

한국심리학회지: 건강  
The Korean Journal of Health Psychology  
2008. Vol. 13, No. 4, 977 - 994

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# The relationship between parent physiological reactivity to infant signals during pregnancy and later infant temperament<sup>†</sup>

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This study examines the relationship between infant temperament and parent physiological reactivity to a infant smiling and crying stimuli tape during pregnancy. The data for this study came from a larger longitudinal study examining newlywed couples and the transition to parenthood. The current investigation examined 23 married couples who took part in both pregnancy and post birth measures. Couples came into the laboratory when each wife was approximately 6 months pregnant and again when their infant was 3-6 months old. At the prenatal visit, ECG and finger pulse transit time were measured during a baseline condition and a condition in which couples watched a tape with a smiling or crying baby. The Infant Behavior Questionnaire (IBQ; Rothbart, 1978) was administered to appraise the parents' assessments of their infant's temperament. Results revealed several measures of parent physiology, in response to infant signals, during pregnancy predicted parent report of infant temperament. Specifically, physiological responses indicating father relaxation were related to positive indexes of infant temperament, and physiological data indicating mother's arousal in response to the smiling baby stimuli predicted later infant distress.

*Keywords:* infant signals, infant temperament, psychophysiology, pregnancy, pre-natal

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<sup>†</sup> This work was supported by a research grant from Seoul Women's University(2008).

I am indebted to Dr. Alyson Shapiro for generous mentorship and wise counsel for the study. I also acknowledge Dr. John Gottman, former advisor, for his invaluable support.

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Research examining parental physiological responses to infant signals is of clear importance from a clinical perspective because the research on this topic indicates that high levels of physiological reactivity to both positive and negative infant signals is linked to child abuse (Frodi & Lamb, 1980). The parents' perceptions and reactions to infant signals may play a critical role in parent-child relationships and infant temperament. Infant temperament, in particular could be influenced either by parenting related to the parent's reactivity, or by a common underlying genetic pre-disposition to being hyper sensitive or hyper reactive. However, there is little research examining parental physiological responses to infant signals. The goals of the present study were twofold: 1) to determine whether parent physiology during pregnancy in response to viewing an infant crying and smiling predict later infant temperament, and 2) to examine possible gender differences in physiological reactivity to infant signals.

#### **Physiological responses to Infant signal**

There has been a handful of research conducted examining physiological responses to infant signals (Frodi & Lamb, 1980; Frodi, Lamb & Wille, 1982; Huffman Pedersen, Del Carmen, & Bryan, 1996). A landmark study by Frodi & Lamb (1980) looked at how

child-abusing parents responded to infant signals relative to non-abusive parents. They found that parents who abuse their children experienced greater increases in heart rate and skin conductance while watching a videotape of a crying infant, indicating high arousal. They also found that child abusers responded with physiological arousal in the smiling segment, instead of relaxing in response to the smiling infant like the non-abusers did. In other words, the abusers responded to the smiling and crying stimuli similarly. Frodi (1981) suggested that these findings along with other research indicate that a combination of parental dispositions and infant characteristics, such as an increased tendency to cry or fuss, contribute to the risk for child abuse.

Research examining gender differences in physiological responses to infant signals have resulted in mixed indications. Frodi and Lamb (1978) found no gender differences in the physiological reactivity of males compared to females during late childhood and adolescence and also found no gender differences in physiological or emotional responsiveness of new parents to infant signals (Frodi, Lamb, Leavitt, & Donovan, 1978). Brewster and Nelson (1998), in contrast, found that adult males showed more reactivity in response to infant crying than females as indicated by their skin conductance and increases in heart rate. The Brewster and Nelson (1998) sample was

unique in that they sampled from a specific population of adults who were part of a military community, and it may be something related to the military training or experiences military personnel are exposed to that promotes a sense of hyper-reactivity to potentially aversive stimuli such as infant crying. While these discrepant results are interesting, no clear conclusion can be drawn due to the contradictory findings. Thus, further research into potential gender differences in physiological responses to infant signals is needed to clarify the findings.

Huffman and her colleagues (1996) examined the responses of expectant parents to infant signals and found that aspects of prenatal responses to infant cries predicted postnatal perceptions of their own infant's temperament and their post-birth marital satisfaction. Specifically, expectant mothers who rated the recordings of infant crying as more aversive prenatally later described their 3-month-old infants as more fussy and unpredictable. Boukydis and Burgess (1982) explored parents' physiological responses to audiotapes of infants' different types of crying (difficult, average, easy) and examined effects of infant temperament, parent status (non-parent, primiparous, multiparous), infant temperament, and parents' gender. First-time parents had the highest levels of arousal and multiparous parents had the lowest levels. Pregnant women

generally show greater arousal to infant stimuli than males or than non-pregnant women.

### Temperament

Developmental researchers have made great strides in their increasing ability to measure and trace the development of early temperamental dispositions over the past quarter of a century (Rothbart, 1973, 1981). Temperament generally refers to individual differences across contexts in reactions to stimuli, in the expression of emotions, in arousal, and in self-regulation (Anselmo & Franz, 1995; Derryberry & Rothbart, 2000; Kagen & Snidman, 1999). Thomas and Chess (1984) described temperament as the "how" of behavior as compared to the "what" (abilities) and the "why" (Motivation) of behavior. Some temperament theorists argue that these individual differences across contexts are biologically based (Kagen & Snidman, 1999). Recent theorists such as Rothbart, however, have conceptualized infant temperament as the results of both one's genetic predisposition and their environment, explicitly allowing for the possibility that environmental factors affect temperament (Rothbart, Chew, & Gartstein, 2001). In the current research, we have adopted Rothbart's definition of temperament as an individual infant's general style of behavior across contexts (Rothbart et al., 2001). Infant

temperament includes a variety of behavioral characteristics such as general activity level, regularity, distress to limitation and smiling.

Temperament is a complex construct with the potential of having a far-reaching impact on the developing infant and his family. There is evidence that temperament can affect relationships (Van Den Boom, 1995), and conversely that the quality of the infants relations has an impact on parental perception of infant temperament (Priel & Besser, 2000). Although there is some variation in parental ratings of infant temperament over the first year of life, there is also evidence that early temperament is linked with later outcome (Prior, Smart, Sanson, & Oberklaid, 2000; Terrikangas, Aronen, Martin, & Huttmen, 1998; Thomas & Chess, 1984).

Researchers examining the long-term predictive ability of early temperament have been successful in establishing links with later child adjustment, psychology, and aspects of adolescent personality. Specifically, Terrikangas and colleagues (1998) found that a fussy/demanding temperament in infancy predicted psychiatric symptoms in adolescence. Thomas and Chess found that infant temperament classified in terms of easy and difficult patterns predicted later child adaptation (1984a). Finally, Prior and colleagues (2000) found that a shy-inhibited temperament in infancy was predictive of anxiety problems as

late as the adolescent period.

There is evidence that infant irritability influences the developing mother-infant relationship (Van Den Boom, 1995). Specifically, mothers of infants who were identified as having difficult temperaments in Brazelton neonatal exams tended to be less responsive to their infants crying. The infants in turn, were more likely to develop insecure attachment relationships with their mothers (Van Den Boom, 1995). Given that attachment has been linked to a number of child outcomes (Hamilton, 2000), these findings could have profound implications for the development of the infant as well as the continuing mother-child relationship.

#### Goals of the current research

The present study was designed to examine parental physiological reactivity to infant signals as a potential predictor of later infant temperament and to extend the research examining the role of gender in physiological reaction to infant signals. Two hypotheses were tested. First, we hypothesized that the physiological responses of expectant parents to infant crying and smiling would predict the aspects of temperament in their infant several months post birth. Specifically, calm or relaxed parent physiology while watching and listening to infant signals was expected to predict

positive aspects of later infant temperament such as smiling and low levels of distress. Second, we hypothesized there would be no corresponding gender differences on psychophysiological measures of responsiveness to infant signals based on the combined findings of Frodi and her colleagues that men and women showed overpay similar physiological arousal and responding to the same stress-related cues (Frodi et al., 1978; Frodi & Lamb (1978).

## Methods

### Participants

The data for the present investigation came from a larger longitudinal study examining newlywed couples and the transitions some of these couples make to parenthood. A sample of 130 newlyweds was initially recruited from the Puget Sound area of Washington through newspaper advertisements. Couples who responded to the ad were surveyed by phone and administered the telephone version of the Marital Adjustment Test (MAT; Krokoff, 1984; Locke & Wallace, 1959) to determine their eligibility. The eligibility criteria for the study consisted of being childless and having been married for the first time within 9 months of participating in the study. Couples who represented an even distribution of marital

satisfaction and met the eligibility criteria were invited to join the study after screening phone interview including health condition. The racial and ethnic distribution in this sample matched the City of Seattle's Planning Commission Report (1990). Demographic characteristics for these newly married couples included a mean wife age of 25.4 ( $SD= 3.5$ ) and mean husband age of 26.5 ( $SD = 4.2$ ). This was a predominantly middle class sample.

The current investigation examined 23 of these married couples who became parents during the time they were followed and who took part in both pregnancy and post birth measures. At the time these families came in for a pregnancy laboratory visit, the average wife marital satisfaction as measured on the Marital Adjustment Test was 129 ( $SD = 14$ ) and the average husband marital satisfaction was 116 ( $SD= 15$ ). These values reflect the relatively high marital satisfaction expected during the pregnancy period (Raush, Barry, Hertel, & Swain, 1974). The infants in the sample consisted of 10 female and 13 male infants. None of them were preterm or underweight. Their health conditions were normal.

### Procedures

*Human Subjects.* The Human Subjects committee at the University of Washington

approved all procedures, and both spouses in each couple gave their informed consent to participate in the current research.

*Prenatal.* Couples came into our laboratory when the wife was around 6 months pregnant. During the lab visit they watched a videotape of both positive and negative infant signals. Specifically, there were 3 two minute video segments that couples watched, one with a crying baby, one with a happy or smiling baby, and one with a baby with neutral affect. The neutral baby segment separated the presentation the smiling and crying baby. Presentation order was counterbalanced such that couples were randomly assigned to groups that viewed either the crying or smiling baby first.

Husband and wife electrocardiogram (ECG), measuring heart rate activity, and Finger pulse transit time (FPT) were collected from each expectant parent. Physiological data was collected during a two-minute baseline period prior to watching the stimulus tape and when couples were watching the videotape with the smiling and crying babies. During the baseline condition, the couple sat quietly with their eyes closed enabling us to examine their physiology while they were relaxed.

*Postnatal.* The Infant Behavior Questionnaire (IBQ; Rothbart, 1978) was administered separately to each parent to appraise parent assessments of their infant's temperament when their babies were 3-6 months of age.

### **Physiological measures**

At the prenatal assessment, physiological data was collected through the use of two Lafayettee Instruments 6-channel polygraphs and a standard PC-AT style computer with 2 Metrabyte Dash 16 boards to record and store the physiological data. Data acquisition and analysis software was developed using the ASYST programming environment. Electrocardiogram (ECG) and Finger pulse transit time (FPTT) were used for this study. ECG is used for gathering heart rate activity. ECG was collected using a bipolar configuration of miniature electrodes. FPTT measures the rate at which one's blood travels from the heart to the finger and is a measure of parasympathetic nervous system activation. Finger Pulse was indexed using a pulse oximeter attached to the middle finger. The FPTT interval was timed between the R wave of the ECG and the upstroke of the finger pulse in milliseconds. Higher heart rate and shorter finger pulse transit time were considered indicators of physiological arousal, while slower heart rate and longer FPTT were considered reflective of a relatively calm and relaxed physiological state.

### **Parent Report Measures**

**Infant Behavioral Questionnaire** (Rothbart,

1978). When infants were approximately 3 months old, their parents were asked to complete the Infant Behavior Questionnaire separately (IBQ). The IBQ is composed of 94 items rated on a seven-point scale ranging from "never" to "always" designed to assess the frequency of infant's behaviors in everyday life situations. Mean item-scale correlations for the IBQ have ranged from .41 to .77, with coefficient Alpha's ranging from .67 to .84 (median = .79). The IBQ was designed to yield six subscales: activity level, smiling and laughter, distress and latency to approach novel stimuli, distress to limitations, soothability, and duration of orientating. These scales were designed to avoid conceptual overlap, allowing for the examination of inter-correlations across scales. Composite scores reflecting two of these subscales of interest are examined in the present study, infant smiling and laughter, and infant distress to limitation. The smiling and laughter composite score was of particular interest because we considered it to be reflective of positive affect and reactivity, while distress to limitations was considered reflective of negative reactivity.

The smiling and laughter scale assesses smiling or laughter from the child in any situation. Although negative affect is most prevalently associated with arousal, this smiling and laughter variable has been identified as an indicator of arousal in the form of enjoyment or

excitement under safe conditions (Rothbart 1973, Sroufe & Waters, 1976), and is worthy of a more thorough exploration. This scale is viewed as an indicator of positive emotional reactivity in the current research. One example item that assess smiling and laughter in the IBQ is, "How often during the last week did the baby smile or laugh when given a toy?"

Distress to limitation assesses a baby's fussing, crying or showing distress while in a confining situation such as when the baby can't perform a desired action due to the care taking activity being performed (such as diapering). This preponderance of crying, fussing, or otherwise signaling distress in situations where the infant's behavior is limited is considered an index of negative emotional reactivity in the current research. An example of an item that reflects infant distress or frustration to limitations is, "When placed on her/his back, how often did the baby fuss or protest?"

## Results

First, Pearson's correlations were conducted to examine the intercorrelations about how mothers and fathers agree about infant temperament. Each IBQ subscale (smiling and laughter, distress to limitation) between fathers ( $M= 5.10$ ,  $SD= .81$  for smiling and laughter,  $M= 3.81$ ,  $SD= .92$  for distress to limitation) and mothers ( $M= 5.08$ ,  $SD= .73$  for smiling and

laughter,  $M= 3.73$ ,  $SD= .59$  for distress to limitation) is significantly correlated each other ( $r= .94$ ,  $p < .001$  for smiling and laughter,  $r= .86$ ,  $p < .001$  for distress to limitation). A series of partial correlations were conducted to examine the Relationship between postnatal infant temperament and prenatal parent physiological reactivity to infant smiling and crying signals controlling for baseline physiology. In all cases, the mean physiology for each person in response to each infant stimulus was computed and used in the following analyses. The results of these analyses revealed that several measures of expectant parent physiological responses to

infant signals predicted later parent report of infant temperament.

Long finger pulse transit time in expectant fathers during the crying ( $M= 221.92$ ,  $SD= 19.22$ ,  $r = .70$ ,  $p < .05$ ) and smiling ( $M= 225.92$ ,  $SD= 16.83$ ,  $r = .72$ ,  $p < .05$ ) stimuli were significantly and positively correlated with later report of infant smiling and laughter. Relatively long finger pulse transit time is related to a slower velocity of blood flow, reflecting calmness rather than arousal. Thus, fathers who were relatively calm, as reflected by finger pulse transit time, in response to both smiling and crying infant signals were more likely to rate their own infant's as expressing more

Table 1. Predictors of Infant Temperament

Physiology			Infant temperament Subscales	
			Smiling and Laughter	Distress and Limitation
Smiling Segment	Finger Pulse Transit Time	H	$r = .72^*$	$r = -.02$
		W	$r = -.32$	$r = .28$
	Heart Rate	H	$r = .28$	$r = .01$
		W	$r = -.39$	$r = .52^*$
Crying Segment	Finger Pulse Transit Time	H	$r = .70^*$	$r = -.18$
		W	$r = -.31$	$r = .42$
	Heart Rate	H	$r = -.17$	$r = .01$
		W	$r = -.43$	$r = .07$

\*Note. H = husband, W= wife

\* $p < .05$ .



smiling and laughter months later. Increased heart rate of expectant mothers during the smiling segment was positively correlated with infant distress ( $M= 86.19$ ,  $SD= 10.65$ ,  $r = .52$ ,  $p < .05$ ). There was no significant relationship found between expectant mother finger pulse transit time ( $M= 205.62$ ,  $SD= 12.50$  for smiling stimuli;  $M= 202.92$ ,  $SD= 13.24$  for crying stimuli) in response to infant signals and later report of infant temperament after controlling for each mother's baseline physiology.

Expectant mother heart rate in response to infant smiling ( $r = .52$ ,  $p < .05$ ), but not crying ( $M= 86.56$ ,  $SD= 12.84$ ,  $r = .07$ , n.s.), was related to her later report of her own infant's distress to limitations. Specifically, if mothers' responded to infant smiling with higher heart rate relative to other mothers, reflecting arousal, they were more likely to rate their own infants as demonstrating more distress to limitations months later. The mean heart rate of expectant fathers ( $M= 69.33$ ,  $SD= 9.03$  for crying;  $M= 70.51$ ,  $SD= 8.98$  for smiling) in response to infant crying, and smiling stimuli were not significantly related to later father report of infant temperament. These results are reported in detail in Table 1.

A series of t-tests were conducted to examine the role of gender in physiological responses to infant smiling and crying signals. The mean baseline physiology was subtracted from the mean physiological response for each

spouse to control for baseline physiology. Expectant fathers did not differ from expectant mothers in their physiological responses to the infant smiling or crying stimuli. Specifically, there were no significant differences in parental heart rate ( $t(15) = .85$ ,  $p = \text{n.s.}$ ) or finger pulse transit time ( $t(8) = 1.1$ ,  $p = \text{n.s.}$ ) in response to the smiling stimuli, and no differences in parental heart rate ( $t(15) = 1.0$ ,  $p = \text{n.s.}$ ) or finger pulse transit time ( $t(8) = 1.9$ ,  $p = \text{n.s.}$ ) in response to the crying stimuli.

## Discussion

The current investigation found that the physiological reactivity of expectant parents to infant signals predicted later parental report of infant temperament along a number of dimensions using the Rothbart IBQ. Specifically, physiological responses indicating father calmness or relaxation was related to later father report of infant smiling and laughter. Physiology indicating mother arousal or agitation in response to infant' signals predicted later reported infant distress to limitations. These results are straightforward in the sense that expectant physiological reactivity to infant signals reflecting arousal or agitation predicted relatively negative aspects of infant temperament (distress to limitations), while physiology reflecting calmness predicted more positive aspects of infant temperament (smiling

and laughter). The findings, however, are complex in that different aspects of physiological responsiveness in the expectant mother and father were related to different aspects of later reports of infant temperament.

A number of theoretical approaches can be taken to explain these results. We address a number of possible explanations in the following section including: a common genetic basis, parenting, and the impact of pre-natal maternal stress through the fetal environment.

### Genetics

The genetic pre-dispositions in the parents, evident in their physiological reactivity to infant signals, may be inherited by their infants. For instance, it could be explained by these traits being sex-linked that babies of relaxed fathers were more likely to be relaxed and elicit positive emotion like smiling and laughter, and babies of jitters might show more anxiety and distress to the limitation. Despite the diversity of child temperament theories, contemporary approaches recognize the importance of genetic influences on individual differences in behavior (Goldsmith, Bradshaw & Campos, 1987). The strongest evidence for genetic influences on temperament comes from twin studies. For example, Neale and Stevenson (1989) analyzed the EASI (Emotionality, Activity, Sociability, Impulsivity) temperament scale (Buss & Plomin,

1975) data from 541 twin pairs with a mean age 42 months. Mothers rated monozygotic (MZ) twins of both sexes as highly similar on the activity scale, whereas dizygotic (DZ) twin ratings of activity showed no resemblance to each other. Additionally, significant genetic variance has been found in activity level, approach or withdrawal, and intensity of reaction and quality of mood (Chen, et. al. 1990).

### Parenting

Parenting is another mechanism through which parent physiology and later infant temperament may be related. Mothers who are more likely to be aroused or agitated by any infant stimuli even if it is positive emotion (reflected by their physiological arousal in response to the videos of infant stimuli), may be more likely to parent in ways that promote infant distress to limitations. Easily agitated mothers, for example, may be more likely to over-stimulate their babies, or simply not be sensitive and responsive to their cues, in situations that are ones of potential distress. These situations are likely to include those that are tapped into the by distress to limitations temperament dimension (Rothbart et al., 2001), such as diaper changing and lying babies down on their backs.

Fathers who are calm or relaxed in

response to positive infant signals (smiling and laughter) relative to other fathers may be more likely to interact with them from the beginning of life in ways that promote infant smiling and laughter. Research in the area of fathering indicates that fathers play a special role in play with their infants (Parke, 1996). This is evident in the bright-eyed and facially expressive responses infants give their fathers during face-to-face play even in the first few months of life, and particularly evident as these infants grow older, and fathers begin engaging in rough and tumble play with them. Thus, it makes sense that infant smiling and laughter would be actively promoted through father-infant interactions even more than through mother-infant interactions. This rationale is consistent with the link found in the current research between father, but not mother, pre-natal physiological reactivity and later infant smiling and laughter.

A link between parent physiological reactivity and parenting behavior makes sense when taking previous research into consideration. Frodi and Lamb's (1980) research, in particular, suggest a link between parental physiological reactivity to infant signals and the parental predisposition towards child abuse. Depressed mothers also tend to be less responsive to their infants cues (Goodman & Gotlib, 2002 ; Jolley, Shapiro, Krentz & Spieker, 2005), either withdrawing from them or

over-stimulating them (Field, 2002).

There are studies examining the effects of temperament on the developing parent-child relationship and parenting-temperament fit (Kochanska, Aksan & Carlson, 2005; Van Den Boom, 1995). Research indicating that early post-partum depression in the absence of depression during pregnancy is predictive of later infant temperament (Jolley & Shapiro, 2006) suggests a link between parenting and temperament. However, further research is needed on the effects of parenting on temperament (Clark, 2005; Gordon, 1981), and thus further research is needed to examine the parenting as a potential avenue that would explain the link between pre-natal parent reactivity and post-natal temperament.

### **The pre-natal environment**

Physiological reactivity in the expectant parents may reflect stress, or lack of stress, during pregnancy which may influence fetal development and thus influence later infant temperament. In the case of the expectant mothers who showed physiological reactivity reflecting arousal or agitation that predicted later infant distress, in particular, is likely to reflect some level of pre-natal maternal stress or predisposition to responding to stress. The calm physiological responses of the expectant father that predicted infant smiling in laughter,

in contrast, may reflect the buffering quality a calm supportive partner could have on his pregnant spouse, relieving her stress.

Research has indicated clear links between pre-natal maternal stress, fetal responses, and child outcome. An investigation that exposed non-human primates to stress resulted in offspring having irritable temperament, shorter attention spans, and enhanced behavioral reactivity to stressors later in life (Sandman, Wadhwa, Dunkelschetter, Chiczdemet, Belman, Porto, Munara, Garite, & Crinella, 1994). The level of anxiety and stress in pregnant women has been related to the motor activity of the fetuses (DiPetro, Hilton, Hawkins, Costigan & Pressman, 2002; Van den Burgh, 1990) and significant increases in fetal heart rate (Monk, Fiber, Mayers, Sloan, Trien & Hartado, 2000). Finally, research predicting from the early marriage to infant physiology (Shapiro, 2005) suggests a link between pre-natal marital stress and later infant emotion regulation difficulties as reflected through low respiratory sinus arrhythmia, a closely related construct to vagal tone that has been associated with emotional regulation abilities (Porges, 2001).

In summary, there a number of possible avenues through which physiological reactivity in expectant parents could be linked to later parental report of infant temperament. We have examined the possibility that infant temperament could be impacted through: genetics, parenting,

and the fetal environment. While each of these explanations are plausible in and of itself, it is likely that genetics, parenting, the pre-natal environment, and interactions between these factors are all avenues through which the parents physiological disposition is related to later infant outcome.

The findings of the current study revealing no gender differences in physiological responses to infant signals are consistent with those of Frodi, Lamb and colleagues in their research with new parents (Frodi et al., 1978) and their research with children and adolescence (Frodi & Lamb, 1978). Although a failure to find significant differences between groups does not mean one can accept the null hypothesis that both groups are the same, the lack of significant differences evident in this research suggests that men and women exhibit similar physiological responses to infant signals. Similar to the conclusions drawn by Frodi and Lamb (1978), we suggest that there is no clear biological basis for differences in sensitivity and responsiveness in fathers compared to mothers.

Based on these findings in combination of those of Frodi and Lamb (1978), we believe the gender differences found by Brewster and Nelson (1998) is likely to reflect differences specific to their military sample they examined. It makes sense, for example, that men with military training would be more likely to be more hyper vigilant or hyper reactive compared

to their non-military wives. However, according to Boukydid and Burgess (1982), first-time pregnant women had the highest levels of arousal to infant stimuli (positive or negative) than males or than non-pregnant women. It would be interesting to see if we can expect the same results for mothers vs fathers when not pregnant.

### Limitations

The current research has a number of limitations that have implications for future research. The sample size examined was small, which both limits the power for obtaining significant results and the confidence with which we can generalize from the results. It is also important to note that the infant temperament variable examined was a parental report of infant temperament measure rather than one derived from actual observation of infant behavior across contexts. Thus, it is parental perceptions of infant temperament rather than observed temperament, which is examined in the current research. These perceptions may or may not be accurate and are subject to parental biases. While previous research reports correlations between observed temperament and parental report (Rothbart et al., 2001), and findings regarding parental report is interesting in and of itself, research replicating the current study with the inclusion

of observed measures of infant temperament would help substantiate the links suggested by the current study. It might be also interesting to speculate about the current design to include participants' rating of perceived temperament to infant stimuli (assessed when mothers were pregnant) and to assess physiological responses to videotaped infant stimuli and temperament rating after pregnancy.

Finally, the research is limited by its descriptive nature. While the findings linking pre-natal parental physiological reactivity to infant signals and later report of infant temperament are proactive, it is impossible to draw causal links from the current research. Further descriptive and experimental research examining possible mechanisms of effect are warranted.

### Implications

Since the parents pre-natal physiological responses to infant signals during pregnancy appears to be predictive of later infant temperament, or at least parental report of infant temperament, it is plausible that the parents attitudes and overall approach to infant signals may be important for positive fetal and infant development. Since not only mothers pre-natal reactivity, but also expectant fathers reactivity was predictive of later infant outcome, this may have implications for the importance

of the father's involvement during pregnancy. One avenue through which both positive expectant father involvement and an overall calm and positive attitudes during pregnancy could be promoted would be during birth preparation classes, or other programs targeting individuals or couples expecting a baby.

### References

- Anselmo, S., & Franz, W. (1995). *Early childhood development: Prenatal through age eight*. Englewood Cliffs, New Jersey: Merrill.
- Braungrat, R. J., Garwood, M. M., Powers, B. P., & Notaro, P. C. (1998). Infant affect and affect regulation during the still-face paradigm with mothers and fathers: The role of infant characteristics and parental sensitivity. *Developmental Psychology, 34*(6), 1428-1437.
- Brewster, A. L., & Nelson, J. P. (1998). Gender differences in physiological reactivity to infant cries and smiles in military families. *Child Abuses & Neglect, 22*, 775-788.
- Buss, A. H., & Plomin, R. (1975). *A temperament theory of personality development*. New York: Wiley.
- Chen, C. J., Yu, M. W., Wang, C. J., & et. al. (1990). Genetic variance and habitability of temperament among Chinese twin infants. *ACTA Geneticae Medicae et Gemellologiae, 39*(4), 485-490.
- Clark, L. A. (2005). Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology, 114*(4), 505-521.
- DiPietro, J. A., Hilton, S. C., Hawkins, M., Costigan, K. A., & Pressman, E. K. (2002). Maternal stress and affect influence fetal neurobehavioral development. *Developmental Psychology, 38*(5), 659-668.
- Derryberry, D., & Rothbart, M. K. (1997). Reactive and effortful processes in the organization of temperament. *Development and Psychopathology, 9*, 633-652.
- Field, T. (1996). Attachment and separation in young children. *Annual Review of Psychology, 47*, 541-561.
- Frodi, A. M. (1981). Contribution of infant characteristics to child-abuse. *American Journal of Mental Deficiency, 85*(4), 341-349.
- Frodi, A. M., & Lamb, M. E. (1978). Sex differences in responsiveness to infants: A developmental study of psychophysiological and behavioral responses. *Child Development, 49*, 1182-1188.
- Frodi, A. M., & Lamb, M. E., Leavitt, L.A. & Donovan, W.L. (1978). Fathers and mothers responses to infant smiles and cries. *Infant Behavior and Development, 1*, 187-198.

- Frodi, A. M., & Lamb, M. E. (1980). Child abusers' responses to infant smiles and cries. *Child Development, 51*, 238-241.
- Frodi, A. M., & Lamb, M. E., & Wille, D. (1982). Mother's responses to the cries of normal and premature infants as a function of the birth status of their own child. *Journal of Research in Personality, 15*, 122-133.
- Goldsmith, H. H., Bradshaw, D. L., & Campos, J. J. (1987). Attachment, temperament, and social referencing-interrelationship among three domains of infant affective behavior. *Infant Behavior & Development, 10*(2), 223-231.
- Goodman, S., & Gotlib, I. H. (Ed). (2002). Children of depressed parents: Mechanisms of risk and implications for treatment. Washington, DC, US: American Psychological Association.
- Gordon, B. N. (1981). Child temperament and adult behavior—an exploration goodness of fit. *Child Psychiatry and Human Development, 11*(3), 167-178.
- Hamilton, C. E. (2000). Continuity and discontinuity of attachment from infancy through adolescence. *Child Development, 71*(3), 690-694.
- Huffman, L. C., Pedersen, F. A., Del Carmen, R., & Bryan, Y. E. (1996). Prenatal maternal reactivity to infant cries predicts postnatal perception of infant temperament marriage appraisal. *Child Development, 67*(5), 2541-2552.
- Jolley, S. N. & Shapiro, A. F. (March 2006). *Relationships between postpartum depression and infant temperament*. Poster session presented at a meeting of the Western Institute of Nursing. Albuquerque, New Mexico.
- Jolley, S. N., Shapiro, A. F., Krentz, U. C., Spieker, S. J. (August, 2005). *The influence of early postpartum depression on the developing mother-infant relationship and observed infant temperament*. Poster session presented at the 11<sup>th</sup> Biennial NCAST-AVENUW Institute. Bellevue, WA.
- Kagen, J., & Snidman, N. (1999). Early childhood predictors of adult anxiety disorders—a control study. *Biological Psychiatry, 46*(11), 1536-1541.
- Kochanska, G., Aksan, N., & Carlson, J. J. (2005). Temperament, relationships, and young children's receptive cooperation with their parents. *Developmental Psychology, 41*(4), 648-660.
- Krokoff, L. J. (1984). A telephone version of the Locke-Wallace test of marital adjustment. Unpublished manuscript, University of Illinois, Champaign.
- Locke, H., & Wallace, K. (1959). Short marital adjustment and prediction tests: Their reliability and validity. *Marriage and Family Living, 2*, 251-255.
- Monk, C., Fifer, W. P., Myers, M. M., Sloan, R. P., Trien, L., & Hurtado, A. (2000). Maternal stress responses and anxiety

- during pregnancy: Effects on fetal heart rate. *Developmental Psychology*, 36(1), 67-77.
- Neal M. C., & Stevenson, J. (1989). Rater bias in the EASI temperament scales: A twin study. *Journal of Personality and Social Psychology*, 56(3), 446-455.
- Parke, R. D. (1996). *Fatherhood*. Cambridge, MA: Harvard University Press.
- Priel, B., & Besser, A. (2000). Adult attachment styles, early relationships, antenatal attachment, and perceptions of infant temperament: A study of first-time mothers. *Personal Relationships*, 7(3), 291-310.
- Prior, M., Smart, D., Sanson, A., & Oberklaid, F. (2000). Does shy-inhibited temperament in childhood lead to anxiety problems in adolescence? *Journal of the American Academy of Child and Adolescent Psychiatry*, 39(4), 461-468.
- Porges, S.W. (2001). The polyvagal theory: Phylogenetic substrates of a social nervous system. *International Journal of Psychophysiology*, 42, 123-146.
- Raush, H. L., Barry, W. A., Hertel, R. K., & Swain, M. A. (1974). *Communication, conflict and marriage*. San Francisco, CA: Jossey Bass.
- Rothbart, M. K., Chew, K. H., & Gartstein, M. A. (2001). Assessment of temperament in early development. In L. T. Singer & P. S. Zeskind (Eds.), *Biobehavioral assessment of the infant* (pp. 190-208). New York: Guilford.
- Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development*, 72(5), 1394-1408.
- Rothbart, M. K. (1981). Measurement of temperament on infancy. *Child Development*, 52, 569-578.
- Rothbart, M. K. (1973). Laughter in young children. *Psychological Bulletin*, 80(3), 247-256.
- Sandman, C. A., Wadhwa, P. D., Dunkelschetter, C., Chicodemet, A., Belman, J., Porto, M., Munara, Y., Garite, T. J., & Crinella, F. M. (1994). Psychobiological influences of stress and HPA regulation on the human fetus and infant birth outcomes. *Models of Neuropeptide Action Annals of the New York Academy of Sciences*, 739, 198-210.
- Shapiro, A. F. (2005). Examining relationships between the marriage, mother-father-baby interactions and infant emotion regulation. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 65(7-B).
- Sroufe, L. A., & Waters, E. (1976). Ontogenesis of smiling and laughter-perspective on organization of development in infancy. *Psychological Review*, 83(3), 173-189.
- Teerikangas, O. M., Aronen, E. T., Martin, R. T., & Huttunen, M. O. (1998). Effects of infant temperament and early



- intervention on the psychiatric symptoms of adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, 37(10), 1070-1076.
- Thomas, A., & Chess, S. (1984). Genesis and evolution of behavior-disorders- from infancy to early adult life. *American Journal of Psychiatry*, 141(1), 1-9.
- Van den Boom, D. C. (1995). Do first-year intervention effects endure? Follow-up during toddlerhood of a sample of Dutch irritable infants. *Child Development*, 66(6), 1798-1816.
- Van den Bergh, B. R. (1990). The influence of maternal emotions during pregnancy on fetal and neonatal behavior. *Journal of Prenatal & Perinatal Psychology & Health*, 5(2), 119-130.

원고접수일: 2008년 11월 12일

게재결정일: 2008년 12월 2일

## 영아 자극에 대한 부모의 생리반응과 영아 기질과의 관계

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본 연구는 임신기에 주어진 영아의 웃음 자극과 울음 자극에 대한 부모의 생리적 반응과 자녀 출산 이후 영아의 기질 사이의 관계를 연구하는 데 목적이 있다. 본 연구의 참여자는 종단 연구인 신혼기에서 부모기로의 전환연구에 참여한 부부들 중 23 쌍의 결혼한 부부들이었다. 부부들은 아내가 약 임신 6개월이 되었을 때 함께 실험실을 방문하여 자극에 대한 생리적 반응을 측정하는 실험에 참여하였고 아이를 출산 한 후 3-6개월 사이에 다시 방문하여 영아 기질을 측정하였다. 임신 중 방문 시는 각각의 부부에게 영아의 웃음과 울음 자극이 담긴 테이프를 보여 주면서 ECG, finger pulse transit time 을 측정하였고 출산 후 방문 시는 영아의 기질 설문지로 자녀의 기질을 측정하였다. 생리적 반응 측정은 baseline 과 자극반응을 모두 측정하여 분석하였다. 결과는 영아 자극에 대한 부모의 생리적 반응과 영아의 기질 사이에 관련이 있음을 시사하였다. 즉 영아 자극에 대한 남편의 이완된 생리적 반응이 자녀의 긍정적인 기질과 관련이 있었고, 어머니의 웃음 자극에 대한 생리적 각성이 이후의 자녀 기질의 어려움을 예측하였다.

주요어: 영아 기질, 영아 자극, 생리 반응, 임신기