to a lower state, and to a more responsive state. The kind of intense reactions which some infants demonstrate when they reach their peak of excitement makes them unavailable to the outside world, and merits a high score. Others are hardly able to be jogged to respond at all, and their peak of excitement is very low. An average response would fall in the moderate, midpoint range, in which the infant could be brought to respond to stimuli in spite of a high degree of upset or excitement, but then return to more moderate states. The infant should reach the highest state for at least 15 seconds.

SCORING:

- 1 Low level of arousal to stimulation. Never moves beyond state 2.
- 2 Some arousal to stimulation. Reaches state 3.
- 3 Infant is predominantly in state 3 or lower but may reach state 4 briefly (for less than 15 seconds).
- 4 Infant is predominantly in state 4 or lower, but may reach state 5 or 6 briefly (less than 15 seconds).
- 5 Infant is predominantly in state 5 or lower, but may reach state 6 (for 15 seconds) once or twice during the examination.
- 6 Infant reaches state 6 more than twice during the examination, but returns to lower states spontaneously, at least twice.
- 7 Infant reaches state 6 more than twice, but with consoling is easily brought back to lower states.
- 8 Infant reaches state 6 more than twice but is consoled with difficulty. Usually needs pacifier or suck to be consoled.
- 9 Infant achieves insulated crying state. Unable to be quieted or soothed.

Rapidity of Build-up (all states)

This is a measure of use of states as the baby moves from quiet to agitated states. It measures the *timing* and the number of stimuli which are used before the infant changes from her initially quiet state to a more agitated one. Since this implies that we start with a quiet baby, it measures the period of 'control' which the infant can maintain in the face of increasingly aversive stimuli, as well as the additive effect of these stimuli.

To score this item, one should consider how much stimulation causes the baby to lose 'control' and the point during the examination at which this occurs. The order of the examination as listed below cannot always be maintained since it is dependent on the baby's state pattern. Therefore, the items below should be placed in the order of the particular examination. If the baby first cries for 15 seconds at a point that is not designated below, score the item which is nearest to this point, and according to the sequence of the examination.

SCORING:

- 1 Never cries.
- 2 Does not cry until the end of the examination, *i.e.* after the Moro.
- 3 Not until after administration of Tonic Deviation of Head and Eyes, Defensive Movements or TNR.
- 4 Not until Pull-to-Sit, Placing, Standing, Walking or Incurvation.
- 5 Not until being undressed.
- 6 Not until Tactile Stimulation of the Foot or the foot reflexes.
- 7 Not until uncovering and being placed in supine.
- 8 During the response decrement items.
- 9 Never was quiet enough to score this.

Irritability (awake states)

This item measures the number of times the infant gets upset as well as the kind of stimuli which make her irritable. To score this item, count the number of items in the following list to which the infant responds with audible fussing or crying for at least three seconds: Uncover/Place in Supine; Response Decrement to Tactile Stimulation of the Foot; Undressing; Passive Tone in Legs/Arms; Pull-to-Sit; Place in Prone; Defensive Movements; TNR; Moro. This item should not be scored if more than two of the items cannot be administered.

SCORING:

- 1 No fussing to any of the above.
- 2 Irritable fussing to 1 of the stimuli.
- 3 Irritable fussing to 2 of the stimuli.
- 4 Irritable fussing to 3 of the stimuli.
- 5 Irritable fussing to 4 of the stimuli.
- 6 Irritable fussing to 5 of the stimuli.
- 7 Irritable fussing to 6 of the stimuli.
- 8 Irritable fussing to 7 of the stimuli.
- 9 Irritable fussing to 8 or more of the stimuli.

Lability of States (all states)

This measures the infant's state performance over the examination period. Every definite state change over a recognizable period of at least 15 seconds is counted. It is recommended that the examiner score this item as soon as possible after the administration of the examination. This may be done by mentally reconstructing the order of the examination and by documenting each state which the baby maintained for 15 seconds. Counting should include changes upward and downward over the examination period. Scores of 1-3 on this item are aimed at the baby whose states are not very labile; scores 4-6 reflect moderate lability; and 7 and higher are reserved for the baby who is very labile.

SCORING:

- 1 1-2 state changes observed over the course of the examination.
- 2 3-5 state changes.
- 3 6-8 state changes.
- 4 9-11 state changes.
- 5 12-14 state changes.
- 6 15-17 state changes.
- 7 18-20 state changes.
- 8 21-23 state changes
- 9 24 or more state changes.

Cuddliness (states 4, 5)

This is a summary measure of the infant's response to being held in alert states. There are several components which are scored in response to the baby being held in a cuddled position both vertically on the examiner's shoulder, and horizontally against the examiner's chest. The baby's resistance to cuddling should be assessed as well as the ability to relax or mold and cling to the examiner. It is best to give the baby a chance to initiate cuddling. It is only if there is no active participation on the part of the baby or if the baby is unable to relax or mold that the examiner should facilitate cuddling. If the infant does it herself, she gets a score of 5 or above.

SCORING:

- 1 Always resists being held, continuously pushes away, thrashing or stiffening.
- 2 Resists being held most but not all of the time.
- 3 Neither resists nor participates, lies passively in arms and on shoulder (like a sack of meal).
- 4 Eventually molds into arms, but after a lot of nestling and cuddling by the examiner.
- 5 Usually molds and relaxes when held. Inconsistency between horizontal and vertical positions.
- 6 Always molds and relaxes when held.
- 7 Always molds, nestles head in crook of elbow and neck of the examiner.
- 8 Always molds initially. In addition to molding and relaxing, the infant nestles and turns head, leans forward on the shoulder, fits feet into cavity of other arm, all of body participates. Head nestles in crook of elbow and neck. Predictably, turns toward body in horizontal and vertical positions.
- 9 All of the above, and baby grasps and clings to the examiner.

Consolability (state 6-4 or lower)

Consolability measures the number of maneuvers the examiner utilizes in order to bring the baby to a quiet state. Some infants will quiet only when they are dressed and left alone. Any stimulus from the environment may disturb them. Others will console only when they are held and actively rocked. A steady hand held on a crying baby's belly will act as a soothing stimulus. Others need one or both arms to be held in addition to the hand on the belly. Holding the arm or arms interferes with disturbing startle activity which may get triggered as the baby cries or fusses. A few babies may quiet to the examiner's voice or face. Consoling is demonstrated when the baby quiets for at least 15 seconds.

To administer this item, one must start when the baby is in state 6. (If she never becomes that upset, it must be scored NA.) Wait 15 seconds to give the baby an opportunity to self-quiet then proceed with the consoling maneuvers. Begin with face alone and allow the baby enough time to respond to each maneuver. The administration of the maneuvers is cumulative (e.g. picking up and holding the infant includes restraining arm movements and using one's face and voice). It is not necessary to go through each step of the consolability sequence whenever the baby cries. However, it should be administered twice during the examination, if possible, and best performance should be scored.

SCORING:

- 1 Not consolable.
- 2 Pacifier or finger to suck in addition to dressing, holding and rocking.
- 3 Dressing, holding in arms and rocking.
- 4 Holding and rocking.
- 5 Picking up and holding.
- 6 Hand on belly and restraining one or both arms.
- 7 Hand on belly steadily.
- 8 Examiner's voice and face alone.
- 9 Examiner's face alone.

Self-Quieing (state 6-4 or lower)

This is a measure of the activity which the baby initiates when in a crying state (state 5 or 6) as an observable effort to quiet herself. Success is measured as an observable state change to state 4 or below persisting for at least five seconds.

Many babies may cry or fuss vigorously at some time during the examination. For those who never cry or fuss, put NA. The activities which can be counted are: (a) hand-to-mouth efforts; (b) sucking on fist; (c) using visual or auditory stimulus from the environment (more than a simple response is necessary to determine this).

SCORING:

- 1 Makes no attempt to quiet self, intervention always necessary.
- 2 A brief attempt to quiet self (less than 5 seconds) but with no success.
- 3 Several attempts to quiet self, but with no success.
- 4 One brief success in quieting self for period of 5 seconds or more.
- 5 Several brief successes (5 seconds) in quieting self.

- 6 An attempt to quiet self which results in a sustained successful quieting with the infant returning to state 4 or below for at least 15 seconds.
- 7 One sustained (15 seconds) and several brief successes (5 seconds) in quieting self.
- 8 At least two sustained (15 seconds) successes in quieting self.
- 9 Consistently quiets self for sustained periods, never needs consoling.

Hand-to-Mouth (all states)

This can be measured in all states. A hand-to-mouth reflex is inborn, and seems to be a response to stroking the cheek or the palm of the infant's hand. It can be triggered in the infant by mucus and gagging, or by discomfort as one places the infant in prone. It is seen spontaneously as the neonate attempts to control or comfort herself when upset. This is a measure of the baby's ability to bring her hands to her mouth in supine as well as of success in insertion. Some infants bring their hands to their mouths repeatedly, insert a part of the fist or fingers, and suck actively on the inserted part.

To score this item the baby must *actively* achieve hand-to-mouth. If the hand is placed next to the mouth accidentally as you place the baby in prone or put the baby on your shoulder, a hand-to-mouth success should not be counted. However, if the baby touches her mouth on her own, or actively inserts the fingers in these positions, it may be counted toward the scoring of this item.



FIG. 3.1.
HAND-TO-MOUTH.

SCORING:

- 1 No attempt to bring hand to mouth.
- 2 Brief swipes at mouth area, no contact.
- 3 Hand or fist brought next to mouth once, contact made but no insertion.
- 4 Hand or fist brought next to mouth twice, contact made but no insertion.
- 5 Hand or fist brought next to mouth at least three times but no insertion.
- 6 One insertion of the hand or fist with brief sucking attempts, unable to be maintained.
- 7 Three or more brief insertions with brief sucking attempts, not maintained.

- 8 Sustained sucking on hand or fist observed on several occasions, each lasting more than 3 seconds.
- 9 Sustained sucking on hand or fist observed on several occasions, one at least lasting for over 15 seconds.

Tremulousness (all states)

Since in its severe form this may be a measure of CNS irritation or depression, and may occur for metabolic reasons, or since it may be a sign of immaturity, it becomes one more indication of all of these. If it is severe, the baby should be considered as suspect and a neurological evaluation is indicated. Milder forms of tremulousness are demonstrated at the end of a startle, and as a baby comes from sleeping to awake states. Some tremor of the extremities can be expected in the neonate's first week. As the infant normally becomes dehydrated during the second and third day, metabolic imbalances cause some tremulousness. In light sleep, or as the infant startles in deep sleep, tremors of the extremities may be noted. Tremors of the chin should not be scored if seen only in crying states. As the infant becomes alert and active, the tremulousness should be overcome with smooth, voluntary behavior of the limbs. Aversive stimuli may set off a startle which is followed by a return of tremulousness. Jerkiness and startles must be differentiated as well.

The scoring of Tremulousness is cumulative (e.g. a score of 6 means one or two tremors were seen in state 4 and may have also been seen in states 5 and 6).

SCORING:

- 1 No tremors or tremulousness noted.
- 2 Tremors observed only in states 1, 2 or 3.
- 3 Tremors only after the Moro or startles.
- 4 Tremulousness seen 1 or 2 times in states 5 or 6.
- 5 Tremulousness seen 3 or more times in states 5 or 6.
- 6 Tremulousness seen 1 or 2 times in state 4.
- 7 Tremulousness seen 3 times in state 4, fewer than 3 times in other states.
- 8 Tremulousness seen more than 3 times in state 4 and may be seen more than 3 times in each of several other states.
- 9 Tremulousness seen consistently and repeatedly in all states.

Startles (all states after the Response Decrement items)

Both spontaneous startles and those which have been elicited in the course of stimulation are included in this. Some infants never startle during an examination except when a Moro reflex* is elicited. Abnormally sensitive infants overreact to any disturbing stimulus with a startle, and have observable startles for no observable reason—hence they must be considered 'spontaneous' or due to internal stimuli. A startle is scored when there is total body movement and should be distinguished from the movements which involve only part of the body. The Moro reflex is used as an example of this kind of total body movement. Anything less than whole-body startle

*There is discussion as to whether an elicited Moro reflex and a startle are the same phenomenon (see Bench *et al.* 1972). For scoring this system we assume they are similarly described.

should not be scored. The examiner should discount startles elicited by clumsy movement on her part, and should not include startles observed during Habituation items.

SCORING:

- 1 No startles noted.
- 2 Startle as a response to the examiner's attempt to elicit a Moro reflex only.
- 3 2 startles, including Moro.
- 4 3 startles, including Moro.
- 5 4 startles, including Moro.
- 6 5-6 startles, including Moro.
- 7 7-9 startles, including Moro.
- 8 10 startles, including Moro.
- 9 11 or more startles, including Moro.

Lability of Skin Color (all states)

This measures the changes of color and vascularity which take place during the period of the whole examination (e.g. the acrocyanosis or peripheral mild cyanosis when the extremity is left uncovered or the change from pink to pale or cyanotic when the baby is undressed). Mottling and a web-like appearance may occur in an effort to maintain body heat. A normal newborn infant is likely to demonstrate mild color changes several times in an examination during which she has been undressed, disturbed and upset. The length of time after undressing before the infant begins to change color is a good way to judge this. Additionally, the amount of the area of the body which changes should be scored as well as the degree of the change and the time to recovery of the original color. When the color is abnormal and there is no observable change in color during the examination, this may be the result of a depressed or overstressed autonomic and vascular system, as seen among lethargic, pale or cyanotic infants. Marked changes which vary from minute to minute will be seen in short-gestation babies or babies who have not yet adjusted to extrauterine temperature changes. These abnormal color changes are seen among infants whose central and autonomic nervous systems are unable to master the changes during an examination.

Acrocyanosis should be recorded when there is more than mild, localized cyanosis of the extremities and around the mouth, and especially when the infant is not in enough stress to account for such mild changes.

Paling should be checked when unusual or excessive.

Reddening might be the result of unusual vascular changes, dehydration or skin irritation.

Other skin abnormalities should also be recorded as they might reflect metabolic or hematologic variations, which could influence the behavioral outcome of the examination.

In babies with deep pigmentation of the skin, from non-white races, it may be difficult to score lability of skin color accurately. In these cases, the item should be marked NA.

SCORING:

- 1 Pale, cyanotic skin color, remaining so during the course of the examination.
- 2 Pale or cyanotic skin color at the outset which improves minimally during the examination.
- 3 Pale, cyanotic skin color through most of the examination but improvement is seen during the course of the examination.
- 4 Healthy color predominates but acrocyanosis in the extremities as well as the chest or abdomen is observed. Mild cyanosis around the mouth or extremities may also be observed.
- 5 Healthy color throughout, but some mild color change is observed on parts of the body after stress during the examination. Good color returns spontaneously.
- 6 Healthy color predominates, but a complete change in color to red, which extends over the whole body may be observed. Good color returns quickly with soothing or covering.
- 7 Color changes to very red when stressed and extends over the whole body. Recovers healthy color slowly if covered or soothed.
- 8 Baby becomes very red early in the examination, and recovery is slow.
- 9 Baby is markedly red throughout the examination. Good color rarely observed.

Smiles (all states)

Smiles are seen in the neonate. They can be grimaces, which are reflexive in nature, and they also occur 'appropriately', or in response to soft auditory and/or visual cues. Occasionally, when the baby is handled and restrained in a cuddling position, a smile comes across her face as she relaxes. There are close replicas of 'social smiles' in the newborn period—when the examiner leans over the crib and talks softly to the infant. They are difficult to be sure of, may consist primarily of a softening and brightening of the infant's face with a reflex grimace thrown in, and they may certainly be difficult to reproduce. Hence, one hesitates to call these 'social smiles', but they surely are the facial precursors of such smiling behavior. A mother reinforces them as such.

SCORING:

Record the number of times a smile is observed.
Leave blank if no smile is observed.

Supplementary items

The supplementary items were first published in the second edition of the NBAS. Some of these items were adapted from the *Manual for the Assessment of Preterm Infants' Behavior* (APIB—Als *et al.* 1982a). These are summary items and were designed to describe the more qualitative aspects of the infant's performance over the course of the examination and to capture the more subtle signs of stress that may not be captured by the standard Scale items described above. The supplementary items are optional but are recommended for scoring high-risk infants or infants who are deemed to be intrauterine growth retarded or immature. They are scored after the standard items, and as will be observed, the scores are unidirectional, with highest scores always reflecting better performance.

Quality of Alertness

This summary score refers to the overall quality of the infant's responsiveness over the course of the examination. It evaluates the level of her focused alertness or the degree to which she maintains intense gaze on the stimulus. It attempts to discriminate between low-level, dull, vague, uninvested alertness and open-eyed 'processing' alertness, characterized by widening and brightening of the eyes, focusing of the eyes on the stimulus, and pursing of the lips, often with raised eyebrows. This degree of alertness is usually accompanied by low activity levels.

SCORING:

- 1 No alertness in state 4 is achieved during the examination, despite examiner's best efforts.
- 2 Infant is dully alert with only fleeting eye attention, facial changes and body stilling. Despite examiner's best efforts, attempts at responsiveness are dull and fleeting but do seem to be responsive, however briefly, to the stimuli.
- 3 Infant is capable of brief periods of bright alertness, with a great deal of examiner facilitation. These periods last for less than 5 seconds and end when the baby becomes either hyperalert, with wide staring eyes and tense body tone, or closes her eyes and returns to a lower unavailable state. Either of these transitions may be accompanied by color change, tremors or startles. This hyperalert look, although apparently focused on the stimulus, gives the appearance of the infant being 'locked on' to the stimulus but the examiner is unable to break through the intensity of the infant's gaze.
- 4 Infant is capable of brief periods of bright invested alertness, with moderate support from the examiner. These periods last for at least 5–10 seconds, are invested in the stimulus but stop when the infant turns away, returns to a lower state or becomes more active, hyperalert or fussy.
- 5 The infant's alert responsive behavior, characterized by a focused gaze, brightening of the eyes and stilling of body movements now lasts for at least one period of 15 seconds. These behaviors are still moderately difficult to bring about, but they are clear and cease when the baby turns away with either dull staring or becomes more active and hyperalert.
- 6 Alert periods as above are present and last for at least two moderate periods of 15 seconds. These periods are achieved with minimal examiner facilitation. The infant does not need to shut out so quickly. Eyes may still wander off and on, and there may still be overshooting of eye movements in response to the stimulus.
- 7 The infant is capable of repeated periods of alertness of moderate duration during the course of the examination. Her eyes are bright, she is able to focus, the head and eyes are coordinated and she is able to maintain quiet alertness without any help from the examiner. These periods may be terminated by restlessness or crying, by dull gaze or staring, but can be easily brought back to quiet available alertness by the examiner.
- 8 Alert periods, with entire face and head participating, are prolonged and last for more than 30 seconds each time. Infant can let go of stimulus and with rest periods can return with ease with a brightened focused alert look.
- 9 Prolonged periods of alert behavior dominate infant's performance. Infant elicits stimulation and can modulate attention in and out with ease. Eye movements are always smooth and focused, head and eyes always coordinated. Infant maintains intense gaze on the stimulus and needs no examiner facilitation to achieve this level of responsiveness.

Cost of Attention

Maintaining a state of attention is demanding for a newborn infant, even more so for an immature or frail one. As the infant recovers or matures, the stress of attending is measured by the demands on other systems, such as physiological or motor systems. Since there is integration between attention, state, motor and physiological systems, this item attempts to capture the cost of this attention by measuring the extent to which the motor and physiological systems are stressed.

Autonomic stress is registered by extreme paling, acrocyanosis, uneven coloring and mottling; and by grunting or rapid, shallow breathing, or deep, regular respirations interrupted by periods of apnea or irregular breathing of over 15 seconds duration.

Motor exhaustion is demonstrated by complete flaccidity, hypertonicity and uneven tone with prolonged tremors. Before this, the baby becomes disorganized—flailing and frantic, or the movements change from smooth and effective to jerky and ineffective. The baby stiffens or arches away from the examiner or may go limp and enter into a sleep state.

State overloading accompanied by attempts to control this are demonstrated by the baby resorting to the shutting-out states of sleep or dull unavailability (Fig. 3.2), crying, eyes floating or saccadic movements, hiccups, yawns, regurgitating or gagging. All of these signal impending exhaustion. As one proceeds from Habituation, then to Motor-Oral and on to Orientation items, there is cumulative stress.

Of course, the examination should be discontinued when the baby becomes really stressed. If, after a period of rest, it can be started again, the examiner should be extremely sensitive to a recurrence of the stress. Then, it must be discontinued for the sake of the baby.



FIG. 3.2.
COST OF
ATTENTION.

SCORING:

- 1 The cost to the autonomic system is so great that the Habituation items have to be discontinued. Paling or cyanosis, grunting or rapid breathing with periods of apnea register the cost to the infant's autonomic system.
- 2 The Habituation package and the minimally stressful items of the Motor-Oral package can be administered, but signs of autonomic exhaustion described above appear. Baby's color and respirations can be maintained by the sensitive adaptations of the examiner, but the examination must be discontinued before the more moderately stimulating items or the Orientation items can be administered.
- 3 The first three packages of the examination can be administered before the autonomic system is so taxed that the examination must be discontinued. The infant is unable to respond to the Orientation items without evidence of acute autonomic stress.
- 4 Although all the examination can be completed, the cost to the baby is extremely high, as represented by the level of behavioral disorganization and stress in the autonomic, motor and state systems. No orientation responses are available. Halfway through the examination, one of these systems demonstrates the cost: (i) motor behavior becomes disorganized as manifested by changes in the quality of tone or activity levels; (ii) the infant's states become disorganized, as manifested by rapid state changes, heightened irritability and loss of state control; (iii) mild acrocyanosis or increasing respiratory rate heralds infant's impending stress.
- 5 The examination can be completed, including some of the Orientation items. Baby maintains stability over the first two thirds of the examination, but towards the end instability appears in one of the three systems described above.
- 6 Baby can be examined without any deterioration in clinical state during most of the examination. However, at the end of the examination, infant is quite disorganized, as demonstrated by instability in any of the three sub-systems.
- 7 Though there may have been some evidence of stress during the examination, after the entire examination there was no longer evidence of any exhaustion, disorganization or instability in any of the sub-systems.
- 8 Baby's level of stress was minimal throughout the examination and improved in stability and organization as the examination proceeded.
- 9 Baby's organization and responsiveness are not compromised from the beginning to the end of the examination. Autonomic stability, motor organization and state regulation are enhanced by stimulation and handling throughout the examination.

Examiner Facilitation

This is a summary score of the amount of help necessary from the examiner to facilitate the infant's optimal performance. It requires sensitivity on the part of the examiner to the availability of the infant at each maneuver, an awareness of the infant's own regulatory capacities, and knowledge of how to help her return to a resting baseline before the next manipulation. Efforts on the part of the examiner include:

- *Massive levels:* carefully instituted attempts at restraint or containment; sustained vestibular stimulation (rocking or jogging); swaddling; holding of arms; continuous use of sucking; need to provide long resting periods between stimulation.
- *Moderate levels:* restraining arms and legs from time to time as baby becomes disorganized; occasional use of sucking to soothe and help the infant become alert;

shifting infant into an upright position and providing moderate rocking stimulation; holding onto hands and feet from time to time; and providing occasional rest periods from stimulation.

• *Mild levels:* few if any special examiner efforts necessary to facilitate the infant's responsivity; holding the infant upright at a 30° angle to maintain alertness, holding onto the extremities; there may be brief breaks from stimulation.

SCORING:

- 1 Despite maximal efforts on part of examiner, responses cannot be elicited and examination has to be abandoned early.
- 2 With maximal efforts, such as swaddling, using a pacifier, long periods of rocking and containment, a few responses can be elicited that can be scored.
- 3 With all the above, a majority of responses can be elicited and scored successfully.
- 4 Infant can be managed throughout the examination, but persistent efforts with rocking, containment and use of pacifier must be utilized all the way through. Baby repeatedly gets upset, goes to sleep or becomes limp, and repeated efforts must be made to bring her back to perform.
- 5 Baby performs adequately throughout the exam, although examiner must use one of the more maximal structuring maneuvers to establish testable behavioral organization.
- 6 Only moderate, and no maximal controls are necessary to achieve behavioral organization; or initially it is difficult and baby needs moderate controls. Yet baby improves over the examination and is relatively easy to work with at the end of the examination.
- 7 Mild visual, auditory and proprioceptive stimuli are all that examiner uses to keep the baby responsive throughout the examination. By the last half of the examination, no controls or effort on examiner's part are necessary.
- 8 Visual and auditory stimulation are used to initiate baby's responsiveness. Maintains alertness with mild stimulation continuously throughout the examination.
- 9 Baby is responsive to all presentation of items in examination. No special efforts from examiner are needed.

General Irritability

The irritability item scored on the basic NBAS reflects the infant's response to the mildly and moderately aversive stimulus situations encountered during the examination. It is possible for an infant to receive a relatively low score on this measure of irritability but actually to be perceived as more irritable than is reflected in the score. This measure of general irritability is not intended to replace the measure of irritability to specific stimuli. If non-aversive stimuli induce either state 5 or 6 for three seconds, the baby is considered generally irritable.

SCORING:

- 1 Irritable to all degrees of stimulation encountered throughout the examination.
- 2 Irritability begins early (somewhere around Uncovering, Pin-prick or Undressing) and increases in frequency during the course of the examination. Irritability commonly results in state 6 crying.
- 3 Irritable to most of the items, both non-aversive and aversive, leading to state 6 crying. Difficult to console.
- 4 Irritable to some of the items, both non-aversive and aversive, leading to state 6 crying. Difficult to console.

- 5 Irritable to aversive and non-aversive stimuli, leading to state 6 crying, but with consoling infant returns to lower states.
- 6 Irritable to aversive and non-aversive stimuli, which leads to state 6 crying, but returns to lower states spontaneously.
- 7 Irritable to aversive and non-aversive stimuli, but control is regained easily. Fussing does not lead to state 6 crying.
- 8 Irritable only to aversive stimulation but control is regained quickly.
- 9 No irritability; infant responds to all stimuli with well-maintained self-control.

Robustness and Endurance

Many immature and stressed infants, as well as those who have been recently ill, have only limited 'energy' resources available and need intermittent rest during the examination to reorganize themselves. Frailty may be evidenced by increasing lethargy, unavailability, or at times by unreachable states of crying or wide-eyed staring. Some infants become more responsive in the course of the examination, as if the action provided by the examination helped to focus this energy. They become robust and have much endurance.

SCORING:

- 1 Infant has no energy at all or appears very frail and the examination cannot be completed.
- 2 Infant's energies are very limited, she is quite frail and long rest periods are necessary; the examination has to be shortened.
- 3 Infant shows considerable exhaustion and frailty, yet with prolonged breaks and slowed timing the examination can be completed, although a few items must be deleted and scored NA.
- 4 Infant shows some exhaustion repeatedly; as she is moderately frail, the examination can be completed but with some breaks.
- 5 Infant repeatedly shows evidences of mild exhaustion or is somewhat frail, but with brief breaks can recover and finish the examination, exhausted.
- 6 Infant is somewhat frail and halfway into the examination needs to be given breaks. She can recover with relative ease to complete the examination and seems somewhat organized at the end.
- 7 Infant is fairly robust and energetic throughout the examination and needs only minimal breaks because of diminishing energy resources, or she starts out somewhat frail but becomes more energetic and robust as she goes along. Organization improves as she is examined.
- 8 Infant may have brief periods of mild exhaustion or of minimal frailty in the beginning, but becomes quite energetic and robust as the examination proceeds.
- 9 Infant is robust and has good energy resources throughout the examination. She performs with ease and shows no evidence of overloading or exhaustion.

State Regulation

State organization improves with maturation and with well-being. The availability of clear, well-organized states, the quality of fluctuation between them, the stability of the alert states and the other states, such as sleep and robust crying, contrast with the situation in an immature baby or in one who is recovering from illness or from a difficult delivery.

SCORING:

- 1 Infant remains in unavailable states of crying and/or sleep for the course of the examination.
- 2 Infant is mainly in sleep states but can come to state 3 on at least one clear occasion.
- 3 Infant is mainly in sleep states, including state 3, but has a brief period (5 seconds) in state 5.
- 4 Infant is mainly in sleep states, but also may move briefly into states 3 and 5 or 6. May exhibit low-level dull state 4 alertness.
- 5 Infant is mainly in stable states 1, 2 and 3. May move into states 5 or 6 but is capable of a brief alert state 4 for 5 seconds or less.
- 6 Infant has stable sleep states and has a robust well-defined state 5 and has state 6 available, although briefly. Capable of a well-organized focused state 4, lasting for more than 5 seconds.
- 7 Infant has state 4 available and can actively keep herself there for at least 15 seconds, with minimal excursions to states 5 or 6. Sleep and crying states are robust.
- 8 Infant needs no support or minimal amounts of support to maintain at least two prolonged periods of alert state 4 behavior. The oscillations to other states may be abrupt or unmodulated but they do not interfere with the infant's ability to maintain several periods of alertness. Sleep states are well-organized and crying is robust.
- 9 Infant has full range of organized states available with only brief periods in states 3, 5 or 6. Infant can actively control herself in focused state 4 without stress and without any need of external supports from the examiner.

Examiner's Emotional Response

It is generally the experience of examiners who regularly administer the NBAS that some babies are easy to examine and provide the examiner with a positive experience while others are difficult to examine and the examiner experiences the examination as stressful. This subjective evaluation can be used as a projection of the degree of difficulty parents themselves can anticipate in responding to their new infant. It forces the examiner to reflect on and examine her own feelings as she administered the examination and then to rate the degree to which the infant's behavior can be seen as reinforcing and positive or anxiety-provoking and negative.

SCORING:

- 1 Moderately aversive throughout the examination; examiner glad to be finished.
- 2 Mildly aversive but never really emits rewarding behavior.
- 3 Aversive with brief periods of rewarding behavior. Examiner is left with a slightly negative opinion of the baby.
- 4 Both rewarding and worrisome behavior during the examination. Examiner has some concerns about the baby.
- 5 Both rewarding and aversive behavior during the examination, about equally. Examiner is left with a slightly positive opinion of the baby.
- 6 Mostly rewarding, with periods of aversive behavior which are brief.
- 7 Rewarding behavior throughout the examination but a few periods are unrewarding.
- 8 Moderately rewarding behavior throughout the examination and examiner likes the baby.
- 9 Very rewarding behavior throughout the examination. Examiner has very positive impression of the baby.

Reflexes or Elicited Responses

Many of these are based on those responses described in Prechtl's *The Neurological Examination of the Full-term Newborn Infant* (1977). The Prechtl procedure is followed for eliciting the 18 responses listed below. The NBAS is not designed as a neurological assessment; however, if an examiner observes an infant whose reactions on the elicited responses depart significantly from normal expectation, this should be brought to the attention of the medical personnel responsible for the infant's care. The responses are scored as follows:

0 = reflex not able to be elicited despite several attempts.

1 = hypoactive response.

2 = normal response.

3 = hyperactive response.

A = asymmetric response, either in terms of lateralization or segments of body (arms vs. legs, etc.). Since this may be of importance in assessing neurological damage, real, repeated asymmetry should be carefully assessed and noted, to be followed by a formal neurological assessment.

Most babies will score a 2 for the elicited responses. Scores of 1 and 3 should be reserved for the items for which a repeatedly disturbing response is seen. The only exceptions are ankle clonus, TNR and nystagmus. These are often scored 0 or 1 and they are not considered to be deviant scores for the neonatal period. When there are more than three scores of 1 or 3, the baby should have an evaluation by a pediatric neurologist.

PLANTAR GRASP

0 Not elicitable.

1 Weak, unsustained flexion of the toes.

2 Good sustained response.

3 Very strong, obligatory flexion of toes, cannot be relaxed.

BABINSKI

0 Not elicitable.

1 Weak dorsal flexion, minimum spread of toes.

2 Good dorsal flexion with marked spreading of toes, including some flexion of great toe.

3 Obligatory, brisk dorsal flexion with obligatory spreading of toes, no relaxation afterward.

ANKLE CLONUS

0 No clonus.

1 One beat only.

2 Two or more beats; up to 4 or 5, if gradual decrease in intensity.

3 More than 5 beats.

ROOTING

0 No lip or tongue movement.

1 Only a weak turn or lip movement and/or slight tongue protrusion.

- 2 Turn to stimulated side; mouth opens and grasps; lips may curl to stimulated side.
- 3 Obligatory rooting, grimacing, with mouthing movements which do not subside.

SUCKING

- 0 No sucking movement at all.
- 1 Weak or barely discernible suction.
- 2 Modulated, rhythmic suck.
- 3 Exaggerated, obligatory suck which does not decrease over time.

GLABELLA

- 0 No reaction.
- 1 Weak; response barely discernible.
- 2 Modulated response.
- 3 Overly brisk closure of eyes and total facial grimace.

André-Thomas *et al.* (1960) defined 'tone' as a measure of consistency and extensibility of the muscle, in reaction to passive stretching of the limb, as well as of the amount and degree of recoil of the limb after extension. As a summary of these in all the limbs and the trunk, it represents the muscle tone of the body plus its reaction to stimulation. A big, floppy baby may have no resistance to stretching of her limbs. A very tense, jittery infant will be very resistant to being moved, and limbs will snap back into flexion after being stretched. Infants normally show some resistance to having their extremities stretched, and a little snapback is normal.

The degree to which limbs must be extended (up to full extension) in order to meet resistance, as well as the amount of snapback (which measures the over-reaction of flexor muscles) is scored. Legs are usually more resistant to extension than arms, and very few infants do not attempt to maintain tone of their legs against stretching. Inequality of the two sides is a very important part of this assessment.

PASSIVE MOVEMENTS—ARMS

- 0 No resistance to extension and no recoil.
- 1 Little resistance to extension and weak recoil.
- 2 Moderate and modulated resistance to extension and good or moderate recoil.
- 3 Hypertonic resistance to extension and obligatory recoil with overshooting.

PASSIVE MOVEMENTS—LEGS

- 0 No resistance to extension and no recoil.
- 1 Little resistance to extension and weak recoil.
- 2 Moderate and modulated resistance to extension and good or moderate recoil.
- 3 Hypertonic resistance to extension and obligatory recoil with overshooting.

PALMAR GRASP

- 0 No grasping movement at all.
- 1 Short, weak flexion.
- 2 Strong, sustained grasp, relaxes at will.
- 3 Obligatory grasp, difficult to relax.

PLACING

- 0 No flexion or extension.
- 1 Minimal flexion and extension of knee and hip and/or foot after several attempts.
- 2 Modulated flexion of knee and hip, extension of foot.
- 3 Obligatory flexion and weight-bearing after first stimulus.

STANDING

- 0 No support by legs.
- 1 Minimal response felt; brief transitory support.
- 2 Supports weight by extension of legs for at least 5 seconds.
- 3 Obligatory hyperextension of legs, no relaxation afterward.

WALKING

- 0 No hip or knee flexion at all.
- 1 Some indication of stepping action with slight hip or knee flexion.
- 2 Discernible steps with knee and hip flexion, step on each side.
- 3 Obligatory hyper-reactive response with hip and knee flexion and ankle extension.

CRAWLING

- 0 No freeing of face and no attempt to flex hip or knee.
- 1 Weak attempts to crawl, minimal action, minimal attempts to free face.
- 2 Coordinated crawling motion and freeing of face.
- 3 Obligatory crawling with arched back and hyperextended neck; no relaxation afterward.

INCURVATION (GALLANT RESPONSE)

- 0 No response.
- 1 Minimal incurvation movement.
- 2 Good incurvation, with hip swing.
- 3 Exaggerated response, with excessive and abrupt hip swing and no relaxation afterward.

TONIC DEVIATION OF HEAD AND EYES

- 0 No head or eye movement.
- 1 Weak, response barely discernible.
- 2 Good modulated response of head and eyes turning in direction of spin.
- 3 Immediate, obligatory head and eye turn, no return to midline after discontinuing the spin.

NYSTAGMUS

- 0 No saccadic movement.
- 1 1 or 2 saccades during rotation.
- 2 3 or 4 saccades per rotation.
- 3 Many sustained saccades per rotation with saccades persisting long after rotation stopped.

TONIC NECK REFLEX

- 0 No adjustment of arms or legs.
- 1 Transient adjustment of arms or legs, not maintained.

- 2 Gradual, modulated adjustment of arms, legs, and trunk away from face side of head.
- 3 Obligatory response of arms, legs, and trunk, no release of response.

MORO REFLEX

- 0 No response.
- 1 Weak response with minimal abduction of shoulders and extension of elbows and wrists; minimal extension of hips and knees.
- 2 As head is dropped, good abduction of shoulders and extension of elbows and wrists, extension of hips and knees followed by some beginning crossover of arms.
- 3 Obligatory, excessive abduction of shoulders and extension of hips and knees; no flexion, no readjustment afterward.

Descriptive Paragraph

• *Descriptive Scores* (optional). Evidences for the infant's stage of maturity should be recorded here. This is also a summary of all the subjective impressions which have been amassed in the period. They include the style with which the infant reacts, the examiner's major impressions and feelings about the appearance and behavior of the infant, the examiner's predictions about the kind of responses these will call up in the mother, as well as predictions about their ultimate outcome as the child grows. This will be the paragraph which will help the examiner to remember the child later and may be an important way of categorizing infants, or understanding the scores in the different categories and of understanding meaningful constellations of these categories. This is not expected to be subject to inter-scorer reliability.

• *Comments*: Write a descriptive paragraph about the baby which includes the particular characteristics which are of interest in your study. This paragraph serves as a reminder of the unique characteristics of the baby which are not recordable elsewhere. The infant's maturity and any evidence of intrauterine growth retardation should be included here.

Five examples of the use of the descriptive paragraph to describe individual differences among neonates are given.

1. This was a well-muscled, well-proportioned, active, responsive boy with an alert, inquisitive face, big dark eyes, and a shock of black hair. He gave the appearance of being 'older' and of 'looking right through you'. As one played with him, he became more alert, and on several occasions seemed to smile as he alerted. He was not fat, but was muscular and square in appearance. There were no signs of dehydration or undernutrition, and he showed remarkable autonomic stability (few skin color changes) even after he was undressed for a long period. He maintained steady states of alertness for long periods. His main feature was the maturity of motor responsiveness that he could command. As one set off a tonic neck reflex, he quickly used it to help him bring his hand up to his mouth. After a Moro reflex and the usual cry, he turned his head to one side and brought his hand up to his mouth to quiet himself. Even as he responded to visual and auditory stimulation with rapid alerting and continuous responses, one felt that he had himself under control. A mother would feel that this was a mature, exciting boy, but she might also feel that he could manage pretty well by himself. Striking about him was his maturity, resourcefulness, and his capacity to respond and master stimulation both from within and without. One would predict a rapid, smooth developmental course for him.

2. This example stresses the individual style of this neonate.

A small, delicate girl with a wispy head of fair hair. She had delicate bones, but was well-proportioned, weighing 2890 g (6 lb 6 oz). She presented no signs of immaturity. She lay quietly in her bed, arms and legs drawn up as if to conserve her energy—when she was disturbed, she gradually began to awaken. As she opened her eyes, she awakened suddenly and became active with movements which were jerky, dominated by reflex activity and jerks. As she built up to crying, she began to make unsuccessful hand-to-mouth efforts to quiet herself down. As the examiner talked to her, she quieted to look, brought her hand up next to her mouth and quieted. She continued to use auditory or kinesthetic stimuli to help her organize her hand-to-mouth behavior, and in turn, to maintain a quiet receptive state. When she became upset, her color changed rapidly to bright red, then bluish, but as soon as she quieted herself, her body color changed back to pink, her extremities acrocyanotic. When she was covered, she quieted easily, but being undressed was a real stress for her. Uncovered, and unstimulated, she became quickly upset, changing from state 2 to 4 and 6. Unless there was an intervention from the outside, she seemed unable to pull herself out of these upset states. This ability to use caretaking efforts contrasted with her own apparent inability to quiet herself and made her appealing to a caretaker. Her doll-like body structure, and her immaturity—as reflected by her color changes and frequent state changes—added to this impression.

3. This thin, wiry boy weighed 2950 g (6 lb 10 oz). He was stringy and long in appearance, had a tense look and tense musculature with little subcutaneous fat. His arms and legs seemed constantly in motion when he was awake. He had been in deep sleep when he was first approached, but he woke up screaming. His changes of state were characteristically rapid, and there was little opportunity to reach him as he moved from sleeping to crying or back again. In order to quiet him, the examiner had to swaddle him or hold him tightly or provide him with a pacifier and rock him. When a rattle, voice or sudden movement was presented, he startled and began to cry. He made little effort to quiet himself. This over-reaction to stimuli seemed to interfere with his ability to attend to auditory and visual stimuli, for when he was successfully restrained he could look around and alert to the face or a red ball, or to alert and turn to the voice or a rattle. As soon as the examiner realized this, his performance could be changed from that of an over-reactive, hyperactive one to that of an alert, responsive baby. But the restraint of interfering motor reactions and the abrupt state changes which went with them was a prerequisite to finding this ability to attend to stimuli.

A kind of autonomic instability when he was undressed and unrestrained went along with this reactivity. As soon as he was uncovered, he turned red then bluish, but when he was covered again, his good color returned. We felt he was the kind of baby who could be very difficult for a mother who was not aware of the need for a calming, restraining environment in which to offer cues from the outside.

4. This 3-day-old female weighing 3855 g (9 lb 8 oz) at birth was a rather fat-looking infant with pretty, round features. Although her subcutaneous fat stores were ample and uniformly distributed, her skin was dry and was beginning to peel. She had lost around 450 g (1 lb) in two days. The soles of her feet and hands were particularly dry and scaly, and suggested recent loss of subcutaneous fluids. This seemed consistent with some jitteriness and mild clonus. Although she was not as pudgy or round-faced and immature-looking as an infant of a diabetic mother, she had a doll-like look with wide fat cheeks. Her legs and arms were pudgy and weak. Her musculature was rather surprisingly flabby, and her responses were slow in the motor sphere. She was alert-appearing, but one had to work hard to produce the low-grade responses to auditory and visual stimuli which we finally obtained. This dichotomy between her mature

appearance (both muscular and sensory) and the difficult-to-produce, delayed, rather flaccid responses are of importance. (Note: this behaviour could have been due to maternal medication, but her mother had had only a single injection of mepivacaine as a spinal anesthetic.) When she reacted, her responses were moderately jittery and she startled at the end of a response. This jittery startling behavior certainly interfered with her capacity to respond to our examination. We were struck with her low-grade responses, and wondered whether they reflected her best capacity or whether she might not improve over the next few days. A repeat evaluation was scheduled three days later in order to assess her rate of recovery, with the feeling that this curve might better predict her future development than a single assessment.

5. This example includes an assessment of the infant's mixture of immaturity and intrauterine growth retardation.

This infant was seen in the highlands of Guatemala in an area which is very depressed economically, and the mother's nutrition during pregnancy was substandard in calories and protein. This was one of the neonates included in a study of the effects of protein-calorie deprivation during pregnancy. The mother had been 'certain' that the date of her last menstrual period presented a 40-week gestation. She had four other live children and three abortive pregnancies prior to this infant. He was a sad-looking baby, weighing 2350g (5lb 3oz), 47cm (18½ inches) long. His skin was dry, peeling, and could easily be picked up off the sparse underlying tissue. The cord was slightly dry, slightly yellowed at birth, and shrank quickly over the next few days. The baby's facies were striking in that he looked like an unhappy old man with wrinkled eyes and pinched nose. When he was alert, he looked around glassily, but it was difficult to catch his attention to follow a face or an object. When he did respond to a moving object, he followed it somewhat automatically, breaking away with fatigue after a full excursion of 45°. After repeated attempts to awaken him from his initial deep sleep, he began to build up slowly to restricted, low-grade activity of his arms and legs. His state behavior was similarly low-grade and delayed in its build-up. When he finally built up to a cry, his whole face screwed itself up and a slightly high-pitched wail came out. One felt saddened by this wizened, unhappy infant who was so difficult to activate. Even when he became active, it was very brief, and he fell quickly into his sleep state again. His obvious immaturity seemed coupled with some dehydration and lack of nutrients. We questioned the mother to find that she was nursing him only when he cried—viz. three times a day.

Wondering whether he was also immature or undernourished, we measured him, estimated his subscapular skin folds, and felt his flimsy, poorly differentiated earlobes, scrotum and breast tissue. All of these seemed to represent the development of a 34- to 36-week-old infant (by the criteria of Dubowitz *et al.* 1970 and Lubchenco 1970). Skin creases of palms of hands and feet were somewhat obscured by peeling, but looked more adequate for his 40-week gestational age. Lanugo hair was sparse but evenly distributed over ears and upper shoulders. Nails of hands and feet were long and appeared firm. In fact, the nails were prominent in comparison to the dried, wizened hands and feet.

After our urgent request that the mother wake the baby to feed him more often, and our instructions about sugar water as supplementation, we returned several days later to find that he was somewhat more alert and energetic in appearance, but the same low-grade responses to sensory and motor stimulation still persisted. Close follow-up of this infant seemed indicated, but was not possible. He next appeared at 6 months and was hospitalized for severe marasmus. Our notes from the initial examination could have predicted this. (For an account of this study, see Brazelton *et al.* 1977b.)

4

RESEARCH USES OF THE NBAS

Introduction

In this chapter we discuss the characteristics of the NBAS as a research instrument, data reduction and data analysis procedures, and the uses of the NBAS in research. The Scale has been used extensively by researchers for the past 21 years and this chapter will summarize that experience. Studies since 1984, when the last edition of the manual was published, will be reviewed here. (See Horowitz and Linn 1984, Brazelton *et al.* 1987, for reviews of earlier studies.)

Methodological issues

Methodological and psychometric issues concerning the NBAS will be briefly addressed in this section. (For a more detailed discussion see Brazelton *et al.* 1987; see also Als 1984, Clopton 1984, Steichen-Asch *et al.* 1986, DiPietro and Larson 1989, Worobey 1990.) Our purpose here is not to repeat what is available elsewhere but to underscore the main issues in data reduction and data analysis.

Normative data

While many studies of normal term infants have been reported, the normative base for the NBAS is limited and complete standardization data are not available. The original cohort on which the NBAS was based (Tronick *et al.* 1976) has been used as a normative sample in many studies. Part of the difficulty in establishing a normative data base lies in defining the selection criteria. It is being increasingly recognized that neonatal behavior is influenced by many factors including subtle ones such as levels of obstetric medication or length of labor or the specificity of gestational age, so that no consensus exists as to the exact criteria for establishing a normative sample. Moreover, in the light of findings describing cultural and ethnic differences in neonatal behavior (Nugent *et al.* 1989, 1991), it is difficult to define a normal population that is representative of the total population within a multicultural society. In the light of these findings, we advise researchers to control for identified pre- and perinatal variables and for the variables of ethnicity and culture in the sample they are studying.

Test-retest reliability and validity issues

Studies which have examined test-retest reliability across repeated NBAS examinations reveal low to moderate test-retest correlations (Lester 1984, Brazelton *et al.* 1987). However, since the neonatal period is characterized by rapid changes in physical, physiological and behavioral systems, the question of test-retest reliability may not be an appropriate question for the NBAS (Horowitz and Linn 1984). Change not stability characterizes healthy development in this period. As Emde (1978) has pointed out, what

is especially adaptive from a biological perspective is a variability and range of behavior. Brazelton's original concept was that the NBAS would measure dynamic aspects of the organization of neonatal behavior and that this required repeated examinations (Brazelton 1973). The idea on which the Scale was based was that it was a measure of the coping capacities and adaptive strategies of the infant, which become apparent as she recovers from the stresses of labor and delivery and begins to adjust to the demands of the extrauterine environment during the first weeks of life.

The process of this adaptation can be measured by studying the patterns of change over repeated NBAS examinations (Lester 1984, Steichen-Asch *et al.* 1986). Although some consistency in scores can be expected from day to day, it may be more appropriate to think of fluctuations in test scores as indicative of how the baby is adapting to changing environmental demands, *e.g.* there is some evidence that behavioral processes such as habituation, which reflect earlier phases of ontogenetic development, are more stable than attentional and state behaviors, which are newly emerging and may be more susceptible to environmental influences. Our understanding of the neonate suggests then that these patterns of change may be the researcher's best index of the infant's current status and that these patterns of change in turn become the best index for predicting future outcome. Again it should not be surprising that the NBAS scores alone do not necessarily predict developmental outcome, as Horowitz and Linn (1984) point out. If one's model of development is based on the assumption that developmental outcome is a function of the interaction of organismic and environmental factors, it is unlikely that either one or the other alone will predict significant amounts of variance at later ages. There is growing evidence that when NBAS scores are combined with measures of the caregiving environment, prediction of later development is enhanced (*e.g.* Bakeman and Brown 1980, Vaughn *et al.* 1980, Horowitz and Linn 1984, Nugent 1991, Murray 1995).

This means that three or at least two assessments should be administered before we can have any assurance that the Scale is capturing the full range of the infant's behavior. Lester (1984) presents a method for scoring patterns of change using 'recovery curves'. The method is based on three NBAS assessments (at 3, 14 and 30 days *post partum*), which provide a profile of how neonates change over the first month of life, across the seven clusters of behavior (see below). Longitudinal studies using the NBAS suggest that predictive validity depends on the use of repeated assessments as well as ongoing measures of the concurrent contributions of the infant's caregiving environment. The timing of any assessment becomes a critical issue in this argument. Our suggestion that an examination be administered under optimal conditions, such as midway between feedings and not after a painful medical procedure, is critical but this is not always feasible. Hence test-retest reliability depends on many uncontrollable variables.

Data reduction

The NBAS yields scores on 28 nine-point behavioral scores and 18 reflex items. In addition, there are seven supplementary items, each scored on a nine-point scale. One of the major problems for the researcher is how to summarize and analyse this large amount of information. While some studies have performed item-by-item comparisons, most sets of

data are typically reduced to summary scores that have been conceptually and/or empirically derived. [Horowitz and Linn (1984) have argued that any study using the NBAS should report means and standard deviations for each item.]

One purpose of data reduction is to reduce the number of statistical tests necessary, thereby reducing the likelihood of spurious results. Another advantage of data reduction is to increase the reliability of measurement by reducing the error variance introduced by individual items and increasing the variance due to more global individual differences in infant behavior.

Factor analysis has been used in many studies to group NBAS items based on their statistical relationships (*e.g.* Lester *et al.* 1976, Horowitz and Linn 1984, Jacobson *et al.* 1984, Sostek 1985, Gyurke *et al.* 1988, Azuma *et al.* 1991, Ziegenhain *et al.* 1991). There is remarkable consistency in the kinds of behavioral dimensions that emerge across populations from such analyses. Most reports yield at least a social/interactive dimension, an irritability/state organization dimension and a motor dimension. Azuma *et al.* (1991) tested out four data reduction models and found two factors, orientation and arousal, to be the best fitting of the four models. Tronick *et al.* (1985) presented a critical examination of several approaches to scoring the behavior of preterm infants.

A non-parametric grouping of NBAS items was developed at the Child Development Unit of the Children's Hospital, Boston. This *a priori* grouping produced four dimensions: (1) interactive processes; (2) motoric processes; (3) state organization and control; (4) physiological response to stress. These dimensions were scored on a three-point scale, with each infant categorized as 'worrisome', 'average' or 'optimal' on each dimension. This four-dimensional system was extended to five dimensions by Sostek and Anders (1977), with the addition of a state regulation dimension. The three-point scoring system was expanded to a five-point one in an attempt to increase the range of scores, the better to tease out individual differences. (Both these scoring systems have been used by clinicians as a way of summarizing the results of the Scale for parents.)

A conceptually and empirically based seven-cluster scoring method was developed by Lester *et al.* (1982) and has become the most commonly used approach to data reduction with the NBAS. It reduces the behavioral and reflex items into seven clusters. The clusters were derived from previous factor-analytical studies and from the four *a priori* dimensions. The following are the seven clusters:

- Habituation: the ability to respond to and inhibit discrete stimuli while asleep.
- Orientation: includes the ability to attend to visual and auditory stimuli and the quality of overall alertness.
- Motor: measures motor performance and the quality of movement and tone.
- Range of State: this is a measure of infant arousal and state lability.
- Regulation of State: measures the infant's ability to regulate her state in the face of increasing levels of stimulation.
- Autonomic Stability: records signs of stress related to homeostatic adjustments of the central nervous system.
- Reflexes: records the number of abnormal reflexes.

Table 4.1 presents the seven cluster scoring criteria and the re-coding conversion rules.

TABLE 4.1
NBAS seven cluster scoring criteria

<i>Cluster Item</i>	<i>Scoring</i>
Habituation	
Light	Raw score
Rattle	Raw score
Bell	Raw score
Pin-prick	Raw score
Orientation	
Inanimate visual	Raw score
Inanimate auditory	Raw score
Inanimate visual-auditory	Raw score
Animate visual	Raw score
Animate auditory	Raw score
Animate visual-auditory	Raw score
Alertness	Raw score
Motor	
Tonus	Recode: 9/1=1; 8/2=2; 7/3=3; 4=4; 6=5; 5=6
Maturity	Raw score
Pull-to-Sit	Raw score
Defense	Raw score
Activity	Recode: 9/1=1; 8/2=2; 7/3=3; 4/6=4; 5=5
Range of State	
Peak of Excitement	Recode: 9/1=1; 8/2=2; 4/3=3; 7/5=4; 6=5
Rapidity of Build-up	Recode: 9/1=1; 8/2=2; 7/3=3; 4=4; 5=5; 6=6
Irritability	Recode: 9/1=1; 8=2; 7=3; 6=4; 5=5; 2/3/4=6
Lability of State	Recode: 1/7/8/9=1; 5/6=2; 4=3; 3=4; 2=5
Regulation of State	
Cuddliness	Raw score
Consolability	Raw score
Self-Quieting	Raw score
Hand-to-Mouth	Raw score
Autonomic Stability	
Tremors	Recode: Invert: 9=1 (1=9); 8=2 (2=8); etc.
Startles	Recode: If 1, drop; otherwise invert 2-9 on 8-point scale
Skin Color	Recode: 5=6; 4=5; 6=4; 3/7=3; 2/8=2; 1/9=1
Reflexes	An abnormal score is defined as 0, 1 or 3 for all reflexes except clonus, nystagmus and TNR where 0, 1 and 2 are normal and 3 is abnormal. Reflex score = total number of abnormal reflex scores

Uses of the NBAS

From the beginning, the NBAS was used in studies of intrauterine growth retarded infants and of preterm infants and to assess the effects of a range of other pre- and perinatal factors on neonatal behavior. Over the past few years there has been a virtual explosion of research using the Scale as a way of measuring the effects of maternal substance use, especially of cocaine and alcohol, during pregnancy. There has also been a significant

increase in the use of the Scale in research settings in different countries and in the number of studies using the Scale in cross-cultural comparisons of neonatal behavior. Several studies have examined the contribution of neonatal behavior to parent-infant interactions and future developmental outcome. In addition, there has been an increase in the number of studies using the Scale as a form of intervention. Studies using the NBAS can therefore be classified under the following headings:

- (1) Studies of risk factors in newborn infants.
- (2) Studies on the effects of obstetric medication and mode of delivery.
- (3) Studies on the effects of maternal substance use.
- (4) Cross-cultural studies.
- (5) Prediction studies.
- (6) Intervention studies.

Examples of research studies from each category will be presented. Only selected studies published since 1984, when the last edition of the manual appeared, will be presented here.

Studies of at-risk infants

The NBAS has been used in several studies to examine the effects of a wide range of pre- and perinatal risk factors such as maternal antenatal nutrition, intrauterine growth retardation, preterm birth, low birthweight, etc. on neonatal behavior.

A prospective study of a sample of 467 predominantly Black nulliparous women by Oyemade *et al.* (1994b) used the NBAS to examine the effects of a range of demographic, medical, nutritional, lifestyle and psychosocial variables on infant behavioral outcome. Results revealed that there was a significant relationship between antenatal nutritional variables (dietary and biochemical) and neonatal outcome on the Orientation, Motor, Range of State, Autonomic and Reflex cluster scores on the NBAS.

The effects of maternal antenatal nutritional status on neonatal behavior, specifically the effects of maternal vitamin B₆ deficiency, were studied in an Egyptian sample by McCullough *et al.* (1990). Results showed that maternal vitamin B₆ status was significantly correlated with infant Consolability and Rapidity of Build-up as measured by the NBAS.

In a study of infants of diabetic mothers, Silverman *et al.* (1991) found significant correlations between poor blood sugar control in the second and third trimesters and lower NBAS cluster scores. In a prospective study of 185 infants of diabetic mothers, Rizzo *et al.* (1990) found that after controlling for preterm birth, NBAS scores were poorer as maternal glucose levels increased.

Many studies have used the NBAS to compare the behavior of preterm or low birthweight infants and term infants. Myers *et al.* (1992) used the NBAS to examine the effects of bronchopulmonary dysplasia and respiratory distress syndrome on neonatal behavior. Results showed that respiratory illness was a more important predictor of behavioral development than maternal marital status, race, age, education and socio-economic status. A study of preterm infants with intracranial hemorrhage (ICH) by Anderson *et al.* (1989) revealed that at 40 weeks corrected age, infants in the ICH groups

had lower levels of arousal and more abnormal reflexes on the NBAS than term babies. Lester *et al.* (1986) also showed that infants with atypical patterns of fetal growth had lower scores on NBAS Orientation, Motor and Reflex clusters. Gestational age was co-varied and showed independent effects on six items.

Beeghly *et al.* (1988, 1993) reported that intrauterine growth retardation results in poor state organization and motor maturity and an increased number of abnormal reflexes. In a study in Barcelona, Costas and Botet (1989) also found differences in behavior in term infants of low birthweight as compared to those of normal birthweight. In an Indian study, Malik *et al.* (1993) compared a sample of preterm and term infants on the NBAS on days 3, 10 and 30. Poor performance on three of the NBAS clusters at 30 days predicted developmental delay at 3 months. Iyer *et al.* (1989) studied patterns of change in another sample of 30 term newborn Indian infants who were small for gestational age (SGA). In results that are at variance with most other findings, the SGA infants in this study demonstrated better Orientation scores on the NBAS than the normal controls. The NBAS was used in a study by Lester *et al.* (1990) to record cardiorespiratory activity while visual and auditory stimuli were presented to term and preterm infants who were in a state of quiet alertness.

In a study conducted in Sweden, Stjernqvist and Svenningsen (1990) used the NBAS to examine a population of extremely low birthweight (ELBW: 500–900g) infants born at 24 to 30 weeks gestational age. In an item-by-item comparison with term infants there were significant differences on eight of the 28 behavioral items. The NBAS revealed many deviant reflexes in the ELBW group, especially in those with grade III or IV intracranial haemorrhage. Ferrari *et al.* (1986) in their comparison of visual orientation in preterm and term infants found that the quality of orientation in preterm infants improved from 32 to 38 weeks post-conceptual age and that at term-equivalent age they showed no statistically significant differences in comparison with the term infants.

Many studies have used the NBAS to examine the effects of bilirubin levels on neonatal outcome. De Caceres *et al.* (1992), in a study conducted in Barcelona, demonstrated the effects of 'physiologic' bilirubin levels on neonatal behavior. Vohr *et al.* (1990) studied the effects of moderately raised serum bilirubin levels. Partial correlation analysis controlling for phototherapy revealed that raised bilirubin concentration correlated negatively with the Orientation and Range of State clusters on the NBAS. Schedle and Diethelm (1988) studied the effects of hyperbilirubinemia on neonatal behavior, while in another Swiss study, Escher-Gräub and Fricker (1986) found that mildly jaundiced infants ($N=76$) scored less well on Orientation, Motor, Regulation of State and Autonomic Stability clusters than a sample of controls who had no signs of hyperbilirubinemia ($N=401$). In a study on the effects of moderate hyperbilirubinemia carried out in Italy by Paludetto *et al.* (1986), no differences were found between jaundiced and non-jaundiced infants. Ju and Lin (1991) found that infants with moderate non-hemolytic jaundice exposed to phototherapy had poorer Orientation scores than a control group of infants who were not exposed to phototherapy, although at two weeks no differences were found in NBAS scores.

Dixon *et al.* (1984) examined the behavioral effects of circumcision, with or without

anesthesia. They administered the NBAS on three successive occasions to evaluate the infant's recovery patterns and found that circumcision affected the behavioral recovery of these infants in Irritability, Motor and Orientation scores. A study on the effects of fetal asphyxia on neonatal behavior by Low *et al.* (1990) found no differences in NBAS clusters on the third day of life and at two weeks. Emory *et al.* (1989) reported a relationship between neonatal seizures and poor NBAS performance, supporting the discriminative validity of the NBAS in identifying the effects of seizures on neonatal behavior. Hattig and Steinhausen (1987) reported that infants born to mothers who took anti-convulsant drugs during pregnancy had poorer scores in Motor, Regulation of State and Autonomic Stability clusters than control infants. Murphy *et al.* (1988) reported significant relationships between persistent pulmonary hypertension in infants and NBAS scores. Rogan *et al.* (1986) used the NBAS to examine the effects of transplacental exposure to polychlorinated biphenyls (PCBs) and dichlorodiphenyl dichloroethene (DDE) on neonatal outcome. Results showed that higher PCB levels were associated with hypotonicity and that higher DDE levels were associated with hyporeflexia.

Spangler and Scheubeck (1993) used the NBAS to examine the relationship between neonatal behavior and adrenocortical and cardiac activity. Among the findings were that Orientation performance on the Scale was predicted by basal cortisol levels and high heart rates were associated with high Irritability and low Regulation of State scores. Murray (1988) examined the relationship between neonatal auditory brainstem evoked responses and NBAS performance.

Field *et al.* (1986) used the NBAS as an outcome measure to evaluate the effects of tactile/kinesthetic stimulation given to preterm infants (mean birthweight 1280g) in the intensive care unit. They demonstrated that the intervention neonates gained more weight per day, and demonstrated better Habituation, Orientation, Motor and Range of State scores on the NBAS than control infants. Koniak-Griffin and Ludington-Hoe (1987) also used the NBAS as an outcome measure to examine the effects of unimodal vs multimodal vs combined forms of tactile stimulation on healthy term infants.

Over the last ten years, many of the studies which have used the NBAS to examine the many pre- and perinatal variables that are likely to influence the at-risk newborn infant's behavioral recovery and adaptation have begun to use a multivariate approach. This enables the researcher to account for other variables such as gestational age, prenatal care, and other co-morbid factors such as poverty, which contribute to NBAS differences (Beeghly and Tronick 1994).

It is also critical that we continue to develop accurate physical as well as behavioral measures of the effects of both preterm birth and intrauterine stress. So far, measures of gestational age and of intrauterine deprivation are relatively crude but it is necessary that they be documented carefully in any study of high-risk infants. We utilize the Dubowitz *et al.* (1970) examination for determining gestational age and compare it to the maternal dates for expected delivery. The Ponderal Index, a ratio of length to weight, is utilized for evidence of intrauterine depletion of tissue storage.

Behavioral assessment can document the degree of the effects of intrauterine stress. By following the changes in behavior over time on the NBAS cluster scores (not on

individual scores), we may be able to retrospectively determine neurological insults *in utero* or at the time of delivery. In addition, the supplementary items can lead us to a better understanding of the cost to the nervous system as it recovers after a CNS insult or as it recovers from a preterm or stressful delivery.

The effects of obstetric medication/mode of delivery

Since it was first published, the NBAS has been used to examine the effects of obstetric medication on neonatal behavior. Sepkoski *et al.* (1992) compared two groups of infants whose mothers had or had not been given bupivacaine epidural anesthesia during labor. The NBAS was administered on days 1, 3, 7 and 28, and the results showed that the bupivacaine group had poorer performance on the Orientation and Motor clusters. Kuhnert *et al.* (1988) also used the NBAS to examine whether behavior would differ in neonates delivered by caesarian section utilizing maternal epidural anesthesia with bupivacaine from that in infants whose mothers were given chloroprocaine. The results revealed that the infants in the bupivacaine group performed significantly better on the Orientation cluster than those in the chloroprocaine group.

Using a randomized double-blind design, in a comparison of sufentanil, bupivacaine and their combination for epidural analgesia, Steinberg *et al.* (1992) found few group differences except that at 1 hour of age, the bupivacaine group had higher Irritability scores on the NBAS.

Kuhnert *et al.* (1985) used the NBAS at 12 hours and again at 3 days to determine whether low doses of maternal meperidine (25–100mg) affected neonatal behavior. Poorer State Regulation and an increased number of abnormal clusters characterized the infants whose mothers received meperidine.

In a study conducted in India, Gathwala and Narayanan (1990) used the NBAS to study differences between babies who were born vaginally and were nursed with their mothers and babies born by caesarian section who then separated from their mothers for a mean period of 2.8 (SD 1.0) days. The former group performed better on the Orientation cluster in the initial NBAS examination and at the one month follow-up examination. Kochanevich-Wallace *et al.* (1988) also used the Scale to determine the effects of mode of delivery on behavioral outcome. Muhlen *et al.* (1986) administered the NBAS on the first, fifth and 28th days of life to examine the effects of obstetric interventions such as anaesthesia, augmentation, induction and caesarian section on neonatal behavior.

These studies all point to the synergistic effect of maternal medication acting along with other stress factors. It is most important to document medication effects over time with multiple examinations. The NBAS cluster scores demonstrate short-term effects as well as longer lasting depression of the CNS, and may predict future dysfunction. The short-term effects vary with dose, timing of administration, and other variables such as (i) fat stores in the mother that absorb medication to protect the fetus, (ii) fat stores in the baby that are not present in babies with intrauterine growth retardation, leaving them vulnerable to lower doses of medication, (iii) duration of labour, (iv) mild CNS stress, (v) type of labour (caesarian section), and (vi) analgesia plus anesthesia. All these factors must be accounted for in any study of medication effects. Minimal levels of maternal

medication do not seem to affect the organization of a healthy baby, but the additive effects of several variables do.

The studies which demonstrate longer lasting effects of maternal obstetric medication have not been able to sort out the direct effects of medication on the infant's central and autonomic nervous systems vs the short-term effects on the infant's behavior, which in turn affect maternal handling and caregiving. More research remains to be done to identify the direct vs indirect, and the short-term vs long-term effects of obstetric medication.

Prenatal substance exposure

The NBAS has been used in numerous studies to examine the effects on behavioral outcome of the maternal use of substances including cocaine, alcohol, tobacco and marijuana (see reviews by Finnegan 1985, Madden *et al.* 1986, Zuckerman and Hingson 1986, Tronick 1987, Neuspiel *et al.* 1991, Zuckerman and Bresnahan 1991, Beeghley and Tronick 1994, Lester and Tronick 1994).

In recent years, several studies have used the NBAS to examine the effects of maternal marijuana use on neonatal behavior (*e.g.* Fried and Makin 1987). In one such study conducted in Jamaica, Dreher *et al.* (1994) found that on examination at 1 month the NBAS supplementary items revealed subtle differences in performance.

In a study of the effects of prenatal cocaine exposure on the behavior of 224 clinically normal term infants, Tronick *et al.* (1994) reported that no neurobehavioral effects were revealed on the NBAS clusters or Supplementary items when confounding factors were controlled for at 2 to 3 days of age. At 3 weeks, controlling for covariates, a significant dose effect was observed with infants exposed to heavier doses showing poorer state regulation and greater excitability.

In a study of cocaine-exposed and non-exposed infants born to mothers with similar demographic characteristics, Mayes *et al.* (1993) found that the cocaine-exposed infants had significantly lower scores on the NBAS Habituation cluster but not on any of the other clusters when differences in birthweight were controlled for. Eisen *et al.* (1991) also showed that cocaine-exposed neonates had poorer Habituation scores on the NBAS. Black *et al.* (1993) studied cocaine-exposed and non-exposed infants, finding differences on the Autonomic cluster at 6 weeks.

Mirochnick *et al.* (1991) studied 20 newborn infants—12 with prenatal exposure to cocaine and a non-exposed control group—to determine concentrations of circulating catecholamines and behavior on the NBAS. They reported a significant negative correlation between norepinephrine concentration and Orientation cluster scores for the cocaine-exposed infants.

A comparison of cocaine-exposed and non-exposed neonates examined on the NBAS on days 1–3 by Neuspiel *et al.* (1991) revealed no significant differences between the groups. However, at the second examination later in the first month, the exposed infants had slightly lower Motor scores. Similarly, Woods *et al.* (1993) found no differences in NBAS performance at birth or at 1 month between cocaine-exposed and non-exposed infants.

Chasnoff and co-workers have used the NBAS in several studies to examine the

effects of maternal cocaine use on neonatal behavior. In one study (Chasnoff *et al.* 1989), they reported that cocaine-exposed infants showed significant impairment of orientation, motor and state regulation behaviors. In a comparison of methadone- and cocaine-exposed infants, the cocaine-exposed infants had poorer scores on state organization than those exposed to methadone (Chasnoff *et al.* 1987). Chasnoff *et al.* (1986) also reported a relationship between maternal cocaine use and depressed interactive behavior and poor state organization, as measured by the NBAS.

Kaltenbach and Finnegan (1988) reported that infants born to substance-using women maintained on methadone had poorer scores on the social-interactive dimension than infants born to drug-free women. In a longitudinal study in Amsterdam comparing infants of drug-using women and non-exposed controls, Van Baar (1995) found no differences in NBAS scores at term but at one month post-term she reported that the exposed infants had poorer scores on the Orientation cluster of the NBAS, specifically on the visual orientation items.

Coles and her colleagues have conducted a series of studies on the effects of prenatal maternal substance use on behavioral outcome. In one (Coles *et al.* 1992), they used the NBAS on days 2, 14 and 28 to examine the effects of cocaine, marijuana, nicotine and alcohol use in a sample of term infants (N=107) born to women in a low-income, predominantly Black population. Another study by these workers, of a group of 149 infants, found that babies born to women who continued to consume alcohol during pregnancy differed from babies of women who did not on measures of orientation and autonomic regulation (Smith *et al.* 1986). Richardson *et al.* (1989) found that second semester alcohol use was a significant predictor of low Orientation scores on the NBAS. In a study of the effects of moderate levels of alcohol, marijuana, tobacco and other drug use on behavior, Richardson *et al.* (1989) found that there were few effects on the NBAS after controlling for specific confounding variables.

In a prospective study of 467 women, Oyemade *et al.* (1994a) found that infants of smokers had low scores on the Orientation cluster of the NBAS. In their study of alcohol consumption in the Ottawa Prenatal Prospective Study, Fried and Makin (1987) concluded that the effects of alcohol on the NBAS were smaller than the effects of either marijuana or tobacco.

Ernhart *et al.* (1986) used the NBAS and parts of the Graham-Rosenblith examination to examine the effects of intrauterine exposure to low levels of lead on neonatal behavior. Abnormal reflexes on the NBAS and neurological soft signs on the Graham-Rosenblith were related to cord blood lead levels.

In an Israeli study of the effects of maternal health variables on neonatal outcome, Auerbach *et al.* (1992) used the NBAS to examine the effects on the neonatal behavior of infants born to a sample of 29 psychiatrically ill women taking antipsychotic and antidepressant medication. Results showed that compared to infants of non-ill mothers, these infants were more tremulous, more hypertonic, and demonstrated poorer motor maturity.

The use of the NBAS to investigate effects of maternal ingestion of toxins has become one of the most productive areas of research with the Scale over the past ten years. This research confirms that exposure to toxic substances such as heroin,

methadone, PCP, cocaine, alcohol, marijuana, caffeine and tobacco during pregnancy, do affect the newborn infant's performance. However, it must be pointed out that in studies of the effects of any one toxin, the observed effects on the NBAS may also be the result of other substances, acting either alone or synergistically. In addition, due to the number of social, medical and psychological co-morbidities associated with prenatal drug use, exposed infants are very likely to have parents who are at high risk for parenting failure than are non-exposed infants. The forces for failure in the parent-infant interaction may be present at birth. Because of her behavioral immaturity, the infant has poor state regulation and is unable to maintain alert states and therefore requires a great deal of support from the caregiver to reach that level of organization. The long-term outcome for these infants depends on the degree to which the caregiving environment can facilitate the infant's recovery (Beckwith and Parmelee 1986, Werner 1989).

Recently, the use of multivariate studies has enabled researchers to address the issue of polypharmacy and to control for other confounding variables which influence outcome in studies of the effects of individual drugs. Pre- and perinatal variables such as maternal undernutrition, hypertension, hypoxia, time and duration of ingestion, the number of toxins and so forth need to be carefully controlled in any study of intrauterine drug exposure. The gestational age and nutritional status of the baby must also be carefully measured. Tests for cord blood levels of toxins are an ideal addition to any study, although they may only measure recent ingestion levels. It is clear, however, that the long-term developmental outcome of prenatally drug-exposed infants cannot be understood without a thorough consideration of the other confounding factors associated with drug use, especially the quality of the infant's postnatal environment.

Studies of neonatal behavior in different cultures

The NBAS is being used increasingly around the world, and a number of studies have been conducted with the aim of documenting cultural variations in neonatal behavior. From the time it was first published, one of the most common uses of the NBAS has been the examination of neonatal differences and their natural variations in different cultural settings (e.g. Brazelton *et al.* 1969, 1976, 1977; Freedman and Freedman 1969). Many of these studies have been reviewed by Super (1981) and by Lester and Brazelton (1982).

Since the last edition of the manual was published, studies using the NBAS from 38 different cultural settings have been described in the three volumes of *The Cultural Context of Infancy* (Nugent *et al.* 1989, 1991, 1995b).

These include studies of neonatal behavior from European countries such as Denmark (Munck *et al.* 1991), France (Stoleru and Morales-Huet 1991), Germany (Grossmann and Grossmann 1991), Great Britain (Hawthorne-Amick 1989, Hopkins 1991, Murray 1995), Italy (Paludetto *et al.* 1991, Bottos *et al.* 1995), the Netherlands (Van den Boom 1991, Van Baar 1995), Portugal (Gomes Pedro 1989), Spain (Cantavella *et al.* 1995), Sweden (Welles-Nystrom 1991) and Switzerland (Fricker *et al.* 1989).

Among the studies conducted with Asian populations, Choi and Hamilton (1986) compared a sample of Korean and US infants on the NBAS and reported that the Korean infants had higher scores on Habituation and State Regulation, although no differences

were found on mother-child interaction assessments. Park Synn (1995) described the behavior of a sample of Korean infants and the influence of social support patterns on neonatal behavior and on the parent-child relationship.

Kato (1991) has studied a sample of Japanese infants in Tokyo, while several reports have been made of a longitudinal study on the social and behavioral factors that influence development in a sample of infants born on the Goto Islands of Japan (Ogi *et al.* 1993, Kawasaki *et al.* 1994, Akiyama *et al.* 1995).

Elsewhere in Asia, the NBAS has been used in studies in China (Bao *et al.* 1991), Indonesia (Piessens 1991), Malaysia (Woodson and da Costa 1989) and Nepal (Walsh-Escarce 1989). Landers (1989) examined the cultural context of development and the role of the environment on behavior in her follow-up study of a sample on infants in southern India.

A series of studies has described behavioral differences in different cultural groups in North America. Rosser and Randolph (1989), in the Howard University normative study, described the behavior of a sample of healthy term Black infants and the influence of child-rearing practices on outcome. Chisholm (1989) examined the relationship between biology, culture and the development of temperament in his study of Navajo infants. Muret-Wagstaff and Moore (1989) described neonatal behavior and child-rearing practices in the Laotian Hmong in a Minneapolis setting.

In Central and South America, there have been studies describing neonatal behavior in Mexico (Atkin *et al.* 1991), the Peruvian Andes (Saco-Pollitt 1989), Puerto Rico (Garcia-Coll 1989) and Jamaica (Dreher and Nugent 1995). Hayes *et al.* (1991) and Dreher *et al.* (1994) in their reports on the effects of maternal marijuana use on neonatal behavior in Jamaica, describe their results in terms of the unique cultural and economic characteristics that mediate the use of marijuana in pregnancy in Jamaica.

In Africa, studies have been reported from Kenya (Keefer *et al.* 1991), South Africa (Niestroj 1991) and Zaire (Winn *et al.* 1989). In a recent report, the neurobehavioral organization of a sample of Efe Mbuti (pygmy) infants was examined over the first weeks of life using the NBAS by Tronick and Winn (1992). The behavior of the Efe was compared to that of three samples of term normally grown US and African infants and a sample of growth-retarded infants. Results showed that the behavioral organization of the Efe was similar to that of the well-grown US and African infants and superior to that of the growth-retarded infants.

Nester *et al.* (1995) have examined neonatal behavior in Saudi Arabia. In Israel, Auerbach *et al.* (1989) reported on the effects of different cultural and social class settings and examined their impact on neonatal behavior. A study by Tirosh *et al.* (1992a) compared the behavior of third-generation Israeli infants belonging to two ethnic groups, Ashkenazi and Sephardic, and that of a group of Panamanian infants. Using item-by-item comparisons, they found significant differences between Ashkenazi and Sephardic infants in auditory habituation, whereas the Panamanian infants differed on motor, range of state and autonomic cluster items.

On the strength of these reports, we recommend that when the NBAS is used in cross-cultural studies, several assessments be added. In addition to the ethnographic

information, Apgar scores, estimates of gestational age, of intrauterine conditions, of maternal antenatal nutrition, and of neurological adequacy, and correct length and weight measurements should be added to any behavioral assessment that attempts to evaluate cultural differences at birth.

Prediction studies

There have been a number of studies examining the relationship between neonatal behavior as measured by the NBAS and parent-child interactions or developmental outcome (e.g. Tronick and Brazelton 1975, Sostek and Anders 1977, Waters *et al.* 1980, Crockenberg 1981, Lester 1984, Linn and Horowitz 1984, Murray 1995). Several studies have found that neonatal behavioral organization scores alone account for significant but small to moderate portions of the variance in outcome. Horowitz and Linn (1984) point out that it is only if NBAS scores are combined with measures of the infant's environment that prediction to later developmental measures might be enhanced.

Many studies have examined the relationship between neonatal behavior as measured by the NBAS and temperament and mother-child interaction (e.g. Worobey 1986b, Koniak-Griffin and Rummell 1988, Green *et al.* 1989). A recent follow-up study of 40 healthy term infants by Tirosh *et al.* (1992b) revealed that there were significant correlations between the Orientation and Motor clusters and the temperament factors, 'fussy-difficult' and 'unpredictable' at 3 months. In a study of 119 term infants, Covington *et al.* (1991) found that those who developed colic over the first 4 months of age, as perceived by parents or physician, had poorer Orientation scores on the NBAS than babies who did not have colic.

Murray (1995), in her longitudinal study of postnatal depression in a Cambridge (UK) community (N=528), administered the NBAS at 10 and 15 days as a way of measuring the contribution of infant irritability to postnatal depression. She reported that mothers whose infants were found to be irritable on the Scale were significantly more likely to be depressed at 6 weeks *post partum* than those with babies who were not described as irritable.

In a study of mother-infant interaction in a sample of Irish mothers and their infants (Nugent *et al.* 1993), the Orientation and Range of State clusters on the NBAS were the best predictors of the quality of maternal-child play. In a one-year follow-up study of Irish infants (Nugent 1991), the combination of state behavior as measured by the NBAS and father involvement in caregiving together accounted for 27 per cent of the variance in Bayley Mental Scale Scores at 1 year. Jones and Heermann (1992), on the other hand, found that infant characteristics were infrequent predictors of maternal caregiving competency and predicted a small amount of paternal caregiving.

Fetal movement and habituation were examined in relation to neonatal behavior as measured by the NBAS by Madison *et al.* (1986). Shadmi *et al.* (1986) used a modified version of the Scale to examine the relationship between fetal movement and infant motor activity. Long *et al.* (1993) also examined the relationship between fetal body movements and neonatal activity levels on the NBAS.

A group of 40 infants were assessed at 3 and 14 days on the NBAS and again at 4, 8

and 12 months on the Griffiths' Mental Development Scales in a longitudinal study by Risholm-Mothander (1989). The results showed that State Control as measured by the NBAS was related to Motor Development at both 8 and 12 months on the Griffiths Scale. Jacobvitz and Sroufe (1987) reported that among 38 early child variables, only a motor maturity factor score derived from two Brazelton examinations was significantly related to child activity levels at 2½ years.

In a study of the determinants of maternal self-esteem, McGrath *et al.* (1993) studied 80 mother-infant dyads comprising healthy, middle class mothers of neurologically healthy preterm and term infants. They reported that the preterm and term infants differed on the State Regulation cluster of the NBAS, and that the NBAS Autonomic cluster, the Fussy/Difficult variable from the Bates ICQ and the Perception of Infant Health (POIH) scale explained a significant amount of the variance in maternal self-esteem.

In a study of Japanese infants, Kato (1991), followed up a sample of 53 healthy infants from birth to 36 months of age. In an examination of infant and social variables, the NBAS clusters on the three examination points at 3, 14 and 30 days accounted for 21-47 per cent of the variance in developmental outcome at 3 years of age.

In two studies of short-term prediction using the NBAS by Moss *et al.* (1988), results showed that the Range of State cluster correlated significantly with visual discrimination at 3 months.

Coles *et al.* (1987a,b) in a follow-up study of the effects of prenatal alcohol exposure found that differences in orientation, motor performance, reflexive behavior and autonomic functioning as measured by the NBAS were predictive of Mental and Motor performance on the Bayley Scales of Infant Development.

Studies of primate behavior

The NBAS has also been used to examine primate behavior. Bard and her co-workers compared orientation behavior in human and non-human stimuli on the NBAS in neonatal chimpanzees and humans. Bard *et al.* (1992) reported that chimpanzees showed a capacity for sustained attention to both social and non-social stimuli and showed significant improvements in orientation from day 2 to day 30. Hopkins and Bard (1993) examined behavioral asymmetries in chimpanzee behavior and found that asymmetrical hand-to-mouth, self-calming behaviors were significantly related to Range of State behavior on the NBAS at 2 days.

Schneider *et al.* (1992) used a modified NBAS in a study of the effects of prenatal stress on the neuromotor development of infant primates. Hallock *et al.* (1989) used the NBAS to compare differences in behavior between chimpanzee and human neonates over the first month of life. They reported that there were more similarities than differences, but that chimpanzees demonstrated a higher level of motor functioning while human babies were more responsive to Animate and Inanimate Auditory and Visual Orientation items.

Intervention

The NBAS is being used increasingly as a form of intervention, and many review articles

have appeared which have examined its efficacy in this regard (e.g. Belsky 1985; Nugent 1985; Anderson 1986; Beal 1986; Worobey 1986b, 1990; Worobey and Brazelton 1986; Brazelton 1989, Gomes Pedro 1989; Nugent and Brazelton 1989; Murphy 1991; Pressler 1991; Tedder 1991; Wolke 1991b; Field 1992; Wolke and Eldridge 1992, Britt and Myers 1994a; Dixon 1994; Miller and Quinn-Hurst 1994). Several studies have been designed to examine its effectiveness as a form of intervention (e.g. Widmayer and Field 1980; Myers 1982; Worobey and Belsky 1982, Liptak *et al.* 1983; Gomes Pedro *et al.* 1984, 1989; Szajnberg *et al.* 1987; Beal 1989; Grimanis *et al.* 1989; Cardone and Gilkerson 1990; Rauh *et al.* 1990; Parker *et al.* 1992; Beeghly *et al.* 1995; Britt and Myers 1994b).

Some studies have reported significant findings, while others have failed to find effects. Reviewing the studies using the NBAS as a form of intervention, it is clear that it has been used in a variety of ways with very different approaches, with a range of populations, some high-risk and some low-risk, and with a range of outcomes, so that the studies are often not comparable. We have always emphasized the importance of the Scale as a way of communicating with and developing a relationship with parents, but one should not expect a single brief examination, conducted in the first days of life, to have long-term effects on development or on the parent-child relationship (Nugent and Brazelton 1989). Some of these issues will be addressed in Chapter 5 of this manual, when different approaches to using the Scale in clinical settings will be presented in detail. The following are recent examples of intervention studies which have used the NBAS.

Rauh *et al.* (1990) tested an intervention based on the concepts of the NBAS with a sample of low birthweight infants and their mothers. No effects of intervention were seen until 36 months (31 months after the intervention had ceased), while at 48 months the effects of intervention were seen on the McCarthy Scales of Mental Development. They reported that intervention mothers were significantly more self-confident at 4 years compared to mothers in a control group.

In a study conducted in Australia, Warren *et al.* (1989) developed a comprehensive multidisciplinary prevention program for low birthweight infants, based on the NBAS self-regulation scores and on information derived from structured interviews with the parents. The results confirm the importance of developing interventions that flow from assessment, and supports the premise that effective parent-infant interaction is the strongest working factor to override the early negative consequences of preterm birth.

Szajnberg *et al.* (1987) compared the impact of demonstrating the NBAS vs a standard physical examination to the mothers of low birthweight preterm infants at 34 weeks gestational age. Results showed that the NBAS-based intervention resulted in an increase in mothers' visits to the neonatal intensive care unit (NICU), and that at 6 months, mothers in this group rated their babies as temperamentally easier.

Parker *et al.* (1992) got mothers to actively participate in the behavioral assessment of their infants in a NICU setting. Compared to mothers of preterm infants who received standard *post partum* care, mothers in the intervention group rated the infants as significantly less difficult temperamentally at 4 and 8 months and had home environments that were developmentally more appropriate at 4 months. The intervention infants also had higher developmental quotients at 4 and 8 months than control infants.

Britt and Myers (1994b) tried the NBAS with low-income, drug-using mothers as an intervention to enhance mother-infant interaction. An NBAS teaching session failed to show such an enhancement. Dixon (1994) pointed out in response, that in intervention work with a high-risk population we should not expect positive effects based on a single NBAS contact. The essence of the NBAS-based intervention is in using the Scale to develop a relationship with the parents, so that serial sessions are embedded in a complex multifaceted intervention approach. This kind of model is essential for developing a therapeutic relationship with families around the Scale and for ultimately contributing to the development of a healthy mother-child relationship.

Beeghly *et al.* (1995) compared the efficacy of a child-centered NBAS-based intervention and a mother-centered intervention with families varying in risk status. Mothers (N=133) were randomly assigned to one of the two intervention groups. No significant main effects were found at 4 months, but first-time mothers who participated in the NBAS intervention reported less parenting stress, while mothers at higher demographic risk, who had poor social support and lower life satisfaction, who participated in the intervention also reported less parenting stress at 4 months. In this case, the NBAS-based approach was based on serial assessments over the first month, with the goal of developing a relationship with the parents.

Further research needs to be done to explore the NBAS as a form of intervention as Nugent and Brazelton (1989), Britt and Myers (1994a), Dixon (1994) and Beeghly *et al.* (1995) advocate. The different ways to use the Scale as an intervention must be studied more carefully. Simple demonstrations of neonatal behavior may influence parents' reactions in certain instances but we have emphasized the use of the Scale as a means of developing a relationship with the parents through the child.

In summary, the effectiveness of the NBAS as a form of intervention depends on many factors, including the nature and goals of the session itself, the risk status of the family, the nature of the contract between parents and clinician and the quality of the parent-clinician relationship, the number of sessions, the degree of readiness of the parents and the nature of the follow-up treatment. The following chapter will describe different approaches to using the NBAS as a form of intervention and as a basis for further research.

Conclusion

From these various studies we have learned that a single assessment is of value only as a screening instrument for gross neurological or behavioral dysfunction. Several consecutive examinations are much more sensitive to intrauterine stress or perinatal influences as indices of future organization. Patterns of change over time are likely to be better predictors of future functioning than are single examinations. The patterns of change in neonatal behavior reflect the ability of the neonate to reorganize after the stress of labor and delivery. They also provide a functional assessment of her ability to assimilate early environmental stimulation and the efforts of the caregiver to assist the baby in this reorganization.

Certain groups of data (such as Orientation, State Regulation, State Organization) are

likely to change in a positive direction over time in a responsive environment. Motor and reflex items that reflect midbrain function may change less in response to environmental input. Autonomic regulation is more indicative of internal regulators and may not reflect the appropriateness of environmental input. Thus if one is concerned with future cognitive or social development, patterns of change in certain groups of data may be more predictive than others. It may be that the Motor, Reflex and Autonomic clusters predict future motor function better. In prediction studies, we must still continue to strive for better indicators of the cost to the baby of achieving internal regulation as she interacts with her environment.

The complexity of the developmental process is such that, while repeated examinations with the NBAS can provide a comprehensive assessment of the infant's adaptation to the extrauterine environment, its predictive validity will be improved by research which increases our understanding of how the infant's behavioral repertoire relates to caregiver behavior and environmental stimulation.

5

CLINICAL USES OF THE NBAS

I: INTRODUCTION

The NBAS was originally designed to be a clinical instrument (Brazelton 1973), and increasingly over the past decade pediatricians, nurses, physical and occupational therapists, social workers, clinical psychologists, parent educators, psychiatrists, early intervention specialists and other allied health professionals have been using the concepts of the Scale in their work with parents.

In the earlier editions of the manual there was considerable emphasis on research uses but few guidelines were given to clinicians on how to use the NBAS as a clinical instrument. In this chapter we present general guidelines for the use of the Scale, followed by descriptions of a series of applications by different professionals in a range of settings, as follows.

- In the first of these sections, pediatrician Constance Keefer describes a model for integrating the Scale into the neonatal physical examination and provides a description of a parent-centered interactive approach to the examination of the newborn infant.
- Donna Karl, Judy Beal and Pat Rismiller present a model for integrating the Scale into nursing practice.
- Psychologist Hanne Munck discusses the use of the Scale as an instrument for therapists who work with parents. She presents three clinical vignettes describing the use of the Scale with high-risk infants and their parents.
- Ida Cardone and Linda Gilkerson describe the FANA (Family Administered Neonatal Activities), a model for the use of the Scale in clinical settings. They emphasize the importance of the development of the supportive relationship between clinician and parents.
- Dieter Wolke describes ways of measuring parental caretaking involvement and confidence as a means of determining clinically relevant material before using the NBAS clinically. He outlines a five-step approach towards using the Scale with parents.
- Finally Jean Cole describes an adaptation of the Scale for use with high-risk infants and the development of an individualized developmental plan for both mother and infant.

Many research studies have reported positive effects of using the NBAS to demonstrate the newborn infant's behavior to parents, on variables such as maternal confidence and self-esteem, paternal attitudes toward and involvement in caregiving, parent-child interaction and improved developmental outcome (*e.g.* Widmayer and Field 1980; Myers 1982; Worobey and Belsky 1982; Anderson and Sawin 1983; Liptak *et al.* 1983; Gomes Pedro and Barbosa 1988; Rauh *et al.* 1988, 1990; Beal 1989; Parker *et al.* 1992; Beeghley *et al.* 1995).

When we use the NBAS in clinical settings, we use it to engage the parents as active participants in the process of observing and learning more about their baby's behavior and as a means of developing a relationship with the family (Nugent 1985). In summary, we use it (i) to sensitize parents to their baby's uniqueness and to promote a positive parent-child relationship, (ii) to share with parents concerns about the baby's future development, and (iii) to promote a positive collaborative relationship between the caregiver and the clinician or the health system which will continue the care of the infant and family. The clinical examination has been described as both infant-centered and family-focused (Nugent and Brazelton 1989). While the session can be neither wholly parent- nor wholly infant-focused, it strikes a balance between the two. The Scale with its description of the baby's individuality is at the heart of the session, and the examiner's goal is to allow it to capture the full richness of the baby's behavior and demonstrate this to the parents, and at the same time to give the parents an opportunity to share their concerns about the baby or about themselves.

We have found that the trained examiner can evaluate the baby successfully while observing and responding to the parent's reactions to the infant. However, when a baby with special needs or one about whom there are concerns must be examined, we sometimes recommend a prior examination to evaluate the baby's overall status and her strengths and difficulties. Then, the examiner can first present the baby's positive behaviors to the parents and follow that with a discussion of 'what will need to be worked on'. Even with an infant who has an impairment of some kind, positive responses can 'capture' the parents' energy which might otherwise be given over to grieving, and then they can be ready to join the examiner in the work of optimizing the baby's future.

General guidelines for using the NBAS in clinical settings

Setting goals for a clinical session

Before using the Scale in clinical settings, the examiner should first ask herself the following questions:

- What is the goal of this session?
- Who asked for this consultation?
- Are there concerns about this infant?
- Are there concerns about the parents?
- What are the parents' perceptions of the session?
- What are the expectations of the parents?
- Why did the parents ask for this session?
- Is the session a 'once-and-for-all' contact?
- Is the examination part of an ongoing relationship between the examiner/clinician and the family?
- How will the information or findings be recorded?

In using the Scale clinically the examiner should be aware of these questions before she begins. If there are concerns about the baby's developmental status, it is important that both the examiner and the parents recognize that a standard neurological examina-

tion may also be necessary to answer those questions. However, even when there are no immediate concerns about the baby's development, parents can approach the NBAS with the expectation that it will reveal the baby's unique developmental status. It can be pointed out that although the examination is not a diagnostic one it can be used as a screening tool to examine the baby's normal status and to identify worrisome behaviors that may influence her development. The Scale does not yield a single score on the baby, since it examines her strengths and difficulties over a range of behavioral dimensions. However, if worrisome behavior is detected, then serial examinations are instituted and the need for continuous monitoring is recommended. Whatever the nature of the consultation, serial sessions are always advisable. If one or two of these sessions take place in the home setting, it may be even more beneficial (Parker *et al.* 1992).

Knowing the parents' concerns makes it easier for the examiner to focus the examination on the needs of the family, since one of the key goals of the session is to establish a relationship between the clinician and the parent. We believe that it is the quality of the examiner-parent relationship that determines the effectiveness of the NBAS as a clinical instrument. It is therefore important for examiners to know as much as they can about what parents expect from the session.

Introducing the examination to the parents

PRE-EXAMINATION QUESTIONS

The examiner attempts to set the tone of the session by establishing open communication with the parents by urging them to share their feelings or concerns throughout the examination. Her readiness to listen to their concerns is vital both for the success of the session itself and for their future interaction. The examiner invites parents to observe and to participate actively. For parents who have concerns about the baby or about their ability to look after her, this gives them an opportunity to use the examination as a forum.

The goal for the examiner is to get some idea about how the parents are feeling in themselves and about their baby. The approaches of Cardone and Gilkerson (section v) and of Wolke (section vi) present a structured method for introducing the Scale to parents in order to set the stage for the session. We have found that even general questions about pregnancy and about labor and delivery give the parents an opportunity to talk about their feelings and to share any concerns they may have about becoming a parent and about the baby. The content and quality of the parents' responses will give the clinician an insight into the concerns they may be bringing with them into the session. This initial conversation should demonstrate to parents that the session will be responsive to their concerns. Above all, their questions and comments can be shared.

The examiner must clearly describe the goals of the session to the parents. It is important to make sure that they do not misunderstand the aims of the NBAS (*e.g.* it is not an IQ test). This is an opportunity to describe what the Scale can do in demonstrating the baby's capacities. Every introduction can benefit from a brief description of states of consciousness, since so much of the baby's behaviors can only be understood through the lens of state. Since the first part of the session is an examination of the baby's

'shutting out' capacities, the parents will understand its significance only if they first understand that the baby's state is the key factor in interpreting her responses. Without this explanation they may think it is a measure of auditory functioning. Similarly, if a baby has a low level of arousal and sleeps through the examination, there is still a range of valuable information for the parents, and it may be that shutting out negative environmental stimulation is the baby's current developmental agenda and that staying in such a low state of arousal is a successful solution to the task.

In introducing the Scale to parents, we emphasize that we want to discover the unique capacities of their baby and that our goal is to see how her individuality is expressed. When an examiner has been trained she will soon learn that this individuality will be seen less in the baby's discrete responses than in how the baby organizes her behavior over the course of the examination. We tell the parents that we will be looking at how the baby's states change as the examination progresses and how the baby responds to different levels of stimulation. This approach enables examiners to interpret a baby's behavior in terms of her own individual responses and not in comparison with other babies, and in a mutually shared framework.

DEALING WITH THE ISSUE OF CRYING

Many parents of new babies become anxious when their baby cries, and the examination, especially with a highly labile baby, may have some difficult moments for them. Again, examiners can prepare them in advance by pointing out that most babies cry during some part of the examination but that there is much to be learned from listening to the quality of an infant's cry, by observing how much stimulation it takes to make a baby cry, and how easy or how difficult it is for a baby to console or be consoled. It may be important for examiners to prepare parents for their seeming unresponsiveness by explaining ahead of time that when the baby cries for the first time they will wait for a few seconds before intervening. A description of the Defensive and Moro Responses, because of the invasive nature of these items, could also be included in this introductory explanation.

In sum, a brief description of states of consciousness and an overview highlighting some of the items in the Scale should be part of the initial introduction to parents. In addition to preparing them for what is to follow, and in some cases alleviating the anxiety they may experience in response to the more intrusive or stressful items, an introductory explanation enhances parents' ability to participate in the clinical process. On the other hand, too much explanation at the beginning can be overwhelming for parents and may reflect the examiner's anxiety rather than the needs of the parents.

The examination: interacting with parents

The clinical examination is designed to engage parents actively in the process. There are many ways to achieve this, and the different approaches will be described in detail in the sections which follow. We will merely state here that we believe that parents should be invited to participate and given the opportunity to be involved as fully as possible, and that the level of involvement should be determined by parents and clinician together. The examiner creates an atmosphere that makes it easy for parents to ask questions and

to share their own observations. The questions and observations of parents are therefore integrated into the assessment of the infant. In addition, providing parents with an opportunity to administer some items, especially the Orientation ones, has long been an integral part of the clinical approach to using the NBAS.

As the session proceeds, examiners need to be sensitive to parents' cues, both verbal and non-verbal. Then, when a direct question is posed or an observation articulated that conveys anxiety, examiners must be ready to use this as a basis for exploring and discussing their underlying concerns.

Our basic guidelines involve three steps. (1) Take definite note of parental concerns when they are voiced. Respond to the question or comment and acknowledge it sympathetically. (2) Tell the parents that you would like to deal with it in more depth when the examination is over, but continue, explaining that a completed examination provides a fuller picture of the baby, thus more information with which to address their concerns. As the examination continues you can stay attuned to this concern and consider it as it manifests itself in the parent or the infant. (3) Finally, when the examination is over, you can raise the issue again, discuss it in depth and work with the parents to formulate a plan to deal with it. We feel that this approach explicitly recognizes a concern and acts on it but allows the parents to see the baby's complete repertoire. You should not 'smooth over' any problems that appear in the course of the examination. Problems must be described and acknowledged and never sidestepped to 'protect' parents from this information. We believe this approach is appropriate for both medical and social issues.

Parents' questions or concerns tend to fall into two categories: (a) questions about the baby, especially about the baby's 'normality'; and (b) questions that reflect the parents' other kinds of concerns about the infant and/or their own parenting capacities. The first group of questions are normative in nature and often relate to the degree to which certain behaviors are found in other babies. They tend to focus on behavioral differences, e.g. 'Do other babies sleep as much or cry as much as this?'; or 'She has been sleeping all the time and hasn't opened her eyes to look at me yet.' These concerns can be dealt with by providing developmental information about the range of variability in neonatal responses that fall within the normal range.

It is this kind of behavioral question that the NBAS session addresses directly. In such settings the goal of examiners is often to confirm, validate or clarify the parents' own observations, e.g. 'Yes, you're right. As you can see, she is able to see more than shadows at this age.' This kind of clarifying comment involves both an acknowledgment and a validation of the parents' observation. It may also provide parents with information about the specific capacities of a baby about which they were previously unaware.

Examiners must be able to describe 'difficult' behavior as well as so-called 'positive' behavior. The goal is not to dismiss problems but to share them with the parents and support the parents in dealing with them. If a baby cries more than usual or is very sensitive to even low levels of stimulation, examiners need to present this information simply and objectively. The examination is designed to elicit the full range of a baby's behavior, and this must include behaviors that may be difficult to manage or may be stressful for parents. This philosophy is expressed in the approach towards

writing up the behavioral profile and individualized plan based on the NBAS findings.

Parents have questions about the baby's 'normality' and they will see the Scale as a diagnostic tool to provide definitive answers. The informed clinician will be able to use the data gleaned from the examination to provide a summary of the infant's current developmental status and to decide whether continuous monitoring is warranted. The results can suggest a need for a more comprehensive neurological examination. Examiners must recognize that assessment needs to be an ongoing set of serial observations. Information is built in a cumulative fashion as the examinations are administered over time.

The second set of issues likely to emerge during the session concerns the parents' own emotional well-being or their underlying feelings of anxiety about the baby or about their ability to meet her needs. These questions or statements may relate to their ambivalent or negative attitudes toward the infant, or they may touch on the quality of their marital relationship; they may even contain hitherto unrevealed information of maternal drug or alcohol use; they may reflect their overall life stress. The first task of the examiner in these situations is to listen to the parents and help them share their feelings. This validates the feelings. Then the clinician must interpret these concerns for the parent, based on her professional expertise. The clinician must have at her fingertips a solid understanding of the developmental principles surrounding the parent-infant relationship.

The following guidelines can prepare examiners to involve themselves in these issues in a way that reflects sensitivity to the parents and is consistent with the infant-centered and family-focused nature of the NBAS model. The level of interest and involvement of both parents can be scored on the score sheet on a minimally involved to highly involved continuum.

First, examiners should monitor parents' non-verbal cues throughout the session, which means taking a global reading of their affective state. This practice provides examiners with an index of the degree of receptivity of the parents to the informational context of the session. The information gained will inevitably shape an examiner's emphasis on particular aspects of a session and will better prepare her for the post-examination summary discussion of the findings.

Second, as we discussed earlier, the examiner must listen to any comment or address any question parents ask during the session. When parents do express concern, the examiner must pause in the examination and support their efforts to articulate their concerns so that she can understand them. The examiner may then say, 'I can see you are worried about this.' She may add after a brief pause, 'Could we continue to examine your baby and at the end of the examination we will have an opportunity to discuss this concern in more detail, and if there's a problem we will work on it together.' In this way, the examiner acknowledges the concern, proposes a way of dealing with it, but continues with the examination. Of course, there may be some instances when the nature of the parents' concern is extremely grave or the degree of their anxiety is so acute that the examination may have to be discontinued, and the problem may have to be dealt with immediately.

Several issues may be raised during the session. They may be articulated through such comments as: 'She seems to be pushing me away, like she really doesn't like me'; 'We never really wanted this baby in the first place'; 'I feel she does nothing but cry'; or 'I just can't handle this whole thing.'

As Cramer and Stern (1988) illustrate, such comments suggest questions about the parents' ability to respond to and look after the infant, or about their emotional well-being. If the parents' questions reflect a need for clinical follow-up, the examiner must be ready to make such a referral. The examiner, however, must have a strategy and a procedure in place for either managing the problem or making a referral and for communicating the information gleaned through the NBAS session to ensure that the parent's concerns are fully addressed.

Whatever the questions, examiners should never dismiss parental questions or concerns raised during a session. Parental feelings must be acknowledged and validated, and while providing normative information on neonatal behavioral differences can be sufficient for most low-risk families, for others it may be necessary for examiners to address specific concerns and to arrange for whatever follow-up supportive services are indicated for the family.

Summary and interpretation: after the examination

When the examination is finished, the examiner then works with the parents to interpret the meaning of the baby's behavior and to discuss its implications for their caregiving.

It is best to begin by asking the parents what the session meant to them and what their reactions were to the baby's behavior. Their reactions provide the basis for the interpretative material you offer and in turn ensure that the material that is discussed is relevant to their concerns. To deal effectively with this stage of the session, the clinician must be able to provide supportive clinical guidance to the parents and have in addition a rich understanding of the developmental tasks of both infant and parents. This in turn is only possible if the clinician allows the parents to bring up difficult material. The examiner can question and probe or ask parents to elaborate on the questions they introduced during the examination.

The examiner should provide a summary and interpretation of the session at its conclusion. Two ways of providing verbal summaries of the NBAS material are (1) the Strengths-Difficulties approach, and (2) the Dimensions approach. The latter approach describes the session in terms of the infant's autonomic, state, motor and interactive systems and the level of integration of these systems.

The Strengths-Difficulties approach is based on the notion that the aim of the NBAS is to present a comprehensive description of the infant's repertoire by highlighting her competencies as well as her difficulties or problem areas (see the scoring form). The Strengths column describes her competencies in terms of her responses over the course of the examination, while the Difficulties column describes the areas she still has difficulty with, or issues her parents may have difficulty with.

This Strengths-Difficulties approach can be used on its own or with any other approach as a way of presenting a final summary of the infant's behavior. It must be

pointed out that it is never presented as an examiner's narrative but rather is embedded in discussions with the parents. It is a collaborative reconstruction of the session, incorporating both NBAS item observations and parent's own perceptions and interpretations of their infant's behavior. Finally, the parents take the lead in the overall integration of the observations as they decide for themselves the shape and direction of their caretaking for their baby.

Scoring clinical NBAS examinations

The standard NBAS Scoring Form (Appendix 1) can be adapted for use in clinical settings. In such settings, the Scale may serve both as a diagnostic screen and as a form of intervention with parents. The aim of the score sheet is to provide the practitioner with a means of recording individual differences in neonatal behavior, to help her communicate this information to the parents, and to develop an individualized caregiving plan for the family. The parents' active participation in this process is emphasized, and the degree to which they become involved and the degree to which the clinician is able to develop a relationship with the parents is recorded.

The Scoring Form summarizes the infant's performance on the six systems of behavior, the supplementary items and the reflexes. In addition to the numerical scores, there is a section for a brief narrative account of the infant's behavior. This is presented in terms of the infant's strengths and difficulties. A parallel summary of parents' strengths and concerns enables the examiner to complete a profile on the family as a system. Finally, a section entitled Recommendations for Caregiving is provided to allow the clinician to present caregiving guidelines for the parents.

II: THE COMBINED PHYSICAL AND BEHAVIORAL NEONATAL EXAMINATION: A PARENT-CENTERED APPROACH TO PEDIATRIC CARE

Constance Helen Keefer

This section describes the incorporation of behavioral items from the NBAS into the routine neonatal physical examination. This combined examination addresses assessment, intervention and communication goals. It allows the pediatric practitioner to assess the normality of the infant's behaviors and to generate an individual behavioral profile. The profile can be organized into six clusters: Response Decrement, State Range and Regulation, Motor Organization, Neurological Organization, Social Organization, and Physiological Regulation, which are based on the 28 behavioral and 18 reflex items of the NBAS. The NBAS-based profile captures behaviors that are significant to the parents' interactions with the infant. Knowledge of this aspect of the infant's behavior enables the practitioner to give more specific anticipatory guidance to the parents and prepares the practitioner for more effective intervention if a problem should arise.

The combined examination provides parents who observe it with a highly articulated view of their infant's behavioral capacities. By narrating the examination for the parents and actively drawing them into it, the practitioner enhances the educational and psychological value of this intervention. The shared observation and interaction with the infant reassures the parents about their child's physical state and enhances their understanding and appreciation of her behavior, thereby improving their self-confidence. This is further enhanced by observing the pediatrician utilizing the baby's behavior as a language. In the future, the parents may be less likely to cloak concerns about the baby's behavior or their parenting skills in the guise of a physical problem. The pediatric practitioner and parents will be able to move more quickly to work on the real issues rather than the somatic distraction.

This model of using a physical examination to educate parents about behavior and development and to strengthen the parent-child relationship is applicable to any pediatric medical encounter. Whitt and Casey (1982) demonstrated its effectiveness during well-child visits in later infancy. Two characteristics of parents in the *post partum* period make this approach particularly effective during the neonatal assessment. They are open to forming new attachments to caregivers as well as to their infant, and they are ready to reshape their image of the child based on the actuality of her behavior rather than just the hopes and fears that they experienced during pregnancy. The more they see and know of their infant, the more realistic and appropriate they can be in their interactions and expectations.

One situation where being able to make an articulated behavioral assessment of the neonate is most valuable is when the infant has an abnormality. The NBAS includes items which can demonstrate the range of possibilities for even the most damaged of children and which can bring a sense of hope to the parents. Even when fears cannot be allayed completely, the diffuse anxiety of an unknown possibility can be focused and reduced by a view and understanding of the actual problem.

TABLE 5.1

NBAS items and clusters that can be assessed during a neonatal physical examination

Response Decrement—to coincidental touch, sound and light during the first phase of the examination
State Range and Regulation—predominant state, threshold of excitability, number of state changes, peak of excitement, consolability, self-consoling
Motor Organization—motor maturity, general tone, hand-to-mouth, pull-to-sit*, activity level
Neurological—Moro, TNR, truncal incurvation*, placing*, stepping*, truncal righting*, grasp (palmar and plantar), Babinski, clonus, sucking, rooting
Social Organization—quality of alertness, animate visual*, animate auditory*
Physiological—color change, jitteriness, tremulousness

*These items require a maneuver for elicitation that is outside the usual physical examination procedure. All other items can be elicited by usual maneuvers and noted incidentally.

For example, the mother of an infant whose cloudy corneas were detected on the second day of life was relieved to watch her sleeping infant blink to a light flashed across her closed eyes, evidence to the mother of the possibility for sight in the infant. This response brought the mother closer to the baby, and she began stroking her cheek and calling her name. The mother then was able throughout the remainder of the examination to watch the infant protect her sleep state but rouse to a lusty cry during abdominal palpation, right her head repeatedly on pull-to-sit and clear her chin when lying prone, and eventually calm down and turn her head to the sound of her mother's voice. Despite the infant's eye problems, the mother now could see her as generally intact, robust, and capable of responding to social and caregiving efforts. Juxtaposing observations of the problem area with the demonstration of the range of other, often normal, behaviors would support the mother in sensing the infant as a whole person, rather than one who is defined first or primarily by the deficit. Whether worrisome or positive, practical detailed knowledge of the infant's behavior is the best guide for developing interventions that help parents to read better the infant's cues and to find appropriate responses.

The combined examination can be done relatively efficiently because the usual 'head-to-toe' sequence of a neonatal physical assessment provides a framework for making observations of a range of infant behaviors that reflect developmental capacity and individual style. Many of the NBAS items can be assessed merely by paying attention to the behaviors that are elicited by the physical examination maneuvers. The behavioral assessment can be completed by performing the few NBAS items not coincidentally observed during the physical examination, adding only a few minutes to the usual examination time.

Terminology from the NBAS items and clusters may be employed for clinical descriptions of the behavioral findings. Table 5.1 shows the items that can be observed incidentally during the routine physical examination and those which must be elicited.

When writing the clinical description the clusters can be used to describe overall performance. Individual items are then noted as markers or examples for the whole cluster, or when the performance on an item was extreme.

Based on the integrated examination, the pediatric practitioner might roughly rate the infant's behavior as optimal, average, worrisome or abnormal. Infants who fall into an abnormal category, by virtue of extreme behavior in a number of items, need to be referred for full NBAS and, possibly, neurological evaluation. Infants who fall into a worrisome category (Als *et al.* 1976) should be monitored with repeated screenings over the first days and weeks of life.

The marvelous plasticity of the young infant's nervous system, and her consequent capacity for behavioral improvement, makes this 'continuous developmental monitoring' (Dworkin 1989) the appropriate process for assessing the need for referral to full evaluation if the behavior worsens or persists. The continuous monitoring process, applicable in the context of either primary pediatric care or early intervention, can replace the alternative 'all or nothing' diagnostic process that often leads to premature labeling of a disorder or delayed recognition of an abnormality. This integrated examination enables the pediatric practitioner to begin developmental monitoring of all patients in the neonatal period and serves as a model for placing developmental monitoring within routine primary care assessments.

Behavioral additions to the physical examination

Table 5.2 presents the specific elements of the physical examination, divided into stages and sequenced to allow a full range of infant behaviors to be elicited efficiently. The sequence places less disturbing physical maneuvers early, and painful or disturbing maneuvers later, so that a maximum number of Motor Organization and State Range and Regulation behaviors can be seen. As described below, certain behaviors should be elicited at particular points, while others can be observed incidentally at any time. Behaviors that are continuously monitored throughout the physical assessment are shown in the footnote to the table. The behavioral elements are listed in the centre column, each juxtaposed to the relevant physical maneuver in the left-hand column and to the specified narration and/or invitation to parental involvement in the right-hand one. Suggested narrations and involvement regarding the physical findings have been developed, but are not included in this chapter.

As Table 5.2 shows, behaviors indicating the range and regulation of state are monitored throughout the physical examination, from the first phase of inspecting the head and exposing the chest in order to listen to the heart, to the disturbing manipulation of the hips and turning the infant for inspection of the back. The practitioner keeps a mental tally of the number and rate of state changes, peak and predominant states, consolability, and the number and types of self-consoling behaviors by the infant, and the amount of crying or irritability. Motor organization is monitored throughout the examination. Noting the shape and quality of spontaneous hand and limb movements at any point in the examination allows an assessment of motor maturity and amount of time-in-motion, a measure of activity level. The examiner can also compile evidence of the infant's

general tone through the constant handling of the examination. Physiological parameters of jitteriness, tremulousness and color change are also continuously monitored.

Stage I

The first of the elicited behaviors can occur in Stage I if the infant is asleep at the beginning of the examination. Evidence of the infant's ability to shut out external stimuli and to protect the sleep state can be observed in her response to any of a number of the early minimally stimulating occurrences, *e.g.* noise introduced by the examiner in positioning the crib, or light touch of the stethoscope on the chest. (The infant who appears not to shut out any stimuli might be assessed more carefully for response decrement to a repeated stimulus, such as a soft rattle or a light. The infant should ideally be in a true sleep state, about an hour after feeding, and examined in a quiet darkened room, where the sound of the rattle or the flash of the light would be the predominant sensory experience.)

Stage II

During the manipulations of Stage II (undressing, light palpation of head and clavicles, full inspection of the skin), the infant is likely to waken and become more active, providing an opportunity for the first incidental observation of the inter-relationship between changes in state and posture and the quality of movement and alertness. Even a small change in posture (*e.g.* a slight turning of the head to the right that increases flexor tone in the left arm and reduces it in the right) can lead to state changes (*e.g.* cessation of crying and opening of eyes) that in themselves lead to other changes in motor performance (*e.g.* reduction in general activity level, with arm movements becoming smooth, circular, and directed to the mouth). The secondary motor changes, especially those that include some hand-to-mouth activity, can then help to sustain the calmer state.

Fussing and crying often begin in Stage II, providing an opportunity for testing the infant's responsiveness to minimal consoling interventions such as talking to the infant or restraining the arms. Thus far, neither additional time nor maneuver has been added to the routine physical examination, and yet a useful behavioral assessment is being developed.

Stage III

During Stage III, the examination of abdomen, hips and genitalia necessitates more vigorous and painful maneuvers, usually taking the infant to a full cry. The practitioner should allow some bouts of crying to proceed unconsolated in order to develop a picture of the infant's capacity for self-consoling with behaviors such as hand-to-mouth and postural changes. Eventually, perhaps when quieting a cry to relax the infant for abdominal or hip examination, the examiner can assess the sucking reflex and palate with a gloved finger.

Stage III is the best time to begin to assess neurological tone and reflexes. The infant's passive tone can be easily assessed after the hip examination by stretching and refolding the legs lengthwise a few times and by pulling and pushing on the arms. The

TABLE 5.2
Outline for incorporating behavioral assessment and demonstration into the neonatal physical examination and eliciting parental involvement

	<i>Physical examination</i>	<i>Behavioral assessment</i>	<i>Narration/involvement</i>
Stage I	Observe respiration, color, posture; facial features, intact and symmetrical Expose chest; listen to heart and lungs	Observe state Observe habituation if infant remains asleep, unawakened by the undressing and touch of the stethoscope; self-consoling, if crying	Point out to parent the infant's habituation to the touch of the stethoscope
Stage II	Undress infant Palpate and observe scalp, fontanelle, clavicles; examine skin for defects and signs of maturity or dysmaturity Examine umbilical cord; observe protuberance of abdomen and evidence of diastasis recti	Observe state changes, motor organization, physiologic reaction* Note point in examination when cry occurs; note quality of cry Try consoling with minimal intervention, e.g. voice, restraining arms	Point out the gracefulness of hand movements and how they become more smooth, less jittery, as state changes from fussy to alert Invite parent to elicit grasp Comment on richness in cry sounds and facial expressions Point out which interventions the infant responds to; invite parent to console
Stage III	Palpate abdomen for enlargement of kidneys, liver, spleen, or presence of other masses; palpate femoral pulses With gloved finger also assess palate and gums, when consoling is necessary (e.g. during abdominal or hip examination) Examine genitalia: labial prominence, vagina, urethral orifice, testes, scrotal fluid	Assess components of suck: coordination with swallow, mature use of tongue against palate, burst-pause pattern Note state changes, hand-to-mouth, other self-consoling maneuvers	Comment on how sucking relaxes the infant's movements, making examination of the abdomen or hips easier and less painful; describe elements of suck Comment on and 'package' organized behaviors such as postural changes and hand-to-mouth activity that leads to quieting

	Examine hips with Ortolani and Barlow maneuvers	Assess tone with passive flexion-extension maneuvers of the legs after hip examination, then elicit plantar grasp, Babinski response ankle clonus	
Stage IV	Turn infant to lie prone; assess breath and heart sounds, inspect spine for defects	Assess tone in arms, hand grasp, pull-to-sit for enhancement of grasp and head lag Watch for head turning, chin lifting, rooting, crawling	Show how the infant can grasp strongly and has some degree of head control When infant is prone, comment on head turning and chin lifting; introduce issue of sleep position <i>re</i> sudden infant death syndrome; while pointing out crawling maneuvers, remind of safety <i>re</i> falls
	Return infant to supine	When returning infant to supine, watch truncal tone in prone suspension, incurvation reflex, stepping or placing; elicit Moro reflex as infant is placed on mattress surface	Point out reflex nature of stepping, quality of muscle tone
Stage V	Dim lights to examine the eyes for red reflex	Observe alerting with dimming of light Wrap and hold infant upright; observe effect of postural change on eye-opening and quality of alertness Elicit visual fixing and following, and turn to voice	Comment on eye opening with dimming of the lights, sucking, postural changes Comment on how the infant can see and hear and therefore will be learning the mother's face and voice as she is held close during feedings Hold the infant supine near the mother and instruct her to speak to show how the infant will turn to her

*Continuously monitored behaviors:

State Changes: threshold, predominant and peak states, number of state changes, amount of fuss/cry, consolability.

Motor Organization: motor maturity, activity level, general tone.

Physiologic Reaction: jitteriness, tremulousness, color change.

neurologic assessment continues with elicitation of plantar and palmar grasp, Babinski response, ankle clonus and tonic neck reflex (TNR). The TNR can be assessed by turning the supine infant's head to each side; often a slight difference in flexor tone of the arms is detectable, even though the fencer's posture of the TNR is rarely seen in term infants. Performing the not-so-usual pull-to-sit maneuver adds only a few seconds to the usual time necessary for these neurologic items.

Stage IV

Stage IV begins with lifting and turning the infant, in order to listen to heart and breath sounds and to check the skin over the spine for defects. Attending to the infant's responsiveness provides considerable information about state and neurological behaviors, with no additional cost in time. Tone in motion, state control during massive position shift, rooting, head lifting and crawling reflexes can all be incidentally observed. While lifting the infant from prone, a few additional seconds of time would allow for elicitation of incurvation, placing, and stepping or trunk righting. Just before re-placing in supine, the Moro reflex can be elicited, and the neurological screening is complete.

Stage V

Dimming the lights marks the beginning of Stage V and often leads to eye opening and calming, allowing an assessment of the red reflex and the infant's responsiveness to the environmental change. In this final stage of the examination, when one is re-wrapping the infant to return her to her mother's arms, her ability to follow a face and to turn to a voice can be elicited. This maneuver is outside the usual physical examination routine, and yet it can be accomplished in just two or three minutes to achieve a complete behavioral assessment for the pediatrician. In addition, the parents benefit by learning more about their infant's orientation skills and about the practitioner's interest in their baby.

Narration of behavior and parental involvement

Table 5.2 shows two types of comments to the parents: narrations about the behavioral findings, and invitations to them to elicit various behaviors. The former provide not only reassurance, by emphasizing the normality of the behaviors, but also education about what all newborn infants can do and about their child's emerging behavioral style. In addition, comments can be made on how these behaviors might affect the parents, and how they might respond, *i.e.* the interactive meanings in the behaviors.

The first suggested narration is a comment on the sleeping infant's ability to respond to a mild stimulus, such as the touch of the stethoscope, but to do so without disturbing the sleep state. Usually examination of the head or undressing disturbs the infant enough to move arms or legs, providing an opportunity to point out the shape and character of the movements. Whether these movements are smooth and graceful or jittery and tense, alerting the parents to them early in the examination will enable the parents to follow how the way they change relates to changes in state. The mother can be invited to help calm the jittery infant by placing a finger in the infant's palm. This becomes the first

demonstration of how a small intervention in the motor system can have a more generalized effect on the infant.

While observing a crying bout, the practitioner should point out the infant's efforts at self-consoling: the useful coordination of head turning, rooting and hand-to-mouth may not be obvious to the parents. The gradually increasing consoling interventions should be demonstrated and described to the parents as approaches they themselves might take with the infant. Eventually some crying or tensing occurs that requires the infant to suck. While assessing the suck the practitioner should take the opportunity to explain its components (*i.e.* milking with the tongue vs chomping with the gums, coordinating the suck with the swallow, the burst-pause pattern), especially important for nursing mothers. This is often a time to point out how sucking relaxes the whole body, allowing for the uncomfortable examination of the hips, changing the jittery or tense hand movements to smooth and graceful ones, and often leading to eye opening.

Many other behaviors can be pointed out to the parents throughout the examination, *e.g.* talking about the 'nerves and muscles' being normal while checking grasp and pull-to-sit. Certain behaviors carry more potential for expanding the parents' understanding. The infant lying prone offers several of these. In this position, head turning and chin lifting not only demonstrate the infant's skill but can be used to introduce the topic of sleep position. Parents should be reminded of the recommendation to place infants supine for sleep and to avoid pillows and soft bedding. The crawling maneuver can be used similarly, to caution against ever leaving the infant unattended on a changing table or unguarded bed.

Finally, the practitioner can show what the alert, calm infant can do by eliciting orientation to face and to voice. Even if the infant orients poorly at this time, the practitioner can use the preparation of the infant for these interactions and description of them to the parents as an educational opportunity, reminding the parents that newborn babies can see and hear, and can use those skills to learn about the parents during feeding and comforting. With the infant in an alert state the practitioner holds the infant for the mother to elicit head turning to her voice, and then hands the infant to her to hold during the final discussion.

Communicating behavioral findings

Individual behavioral items seem more relevant than clusters when summarizing the examination for parents. Common terms should replace the language of the Scale items. For example, rather than 'motor maturity' we would refer to the 'gracefulness' or 'relaxed nature' of the infant's hand movements. Interactive meanings can be highlighted, as for example in an infant's preferential turning to voice over face or persistent efforts to get hand to mouth. The practitioner can refer to items that give evidence of the normality of the infant's behavior and those that show the infant's particular behavioral style. For example, 'All babies can see and hear at birth, but your little boy really uses my voice to help himself calm down.'

Some parents have their own questions and interpretations of the examination, and some even direct the sequence or vigor of the examiner's maneuvers. When they do, she

should defer to them, for, in fact, they are making use of the examination as it was intended. The parents' intuitively derived framework—as evidenced by their questions and assertions—heightens the learning and perhaps also the emotional value of the encounter for them. While clinicians may have difficulty deferring to patients, this 'looking with' under the direction of the parents establishes a trust between practitioner and parent that enables future work together to proceed more efficiently. (Later in this chapter Hanne Munck develops this concept of frames of reference.)

The emphasis of the behavioral information should vary according to the parents' needs. The importance of carrying and consoling the infant might be emphasized with a teenage mother; infant behaviors which show self-consolability or independence, such as hand-to-mouth or habituation, might be pointed out for a mother who is overly protective.

Statements of judgment as to which behaviors are good or preferred should be avoided. American middle-class culture may value independence and social skills, but those same behaviors are not desired or even appreciated among certain other cultures. Japanese parents value and even foster the dependence of the new infant (Caudill and Weinstein 1969), while some African parents believe that direct eye-to-eye gaze is inappropriate (Dixon *et al.* 1981). The examiner's language should be descriptive and informative, emphasizing what this infant can do and how unique she is.

Some parents will not appear to be paying attention or will refuse invitations to become actively involved. Unless the parents flatly refuse to be present for the examination, the practitioner should persist in completing it within their view or earshot. The narration can also be continued, at least intermittently, but without insistence and without the expectation of a response. We have found that these parents often are paying attention but are withholding involvement in a relationship until they can develop a sense of trust.

Preparation/training

Experienced pediatricians and nurse practitioners, when informed by the descriptors and categories of the NBAS, can train their vision to detect a fine level of detail in the infant's behavior and to see coordinations among behaviors as they move through the familiar structure of the physical examination. Achieving an 'informed' level of competence in assessing neonatal behavior takes first a careful reading of the NBAS manual to learn the behavioral points defined on each Scale item. Eliciting and observing the items comes next, and then practice making those observations in the course of the physical assessment. Ideally, a session with an NBAS trained clinician would make the assessments more valid. The final stage of turning the whole examination and assessment into a relationship-building intervention with the parent requires the practitioner to attain a full working familiarity with the structure of the behavioral assessment so that its application becomes intuitive, just as she has done with the physical assessment. This allows a mental availability for observing physical and behavioral characteristics of the infant, narrating those characteristics for the parent, and noticing the parent's response.

Summary

The NBAS manual serves as the most complete compendium of common patterns and descriptors of newborn behavior that are also relevant to parenting and observable during a pediatric assessment. Experienced clinicians, building on their knowledge of infants and parents, can use this guide to expand their pediatric role with parents in the neonatal period, so important as *post partum* in-hospital time is shortened.

The pediatric neonatal physical examination provides a structure for the demonstration and assessment of newborn behavior. Use of the combined examination-demonstration can strengthen the parent-infant relationship. Elicitation of the behavioral capacities of the infant in the course of the physical examination has relevance for both the pediatrician and the parents. The practitioner can assess the normality of the infant's behavior and generate a functional behavioral profile of the infant. Knowledge of this profile is useful in anticipatory guidance and in responding to future concerns about behavior.

In addition, the parents watch their baby unfold behaviorally. They see her protect her sleep state, get upset, and retrieve herself from cry. They also have a first glimpse of the infant's abilities to control and coordinate motor movements and to see and hear. The concurrent observation of the physical assessment reassures parents that the infant is intact and can respond appropriately to painful stimuli. The parents' inevitable hopes and fears for the child can now include some of the actual behaviors of the child. By thus seeing those fantasies grounded in the reality of the child, parents may become less vulnerable to failed expectation, less trapped by unwarranted fears, and more emotionally available in interactions with the child.

III: A MODEL FOR INTEGRATING THE NBAS INTO NURSING PRACTICE

Donna J. Karl, Judith A. Beal and Patricia N. Rissmiller

The NBAS is widely recognized as a valid and reliable measure for assessing neonatal capabilities. Until recently, it has most consistently been used as a research tool. Many clinicians, including nurses, still have not incorporated either the NBAS or infant behavior teaching into their clinical practice. With the current *post partum* emphasis on family-centered care and early hospital discharge, nurses now have the opportunity to integrate infant behavior into their assessment of newborn infants and to make parents active participants in learning about the ways their babies behave.

The Nursing Model of the Scale, which will be described in this section, is a selected neurobehavioral assessment adapted from the NBAS for incorporation into existing nursing practice. It is unique in that it includes both assessment of the infant and intervention with the family. The parents and nurse work together to observe and understand specific neonatal behaviors. Items selected from the NBAS for the Nursing Model highlight the infant's capabilities and are used by the nurse to facilitate reciprocal interaction between parent and baby.

The Nursing Model of the NBAS can be used in any setting where nurses see babies in their first month of life. This includes: the neonatal unit, the primary care office, the early intervention classroom, and the home. It may be used as either a structured assessment/intervention or more spontaneously with families as parents ask questions or the nurse discovers a casual opportunity during which to intervene around infant behavior.

The Nursing Model is guided by the following set of assumptions:

- (1) The model is dyadic in approach and respects the inseparability of parents and newborn infants.
- (2) The model is individualized to assess and meet the unique needs of each family unit.
- (3) The model is a responsive approach to parent-infant interaction. In being responsive to parental needs, the nurse can model a way for parents to be responsive to their infant's needs. While the traditional nursing approach dictates that one must teach it all, the responsive approach selects out critical needs and intervenes with each parent-infant dyad on the basis of what will have the most positive impact.
- (4) The model nurtures parents. It involves listening to them and supporting their availability to the baby by sensitively transferring infant behavior information to them in ways they can understand and remember. It is a positive approach that builds on parent/infant strengths and normalizes deficits.
- (5) The model has a preventive emphasis. It addresses anticipated difficulties in parent-infant interaction in order to prevent problems and improve outcome.
- (6) The model reinforces the notion that babies are dependent on others. Their skill is largely in their ability to communicate their needs for food, warmth, interaction and touch to their caregiver.

- (7) The model implies a non-judgmental attitude in that there are no 'right' or 'wrong' infant behaviors. All behaviors present a need for response and are treated by the nurse as an opportunity to intervene and teach parents about their babies.

The overriding goal of the Nursing Model of the NBAS is to facilitate responsive parenting. To achieve this, it aims to help parents to become good observers of their babies and to develop a varied set of appropriate responses. Parents need to know both that each baby is an individual and responds as an individual and that their baby may respond differently at different times. With this complexity of possible behavioral combinations, it is necessary for parents to observe the baby closely and react in the most appropriate way, utilizing a broad repertoire of responses. Parents need opportunities to learn and experiment with these responses.

The Nursing Model uses the following neurobehavioral assessment of the infant as the basis for teaching and guiding parents. The assessment categories are: (1) Motor Maturity; (2) Interactive Skills/Orientation; (3) State Management; (4) Autonomic/Physiologic Integrity; (5) Reflexes.

Motor Maturity

To assess neonatal motor performance, the Nursing Model focuses on muscle tone and strength, and quality and symmetry of movement. Motor assessment involves a great deal of observation and, in this way, supports parental observation skills. It is always important to point out motor strengths to parents. Smooth, wide-arc arm cycling, for example, can be an indication of a baby's good motor organization. On the other hand, deficit behaviors require intervention. If the nurse observes a jittery baby, she can suggest to parents that swaddling may help the baby control disturbing movements. Babies with high muscle tone often maintain a stiff, non-cuddly posture which parents may interpret as the baby's rejection of them. A high-tone infant can be held in flexed positions to reduce tone and thus help her become more cuddly.

The Pull-to-Sit item is another important maneuver to demonstrate to parents. Parents are often, and quite understandably, fearful about lifting the baby by the arms to an upright position. Observing the baby righting her own head as the nurse pulls her to sit can reduce parental fears about the baby's fragility. A baby in an upright position also offers the parents a different, more animated infant than one lying down or resting at the shoulder. In the upright position the baby often becomes alert.

Interactive Skills/Orientation

Orientation items, including both visual and auditory orienting to animate and inanimate stimuli, are easily incorporated into the Nursing Model's assessment and intervention. These items can be used either in a structured assessment where the nurse has a planned sequence of these items to demonstrate, or in a spontaneous situation when the baby is in quiet/alert state and presents an ideal opportunity for the nurse to initiate a demonstration and discussion about neonatal orientation skills.

Orientation activities can powerfully enhance the connection between parent and infant by demonstrating a baby's ability to respond to people and objects in the environ-

ment. In this activity parents are able to see their infant as more purposeful than babies are frequently perceived. It is best to leave the orientation exercise open-ended and, rather than describing what babies typically do, offer stimuli to the infant and observe with the parents what she does.

For nurses, it is particularly important to elicit animate visual and auditory orientation. Babies may not respond to an inanimate object such as the rattle, especially under less than ideal conditions, e.g. post-circumcision, when hungry, or in a noisy hospital room. They will respond more consistently to animate auditory or visual stimuli. If held in a supine position in front of the mother, a baby is likely to overcome internal physiological stimuli and turn her head to look at the mother when she calls the baby's name. Another tool nurses can use stems from the common belief still held by many parents that newborn infants are blind. Once they understand that young babies can see from birth, parents are often much more observant of and interactive with their baby.

State Management

State management is one of a baby's most useful skills. Babies manage their states by crying or calming down, by waking or sleeping, and by 'tuning out' annoying noise. Using much of her energy for state management, the infant ideally moves smoothly from state to state and utilizes a variety of states.

For the neurobehaviorally intact infant this task of control is easy. The baby can achieve and sustain a quiet/alert state, critical for interacting with people and learning about the world. If presented with a particularly interesting stimulus, she may even suppress a need as strong as hunger in order to look at or listen to it. This infant demonstrates state control by her ability to inhibit her reactions to every internal physiological feeling and every external stimulus. The neurobehaviorally frail neonate, on the other hand, who may be unable to come to a quiet/alert state, who wakes screaming, or reacts to every stimulus in the environment, demonstrates poor state management skills.

An infant uses all available internal resources to regulate states. When stimulation is too overwhelming, however, and she is unable to maintain self-control, she communicates to her parents that help is needed. Parents have a critical role in helping their infant manage states. Nurses can be instrumental in helping parents to interpret their baby's behaviors accurately and intervene appropriately.

Observing infant states

Infant states can be discussed with parents in a variety of ways depending on their interest and need. The nurse may describe a single state in which a baby is observed, or a series of states as the baby moves through them. The nurse might point out: 'Look how quiet and alert Melissa is. She has her eyes open wide and is looking right at you.' or 'Michael was fussy when he was undressed. He calmed himself by putting his hand in his mouth and he is quiet now—just looking around.' This kind of introduction to infant states facilitates parental observation skills and gives them useful information to apply to their baby.

Habituation

Habituation is a behavior that neonates use for protecting themselves from disorganizing stimulation. Observing this phenomenon and explaining it to the parents is an important component of the Scale. Knowing that infants have self-protective capabilities for tuning out annoying environmental stimuli can reassure parents that babies are able to live comfortably in a family while coping with the normal sights and sounds of daily living. Well-organized neonates habituate so effortlessly that parents are often unaware they are doing it, but for infants with less developed internal organization who are more sensitive to external stimuli, the effort to habituate can be difficult and exhausting.

Auditory habituation can be demonstrated to parents with a sleeping baby or an alert baby who has her eyes closed. A rattle vigorously shaken near the child's ear will produce decremental response in an appropriately habituating infant. As parents often mistake habituation for true sleep, they need to know that babies with closed eyes may be habituating. After a particularly stimulating experience, like a bath or physical examination for example, an infant may close her eyes, looking asleep, but remain selectively responsive to environmental stimuli. While keeping her eyes shut, she may, for instance, turn her head to a familiar voice. She may also determinedly squeeze her eyes more tightly shut in response to an aversive sound.

Babies often habituate to bright lights and environmental noises. In a brightly lit or noisy nursery or primary care examining room, for example, the neonate will often keep her eyes shut. When trying to demonstrate an alert state with eyes open, it is often wise to first dim the lights and eliminate the most obvious noises.

Self-quieting activity

Self-quieting activities initiated by the baby to calm herself include: hand-to-mouth efforts, sucking on the fist or thumb, staring, and position changes such as turning the body slightly to one side. Sometimes babies quiet for no apparent reason. Self-quieting activity is readily observable and shows a wide range of individuality in newborn infants. Each baby may use a variety of these behaviors or rely on just one. When a baby is fussy, the nurse can guide parents to wait for the baby to self-calm. They should understand that this is a useful skill for their baby to learn.

Stress cueing

When babies are unable to manage their own states, they use cues to signal that they are experiencing stress and need help. As observers of their baby, parents can learn to recognize these signals so that they can respond appropriately when the baby needs them. Awareness of when the baby is experiencing disorganization and stress can help parents modulate their interaction with the baby. By watching these stress signals closely, parents can intervene without either overwhelming the baby with too much stimulation or not offering enough intervention to soothe her.

Parental role in state management

Nurses are responsible for teaching parents about infant states and state management.

During caregiving activities, the nurse can guide parents through calming maneuvers if the baby becomes stressed. An incremental calming method, described in the NBAS, when modeled for parents, can encourage them to offer the baby only as much help as she needs.

In addition to calming activities, the nurse can give parents 'permission' to initiate state changes in their baby. Many parents feel it is bad to 'wake a sleeping baby'. The nurse can discuss when it may be necessary for them to wake the baby, for example if she is small or a poor feeder and needs to eat frequently. Parents can be shown how to bring the baby to an awake state ready for feeding. The nurse can also help parents to facilitate the baby's quiet alerting. When the baby is available for interaction, her orienting capabilities can be explored.

Autonomic/physiologic integrity

Assessing the physiologic integrity of the newborn infant is a vital part of the Nursing Model of the NBAS. Neurobehaviorally intact neonates demonstrate physiologic integrity. Those who are more frail, however, demonstrate autonomic instability through skin color changes, regurgitating, gagging, and respiratory changes, which can be extremely disturbing for parents. The nurse should show them that such reactions provide them with important information about how to modulate their stimulation of the baby and how, for example, to use various calming strategies in response to an overstimulated infant who begins to pale or to regurgitate.

Reflexes

Many of the skills and self-protective mechanisms with which babies are born are reflexive. Nurses can select reflexes that best demonstrate infant capabilities and their 'reaching out' to the parents. The grasp reflex, for example, can be demonstrated with the infant clasping the parent's finger. This is often surprising for the parent and usually interpreted as the infant relating to the parent. Another reflex commonly discussed by nurses is rooting, which parents can be shown to use for feeding. This reflex, used by neonates as a survival skill, can be elicited by stroking a corner of the baby's mouth or cheek with either a breast or bottle nipple. The baby will turn toward, root for, then grasp the nipple, and begin nursing. Even though these reflexes are automatic, parents interpret them as skills and enjoy watching their babies perform them.

The following two case studies are included to illustrate ways in which the NBAS may be clinically integrated into a busy nursing day. The interventions described are not limited to a hospital setting. They could be equally effective in the home or in a primary care office.

Haley was a normal 2-day-old infant. His mother showed a great deal of interest in him. She had observed him on her own and had much sensitive information to offer about his hunger and satiation cues, his crying and self-calming, and his feeding patterns. As she held him on her lap, he looked at her intently. She snuggled him but seemed unaware of his gaze. I pointed out his behavior to her and mentioned that we know that babies can see at birth. She brightened and seemed surprised. She reported that her family had told her that her 3-year-old daughter was

blind at birth. 'They said babies didn't see at all for the first few weeks.'

I invited her to move her face back and forth in front of Haley. When she did, his eyes then his head moved in wide horizontal arcs following her face as she talked softly to him. Offered a rattle sound, Haley first wrinkled his eyebrows, listened briefly, then moved his eyes searching for the source of the sound before turning his head slowly to locate it with his eyes. His mother was charmed. She reported that she had noticed before that he reacted to loud noises but had no idea he could be so subtle or purposeful about looking for sounds. 'He looks like he's really thinking about it.'

Amelia was born at term, by caesarian section because of failure to progress in labor. She weighed 3185g (7lb 5oz) and was thought to have aspirated some meconium. Except for an initial fever, there were no abnormal signs and she fed well. Her mother, a young primipara, was very concerned about the baby's possible illness, needing repeated reassurance that the baby would be fine before she relaxed and initiated appropriate caregiving. When she learned on the second day *post partum* that the baby would have to stay in hospital for several days of antibiotics after her own discharge, she cried and returned to her questions about the baby's health, which the hospital staff considered had already been answered.

Concerned about the potentially negative effects of this mother-infant separation and the development of a 'vulnerable child' syndrome, I talked with the mother. She described the unexpected caesarian section and her sadness about not having a normal, vaginal birth. I listened then clarified the logistics of the baby's hospital stay, explaining that she would be able to visit her whenever she wished. I took an instant photo of the two of them together for the mother to take home with her, and I performed the NBAS at the bedside with her.

Amelia maintained a sustained, quiet alert state during which she visually oriented to my face, to my voice, and to a red ball, using multiple tracking pathways. She consistently turned her head in both directions to a rattle sound. The mother watched her daughter's performance, almost holding her breath, then said, 'My you are such a smart baby.'

I discussed Amelia's organization and orientation skills with the mother, reminding her that a sick baby would lack the energy and motivation to do all of the difficult work Amelia was able to do. I pointed out stress cues to illustrate the ways Amelia was telling us that she was working hard, and her hand-to-mouth behaviors to illustrate how she was managing the stimulation.

When the mother called Amelia's name as I held the baby in a supine position in front of her, the baby turned her head immediately to look at her face. Her mother returned the gaze and said, 'You won't forget me, will you.'

IV: USING THE NBAS WITH FAMILIES: A PSYCHOTHERAPEUTIC APPROACH

Hanne Munck

Parenthood: opportunity and vulnerability

Pregnancy, birth and the process of attachment to a newborn infant affect every aspect of a parent's life. The inner turmoil this creates results in a state of being that energizes the parent to meet the baby's needs and produces a heightened sensitivity to the subtle cues of the baby. At the same time, it produces feelings of heightened vulnerability where all kinds of problems, even seemingly small ones, can tip the balance of the parent's well-being and cause feelings of inadequacy, guilt and even despair, thus disturbing the emerging parent-infant relationship.

However, the energy that flows from the parents toward their baby is deep-rooted and strong, motivating them to cope with whatever is standing between them and the infant. Even when their motivation seems blocked or disturbed it is essential for the clinician to have a basic trust in, and a respect for, this force and to find ways to ally herself with it.

The NBAS as a therapeutic tool

The use of the NBAS can help the clinician develop a more differentiated listening and supportive stance toward the infant and parents. In this way the Scale can be looked upon as a therapeutic tool. Its therapeutic value is not to be found in specific items, but in an overall attitude the clinician brings to the Scale. She should be guided by the infant and respond to the infant's behavior in a supportive and communicative way.

Clinical vignettes

A request for an NBAS examination at the Neonatal Intensive Care Unit (NICU) had come for a 10-day-old boy, described as being small for his gestational age. He was born at 38 weeks, weighing 1800g, and was very weak and hypotonic. His mother was well-educated, married, and had already given birth to two healthy children, then 3 and 7 years old.

As is the custom in many NICUs in Denmark, the mother was quite involved in the ongoing care of her newborn infant. However, she was alarmed and very worried about him. When I met with her, the baby was lying in her arms, and she was constantly rocking, caressing, and talking to him. Her reaction was quite understandable. The way she handled him, though, seemed very inappropriate. Her almost incessant motor restlessness and stimulation stressed the infant even further. However, I was very careful not to comment directly on this. When I felt I had developed a good rapport with the mother, I very cautiously began an NBAS observation. As she watched, it was now I who provided the stimulation to her infant. He was easily overtaxed. This situation allowed me to comment more freely on his low input threshold. He was too weak to cry loudly,

and his physiological reactions, his pallor, hypotonicity, open mouth, and strained respiration showed us how exhausting it was for him to be stimulated. At the same time, because I handled him with care and provided him with long pauses when I waited and swaddled him, he was now able to focus, to follow a face, and to listen to a voice. Respecting his need for pauses enabled him to recuperate, and his tone and movements began to improve.

The mother then realized for the first time how fragile her infant really was. She told me that in her frustration she had interpreted his lack of response as a rejection of her. As a result of the NBAS observation, her anxiety and caring for him could now find new outlets. No longer overstimulating him, she began actively to protect him. That same afternoon she found a protective cover for his crib and discovered that sometimes he was more relaxed in the crib than in her arms. This very appropriate change in her behavior was brought about by our shared observation, which made it possible for her to recognize and differentiate her own perceptions of her baby. This was further refined, as she is now able to appreciate the infant's strengths as well. Having been reassured of these strengths and competencies, she has now acquired the emotional strength to recognize and accept his weaknesses.

The 'informal NBAS'

Often we find that mothers in crisis situations are in fact better able to handle their infant than they realize. In such cases, if our aim is to strengthen the parents' confidence in their parenting skills, our clinical intervention may be characterized by a highly integrated and almost imperceptible administration of the NBAS. Such intervention encompasses all the experience and knowledge the clinician brings from her training, and may be described as an 'informal' administration of the Scale.

The clinician who has been trained to reliability on the NBAS and has experience using the Scale clinically, is able to make very accurate observations of infant behavior in ordinary settings with the parents. One can get a qualified impression both of the infant's strengths and difficulties in all areas of functioning and of the degree to which the mother's caregiving is facilitating the well-being of the child. The 'informal NBAS' relies not on a fixed abbreviated version of the Scale, but rather on a flexible focus on whatever is appropriate in each individual setting and in every parent-infant interaction.

In this clinical vignette, the mother is standing next to the incubator with her 4-day-old preterm son. 'The awful thing is that you never know how to make him feel at ease', she says with tears running down her cheeks. As she says this, she is holding both his feet calmly in one hand while letting him grasp the fingers of her other hand. The boy is relaxed, his body slightly curved, his color is good, his respirations are normal and his eyes are open. The professional trained in infant observation will have no trouble seeing that this mother is providing exactly the kind of support her baby needs. The goal of the intervention is to help her see this also. Helping this mother recognize her own strengths and the validity of her own observations need not entail taking over and demonstrating the infant's capabilities using the full Scale. This could make her feel even more helpless. Rather, this special moment and situation can be used to focus on the baby's

behavioral cues. This form of subtle supportive guidance is more appropriate by far in this instance, since it nurtures the mother and at the same time confirms her in her parenting skills.

Focus on the infant or focus on the mother?

Individual patterns of more deep-rooted conflicts and deficits, stemming from the parents' own developmental history and reactivated by the present events, can have a tremendous influence on the mother's relationship with her infant. The more such problems are perceived actively to interfere with her capacity to bond with her newborn baby, the more cautious we have to be in selecting our focus of intervention.

Anna's 6-year-old son was delivered by emergency caesarian section. The nurse observed that Anna's relationship with her baby was lacking affection and pleasure and suggested an NBAS examination. During the first contact with Anna and her baby, it immediately became clear that she was emotionally stressed and was not interested in talking about her baby at all. She explained that her delivery had made her feel victimized, as if she had suffered a violent attack. She had talked with no-one, she felt detached from her baby and overwhelmed by emptiness and despair. Everybody was telling her that she was lucky that her son was healthy and wonderful, but she had the feeling that he was not at all hers. All the positive things being said about him only made this feeling worse. 'I didn't get a baby,' she said, 'I just got a heavy responsibility.' Nobody asked her how she felt. Nobody saw that she was not happy. She was ashamed at having such self-centered and forbidden thoughts and feelings, and she blamed herself for everything.

Using the 'informal NBAS' enables the clinician to monitor the infant's activity and reactions, and at the same time to concentrate on the mother and listen to her story. After four sessions of talking about her inner turmoil and thoughts, Anna's emotional tone and affection towards her baby changed dramatically. Once she had absorbed the experience that somebody cared about her for her sake, somebody who listened and understood, she was then able to transfer this concern to her infant, to discover him on her own, and to begin to enjoy being with him for the first time. However, she still had difficulties, and through continued clinical contact it became clear that a considerable amount of neglect and abandonment in her life had aggravated the impact of her negative delivery experience. In this intervention, it was absolutely necessary to focus on the mother's preoccupations. If it had focused on her baby before she was ready, she would have been at great risk, once more, of being deprived of the experience of becoming a mother.

In clinical work we are guided much more by the uniqueness of each family—their personal resources, and their ways of experiencing and coping with their situation—than by the external characteristics of the situation alone. Hence, it is crucial to have the courage to meet every family without preconceptions or prepared programs, to come open-minded and ready to listen, not knowing in advance what form our intervention may take.

V: FAMILY ADMINISTERED NEONATAL ACTIVITIES (FANA)

Ida Anne Cardone and Linda Gilkerson

The Family Administered Neonatal Activities (FANA) (Cardone and Gilkerson 1989, 1990, 1992) is a specialized adaptation of the NBAS which involves families in a hands-on exploration of their newborn infant's behavior. The activities are nested within a guided process which offers families an opportunity to begin to process the labor and delivery experience, to observe and interact with their baby with the supportive presence of a trained facilitator, and to integrate the reality of the infant with their prenatal expectations. The FANA integrates the practices of short-term, focused, psychodynamic interviewing with a family empowerment approach. Previously published aspects include the theoretical framework, with illustrative clinical case examples (Cardone and Gilkerson 1990); detailed description of the role of the facilitator (Cardone and Gilkerson 1989); specific strategies for its adaptation for special populations (Cardone and Gilkerson 1992); and discussion of the relative advantages of the NBAS and the FANA for different clinical needs (Cardone and Gilkerson 1990). In this section we provide an introduction to the FANA process and to its adaptation for families of infants born with Down syndrome.

The FANA process

The primary goals of the FANA are:

- to begin the process of re-establishing a sense of equilibrium and mastery over the events of pregnancy, labor and delivery;
- to affirm and enhance parental capacities to observe and engage with their infant;
- to provide an opportunity for the integration of initial parent perceptions and expectations with the infant's present behaviors.

The FANA typically lasts about 45 minutes and takes place on the first day *post partum* in the mother's room, with the mother, father or other support person present. Given the shorter hospital stays generally allowed today, FANAs may be administered as soon as five hours *post partum* or on an outpatient basis within the first 28 days. At our hospital, the FANA is routinely offered to all first-time families and to families referred by their physician or primary nurse. The reasons for referral are multiple, including parental fear of handling the infant, resurgence of grief due to prior perinatal loss, or distress from an especially difficult labor and delivery. Thus, the FANA serves as a supportive activity to promote competence and adaptation for families who are coping well with the transition to parenthood; as an intervention for functioning families experiencing situational stresses around the birth of a new baby; and as an assessment in situations where pre-existing or current family issues have raised concern about the family's ability to care for the infant at home.

The FANA process includes four phases: Chart Review, Parent Perception Interview, NBAS Application, and Integrative Summary.

Phase I: Chart Review

Prior to meeting with the family, the FANA facilitator reviews the mother's and the baby's medical charts to cull relevant health and psychosocial data including pregnancy history, labor and delivery information, and infant status variables. The Chart Review orients the facilitator to the family in two ways. First, taking time to read the chart helps to slow down the facilitator, to clear her mind of other responsibilities, and to focus attention on the family. This is central to the role of the FANA facilitator. Second, the information provides a context for understanding the family's immediate experience. The facilitator keeps in mind the antecedent history and how this history might have an impact on the parental observation and perception of their infant and on their sense of themselves in relation to her.

Phase II: Parent Perception Interview

Phase II begins the family contact portion of the FANA. The facilitator greets the family and then engages with them in a 10–15 minute conversation about: (i) their personal well-being, (ii) their labor and delivery experience, (iii) the baby's name and the meaning of that name to the family, and (iv) their observations and perceptions of the infant so far.

The facilitator's primary role is to listen empathically, encourage elaboration, accept the expression of feelings, and acknowledge questions and concerns. In this phase, the facilitator does not normalize the experience (as with, *e.g.* 'All new mothers feel that way'), or provide reassurance ('You'll feel better soon'), or teach new information ('In three or four more weeks, your infant will be able to hold her head up more steadily'). For example, when parents describe their labor and delivery, their experience is acknowledged as uniquely theirs and, whether unexpectedly difficult or easy, treated as an event for which they are entitled to have strong feelings. The assumption here is one that underlies classic psychotherapeutic interventions: that is, providing parents with the opportunity to make salient points and then discharge strong feelings about a major developmental event begins to help them re-establish a sense of equilibrium and mastery. The Parent Perception Interview also provides the first in a series of opportunities to acknowledge parental observations of their infant as well as their interpretations of the behaviors ('You've noticed so much about your baby already'). The techniques of 'mirroring' and 'reframing' (Cardone and Gilkerson 1990) are used to help make parental observations and concerns more relevant to the family and to convey acceptance of the family's subjective experience. The goal for this phase is to set a tone of emotional sensitivity, responsiveness and mutual engagement.

Phase III: NBAS Application

Next, with the support of the facilitator, the parents engage in a 15–20 minute, hands-on exploration of their baby's behavior using 28 items selected from the NBAS. Depending on the infant's state, the activities include the habituation items (excluding the heel-stick), selected reflexes and muscle tone, and animate and inanimate orientation. The reflexes include those which, in pilot work, appeared to be both easy for parents to elicit

and of special interest to them, *e.g.* the plantar, Babinski, hand grasp, crawling, walking, sucking and glabella responses. The facilitator relies on seven interactional processes adapted from Bromwich (1978): inviting, elaborating, modeling, alerting, encouraging, describing and guiding. The NBAS Application begins by inviting the parents to notice what their infant is doing at that moment. The facilitator integrates the parents' comments into a discussion of infant state. Throughout the NBAS Application, the parents are encouraged to continue to comment on state changes and on the infant's efforts toward self-regulation.

Typically, the father is invited to use the flashlight to elicit habituation. The facilitator models the activity by shining the light across her hand and explaining: 'Here's a flashlight. If this is baby's closed eyes [the facilitator presses her thumb against her index finger], let's see what happens when you run this light across them.' The mother watches, shares her observations along with the father's and then tries the activity herself with the rattle and the bell. The parents are asked if they would be comfortable placing the infant on the bed and unwrapping her. This provides another opportunity for them to watch how she handles changes in her environment. The facilitator guides the mother's or father's hands to the baby's ankles to engage them in flexing, then extending the infant's legs, saying, 'Let's see what his muscles feel like.' At this point, parents often comment on their infant's strength. With support, parents are then guided in eliciting the reflexes. The Babinski is usually easily elicited by parents after an explanation. The plantar may need to be demonstrated. Parents often take great pleasure in feeling the hand and toe grasp. One mother described the toe grasp as the first hug from her baby. They may also elicit standing and crawling. Seeing the baby stand is a powerful experience for many parents. One mother said: 'I knew from that very moment he had a future. I can't wait!' Fathers often are exuberant about their infants' ability to lift their head off the blanket. As in the examiner-administered NBAS, the orientation items, particularly turning to the parent's voice, are frequently the highlight. One parent is guided in holding the swaddled, supine infant with one hand on the small of her back and the other, flattened hand, under her head. The other parent standing to the side is encouraged to call the baby's name. The parents usually switch roles so that each has a chance to experience the infant's response to their voice. Within the context of usually joyful parental feelings, the facilitator and the parents talk about the ways babies have of truly knowing their parents. The parents take turns using their face and voice to elicit visual following. Parents often comment on the pleasure they experience in watching their partner and their baby get to know one another. The ball and the rattle are used to elicit auditory and visual following. The facilitator tends to wait for the parent's response to an infant's behavior before responding herself. When appropriate, she may cast the parents back on their own experience by asking 'What did you see?' or 'How did that feel?', or may provide feedback from the point of view of the baby: 'I heard you, Mom!' or 'She heard you!' Last, to encourage parental authority, the facilitator speaks about the baby as belonging to the parents and asks for permission if she needs to interact with the infant: 'May I pick up your baby?' Throughout the NBAS Application, the family is encouraged to observe and share not only their infant's responses, but also

their own responses to what they are seeing and doing and feeling. The tone is often one of quiet and absorbed attentiveness. However, for families who have experienced prior or recent losses, the tone may be one of sadness and of wonder (for case presentations, see Cardone and Gilkerson 1990).

Phase IV: Integrative Summary

During the Integrative Summary, parents are encouraged to reflect upon their initial observations and perceptions of the infant with the behaviors displayed by her during the NBAS Application. The facilitator begins by briefly summarizing what the parents observed: 'Let's think about what we just did together. We saw . . .' Next, she engages the parents in a series of open-ended questions: 'How did you feel about what we did together?' 'What did you see that you expected to see?' 'What did you see that surprised you?' When appropriate, the facilitator relates the parents' observations back to their initial perceptions of the baby: 'Remember in the beginning you mentioned that she looked weak to you? What are your thoughts at this point?' The facilitator helps the parents develop expectations for the immediate days to come and provides anticipatory guidance relevant to the issues that have emerged.

More often than not, the initial parental perceptions are affirmed by the baby's behavior. At times parent perceptions shift. For example, one young father's immediate concern was: 'I don't think she likes me; she cries when I hold her.' During the NBAS Application, this father was able to elicit visual following as he looked into his daughter's eyes and she followed his face through a 45° arc; he saw her head turn quickly in his direction as he called her name. He also experienced her crying as just one of six states that she could be in and saw that he had some considerable influence in soothing her when she cried. In the Integrative Summary, the father was encouraged to draw his own conclusions: 'She really looked at me!', this father said with pleasure.

Modifications for families of infants with Down syndrome

For families whose newborn baby unexpectedly has Down syndrome, emotional support is a large component of effective care during the neonatal period. Thus, the FANA process was adapted to extend the first phase into two contacts to allow families more time to begin to process the powerful feelings that accompany the birth and to receive support as they reach out to family and friends. Engaging the families with their infant through the NBAS application occurs on the third contact. The modified FANA has three primary goals:

- to recognize and acknowledge the parents' emotional responses to the birth of their infant;
- to facilitate their efforts to reach out to family members and friends at a time when they need support but simultaneously may be apprehensive or ambivalent about making contact;
- to provide an opportunity for parents to observe and interact with their infant in order to highlight her uniqueness, their capacity for observation, and the special challenges and rewards of such interaction.

Visit 1. Parental response to the birth

The initial contact takes place in the first few hours after birth. The timing of this visit is decided in collaboration with the family's primary nurse. In those first, important introductory moments, the facilitator must convey several messages. First, there must be a clear, gentle acknowledgment of the birth in the context of acceptance for whatever feelings the parents bring to this moment: despair, rage, helplessness or acceptance. Second, the facilitator must provide a steadying and supportive presence. Are the parents tired? Are they comfortable? Has a bed been provided for the father if he wishes to spend a night in the hospital? Anxieties and needs must be acknowledged at the same time as efforts at soothing prevail. Third, the facilitator must convey a sense of certainty of purpose. Parents need to feel that they are in good hands at a time when they may feel on very tentative ground and have a sense that time is standing still. The facilitator should alert the parents to what is going to happen next: 'I would like to see you early tomorrow (or later today). You have so much to say. We'll talk more. I'll see you one more time after that before you go home and we will engage [infant's name] together.' One father remarked, 'She [the facilitator] went right into action. It gave us the feeling that there was some kind of rhyme or reason to this thing.' Finally, the facilitator must convey a sense of interest in the infant, at a time when the parents may not yet know how they feel about their baby or what they may hear from family and friends. As in the FANA, the facilitator may say, 'Tell me what you've noticed about your baby so far.'

Visit 2. Exploration of parental initiative to announce the birth

In this visit, which usually lasts at least 30 minutes, there is an effort to examine more fully what the parents understand about Down syndrome and to support them in their efforts to reach beyond the world of the hospital. Typical questions explore what they will say to family and friends and how they will say it. The facilitator might begin by asking, 'Who have you told about the birth of your baby?' At the time of the second visit, parents may ask about their child's developmental needs and may be ready for contact with an experienced parent of a child with Down syndrome. The facilitator must be knowledgeable about both the developmental capacities and needs of children with Down syndrome and the services that are available in the community. The facilitator need not be an expert on Down syndrome but must have enough knowledge to reflect and discuss parental questions, to work collaboratively with other team members, and to link families with support in the community.

Visit 3. NBAS Application and Integrative Summary

During the third visit, usually held on the second day *post partum* near the time of discharge, the focus is on the infant and the parents together. The facilitator begins the NBAS Application: 'There are many, many different challenges and rewards your infant will present you with in the months ahead as you get to know each other. Just as all children change, over weeks and months, she will change. Let's look together at what we see her doing right now.' In the authors' experience, the facilitator usually touches the infant more and models more interactions than in the FANA. One mother said, 'It was

good to see the facilitator hug Mary and talk to her in an affectionate way. I realized then how lovable Mary could be and that, more than anything, she was a baby.' As with any infant, the whole range of infant competencies and challenges are seen. With the most involved of the infants, one may see very low tone, drooling, a poor sucking reflex, and difficulty in achieving an alert state. Parents may need an opportunity to express their disappointment: 'Lisa never gives me a chance to calm her. She doesn't cry; she just whimpers every three hours.' This lack of response can be deflating for parents because the neonatal cry leads to parental soothing strategies, which in turn may promote a sense of parental mastery, engagement and attachment. The task of the facilitator is to hold the process: to hear the parental observations, acknowledge the sadness and disappointment associated with it, and to stay connected with the family and the infant in the present moment.

The more common scenario, however, is an infant with good tone and state organization who can alert to the parental voice. Parents report how important it is to see the infant respond: 'What was so good about the FANA was she wasn't just sitting there. She was responding! Right at that moment, we felt some relief, that at least she was doing this. She could see me and she could hear me.' Parents doubt that they would have seen these qualities of their infant if left to find them on their own: 'It was so overwhelming that first week. I just think we wouldn't have noticed much of anything.' Parents held on to these early memories of their infants' responsiveness when at home: 'I remembered what she had done in the hospital and that helped me keep the faith.'

In the Integrative Summary, the facilitator provides an opportunity to bring the parents back to their original observations and to reflect on these in light of their infant's behavioral responses. For families with infants with Down syndrome, the summary also offers time to focus on the transition home and on the resources available to families. Throughout the FANA, the facilitator needs to maintain a receptive and steadying posture that fully accepts the family's emotional responses and that respects and reflects the wholeness and integrity of this new life.

Conclusion

The NBAS offers the gift of understanding development as a mutual process. The FANA adaptation puts this gift in the hands of families as parents respond to their infant and the infant responds to her parents.

VI: PARENTS' PERCEPTIONS AS GUIDES FOR CONDUCTING NBAS CLINICAL SESSIONS

Dieter Wolke

The idea that the infant represents a *tabula rasa* and can be shaped according to the caretakers' will and behavior has long been abandoned since publication of the landmark research by Bell (1968). Infants are now seen as active organisms and agents creating their own environments in interaction with their caretakers (Scarr 1992, Plomin and Daniels 1987, Plomin and Rende 1994).

The NBAS was the first structured tool to assess the newborn infant's behavioral organization. It has been successfully used in research to assess the effect of pre- and perinatal events on the neonate's behavior (*e.g.* Sepkoski 1986, St James-Roberts and Wolke 1989, van den Boom and Gravenhorst 1995). In the late 1970s the NBAS began to be used more frequently in demonstrating the individual neonate's abilities for self-organizing behavior and was employed as a tool to enhance mothering (*e.g.* Widmayer and Field 1980, Myers 1982, Worobey and Belsky 1982). The perinatal period was seen as a window of opportunity for enhancing parent-infant communication (Helfer 1987). In much of this research it was assumed that demonstrating or actively involving parents in the NBAS assessment would influence their understanding of the skills and abilities of their babies and thereby "create a conception of the newborn as an organism that does more than 'eat, sleep, cry and poop'. Such awareness . . . would provide parents with 'windows' to see their babies and 'handles' to grab on to during interaction" (Belsky 1985). Although positive effects on parent attitudes or behaviors have been demonstrated in some studies, they have been limited or not found in others (Liptak *et al.* 1983, Belsky 1985; see Worobey 1986a for a review).

These failures are not explained on methodological grounds alone (Dolby *et al.* 1982, Belsky 1985, Heinicke *et al.* 1988). Rather, there is growing awareness that single short interventions have no or only very limited long-term effects. Interventions have to be repeated over a period of time, and need to center on parent-infant interaction and adhere to a structured curriculum to have measurable long-term effects (Als *et al.* 1986, Shonkoff and Hauser-Cram 1987, Achenbach *et al.* 1990, Wolke 1991b, McCormick *et al.* 1993). The expectations that a single NBAS demonstration would result in major changes has been over-optimistic and unrealistic. This interpretation was also not intended by the developers of the NBAS. Nugent (1985) defined the major goal of the NBAS as working to establish a collaborative relationship with the parents, using the baby's behavior as the language of communication. There are other possible ways to establish such a relationship, for example by talking to the mother, the father, or possibly the siblings. Whichever way is chosen, an important consideration is that the clinician is dealing not with simply an infant and a mother, a father or a sibling, but with a family (Belsky 1985).

The early NBAS 'education projects' dealt with the parents as if they were now a

tabula rasa: if they could see and learn about their baby this would change their caretaking in the intended way. However, parents bring cultural and personal experiences into this new relationship. These experiences can be global, such as their representation of relationships and attachment (e.g. Belsky and Isabella 1985), or specific, like their previous experiences of caretaking actions such as diaper changes. Parents have preconceptions regarding their infant's personality and beliefs about what supports or hampers the development of children (McGillicuddy-DeLisi 1982, Sameroff and Feil 1985, Sigel 1986). Preconceptions have been studied in many guises and called different names such as internal working models (Murray-Parkes *et al.* 1991, Cassidy and Berlin 1994), stereotypical preconceptions (Stern and Hildebrandt 1986), parental perceptions (Hubert and Wachs 1985), subjective components or social perceptions (Bates and Bayles 1984, Wolke and St James-Roberts 1986), to name but a few. There is now ample evidence that, for example, mothers' reports of infant characteristics such as temperament are partly reflections of expectations (e.g. during pregnancy—Zeanah *et al.* 1986) and maternal characteristics such as anxiety, depression or self-confidence (Sameroff *et al.* 1982, Cutrona and Troutman 1986, Vaughn *et al.* 1987). Even mothers and fathers, although rearing the same infant, show more divergence than agreement in their views about their infant's temperament (Bates 1987, Wolke and St James-Roberts 1987) or behavior (Achenbach *et al.* 1987). Parents also bring behavioral programmes with them which are neither reflex nor conscious but intuitive (Papousek and Papousek 1987).

The influence of parental characteristics and beliefs can already be demonstrated in the first days of life. Maternal reports of the infant as irritable or difficult are better predicted by maternal characteristics, in particular maternal feelings of lack of confidence in caretaking, than by 'objective' infant assessments such as repeated NBAS administrations, direct observation or nurses' ratings (St James-Roberts and Wolke 1986, 1988; Wolke and St James-Roberts 1987; Wolke 1990). A mother who lacks confidence in taking care of her infant attributes problems to her own inability and is tense when dealing with her baby, perceiving her as more irritable and difficult (Wolke and St James-Roberts 1986).

To summarize: (1) Demonstrating the NBAS to parents or helping them to administer NBAS items once is unlikely of itself to have long-term implications for parental caretaking and infant development. (2) Mothers and fathers are not scientific (i.e. purely 'objective') observers of their baby; they are emotionally involved (and that is one of the most important characteristics of parenthood) and have preconceptions about their infant's behavior. (3) Parents' perceptions of their baby are rooted in 'objective' infant behavior as well as determined by expectations and parental characteristics. Under two circumstances a deviation is found from this general finding. First, if a parent suffers significant psychopathology (e.g. puerperal psychosis) then the perceptions may be exclusively determined by parental intrinsic factors and little related to 'objective' infant behavior (Hipwell and Kumar 1994). Second, if the infant is highly irritable or an excessive crier then parents are highly accurate in reporting these behaviours (Barr *et al.* 1988, St James-Roberts *et al.* 1993, van den Boom 1988, Wolke *et al.*

1994b). Extremely difficult behaviors override any subjective perceptions the parents may hold.

Maternal report measures of neonatal behavior and caretaking confidence for clinical use: the Mother and Baby Scales (MABS)

If parent characteristics are important in influencing parent perceptions of infant behavior and these in turn are likely to influence caretaking behavior, then it appears important for clinical work with parents to gain information about these social perceptions.

We have developed a parent-report measure, the 'Mother and Baby Scales' (MABS—Wolke and St James-Roberts 1987; see Appendix 2), which includes a number of subscales that assess neonatal negative emotionality and alert behavior* and parental perceptions of their own caretaking confidence. The infant subscales were designed to reflect naturally occurring behaviors of newborn infants. They are not given to test whether the parents have observed the NBAS administration accurately (*e.g.* Widmayer and Field 1980, Stringer *et al.* 1986) but are filled in before administering the NBAS in the presence of the parent(s) to determine clinically relevant perceptions of neonatal behavior (*i.e.* highly irritable, average, very content). Similarly, the caretaking confidence measures of the MABS provide a quick check as to whether or not the parents feel confident in dealing with their baby.

Neonatal behavior

Irritable behavior occurs in two major settings: during feeds and in between feeds. Two parental report scales measuring these aspects, labeled 'Unsettled-Irregular (UI)' (Appendix 2A) and 'Irritable during Feeds (IDF)' (Appendix 2B) have been developed, subjected to factor analysis and psychometric testing, and are part of MABS (Wolke and St James-Roberts 1987; St James-Roberts and Wolke 1988, 1989; Wolke 1989, 1990; see also Murray 1994). As shown in the appendices, each item is rated on 6-point unidimensional rating scales ranging from '0' (not at all) to '5' (very much/often). The means, standard deviations and internal consistency coefficients are given in Table 5.3.

Furthermore, to provide a reliable but even shorter measure, a temperament impressions rating of infant 'Easiness (E)' was designed and subjected to psychometric testing (Wolke and St James-Roberts 1987; St James-Roberts and Wolke 1988, 1989; see Table 5.3). The three item 6-point rating scale is shown in Appendix 2A ('Overall Impressions and Experiences'). Some authors (*e.g.* Carey 1982, 1983) have suggested that impressionistic measures (*e.g.* the Easiness scale) may be less valid measures of infant behavior than parent-report measures inquiring about specific behaviors (*e.g.* Unsettled-Irregular).

*Measures of neonatal alertness are included in the MABS; however, negative emotionality (irritability and amount of fuss/cry) rather than early alertness have been found to have more significant influence on later caretaking behavior and attachment (Wolke and St James-Roberts 1987, van den Boom 1988, van den Boom and Hoeksma 1994) and are thus of particular clinical relevance. For reasons of space limitations, the discussion focuses on the 'difficult neonatal behavior' scales only.

TABLE 5.3
Psychometric indices and clinically relevant cut-off points of the Mother and Baby Scales
(MABS-Neonatal)¹

Sub-scales ²	Mean	SD	Reliability ³	Clinical bands ⁴		
				≤-1 SD	Average	≥+1 SD
NEONATE						
Unsettled-Irregular (15)	31.8	15.6	0.92	16	17-47	48
Irritable during Feeds (8)	11.8	8.3	0.86	3	4-20	21
Alertness-Responsiveness (8)	26.5	7.6	0.83	18	19-34	35
Alertness during Feeds (5)	11.0	6.0	0.82	5	6-17	18
Easiness (3)	9.4	2.3	0.82	7	8-12	13
PARENT						
Lack of Confidence in Caretaking (13)	26.5	14.5	0.93	11	12-41	42
Lack of Confidence in Feeding (8)	10.2	8.8	0.84	3	4-19	20
Global Confidence (3)	10.3	2.8	0.81	7	8-13	14

¹MABS version for 6- to 8-week-old infants is also available but not shown here.

²Number of items per scale in parentheses.

³Cronbach's alpha.

⁴Numbers in bold indicate cut-off scores (≤/≥) for high irritability, low responsiveness or low confidence.

This could not be confirmed in our empirical research. First, the convergence of Easiness with Unsettled-Irregular ($r = -0.68$) and Irritable during Feeds ($r = -0.40$) was moderate to high (UI and IDF correlated $r = 0.43$). Second, good to very good agreement with 24 hour detailed behavior diaries (*i.e.* amount of fussing and crying during the day, $r = -0.66$, and during the night, $r = -0.53$) was found (St James-Roberts and Wolke 1988). Third, the convergence with objective assessments, such as the NBAS (*e.g.* Regulation of State on day 2: $r = 0.52$), nurses' ratings and direct observation, was even slightly higher for the three item Easiness scale than for the specific behavior rating scales (St James-Roberts and Wolke 1988, Wolke and St James-Roberts 1987).

Maternal confidence

The 13 item subscale of MABS labeled 'Lack of Confidence in Caretaking (LCC)' assesses maternal feelings of self-efficacy outside the feeding situation (Appendix 2A); the eight item subscale 'Lack of Confidence in Feeding (LCF)' (see Appendix 2A) assesses maternal confidence to breast-feed efficiently (Wolke 1989, 1990; Wolke and St James-Roberts 1986). A short (three item) impressions measure, 'Global Confidence (GC)' was also developed and tested (Appendix 2A, 'Overall Impressions and Experiences'). The psychometric properties are shown in Table 5.3. The separate MABS subscales of maternal confidence show high convergence: LCC vs LCF: $r = 0.57$; LCC vs GC: $r = -0.68$; LCF vs GC: $r = -0.67$.

Clinical use of the MABS with the NBAS

Using the NBAS, our aim is not to show off the amazing newborn infant or in discussions with the parents to provide recipes for caretaking. Rather, our approach is

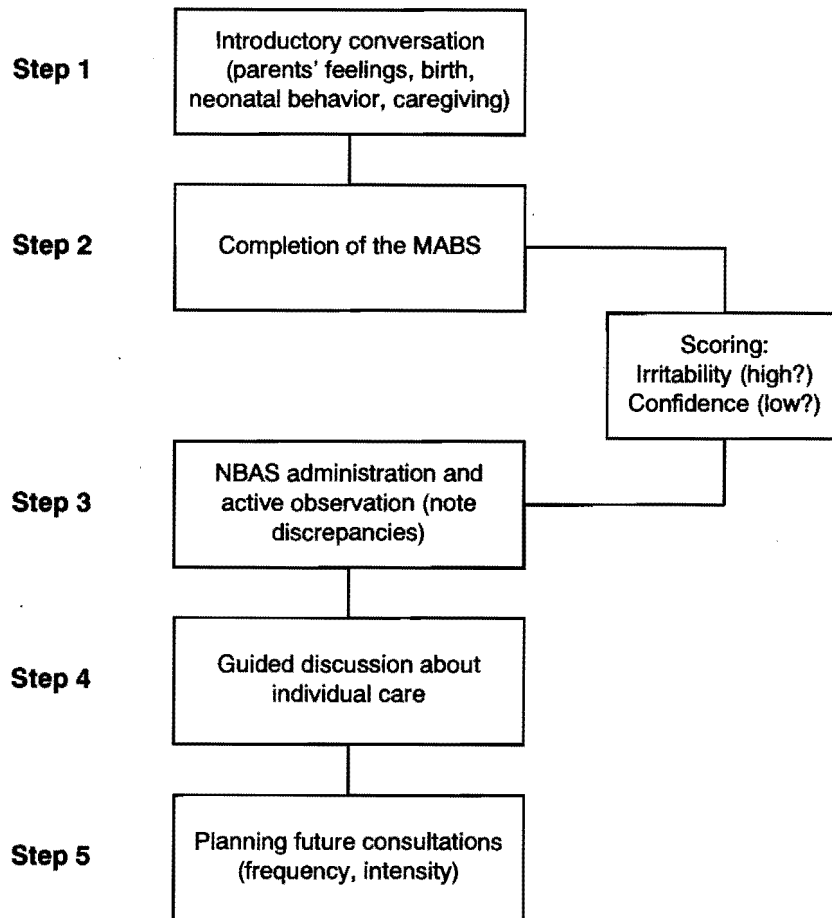


Fig. 5.1. Clinical session using the NBAS: the five-step approach.

geared toward pointing out *principles* of caretaking (Wolke 1987a,b, 1991a,b; Wolke and Eldridge 1992):

- learn to observe your infant;
- design a care plan which suits your infant with her individual characteristics;
- grow up with your infant—she will change and you need to change your caretaking behavior accordingly.

A five step approach, as summarized in Figure 5.1, is used.

Step 1

The clinician has a brief unstructured introductory talk with the parents. Enquiries are

made about their experiences of birth and hospital care; how the mother feels now (are there still pains or problems related to labor and delivery?; does she feel tired?); how the baby has been in the first few days; how she is feeding and sleeping; how the mother feels about caretaking. The clinician also explores how the siblings (if any) have taken to the new baby and how the father (if present) is coping. The introductory conversation is important to establish rapport and to indicate to the parents that the clinician is interested not only in the baby but also in the family as a whole.

Step 2

If no problems with feeding are mentioned, only the MABS subscales shown in Appendix 2A (Unsettled-Irregular, Easiness, Lack of Confidence in Caretaking, Global Confidence and Alertness-Responsiveness) are given to be completed by both parents. If irritability, frequent crying or problems with establishing breast-feeding were mentioned (step 1), then the MABS subscales shown in Appendix 2B (Irritability during Feeds, Lack of Confidence in Feeding, Alertness during Feeds) should also be given to the mother (they are unsuitable for the father to complete).

The UI, IDF, LCC, LCF and the two alertness scales are scored by totalling the individual item scores per subscale separately. Those scores which need inversion (*i.e.* 0 scored as 5, 1 as 4, 2 as 3; 3 as 2, 4 as 1, 5 as 0) are indicated in the appendices ('R' in the left-hand column). The two impression measures GC and E have scores ranging from -3 to +3. These need to be converted as follows: -3 = 1, -2 = 2, -1 = 3, +1 = 4, +2 = 5, +3 = 6; the converted scores are then totalled separately for GC and E, respectively. The total subscale scores are compared with the standard scores shown in Table 5.3. Scores indicating high irritability/difficultness, low responsiveness of the baby or low confidence (all defined as >1 SD below or above the scales mean respectively) are of particular clinical interest.

Step 3

The NBAS is presented in accordance with the guidelines given by Nugent (1985). The advantage of having assessed the parents' perceptions beforehand is that the clinician can direct the dialogue during the NBAS administration accordingly. For example, if a mother perceives her infant as quite irritable, attention can be guided to demonstrating the control behaviors of the baby in self-soothing and how to encourage these. Often, as parental perceptions are not inventions but observations colored by expectations and feelings, these infants will also show poorer state control, less optimal range of state behavior, higher irritability and lower robustness and endurance. The clinician should be understanding and explain that at this stage of development the baby may need particular external support for soothing from the parents and others. It can be explored with the parents how to help the infant to develop effective state control and soothing techniques (*i.e.* regular daily routines, differential responding, etc.) (Wolke 1993, 1994a; Wolke *et al.* 1994a). We usually only mention such possibilities in passing and postpone detailed discussion until after the NBAS administration (see steps 4 and 5).

Less confident parents are more inclined to see 'non-optimal' responses as confirma-

tion of their concerns. It is again important to point out the large variability in neonatal behavior and to provide information on their often transitory quality: infants change over time and this process can be supported. Information needs to be provided on how to deal with certain behaviors and how to elicit alertness at appropriate times in order to play with the infant (e.g. in pauses during a feed, while changing diapers). While the mother or father may be inclined to elicit some of the items themselves, this should be made dependent on the behavior organization of the infant (i.e. the clinician's judgment that the behavior can be maintained without too much cost for the infant). Also, it may not have the intended positive effect. If the infant does not respond favorably to the elicitation of the behavior by the parent it may further engrain the negative attribution: 'The expert can do it but not me.' Furthermore, the NBAS tester should not assume the role of a teacher who knows best and can show off all the best behavior. During the examination it should not be the clinician who explains all the time, but rather the parent should be encouraged to describe what the baby does—this is particularly important for the less confident parent. No feedback should be given whether the parent's interpretation is right or wrong, but the examiner is there to probe: 'What else did she do?' 'What does it mean?' 'How could we try it another way?' 'What do you usually do when she is like that?' The NBAS may confirm parental perceptions or appear to contradict their reports in the MABS subscales completed before the NBAS administration. The clinician notes discrepancies but does not point them out. Otherwise, she would increase the pressure for the parents to justify their perceptions ('Well, she may be like this with you here but you should see her in the nursery/at home'), which is most counterproductive in establishing a trusting rapport.

Step 4

What has been observed during the NBAS, what has been learned from the parent report scales, and the parents' comments are now brought into the wider context of naturalistic caretaking. The parents' observations are further cued and reflected within and beyond the NBAS. For instance, the clinician should ask: what we saw of your baby, is she like that in the nursery or at home?; how does she react to handling by you and by others?; how sensitive is she to noise, light, changes in daily routines?; how does she react to social interaction attempts?; how does she show distress and what domains of behavioral organization are affected (state changes, motor or physiological organization)?

The aim is to use this knowledge to plan how stress could be reduced for the infant and parents, if necessary, and what can be done to provide optimal support for the infant's behavioral organization. Concrete maneuvers for handling the baby to assist behavioral organization can be discussed and linked with the observations in the NBAS, e.g. the soothing techniques, bringing the infant into an alert state, etc. Many parents, in particular when insecure, use rather inflexible and repetitive routines of caretaking such as always just rocking or feeding the infant when crying or waking (Wolke 1993, 1994b; Wright 1993). Providing a number of alternatives as applied in the NBAS is an important goal. However, it should be emphasized that it takes time for a procedure to work and that rapid jumping from one intervention to another is similarly unproductive and

often distressing to the baby. Arrangements of daily routines, feeding and the physical caretaking environment should be addressed, if necessary (*e.g.* feeding without distractions such as television or radio, too many people in the room, etc., may be suggested if the infant reacts irritably and regurgitates food—Wolke and Skuse 1992). Infants who show poor behavioral regulation (*i.e.* are irritable) need more external control and a more predictable environment (Wolke *et al.* 1994a). Clear daily routines including regular times for feeding, naps, outings, play and bedtimes are helpful for these infants, while well-organized infants can cope with irregular changes in environmental events. Designs of individual care plans have been proven to be successful in groups of infants with particular regulatory problems, including sleeping problems (Messer 1993), excessive crying (Wolke *et al.* 1994a) and feeding difficulties (Wolke and Skuse 1992), and in preterm infants (Als *et al.* 1986, Wolke 1991b). Joint planning of care needs to take into account the demands of the parents (partnership), siblings and other relevant caretakers (*e.g.* grandmother).

Step 5

Newborn infants quickly become toddlers. They develop new competencies and have to master new tasks. At times of biobehavioral changes new challenges may occur such as increased evening crying (Brazelton 1962, Barr 1990, van de Rijt-Plooij and Plooij 1992). New demands are made such as the introduction of solid foods or the increasing hopes of parents that their infant will sleep through the night (Wolke *et al.* 1995). New motoric, cognitive and social abilities arise and require new ways of responding by the parents. The parents need to adapt to these changes and foster their baby's individual growth: they need to grow up with their baby. Some parents have problems in being flexible, sticking with the same techniques which are not adapted to their infant's changing needs and abilities, *e.g.* continuing long-term exclusive breast-feeding (Skuse *et al.* 1994), providing the bottle every time the infant cries or trying to trick the infant into sleep by constant rocking or car rides (Wolke 1993), behaviors which often lead to caretaking difficulties or even ill health (Skuse *et al.* 1994, Wolke 1994b).

If parents show a lack of confidence or appear to have little flexibility for caretaking, then the clinician should plan to assist by more frequent consultations. These do not need to be face to face, but telephone counseling, and the regular completion of behavior diaries (*e.g.* feeding, sleeping, crying, playtimes—Wolke *et al.* 1994a) or the posting of filmed interactions (using home video camcorders—Wolke and Skuse 1992, Wolke 1995) are ways to stay in touch. Diaries or filmed records are, in our experience, diagnostically most informative. The parents will always look over these records again in detail before posting—they learn to observe and reflect on their infant's behavior. These posted records provide ecologically relevant information that can be discussed at the next personal consultation.

Practicalities

These five steps require around 1–1.5 hours of the clinician's time. It is time well spent, in particular for those parents who feel less confident or already perceive their baby as

difficult in her behavior. Feeling reassured and knowing that someone is there to help has a paradoxical effect: the parents are less likely to return for 'trivial' reasons because they are more confident to apply the principles of care to cope with new challenges. The clinician also gains a lot: it is rewarding to have provided the support which has helped prevent problems from becoming engrained.

VII: USING THE NBAS WITH HIGH-RISK INFANTS

Jean Gardner Cole

The behavior of the high-risk infant is different from that of the healthy newborn infant and this difference changes all the rules of interaction for the infant's caregiver. When an infant is born at term and healthy, she is equipped to handle the intensity of the extra-uterine environment, and can relatively quickly establish physiologic and behavioral organization gaining control over her respiratory effort, her temperature regulation, and her digestive and visceral functioning after the birth process (D'Apolito 1991). The healthy newborn infant demonstrates smoothness of movement, clear sleep and awake states, with energy available for alert interaction. Her easily readable behavioral cues provide opportunities for reciprocal interaction with her parents and foster the attachment process. When an infant is born at risk, then the risk factor, regardless of whether it is preterm birth, drug exposure, a congenital anomaly or even a traumatic delivery, will affect her ability to sustain physiologic and behavioral organization, an effect that can be transient or long-lasting depending on the cause of the disorganization. Commonly, high-risk infants are easily overstimulated and their behavioral cues difficult to read. They have difficulty dealing with environmental stimuli, exhibiting physiologic disorganization such as color change, increased respiratory effort, poor temperature regulation and disturbed visceral and digestive functioning. They often sleep poorly, have difficulty habituating, and have problems sustaining relaxed tone and posture. All or any of these signs of disorganization in the newborn infant affect her ability to have the energy to interact with her caregiver and sustain her efforts at self-regulation. This disorganized behavior causes a dilemma for parents who may find that all the normal, nurturing behaviors such as rocking, touching and interacting are too stimulating, so that they unwittingly overload the infant in their efforts to communicate with her. Infants who are this easily overstimulated may respond with 'shutting out', intentional non-responding behavior, or with over-reactive behavior, leaving parents with a feeling of rejection and dismay. Parents can be as vulnerable as their infants around the time of birth, and even mildly distorted behavioral cues from the infant can be quite disturbing (Brazelton 1982).

When an infant is born at risk, parents frequently grieve over the loss of the 'expected or fantasized child'. This grieving can prevent them from making adjustments in their behavior necessary for helping the infant. Parents of preterm infants have a grieving period which seems to have stages that parallel the infant's recovery. If these are recognized and staff at the neonatal intensive care unit can offer support, then the parents will be ready for the baby at discharge. Experience shows that following delivery, many parents are caught in denial. They tend to speak of the baby as if she were merely chemicals. However, as their grief work proceeds they start to notice reflex behaviors. As grieving is handled better, they begin to note and value organized responsive behaviors. Finally, they are able to see that the baby is responsive to them:

'She knows my voice. She turns to my face.' This is evidence that the infant is ready for discharge and the parents themselves are now ready to become attached to their frail infant (Brazelton 1982).

An assessment of an at-risk infant is a 'multidimensional opportunity for diagnosis, for prediction, and for entering the parent-infant interaction' (Brazelton 1982). When assessing such an infant it is imperative to observe her closely, documenting particularly how she responds to the examination in all behavioral parameters. Als (1982), in her work with frail preterm infants, has helped us to understand that there is an 'interplay of various subsystems of functioning within the newborn infant'. The task of the baby then becomes 'synchronizing these subsystems whilst dealing with the impact of the caregiving environment'. An environment that is not sensitive to the needs of the infant can disrupt the balance in each of her systems of functioning. High-risk infants who exhibit physiologic disorganization invariably show disorganization in other systems. The disorganization may be dramatic or subtle and is not always recognized or understood by the caregiver. Motor disorganization can be slight or dramatic, from loss of tone in face, or finger splay, to strong hyperflexion or hyperextension of limbs and trunk, with diffuse movement. Active gaze or auditory averting that goes beyond the normal resetting of attentional energy of the newborn infant can be an extreme reaction to overstimulation. Staying asleep, inconsolable crying and rapid oscillations in state are alternative strategies.

All these behaviors are signs of state disorganization. Their causes are not always recognized by the caregiver, and if not addressed, they can increase in intensity which can be energy depleting for the infant and upsetting and puzzling for the caregiver. Attention also needs to be paid to the infant's efforts to self-regulate. These are the coping strategies she uses in attempts to regain her inner control. They may be hand-to-mouth behavior; postural change, pulling into flexion and getting onto her side; visual or auditory locking; or going to sleep. When these strategies are supported or co-regulated by the caregiver, they begin to define the limits the infant cannot at this time set for herself. Behavioral disorganization may be transient, and with support the infant can be helped to regain physiologic balance. If the behavioral disorganization is severe, more intensive intervention may be needed, but the procedure is the same: reading of behavioral cues, support of the infant's efforts to self-regulate, modulation of the environment, and reduction of stimulation (Cole 1991). When the NBAS examination is administered by a clinician sensitive to the subtleties of a behaviorally disorganized high-risk infant, it can not only help identify the areas of deficit and guide the clinician in planning interventions, but it also provides a unique opportunity to support the infant and family and help the parents to read the infant's behavior as meaningful communication (Als 1982). Using the NBAS in this way can enable parents to see their baby as an interactive being, communicating with them via her behavior. It helps to move them away from initial perceptions of the baby as frail and sickly, or from feelings of loss of control as she appears to respond only to nurse caregivers. They can begin to see her competencies and understand the reasons for her over-reactive behaviors. This new information can instill in them a sense of pride in how their infant's behavioral

cues empower them to provide appropriate interventions, such as swaddling their squirming, crying infant with their hands and watching her gradually relax and settle down. This enhances their feelings of competence, and parents and infant begin to act in synchrony as they co-regulate her behaviors and observe her responses. Thus the NBAS gives clinicians the chance to influence parent-infant relationships positively from the very beginning (Nugent and Brazelton 1989). The following case history illustrates this point.

Case history*

Jerry was born at 36 weeks gestation following emergency caesarian section for fetal distress and maternal toxemia. His Apgar scores were 0 at one minute and 5 at five minutes. He weighed 1600g, and was thus small for gestational age. Seizures were witnessed by his mother shortly after birth. He was transferred to the Special Care Nursery, and at 1 week an NBAS examination was performed. The results of the examination presented a profile of a sensitive and poorly organized infant. When in light sleep, Jerry could not habituate to visual or auditory stimuli. He reacted to every presentation of the stimuli, with constant squirming, grimacing, color change and increase in respiratory effort, followed by waking and crying. Even modifications of the presentation of the stimulus, *e.g.* a sweep of the light across his eyes rather than a two second presentation, and a softer presentation of the rattle, made no difference in his reactions. This type of behavioral response and inability to habituate is not unusual in high-risk infants. They commonly do not have the behavioral or neurological competence or energy to habituate and are very much at the mercy of the environment. The assessment of habituation reveals how fragile their hold is on the level of balance they are attempting to sustain.

Jerry was allowed a 'time out' before the examination continued, and once his color and respirations had improved he was uncovered and placed in supine. He immediately alternated between rigid extensor tone with arching and strong hyperflexion, and he was very reactive to being uncovered, moved and handled. His color became ruddy and his respirations rapid, he had tremors and startled, he had diffuse, frantic movement and he cried briefly. He was consoled by the examiner who swaddled him with her hands and waited until his color and respirations had improved and his tone had relaxed before continuing. This intervention helped to set the limits Jerry could not set for himself and began the process of reducing his maladaptive response to stress. During the examination, he continued to be very reactive to handling and demonstrated poor sensory integration when moved, becoming quite frantic with a panicked facial expression, breath-holding and color change. His tone fluctuated throughout, alternating between hyper- and hypotonicity, and many of his primitive reflexes were exaggerated and prolonged. When he was consoled and awake, Jerry could not deal with interaction, either animate or inanimate, constantly averting to visual and auditory stimuli with color change, visceral responses, tremors and changes of tone. All interactions ended in fussing or crying. Frequent breaks were required, and interaction was modulated with one sensory stimulus presented at a time, with some brief success. Jerry needed constant support and examiner facilitation to help him deal with the stimulation and to become more stable physiologically. The findings from the examination were shared with his mother, and an Individualized Developmental Plan (IDP) was written and posted by his bedside (Cole and Gilkerson 1982). The IDP identified Jerry's strengths, what was stressful for him, how he manifested stress behaviorally, and what interventions were needed to help him.

*Names changed in case history.

Recommendations

Recommendations were for slower, gentler handling to reduce Jerry's hyper-reactive response to quick movement; deep firm pressure when holding him rather than patting, rocking and stroking, as he appeared to be sensitive to light touch; and allowing him as much undisturbed sleep as possible in order to maximize his rest, with protection from light and noise. Positioning him on his side with forward flexion supported by swaddling and boundaries (blanket rolls at his feet and sides) in an effort to decrease his hypertonicity was recommended. When awake, it was suggested that low-keyed interaction using one sensory modality at a time be used, e.g. talking to him without looking at him, or looking at him without talking, in order to maximize interaction and minimize overstimulation. It was also suggested that periodically both modalities, visual and auditory, be presented, observing his response to assess readiness and availability to deal with more stimulation. These kinds of interventions often help infants become more stable in their behavioral organization, and they spend less energy and calories defending themselves from stimulation. They also assist parents in reading behavioral cues and adjusting their behavioral responses to the infant's needs, thereby facilitating the infants' physiologic and behavioral organization.

Portrait of Jerry's mother

Sharon was a single mother, 17 years old, with no family support. Her behavior in the nursery tended to be disruptive. She used the nursery telephone to deal with the many social problems in her life, possible eviction, and a pending court case. She gave an appearance of having a rather chaotic lifestyle. Sharon was very intrusive with Jerry, wanting to wake him from sleep when she came to visit. Her interactions and handling were vigorous and very inappropriate for an infant with his easily overstimulated physiologic system and poor behavioral organization. The nursing staff were dismayed by Sharon's inability to read her infant's behavioral cues and respond to them appropriately. Jerry's primary nurse referred frequently to the IDP posted by the bedside and discussed his behavioral cues and responses to stress to no avail. Sharon appeared not to hear the nurse's concerns. As Jerry neared his discharge date, the nurse and social worker were considering not allowing him to be discharged to his mother's care. They were afraid for his well-being, and even discussed involving the Department of Social Services in an attempt to get Sharon involved in parenting classes. However, Sharon's greatest strength was that she obviously loved her baby. She came in every day to be with him and stayed all day. She had been very frightened by the events surrounding his birth and she obviously had a great many problems. Jerry was the one positive factor in her life.

In a final attempt to help Sharon understand her baby's behavior, the primary nurse asked her to observe Jerry during the administration of his next NBAS examination and then write up her observations. Jerry was being evaluated weekly in a new program at the hospital called Project WELCOME (Cole and Gilkerson 1982). One of the goals of this program was to train the nursing staff in how to incorporate developmental concepts into nursing care. Jerry and his mother were referred to the Developmental Specialist in Project WELCOME for more direct intervention. Sharon met with the clinician and observed Jerry's responses to the examination. The Infant Specialist used this opportunity to elicit from Sharon her interpretation of Jerry's behavior, his strengths as well as his deficits. She commented on Jerry's attempts at self-regulation, how to read and support his coping strategies, and when and how he signaled the need for a 'time out', demonstrating for Sharon the types of intervention that he currently needed. The clinician also validated Sharon's accurate observations and enhanced her emerging understanding of his behavior.

After the examination, Sharon wrote the IDP for Jerry reproduced in Figure 5.2.

A DEVELOPMENTAL PLAN FOR JERRY FROM MOMMY

My Strengths are:

Raising my hands to my bottle when feeding
Moving my head and eyes more than before
Hearing more voices talking to me
Waking up on my own when I'm hungry
Being more alert

These things stress me:

Being moved around a lot
Crying for a long period of time
Taking a bath at times
Getting my diaper changed

Time Out Signals:

Fingers and toes splaying
My face gets very red
Moving about in an unusual way
Starting to fuss

How you can help me:

Be gentle with me
Don't be too loud
Don't bother me or wake me when I'm sleeping
You can spoil me like a baby—Ha!

Fig. 5.2. Individualized Developmental Plan written by Jerry's mother following his NBAS examination.

In reviewing Sharon's plan for Jerry and her interpretation of the NBAS examination, it is apparent that some of the items are projections for the future, *e.g.* Jerry raising his hands to his bottle when being fed. This is probably more a facet of the baby's hypertonicity and his typical high guard posture. But Sharon is quite right in seeing Jerry as a more available infant, having energy to respond to social interaction, to cry, and to be more stable in his states of consciousness as in waking for feedings. She also identified Jerry's poor sensory integration in his reaction to being moved. Sharon read his 'time out' signals correctly, identifying his motor disorganization in toe and finger splaying and moving about in an unusual way. This was due to his tone, which fluctuated between being hyper- and hypotonic, especially in his trunk, a worrisome sign in terms of possible developmental outcome (Georgieff *et al.* 1986). She also noted his autonomic disorganization when she identified his color change. Sharon's recommendations for support were also on target and addressed directly Jerry's need for his mother to be gentler, quieter and less intrusive with him. The clinician had discussed with Sharon that parents need to respond immediately to the infant's cues of stress, helping to build for Jerry a sense of trust in his caregiver and to support his efforts at reorganization. Sharon was complimented on her plan and it was posted at the baby's bedside. Now that she had demonstrated that she had indeed heard the concerns about her infant, and could describe his behaviors, a gradual change occurred. Sharon's behavior with Jerry became more appropriate—not perfect, but as Winnicott (1964) declared, 'good enough mothering is perfectly acceptable' and what parents need is

'enlightenment about underlying causes and room to experiment and learn from their own mistakes.'

Observing one's infant during the administration of an NBAS examination can create a therapeutic relationship between the examiner and the parents and can be highly influential when the parents write up their observation in the format of the IDP. They then establish ownership of the information, describing it in their own terminology, and begin to act upon it (Parker *et al.* 1992). The IDP can be written by the developmentalist or nurse, but it has been found to become a more powerful intervention tool when one or both parents are involved in writing it. By observing the NBAS, Sharon began to model the strategies used in the examination to produce a similar performance from her infant. Jerry was discharged to his mother's care, and follow-up home visits by the developmental specialist were arranged at 1 and 4 months. Prior to these visits, Sharon was encouraged to write new IDPs. These were found to be developmentally and behaviorally on target as Sharon used the conceptual framework of the NBAS to describe Jerry's current behavioral ability.

Conclusion

Parents are vital partners in their infant's development, and the NBAS can be a powerful mechanism for strengthening the parent-infant relationship especially when there is a risk factor. As seen in the case history presented above, 'short term changes in parental attitudes and behavior can serve to launch positive cycles of intervention between infant and parent that may have long term consequences' (Nugent and Brazelton 1989). Mothers construct mental images both of the expected infant and of themselves in the role of a parent. Any violation of the mental image of the infant, as in the case of an unexpected risk factor where the infant does not 'match' the mother's expectations, challenges the mother to go through a process of assimilation and accommodation in order to begin to change her image of the child (Stern-Bruschweiler and Stern 1989). Parents of high-risk infants often go through a grieving process. When providing intervention or nursing care, it is important to understand this grief reaction. The parent is dealing with the loss of the 'expected or fantasized child', and according to Brazelton (1982), 'even a minor violation of this expectancy can cause defenses of denial, projection and detachment.' The intervener 'must be aware of the power of these defenses as they operate to protect the emotional integrity of the parent who is dealing with unexpected differences in the responses and the development of her infant.' Parents need time to reorganize their energies and their expectations, and when they do, that energy can be made available to the infant to enhance her development. In the above case history, the NBAS intervention helped Sharon to see Jerry's competencies without negating his deficits. She was able, with support from the Infant Specialist and the nursing staff, to change her mental image of her infant and adjust her parent-role behavior to better fit Jerry's 'real' physiologic and behavioral style, using new strategies that helped support his developmental goals. Jerry then became a reinforcing partner in these more appropriate interactions with his mother, and was no longer a difficult partner providing only negative feedback to a mother who was as vulnerable and at-risk as her

son. Parents can be astute observers of their infants when they understand the reason for the infant's behavioral disorganization. When they learn to read behavioral cues and carefully titrate interaction with their sensitive infant, they can help in the process of getting back on track toward a more optimal developmental outcome.

APPENDIX 1

NBAS SCORING FORM

Name		Sex	Date of birth
Gestational age	Weight	Height	Head circumference
Mode of delivery	Length of labor		Apgar scores
Parity	Type of feeding	Examiner	Date of examination

	Infant behavior									Comments
	9	8	7	6	5	4	3	2	1	
HABITUATION										
Response Dec.—Light										
Response Dec.—Rattle										
Response Dec.—Bell										
Response Dec.—Foot										
SOCIAL—INTERACTIVE										
Animate Visual										
Animate Vis. + Aud.										
Inanimate Visual										
Inanimate Vis. + Aud.										
Animate Auditory										
Inanimate Auditory										
Alertness										
MOTOR SYSTEM										
General Tone										
Motor Maturity										
Pull-to-Sit										
Defensive										
Activity Level										
STATE ORGANIZATION										
Peak of Excitement										
Rapidity of Build-up										
Irritability										
Lability of States										
STATE REGULATION										
Cuddliness										
Consolability										
Self-Quieting										
Hand-to-Mouth										
AUTONOMIC SYSTEM										
Tremulousness										
Startles										
Lability of Skin Color										
Smiles	<input type="checkbox"/>									

SUPPLEMENTARY ITEMS	Infant behavior								Comments	
	9	8	7	6	5	4	3	2		1
Quality of Alertness										
Cost of Attention										
Examiner Facilitation										
General Irritability										
Robustness/Endurance										
State Regulation										
E's Emotional Resp.										

REFLEXES	0	1	2	3	Asym	Comments
Plantar Grasp						
Babinski						
Ankle Clonus						
Rooting						
Sucking						
Glabella						
Passive Resist.—Legs						
Passive Resist.—Arms						
Palmar Grasp						
Placing						
Standing						
Walking						
Crawling						
Incurvation						
Tonic Dev. Head/Eyes						
Nystagmus						
TNR						
Moro						

SUMMARY: INFANT		SUMMARY: PARENT(S)	
Strengths	Concerns	Strengths	Concerns

RECOMMENDATIONS FOR CAREGIVING:

APPENDIX 2

MOTHER AND BABY SCALES (MABS)

A: YOUR BABY AND YOUR FEELINGS

In the following, a number of statements are given about baby's and parent's behavior and feelings. Please answer each question by circling one of the numbers. "0" is circled if the statement does "not at all" apply. The choices "1, 2, 3, 4" indicate increasing degrees of agreement, and "5" indicates that the behavior or feelings occur "very often/very much".

Coding*	Scale**	Not at all	1	2	3	4	5	Very much/ often
	A	When I talk to my baby s/he seems to take notice	0	1	2	3	4	5
	UI	My baby has fussed before settling down	0	1	2	3	4	5
	LCC	It makes me insecure when my baby cries	0	1	2	3	4	5
	UI	My baby has fussed or cried at times when I know s/he is not hungry	0	1	2	3	4	5
R	UI	My baby has settled quickly and easily	0	1	2	3	4	5
R	LCC	I've felt confident about looking after my baby	0	1	2	3	4	5
	A	My baby watches my face	0	1	2	3	4	5
	UI	During the last 24 hours I've needed to coax my baby to persuade her/him to settle after a feed	0	1	2	3	4	5
	LCC	I've felt clumsy in caring for my baby	0	1	2	3	4	5
	LCC	I would have liked more advice on what to do during this period	0	1	2	3	4	5
	UI	After feeds I've used rocking or cuddling to settle my baby	0	1	2	3	4	5
	A	My baby clings to me when s/he is held	0	1	2	3	4	5
	LCC	Looking after my baby has been more difficult than I expected	0	1	2	3	4	5
	UI	After feeds my baby's mood has been fussing or crying	0	1	2	3	4	5
	A	When my baby is feeding s/he gazes into my eyes	0	1	2	3	4	5
	LCC	I've been feeling anxious about coping when my baby and I get home	0	1	2	3	4	5
	UI	My baby's mood after a feed has varied from one feed to another	0	1	2	3	4	5
	UI	My baby has varied in how easy s/he is to settle	0	1	2	3	4	5
R	LCC	I think I've been coping all right with my baby	0	1	2	3	4	5
R	A	At this age my baby is disinterested in interacting with people	0	1	2	3	4	5
	UI	During the last 24 hours my baby's sleeping and waking behavior has been disturbed by wind/hiccups	0	1	2	3	4	5
	LCC	I've been afraid that I might drop my baby	0	1	2	3	4	5
	LCC	I've asked the nurse for help when my baby is unsettled	0	1	2	3	4	5
	A	My baby is really alert and attentive	0	1	2	3	4	5
	UI	In between night-time feeds my baby was fussing and crying	0	1	2	3	4	5

	UI	To settle my baby I've given her/him a top-up feed	0	1	2	3	4	5
	LCC	I've felt worried I might hurt my baby when handling her/him	0	1	2	3	4	5
	A	I think my baby is responsive	0	1	2	3	4	5
	UI	In between feeds my baby has been irritable	0	1	2	3	4	5
	LCC	I've felt unsure whether I've been doing the right thing whilst looking after my baby	0	1	2	3	4	5
	UI	To settle my baby I've carried her/him around	0	1	2	3	4	5
	A	When I play with my baby s/he responds straight away	0	1	2	3	4	5
R	LCC	I cope well with my baby when s/he is unsettled	0	1	2	3	4	5
	UI	The length of the period between feeds has varied	0	1	2	3	4	5
	UI	My baby has spent long periods between feeds unsettled or only settled if held	0	1	2	3	4	5
R	LCC	I think I've been making a good job of being a mother	0	1	2	3	4	5

Overall Impressions and Experiences

Your Baby

Scale**		Very irritable					Very calm	
E	Overall how irritable is your baby?	-3	-2	-1	0	+1	+2	+3
		Very poor						Very good
E	Overall how good a sleeper is your baby?	-3	-2	-1	0	+1	+2	+3
		Very drowsy						Very alert
	Overall how alert and responsive is your baby?	-3	-2	-1	0	+1	+2	+3
		Very difficult						Very easy
E	Overall how difficult is your baby?	-3	-2	-1	0	+1	+2	+3

Yourself

GC	Overall how confident do you feel about coping with your baby?	Very unsure						Very confident
		-3	-2	-1	0	+1	+2	+3
GC	Overall how stressful do you find it looking after your baby?	Very difficult						Very easy
		-3	-2	-1	0	+1	+2	+3
GC	Generally how anxious a person do you think you are?	Very anxious						Very composed
		-3	-2	-1	0	+1	+2	+3

*R = recode as inversions of scores (0=5, 1=4, 2=3, 3=2, 4=1, 5=0) before totalling subscale scores.

**A = Alertness-Responsiveness; UI = Unsettled-Irregular; LCC = Lack of Confidence in Caretaking; E = Easiness; GC = Global Confidence.

MOTHER AND BABY SCALES (MABS)

B: FEEDING OF MY BABY (OVER THE LAST FEW DAYS)

Coding*	Scale**		Not at all				Very much/ often	
	ADF	During feeds my baby has tended to be awake and alert	0	1	2	3	4	5
	IDF	During feeds my baby has tended to fuss or cry	0	1	2	3	4	5
	LCF	I've had problems with breast-feeding because I've been tense	0	1	2	3	4	5
	IDF	My baby has been irritable during feeds	0	1	2	3	4	5
	IDF	The mood of my baby during feeds has varied	0	1	2	3	4	5
	LCF	My lack of technique has held up breast-feeding	0	1	2	3	4	5
R	ADF	During feeds my baby has tended to be drowsy	0	1	2	3	4	5
R	LCF	I've been enjoying breast-feeding during the last 24 hours	0	1	2	3	4	5
	IDF	My baby's overactivity (kicking, turning head, etc.) has been making it difficult to fix her/him to the breast	0	1	2	3	4	5
	IDF	My baby has been reluctant to suck	0	1	2	3	4	5
	ADF	After feeds my baby has been lively and active	0	1	2	3	4	5
	LCF	I felt I haven't always had enough milk to satisfy my baby	0	1	2	3	4	5
R	ADF	During the last 24 hours my baby has interrupted feeding by becoming drowsy or sleepy	0	1	2	3	4	5
R	IDF	During this period feeding has been easy	0	1	2	3	4	5
	LCF	The after-effects of birth have been making breast-feeding difficult for me	0	1	2	3	4	5
	LCF	Breast-feeding has been hampered by the conflicting advice I've been given	0	1	2	3	4	5
	IDF	During the last 24 hours my baby has interrupted feeding by wind, hiccups or tummy ache	0	1	2	3	4	5
	LCF	My lack of confidence has held up breast-feeding	0	1	2	3	4	5
	ADF	After feeds my baby's mood has been awake and alert	0	1	2	3	4	5
	IDF	During the last 24 hours my baby has interrupted feeding by fussing and crying	0	1	2	3	4	5
	LCF	I've asked the nurse for help to settle my baby	0	1	2	3	4	5

*R = recode as inversions of scores (0=5, 1=4, 2=3, 3=2, 4=1, 5=0) before totalling subscale scores.

**ADF = Alertness during Feeds; IDF = Irritable during Feeds; LCF = Lack of Confidence in Feeding.

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