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Behavioral Patterns in Full-Term and Preterm Twins

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Scores from a behavioral assessment of 160 stable preterm newborn twins were compared with those obtained from 120 full-term newborn twins. The twins were examined during various activities to obtain representative samples of behavior in the following behavioral categories: irritability, resistance to soothing, reactivity, reinforcement value, and activity level. Within-pair correlations were found in all of the behavioral categories, suggesting a constitutional influence on behavioral patterns during the neonatal period. The preterm infants demonstrated internal consistency of behavior similar to that of the full-term group in the first three categories. However, group differences were found when comparing the preterm with the full-term infants on actual ratings of the items. Behavioral differences between these full-term and preterm twins were comparable to those published for samples of singleton infants.

Key words: Newborn twins, Neonatal behavior, Preterm behavior, Twin concordance, Twin assessment

INTRODUCTION

In recent years a significant amount of research has focused on the evaluation of the behavioral repertoire and the integrity of the newborn infant, and the effect these neonatal characteristics may have on the interaction between the neonate and its caregivers. Reviews and descriptive critiques of some of the better known and more frequently used neonatal assessment techniques (e.g., Brazelton, [2]; Graham et al., [13], etc.) are available [23, 24]. An expanded assessment designed to examine neonatal behavioral consistency across a variety of situations has recently been described [21]. Using this expanded procedure it is possible to obtain several aggregate, or summary, scores, each of which represents a specific area of behavior measured during several situations [9]. The evaluation was designed to examine various aspects of the behavioral repertoire of the neonate, including aspects of predominant emotional tone (irritability, soothability), rudimentary mainte-

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nance activities (feeding, sleeping), more discrete behaviors elicited by specific visual and auditory stimuli, and reactions to stressor stimuli.

The items in the assessment describe five categories of behavior: irritability, resistance to soothing, reactivity, reinforcement value, and activity level. Ratings within each of the behavioral catgeories are combined into summary scores. The performance of 120 full-term infants in these areas of behavior has demonstrated behavioral consistency in the categories of irritability, resistance to soothing, reactivity, and reinforcement value [22]. The two activity level items were found to have a low-order correlation ($r = .15$) and, therefore, were maintained as independent measures of behavior. It was concluded that individual differences in behavior were successfully detected by the assessment procedure.

The assessment was used to evaluate behavior in a group of newborn twins participating in an ongoing longitudinal study designed to investigate the continuity or discontinuity of temperament variables during development, and how this may be influenced by constitutional and environmental factors. Since twins share their prenatal experiences, as well as genetic factors, examination of newborn twins may provide information on the contribution of familial factors to neonatal behavioral patterns. Therefore, although zygosity determination for same-sex twins was not available, the degree of similarity of performance on the assessment among the twins within each pair was examined.

Since twins are frequently born prematurely, both full-term and preterm twins were assessed. There is a great deal of interest, in general, in the preterm infant who has been described as being at risk for various developmental disabilities [3, 4, 6, 17]. The preterm infant may experience a lack of interaction with its parents because of medical complications and/or prolonged hospitalization, and it may be deviant in certain behaviors that affect the caregiver's attitude toward the infant. For example, a difference in face-to-face interactions has been found between high-risk infants and their mothers, as compared to normal infants and their mothers [11]. Two preterm infants may present different stresses to a family situation in which the addition of two healthy newborns would, by itself, be problematic. Therefore, it would be useful to compare the behavioral repertoire of the preterm infant with that of the full-term infant, especially to expand the evaluation of risk factors to which the preterm infant twin may be exposed. One purpose of the present study was to compare the performance in each of these behavioral categories of a sample of stable preterm twins with that previously described for the full-term sample of neonate twins. The ability of ratings on the behavioral categories to differentiate between the full-term and preterm infants was also examined.

METHODS

Subjects

The present sample included 160 medically stable, preterm neonates from 58 pairs of same-sex twins (30 female, 28 male), and 22 pairs of opposite-sex twins. The comparison sample [22] included 120 full-term neonates from 47 pairs of same-sex twins (21 female, 26 male), and 13 pairs of opposite-sex twins.

A subsample of the twins assessed as neonates are being recruited for participation in a longitudinal study of temperament. Zygosity determination for the same-sex twins was not available because, for practical and technical reasons, the twins are not bloodtyped until after their third birthday. The use of the placenta for zygosity determination was not possible because placenta information was not always available, and, more important, because zygosity determination by placenta examination is often inconclusive even when the placenta in intact [10].

TABLE 1. Characteristics of the Sample by Gestational Age at Birth

	29–34 wk	35–37 wk	38–41 wk	Total
N	72	88	120	280
Male	35	43	67	145
Female	37	45	55	137

	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Birthweight	1,233–2,580	1,678	1,219–3,289	2,307	1,680–3,714	2,809	1,219–3,714	2,352
Test weight	1,690–2,438	1,996	1,729–3,260	2,299	1,701–3,686	2,716	1,690–3,686	2,387
Test GA	34–38.6	36	35.9–39.5	37	38–42.5	39.6	34–42.5	38
Test CA	5–53	22.7	2–26	7.3	1–8	3.6	1–53	10

The characteristics of the samples, by gestational age at birth, are presented in Table 1. Full-term infants were generally examined between days 1 and 4 of life. When infants were born before term and/or had medical complications, they were examined when they were medically stable; in such cases testing generally occurred shortly before the infant was to be discharged. Twins from each pair were tested separately and at different times. Some twin pairs were tested on the same day, i.e., one in the morning and one in the afternoon. For other twin pairs testing occurred on consecutive days. In both sequences, test order for the first- and second-born twins was counterbalanced for consecutive pairs.

Procedures

Neonates were examined during an assessment period that went from one feeding to the next. The interval between feedings was either three or four hours, as determined by the infant's weight. A summary of the assessment schedule is presented below.

I. Feeding
II. Observation of spontaneous behaviors during active sleep
III. Assessment of maturational level, sensorimotor status, and orienting behaviors
IV. Reactivity to stress (cold disc)
V. Evaluation of spontaneous irritability and soothability
   A. Presentation of pacifier and responsivity to pacifier withdrawal
   B. Soothability by various techniques

The detailed procedures for administration and scoring of each item in the assessment, plus the rating scales and descriptions of what each item in each of the behavioral categories measures, are available elsewhere [21]. Illustrative material is briefly summarized below.

Feeding. At the scheduled feeding time the infants were fed either by bottle by the examiner, by breast by the mother, or by gavage. In all cases the examiner was present to observe the behavior of the infant. The infant's behavioral state and irritability were noted immediately before, at the start of the feed, at the end of the feed, and immediately after the feed. Although the information concerning behavioral state was not used in the development of the final assessment, it is potentially useful to categorize the infants, for example, by those who are awake and those who are asleep before their scheduled feed.

The infants were rated for spontaneous activity, responsiveness to the caregiver, and rooting and sucking abilities during the feed.

For illustration, irritability before feeding was rated as follows: (1) not irritable, (2) fussy, (3) whimpering, (4) crying moderately, (5) crying intensely. This particular scale was also employed later whenever irritability was rated during the subsequent assessment procedures. However, in order to accurately reflect the performance of certain infants who were too irritable and unsoothable to have a specific stimulus presented and who, therefore, could not be assigned scores for specific items on the irritability and resistance to soothing scales (the latter to be described shortly), a sixth point was included to describe the highest degree of irritability. Thus, a rating of 6 was used to describe an infant too irritable for the stimulus to be presented.

Observation During Sleep. During the first active sleep state, time-sampling recordings were made of specific spontaneous behaviors, including the occurrence of limb movements, body movements, and head and facial activities. The schedule consisted of alternating 15-second observation and recording periods, for a total of 10 minutes when possible (6 minutes minimum). For this assessment, only the number of limbs moved (0 to 4) and the vigor of movement (slight, moderate, or large) were evaluated for an index of activity during sleep. For each subject, a mean score was determined for activity during the observation period and each infant's initial score was transformed to a normalized five-point scale.

Maturational Level, Sensorimotor Status, Orienting. Approximately midway between feedings the infant was awakened so that maturational level, sensorimotor status, and orienting behaviors could be assessed by a series of items adapted from the Einstein Neonatal Neurobehavioral Assessment Scale [14]. Additional items described by Graham et al. [13] were also included at this time.

Measures included were (1) visual and auditory orienting items; visual tracking of a bulls-eye; auditory orienting toward a rattle, bell and voice; following of face and voice; (2) reflexive responses—leg and thigh flexion in response to foot prick; and Moro; (3) summary scores measuring alertness, cuddliness, frequency of spontaneous movements, and reinforcement value of the infant's behavior (this last item adapted from Lancioni et al. [15]). In addition, individual patterns of arousal level and responsivity, as well as irritability and consolability, were obtained by the observation of behavioral state characteristics throughout the administration of these items. Detailed instructions for the administration of these items may be found in Kurtzberg et al. [14].

For illustration, the auditory orienting items were scored on the scale designed by Kurtzberg et al. [14] as follows: (1) no orienting response, (2) quieting, eyes brightening and widening; blink, no eye movement, (3) quieting, eyes brightening and widening; some searching movements with eyes only, (4) eyes brightening and searching with head turning to side of sound. Each auditory stimulus was presented for six trials: three times each to the right and the left of the infant's head. A mean score for the six trials was determined for each infant and then converted to a five-point scale. Other items were similarly adapted to a five-point scale.

Reactivity to Stress. Following the previous procedures, an evaluation was made of the infant's response to a potentially stressful situation. For this procedure, adapted from Birns [1], a metal disc, 6.5 cm $\times$ 3.8 cm., was immersed in ice water for three minutes, and then placed against the infant's thigh for five seconds. Recordings were made of behavioral responsivity, behavioral state changes, and irritability during placement, as well as for five seconds following the removal of the disc from the thigh. The infant was

required to be quiescent before each application of the disc. The disc was presented five times, with an intertrial interval set at 60 seconds. Between trials the disc was replaced in the ice water. If the infant was irritable, it was soothed before the next trial.

The overall behavior of the infant during this procedure was evaluated and scored for soothing in response to this stimulus as follows: (1) not irritable to cold disc, no soothing necessary; (2) always soothed within one second after disc removed from thigh; or irritable only once; (3) latency to soothe decreased over trials; or always soothed within five seconds after disc removed from thigh, or within five seconds after irritability began; (4) latency to soothe increased over trials; or often took more than five seconds; (5) could not soothe, had to discontinue before five complete trials; (6) did not get cold disc because infant too irritable to test.

Irritability and Soothability. When necessary throughout the assessment period, and especially prior to the feeding period, an evaluation was made of spontaneous irritability and soothability. A standardized series of soothing techniques was applied, beginning with the presentation of a pacifier. The degree of initial irritability was noted, then latency to suck on the pacifier and latency to console were recorded. The infant was allowed to suck on the pacifier for 30 seconds, at which time the pacifier was removed during a sucking spurt. If the infant did not remain soothed, latency to cry and degree of irritability were recorded. The above procedure was repeated up to a total of five trials, providing the infant did not remain soothed for three minutes following removal of the pacifier.

If crying continued or occurred at a later time, additional attempts at soothing were made. These were, in the following sequence: (1) leaning over the bassinet, placing one's face close to the infant's, and speaking in a soothing voice; (2) continuing the above while gently but firmly stroking the infant; (3) placing the infant in a prone position in the bassinet; (4) lifting the infant to the examiner's shoulder, cuddling, stroking, and speaking in a soothing voice; (5) swaddling the infant in a triangulated blanket so that all four limbs were held close to the body; and (6) cradling the infant horizontally in the examiner's arm while rocking. Each procedure was continued for 30 seconds. Degree of irritability before intervention, duration of intervention necessary to reduce irritability, and degree of soothability in response to each intervention were recorded using the previously described scales.

Behavioral Categories

The specific items drawn from these assessments to form the five behavioral categories were as follows:

1. Irritability (five items): Irritability before feeding, and in response to visual stimuli, auditory stimuli, manipulation, and aversive stimuli.

2. Resistance to soothing (five items): Console latency after withdrawal reflex (prick on sole of foot), soothability after aversive stimuli and the cold disc, soothability by the various handling procedures described, soothability by pacifier.

3. Reactivity (six items): Visual following of bulls-eye; auditory orienting to rattle, bell, voice, and face and voice; alertness during presentation of orienting items.

4. Reinforcement value (three items): Cuddliness; reinforcement value of infant's behavior during all assessments, but expecially for maturational level, sensorimotor status, and orienting behaviors; irritability in response to manipulation.

5. Activity level (two items): Spontaneous movements during assessment of maturational level, sensorimotor status, and orienting behaviors; frequency and vigor of limb movements during active sleep.

TABLE 2. Behavioral Categories for Neonatal Assessment

	Distribution of responses by scale number (%) (N = 280)					
	1	2	3	4	5	6
IRRITABILITY						
Irritable before feeding ($\bar{X}$ = 2.04; SD = 1.49)	60	10	09	07	14	0
Irritability in response to visual stimuli ($\bar{X}$ = 1.58; SD = 1.11)	71	13	08	04	02	02
Irritability in response to auditory stimuli ($\bar{X}$ = 1.72; SD = 1.04)	56	26	11	04	02	01
Irritability in response to manipulation ($\bar{X}$ = 3.06; SD = 1.36)	17	18	26	21	18	01
Irritability in response to aversive stimuli ($\bar{X}$ = 3.35; SD = 1.32)	07	22	29	19	19	04
RESISTANCE TO SOOTHING						
Console latency after withdrawal reflex (prick on sole of foot) ($\bar{X}$ = 3.34; SD = 1.31)	07	18	38	19	09	09
Soothability after aversive stimuli ($\bar{X}$ = 2.66; SD = 1.12)	07	50	26	10	04	04
Soothability after cold disc ($\bar{X}$ = 4.20; SD = 1.67)	09	08	20	20	07	37
Soothability by various techniques (requiring varying amounts of intervention) ($\bar{X}$ = 2.49; SD = 1.45)	43	04	24	18	10	—
Soothability by pacifier ($\bar{X}$ = 2.45; SD = 1.26)	36	10	35	14	06	—
REACTIVITY						
Visual following (inanimate) of bulls-eye ($\bar{X}$ = 3.01; SD = 1.38)	21	15	20	29	15	—
Auditory orienting to rattle ($\bar{X}$ = 3.69; SD = 1.05)	03	11	21	42	22	—
Auditory orienting to bell ($\bar{X}$ = 3.20; SD = 1.06)	06	24	21	41	07	—
Auditory orienting to voice ($\bar{X}$ = 2.74; SD = 1.13)	13	33	28	19	07	—
Orienting to face and voice ($\bar{X}$ = 2.13; SD = 1.13)	36	34	16	10	04	—
Alertness during presentation of orienting items ($\bar{X}$ = 2.80; SD = 1.14)	15	25	33	20	07	—
REINFORCEMENT VALUE						
Cuddliness ($\bar{X}$ = 2.44; SD = 1.52)	39	27	—	19	15	—
Reinforcement value of infant's behavior during all assessments, but especially for maturational level, sensorimotor status and orienting behaviors ($\bar{X}$ = 2.89; SD = 1.23)	19	14	38	17	11	—
Irritability in response to manipulation ($\bar{X}$ = 2.96; SD = 1.34)	18	21	26	19	17	—
ACTIVITY LEVEL						
Spontaneous movements during assessment of maturational level, sensorimotor status, and orienting behaviors ($\bar{X}$ = 3.54; SD = 1.03)	01	18	28	32	21	—
Frequency and vigor of limb movements during active sleep ($\bar{X}$ = 2.93; SD = 1.17)	15	18	38	20	10	—

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The presentation and scoring of all items is described in detail in Riese [21]. To facilitate obtaining summary scores, all scales were designed so that a higher number indicated a higher level of the attribute being measured.

Many of the behaviors measured by this assessment share features with those measured by the Brazelton Neonatal Behavioral Assessment Scale [2] in that evaluations of orienting behaviors, irritability, soothability, etc., are obtained by both. Compilation of the present assessment, however, took into consideration the caregiver's involvement with the infant during extended periods of time, thereby observing behaviors that occur both spontaneously and as a result of specific manipulations. The purpose of this assessment, therefore, was to broaden the range of situations during which the infant's behavior is observed, and obtain aggregate measures that would more fully reflect the neonate's typical response, as averaged over several situations, since any single measure may be unduly susceptible to the specifics of the situation [9]. Consequently, the present assessment provides scores which represent a more extensive measure of specific behaviors such as irritability or resistance to soothing. The success of this procedure is evidenced by the behavioral consistency previously demonstrated with full-term infants [22]. In addition, items adapted from the Einstein scale were modified by Kurtzberg et al. [14] to eliminate redundancy and improve reliability. And, these items were selected to be suitable for both full-term and preterm infants of varying appropriateness of weight for gestational age [14].

RESULTS

Each infant received a score for all items in the neonatal assessment. The distribution of ratings for each item, based on the entire sample of 280 full-term and preterm infants, is presented in Table 2, along with the mean rating (X) and standard deviation (SD) for each item.

As indicated above, one purpose of this assessment was to begin to examine the contribution of constitutional factors to neonatal behavioral patterns. Therefore, the data were analyzed for concordance of scores within twin pairs, i.e., whether the average scores for the twins within each pair were more similar to one another than they were to the average scores of twins from other pairs. For this analysis a repeated-measures analysis of variance adapted for twin data [27] was used. The within-pair concordance is expressed in the form of a correlation coefficient. The correlation coefficients for average scores in each of the behavioral categories are presented in Table 3. [Tests of significance given by $F = (1 + R)/(1 - R)$].

TABLE 3. Within-Pair Correlations for Scores on Behavioral Categories

	Within-pair correlation	N (pair)
Irritability	.45[c]	132
Resistance to soothing	.33[c]	130
Reactivity	.22[b]	128
Reinforcement value	.35[c]	130
Activity level	.16[a]	132

[a] $P < .05$.
[b] $P < .01$.
[c] $P < .005$.

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The results indicated that there was significant concordance, or similarity, in the average scores between twins of each pair in all of the behavioral categories. For example, if one twin of a pair was generally highly irritable, its cotwin was likely to be generally highly irritable.

Because this combined sample included both full-term and preterm infants, it was necessary to determine if the twin similarities differed as a function of gestational age at birth. For this purpose, difference scores were created by subtracting twin B's score on each behavioral category from twin A's score on that category. These difference scores were then correlated with the gestational age of the twin pair. The resulting low-order correlations (range = .03 to .12) indicated that the twin correlations were not systematically related to gestational age.

As described previously [22], examining the data for each behavioral category separately, the analysis for the full-term sample indicated that there was behavioral consistency in four behavioral categories (irritability, resistance to soothing, reactivity, and reinforcement value). To examine possible differences between full-term and preterm infants, the first consideration was whether the preterm infant might display less consistency than the full-term infant within the categories of behavior. The preterm infants were divided into two groups: (1) preterm infants born between 35 and 37 weeks gestation and (2) preterm infants born between 29 and 34 weeks gestation. For the data analysis, the items within each category were analyzed for internal consistency [5] to determine if infants were relatively consistent in the scores they received over the various test situations. This analysis was performed separately for each of the preterm groups and the results were compared to those of the full-term group. Table 4 displays the internal consistency coefficients for each gestational age group separately.

As can be seen in Table 4, a comparison of the results for the full-term and two preterm groups indicated that there was no change in the basic measures of internal consistency in the categories of irritability, resistance to soothing, and reactivity. However, there was a decline in the consistency measure for reinforcement value as prematurity increased, with a significant difference ($P < .01$) between the 38–41-week group and the 29–34-week group. Thus, the preterm infants were not more erratic than the full-term infants in the behaviors displayed for the items in the first three categories. However, higher variability was observed for the earlier preterm group for the behaviors that affect reinforcement value. Within-individual variability was more likely to increase, therefore,

TABLE 4. Individual Consistency Within Behavioral Categories by Gestational Age at Birth

	Age at birth					
	38–41 wk		35–37 wk		29–34 wk	
Behavioral category	Internal consistency	N	Internal consistency	N	Internal consistency	N
Irritability (five items)	.75	112	.73	84	.75	68
Resistance to soothing (five items)	.86	108	.80	84	.86	68
Reactivity (six items)	.74	106	.72	82	.71	68
Reinforcement value (three items)	.72	108	.60	84	.46	68

for the items in this category as prematurity increased, reflecting differences in behavioral consistency based on gestational age at birth.

The second consideration pertaining to possible differences associated with prematurity was whether the ratings on the behavioral categories might differentiate between full-term and preterm infants. Differences between full-term and preterm singleton infants in specific areas of behavior have been discussed by several authors. For example, a difference in the ability of infants within these two groups to maintain a high level of arousal has been suggested [19]. Full-term infants have been found to score higher on the visual following and auditory orienting items than low-birthweight infants [14]. Less frequent crying during brief examinations has been reported for preterm infants tested at term gestational age than infants born at term [7, 16, 19, 25, 28]. The organization of active sleep in preterm infants of term gestational age has been described as atypical when compared to that of full-term infants [8].

Therefore, to determine if the ratings detected differences associated with prematurity, a stepwise discriminant analysis was performed on the behavioral category scores for the two extreme groups (BMDP Biomedical Computer Programs, P-Series, 1979 [Health Sciences Center, UCLA]). The means for the two groups and the results of the discriminant analysis are presented in Table 5.

The analysis indicated that four of the behavioral categories contributed significantly to the discriminant function. The behavioral category resistance to soothing best discriminated between the two groups, with an F - to - enter of 35.34. The three other variables which significantly contributed to the discrimination between the two groups were, in descending order, reactivity, irritability, and activity level during active sleep. Inspection of the means for the two groups of infants indicated that (1) the full-term infants were more irritable, more resistant to soothing, and more reactive than the preterm infants; (2) the preterm infants demonstrated a higher activity level during the active sleep period than the full-term infants; and (3) there was no difference between the two groups in activity level while awake, or in the reinforcement value of their behavior.

The discriminant analysis also predicts group membership on the basis of the composite discriminant scores and accomplished an average of 71.2% correct placement in the full-term or preterm group based on scores on this assessment. Thus, the discriminant analysis

TABLE 5. Means and Standard Deviations (SD) of Scores on the Behavioral Variables by Gestational Age at Birth

	38–41 weeks (N = 108)		29–34 weeks (N = 69)		
Variable	Mean	SD	Mean	SD	F-to-enter
Irritability	2.66	0.93	1.95	0.70	5.40[b]
Resistance to soothing	3.44	1.06	2.48	1.01	35.34[d]
Activity (awake)	3.73	1.03	3.45	1.06	0.60
Activity (active sleep)	2.78	1.10	3.04	1.14	4.12[a]
Reactivity	2.99	0.79	2.86	0.70	6.74[c]
Reinforcement value	2.56	1.17	2.92	0.83	2.25

[a]$P < .05$.
[b]$P < .025$.
[c]$P < .01$.
[d]$P < .001$.

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demonstrated that the assessment procedure was sensitive to behavioral differences between full-term and stable preterm infants.

DISCUSSION

These results have demonstrated concordance, or similarity, of behavior within twin pairs, suggesting a constitutional influence on certain behavioral patterns during the neonatal period. The observed similarities in these behaviors may reflect zygosity, prenatal experiences, and other birth experience factors to varying degrees. For example, the items in the reactivity category are also a measure of the neonate's integrity [14], which could be influenced by prenatal and perinatal factors.

Finding individual consistency in the behavioral categories irritability, resistance to soothing, reactivity, and reinforcement value across birth gestational ages indicates that even in the stable premature infant a patterning of behavior can be demonstrated. The decrease in individual consistency of scores as prematurity increases as found in the reinforcement value category may be giving us some valuable information about some characteristics of the preterm infant. Since the preterm infant is at risk for child abuse and failure-to-thrive [18], and since it has been suggested [12] that characteristics of the child may differentially induce abuse, one consideration may be that the parent is getting "mixed signals" from the infant.

It has also been demonstrated that scores on four of the behavioral dimensions were highly successful in discriminating between full-term infants and preterm infants born between 29 and 34 weeks gestation, confirming and adding to the observations of others on behavioral differences between full-term and preterm singletons. The largest discriminating factor indicated that the full-term infants were more resistant to soothing than the preterm group. Differences in degrees of reactivity, irritability, and activity level during active sleep were also found. The difference in degree of reactivity confirms the results of Kurtzberg et al. [14], who reported higher performance on the visual following and auditory orienting items by full-term infants than by low-birthweight infants. Where it has been observed by others that preterm infants do not cry as frequently as full-term infants during a brief examination, it has been demonstrated here that this lower irritability rating for the preterm infant is maintained during a more comprehensive testing session. Finding differences between these two groups in activity level during active sleep provides an additional factor which differentiates the state organization of full-term and preterm infants. These findings suggest, therefore, that behavioral differences observed between full-term and preterm twins are comparable to those observed by other investigators between full-term and preterm singleton infants.

It is apparent, then, that even though internal consistency within several areas of behavior has been demonstrated throughout the range of gestational ages reported here, the finding of singificant differences in average scores between full-term and stable preterm infants indicates that the preterm infant's behavior may not be quite what the parent expects at this stage of development. That is, the preterm infant appears to present a lower level of arousal in several areas of behavior. Not only is the preterm infant generally less irritable than the full-term infant, but it is also not as responsive to auditory and visual stimulation. In one sense this type of behavior makes caregiving easier, especially in the case of twins when the greater demands of caring for two newborn infants simultaneously places increased stress on the family. However, neonatal crying expresses various needs and demands to the caregiver [28]. In addition, alert and responsive neonates

have been shown to have more responsive and stimulating mothers [20]. Thus, in terms of presenting clear or invitational signals to the caregiver, the preterm infant does not elicit as much interactional behavior as the full-term infant: If an infant is not irritable it does not have to be soothed; if it does not respond in some demonstrable way to auditory stimulation, the caregiver is likely to reduce attempts at stimulation. If the parent has two infants exhibiting these behavioral patterns, the opportunities for stimulation for each infant will be even less than for a single preterm infant. It may be helpful to counsel the parent that, even though these preterm twins are now medically stable, the range of behaviors exhibited may not be that which would generally be anticipated. Thus, the infant's behavior (or lack of certain behaviors) would not as likely elicit inappropriate responses from the parent, and increased opportunities for interaction may be encouraged.

Many of the neonates described here will be followed as part of longitudinal study of development in twins. As suggested by Thomas et al. [26] such a study may not only provide information about the origins of behavioral style, but also about the contribution of initial similarities and differences in behavior to parent-child interaction.

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