Psychophysiological Resilience: A Theoretical Construct Based on Threat Perception and Early Programming of Restorative and Arousal Based Adaptive Mechanisms

Author: Mandel, Dorothy Marie, MA

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Full Text: Headnote ABSTRACT: Why can some people be exposed to toxins, stressors, or traumatic events and be significantly less affected than others? The author conducts a review of research, constructs a theoretical model psychophysiological resilience, and examines the impact of prenatal and early childhood events on the formation of neural regulatory circuits. Psychophysiological resilience involves psychological, physiological, emotional, and spiritual resilience. Research is cited to support the theory that events occurring during gestation and birth offer clues to sustained adaptive programming that supports species preservation. Research relating the impacts of adaptive vs. maladaptive neurodevelopmental programming on currently relevant issues including psychosocial violence, functional intelligence, and somatic disease processes is cited. Emerging research on the role of the heart and the use of guided imagery and Heart Rate Variability (HRV) biofeedback in rebuilding physiological and emotional adaptive processes of resilience is articulated. INTRODUCTION Many current diseases, educational problems, and instances of psychosocial violence may have the common thread of threat perception and biological consequences associated with autonomic nervous system (ANS) dysregulation at their roots. In his book, Clinical Behavioral Medicine, Wickramasekera (1988) noted that the diseases most prevalent today are not the acute infectious diseases of the past such as pneumonia and tuberculosis, but rather conditions such as cancer and cardiovascular disease that are being more readily attributed to chronic stress and life style-related factors. This information deserves attention and an exploration into roots and etiology. Threat perception is viewed as the basis for physiological and emotional arousal responses that can lead to either health deteriorating stress patterns, or as evidenced in the work of Taylor, Klein, Lewis, Gruenewald, Gurung and Updegraff (2000), a more restorative "tend and befriend" response. Health deteriorating stress patterns arise from ANS dysregulation and negatively affect physical health, intellectual functioning, and psychosocial well being. This hypothesis involves a theoretical consideration that the foundations for ANS response pattern's and neural regulatory circuits can and often do begin during early gestation and birth periods. This author further hypothesizes that patterns of physical health and psychosocial well being involve a balance between arousal and restorative based processes associated with physiological and psychological resilience. These restorative responses are hypothesized to be based on successful affiliative relationship abilities whose origins can be found in heart-related emotions and physiology involved with maternal infant bonding. Research cited demonstrates how early threat perception occurs at a time of relative helplessness, can interrupt maternal infant bonding, and can have lasting effects on neural development, affect regulation (Schore, 2000), restorative response mechanisms, and somatic disease processes (Barker, 1995; Scaer, 2001). Definition of Psychophysiological Resilience (PPR) and Threat Perception The perception of threat sets in motion biological arousal responses that can trigger the more commonly known "fight or flight" responses (Cannon, 1932), or the more recently recognized and restorative "tend and befriend" responses (Taylor et al., 2000). Fluid movement between arousal and restorative based mechanisms is needed to insure optimal adaptation to an ever-changing environment. In his book Stress, Cox (1978) noted that the ability to maintain a stable inner environment through dynamic processes of homeostasis is a characteristic of health. This same dynamic homeostasis is also characteristic of what is referred to in this model as physiological resilience, and connotes the fluid movement between arousal and restorative responses. When autonomic nervous system (ANS) response patterns do not move fluidly between arousal-based and

restorative-based processes, they can become dysregulated via dominance or immobilization in one direction or the other. When dysregulation occurs, homeostasis and adaptive functions are significantly inhibited. In his article titled "Protective and Damaging Effects of Stress Mediators," McEwen (1998) noted that the adaptive physiological systems that are activated by stress can protect, restore, and also damage the body. The psychological response to stress can be adaptive or maladaptive as well. The etiology of neurotic behaviors and successful coping strategies in response to stress is of interest in understanding the mechanisms of health and disease. An exploration of the pathways through which these adaptive processes become protective and restorative or damaging to physical, emotional, and mental health may facilitate future directions in preventive health care and behavioral medicine. Anatomy of the Biological Responses to Threat Perception The sympathetic branch of the autonomic nervous system (ANS) is linked with the parts of the adrenal glands that are responsible for the secretion of adrenaline and noradrenaline. The sympathetic nervous system (SNS) and the adrenal medulla together prepare the body for fight or flight and are responsible for arousal based catabolic body processes. They are known as the sympathoadrenal system (Sheridan &Radmacher, 1992). The parasympathetic branch of the ANS is responsible for containment, anabolic, and restorative processes that are often associated with relaxation and rest. Perception of threat, whether conscious or unconscious, triggers the same potentially adaptive or maladaptive biological responses. According to Wickramasekera (1998), measurable psychosocial traits may contribute to blocking threat perception from conscious awareness, though not from processes of biological adaptation. These measurable traits include high or low hypnotic ability in combination with negative affect, a tendency to catastrophize, and/or a tendency toward self-deception. Adaptation to ongoing or prolonged perception of threat, whether conscious or unconscious, has health-deteriorating consequences. This biological response pattern to an ongoing perception of threat places health increasingly at risk (Wickramasekera, 1988). Levine (1997) theorized that when arousal, including threat based fight/flight arousal, results in satisfaction, safety, or affiliative bonding, a relaxing, energy conserving, and restorative physiology ensues. The work of Benson (1975) supports this theory. An intricate and ongoing physiological dance between arousal and restoration is continuously in motion. This dance provides a means to achieve psychophysiological resilience and dynamic homeostasis. The flexibility and fluidity of this dance can be measured via biofeedback instruments. Heart Rate Variability (HRV) is becoming increasingly recognized as a mode of choice in recognizing ANS balance and dysregulation (McCraty, Atkinson &Tiller, 1995). Psychophysiological Resilience (PPR) The term psychophysiology refers to a discipline that deals with the relationship of physiological processes to psychological processes including thoughts, emotions, perceptions, and behaviors (Costello, 1993). The brain's role in directing cognitive processes that relate to both species and individual survival has been and continues to be wellresearched (LeDoux, 1996; Papez, 1937; Pribram, 1991). Both cognition and emotion involve complex systems of interaction between the nervous system and the hormonal system. Bi-directional input between brain and body is a key factor in biological, emotional, and behavioral function (Lacey &Lacey, 1978). The heart is becoming increasingly recognized as a significant part of the endocrine system (Cantin &Genest, 1986) and a key player in this bi-directional input (Lacey &Lacey, 1978). Resilience is defined as "the ability to recover quickly from illness, change, or misfortune," (Costello, 1993, p. 1160), and as "the property of a material that enables it to resume its original shape or position after being bent, stretched, or compressed" (Costello, 1993, p. 1160). PPR, in the context of this paper, includes concepts of physiological and psychological resilience. Physiological resilience includes the ability of the ANS to move fluently between its sympathetic and parasympathetic activation processes to maintain dynamic homeostasis. Psychological resilience includes the ability to return to a state of mutual social support and/or well being after a perception of threat and/or psychologically isolating experience. Contemporary researchers in neurobiology and molecular biology concur that cognition and emotion are separate functions mediated by distinct and interconnected neural and neuroendocrine systems (Pribram &McGuinness, 1975, Pribram, 1984; Damasio, 1999; Bower 1992; Pert, Dreher, &Ruff, 1998). Emotion and perception are interactively

interdependent. Emotions and cognition affect and are affected by ANS arousal levels and by each other. States of high and low hypnotic ability can restrict or amplify attention and perception (Wickramasekera, 1988). High arousal states can also restrict or amplify attentional and perceptual processes. Perceptual processes are present in the womb (Manrique, Contasti, Alvaredo, Zypman, Palma, Jerrobino, et al., 1993; Sandman, Wadhwa, Chicz-DeMet, Porto &Garite, 1999) and are integral to ANS function and PPR. Prenatal Origins and Social Consequences of Threat Perception and Psychophysiological Resilience Social support is considered a buffer from the harmful effects of threat perception (House, Landis, &Umberson, 1988; Wallston, Alagna, DeVallis, &DeVallis, 1983; Wickramasekera, 1988). Secure maternal-infant bonding is the basis of social support (Bowlby, 1977; Schore, 2001), and is also linked to PPR. Animal models of ANS dysregulation have been more thoroughly studied than human models and are thought to be highly applicable to humans in relation to ANS dysregulation theory. Though more definitive research is needed to substantiate the accuracy of animal model responses in relation to human responses, they currently offer a significant window through which to view theories of ANS dysregulation. The concept of helplessness is key in understanding the etiology and full spectrum of ANS dysregulation. Hofer (1970) exposed rodents to predator-related stimuli with no means of escape and found that they entered a deep phase of freeze or immobility that persisted for up to 30 minutes. During this freeze response, they experienced cardiac arrythmias and marked bradycardia associated with states of dominant vagal or parasympathetic tone. Richter (1957) found that wild rats would swim for up to 60 hours before dying from exhaustion. If, however, they had experienced immobility at the hands of the investigator, 95% would die in minutes. Seligman (1992) noted that animals that were subjected to an environment of inescapable shock would predictably freeze with subsequent shock exposure even when routes of escape were later introduced. The experimental animals exposed to environments of inescapable shock remained immobile and continued to exhibit helplessness while control animals subsequently exposed to escapable shock learned to use the escape routes and did not freeze (Franselow &Lester, 1988). This research suggests that initial exposure to inescapable shock may involve learned helplessness that prevents further related learning. The implications for associating perceived inescapable threat perception with prenatal threat perception and with later learning, behavior, and health difficulties offer fertile ground for additional research. Scaer (2001) noted research in an unpublished manuscript by Ginsberg (1974). The research indicates that immobilized chicks that were allowed social support recovered spontaneously from immobility and fared better than those that were immobilized and were interrupted in recovery, or those who had not been immobilized. Ginsberg's research, if substantiated, would support Levine's (1997) clinically based theory that it is the inhibition of the recovery response from immobility, rather than the immobility response itself, that is responsible for the evolution of somatic and psychological symptoms in PTSD. Ginsberg's work might also substantiate the work of UvnasMoberg (1998) which suggests an oxytocin-based link as the basis for the positive affects of social interaction. The work of Scaer, (2001) and Forges (1995) suggests that if deterrence of threat via fight or flight fails, or if resources are determined insufficient, a state of helplessness associated with increased Dorsal Vagal Complex (DVC) tone occurs. Deep parasympathetic activation that is theoretically associated with the immobility response and is characterized by marked bradycardia, apnea, sphincter relaxation, and gastrointestinal activation are associated with this state (Forges, 1995; Scaer, 2001). Scaer (2001) notably articulated that although "a persistent state of DVC activation is common to reptiles, it is in fact dangerous for mammals due to its association with marked bradycardia and life-threatening arrythmias" (Scaer, 2001, p. 81). The younger the person, the fewer are the defensive capabilities present, and the greater is the likelihood for perceived helplessness. Reasoning and cognitive capabilities develop with experience and facilitate adaptive strategies and responses. Unborn and newly born infants have fewer autonomous resources available than do older children and adults and are relatively helpless. Although research on DVC activation in prenates and neonates is relatively lacking, the likelihood that this activation is present in stress-laden situations can be considered a reliable hypothesis (Forges, 1983). Although prenates and neonates are relatively helplessness

and unable to express verbally their experience, they can, however, experience the processes of learning and memory (Manrique et al., 1993; Sandman et al., 1999). Scaer, (2001) noted that Procedural memory relates to the acquisition of motor skills and habits, to the development of emotional memories and associations, and to the storage of conditioned sensorymotor responses. Procedural memory is unconscious, implicit, and extremely resistant to decay, especially if it is linked to information of high emotional or threat-based content. (Scaer, 2001, p. 76) Threat perception during gestation and birth occurs at a time of vulnerability and helplessness, during a time of high ANS arousal, and at a time when procedural memory is, present (Cheek 1974, 1975). Procedural memory is hypothesized to be the link that keeps post traumatic stress responses active (Scaer, 2001). Although science may not have a way to measure maternal-infant bonding, it is likely to begin in utero. Maternal-infant bonding is the first form of social support, is the basis for later affiliative behaviors, and is hypothetically foundational for PPR. According to numerous researchers (e.g., Barker, Eriksson, Forsen &Tuomilehto, 2001; Kennell, Trause, &Klaus, 1975; Klaus, 1998; Sandman et al., 1999), early incidents involving threat perception and PPR affect prenatal, birth, maternal-infant bonding, and later health and developmental experiences. Early threat perception is theoretically likely to interrupt maternal-infant bonding and is linked to social violence (Raine, Brennan &Mednick, 1997), educational insufficiencies (McCraty &Atkinson, 1996; Paneth, 1999), and long range healthcare problems (Barker et al., 2001). Existing research links prenatal experiences involving threat perception to birth and subsequent health outcomes. Wang, Zhang, and Zhang (2001) studied 616 young students who had experienced an earthquake during gestation and 616 control students who had not. This study used Raven's Standard Progress Matrices (RSPM) to evaluate cognitive function. The scores of the earthquake group were significantly lower than the scores of the control group (Wang et al., 2001). Those who had experienced the earthquake in their second or third trimester were affected the most, and the researchers concluded that severe stress caused by an earthquake had negative and lasting effects on cognitive function (Wang, et al. 2001). DePietro (1996) found that maternal stress appraisal was associated with reduced fetal heart rate variability. Habituation research on human fetuses indicated that brain circuits for fetal imaging and learning are in place by the 20th week of gestation (Sandman et al., 1999). Additional studies focusing on the causal factors and predictability of maternal threat perception would likely have significant clinical value for the intervention and prevention of later emotional and developmental complications in infants. Studies tracking potential links between maternal threat perception, medically intervened births, and subsequent emotional and developmental delays are also needed. Maternal Stress, Fetal Stress, Neural Development, and Fetal Outcome Gestation normally lasts 9 months and labor can last anywhere from a few hours to a few days. Stress occurring prenatally and during birth is likely to be perceived as both intense and prolonged (Cheek, 1975; Ham &Klimo, 2001; Chamberlain, 1987). Animal research has shown that enhancing the quality of maternal behavior resulted in a more efficient stress response system, and a reduction in fearful behavior in the offspring (Coplan, Andrews, &Rosenblum, 1996; Coplan, Rosenblum, &German, 1995). Animal research has also revealed that disrupting maternal behavior increased stress responses and fearful behavior (Coplan et al., 1995). Later research by Coplan et al. (1996) indicated that these early experience effects appeared to last into adulthood. Research tracking the effects of stress responses with human subjects also supports the view that early experience effects appear to have substantial lasting power. In healthy newborns, painful events like routine circumcision performed without anesthesia produce three- to fourfold elevations in plasma cortisol concentrations (Gunnar &Barr, 1998). Nerve blocks (e.g., dorsal penile nerve block) prior to circumcision reduce crying and lower the HPA axis response but still produce an increase of at least two to two and a half times the cortisol production (Stang, Gunnar, Snellman, &Condon, 1988). Cortisol levels return to prestress levels by about 2 hours after circumcision, but the impact of this event on stress physiology and behavior may persist for many months. After 24 hours, a simple heel-stick blood draw produces significantly more distress (crying, increased heart rate, lowered vagal tone, and elevated cortisol) in boys who were circumcised than in boys who had not undergone this procedure (Konner, 1987).

Four to six months later, circumcised boys were rated as showing a greater pain response than uncircumcised boys (Taddio, Goldach, Ipp, &Stevens, 1995). Thus, painful routine procedures with healthy newborns that elevate cortisol and increase heart rates do appear to program the brain's stress systems, and these effects persist for at least several months. (Gunnar &Barr, 1998, p. 10) Circumcision is not the only medical procedure that might involve threat perception and elevated cortisol levels. Barker (1995) explored the nature and numbers of invasive procedures in 54 consecutive infants admitted to a neonatal intensive care unit. The study recorded more than 3000 procedures. Heel prick blood sampling constituted 56%, endotracheal suction 26%, and intravenous cannula insertion 8%. One infant of 23 weeks gestation underwent 488 procedures. Preterm babies who were checked at 12 and 18 months of age showed greater sensitivity to even low levels of stress and less ability to modulate distress once aroused (Stiefel, Plunkett, and Meisels, 1987). They did not relate to toys in the same way as did full term babies (Stiefel et al., 1987). Courchesene, Chisum, and Townsend (1994) state that many aspects of brain development are activity-dependent and that experience shapes both growth and function of the developing brain and neural mechanisms. Impacts of Maternal/Fetal Stress on Maternal-Infant Bonding Fetal threat perception can theoretically occur in a number of ways. Maternal-infant separation is a common practice in our culture and may have more significant effects than previously realized. Harlow (1958) and Prescott (1995) documented the profound effects of maternal-infant separation. Righard's (1992) video documentation demonstrated a significant interruption in core bonding behaviors as a result of maternal anesthesia and maternal-infant separation. During a 30-year period in Finland, Sweden, and Czeckoslovakia, when mothers were repeatedly denied abortion, David, Dytryeh, Matefeek, and Schuller (1988) studied the effects on their offspring. In comparison to the control group, these children proved to be at greater risk for social and psychiatric problems. Children in the Prague cohort had almost 3 times the likelihood of becoming criminally involved (David et al., 1988). Later research by Raine, Brennan, and Mednick (1994) further demonstrated the link between rejection, postpartum separation, and later criminal violence. Magid and McKelvey (1988) noted that family histories of psychopathic killers typically revealed that those who had become killers had never had an affectionate, supportive relationship with anyone from the beginning of life onward. They noted that the would-be criminals grew up unable to follow rules or form lasting social relationships, and lacked guilt, empathy, and trust (Magid &McKelvey, 1988). Based on clinical experience, Feldmar (1979) theorized that vulnerability to rejection might be felt prenatally though not necessarily on a conscious level. He noted a clinical experience in which he encountered 4 adolescents who repeatedly attempted suicide at the same time each year. He later learned from their mothers that the suicide attempts occurred each year at the time that the mothers had tried to abort them (Feldmar, 1979). The response to threat perception involves a number of physiological and behavioral adaptations that can lead to defensive patterns that can persist over time. Uvnas-Moberg (1997) proposed the existence of an opposite psychophysiological pattern associated with relaxation and growth, activated by non-threatening stimuli, and integrated by oxytocin. He proposed that attachment failures and impairments of the early development of right brain stress-coping systems predispose maladaptive responses in this oxytocin-mediated restorative response system (Uvnas-Moberg, 1998). Research has shown that social support mediates the harmful effects of stress (House, Robbins, &Metzner, 1982; Ornish, Brown, Scherwitz, Billings, Armstrong, Ports, et al., 1990; Wallston et al., 1983). Oxytocin mediates both maternal bonding behaviors and social behaviors (Uvnas-Moberg, 1998). If UvnasMoberg (1998) is correct, early threat perceptions and associated bonding interruptions may predispose a person to later deficits in affiliative behaviors that are necessary to sustain social support and PPR. Impacts of Maternal/Fetal Stress on Later Health and Behavior Early stress sets potentially long-lasting foundational physiological response patterns. A longitudinal study done in Helsinke, Finland concluded that low prenatal weight gain during gestation is associated with increased risk of coronary heart disease in adult life (Barker, 2001). Epidemiologists have postulated that breast cancer may originate in utero (Ekbom, Tiechopoulos, Adami, Hsieh &Lan, 1992; Trichopoulos, 1990). Nathanielsz (1996) detailed a variety of adult diseases that are

associated with fetal origins. Barker, Gluckman, and Robinson (1995) noted that events occurring during gestation, birth, or infancy can affect programming of cardiovascular, endocrine, and metabolic regulatory systems. Neurodevelopmental Sequelae of Violence Threat perception activates arousal responses that can trigger individual survival responses. When these individual survival responses occur within a matrix of social safety, they theoretically resolve into restorative responses that promote species survival. When social support or early maternal infant bonding does not buffer these arousal responses, restorative physiological and social processes are inhibited. In a study involving 4,269 males, Raine, Brennan and Mednick (1994) collected demographic, family, and psychosocial variables through interviews during pregnancy and when the participants were one year old. The study determined criminal status when participants were 17 to 19 years old. Birth complications in combination with early childhood rejection were clearly associated with violent crime in early adulthood (Raine et al., 1994). As far back as 1956, Pasamanick (1956) found links between obstetric complications and behavior disorders in children. Perry (1994) postulated that abnormal patterns of catecholamine activity associated with prolonged alarm reactions induced by traumatic events during infancy and childhood could result in altered development of the central nervous system and a dysregulated brain stem. He hypothesized that numerous symptoms related to altered cardiovascular regulation, affective lability, and behavioral impulsivity could be developmental sequelae of early trauma (Perry, 1994). Lewis, Shanok, Pincus, and Glaser (1979) found links between perinatal complications and juvenile delinquency. Kandel and Mednick (1991) found a significant correlation between delivery complications such as eclampsia, forceps use, cord prolapse and violent offending in adolescents and adults. Pre- and perinatal psychology pioneer David Chamberlain (1995) noted the effects of neonatal intensive care units that emerged in the 1960s and noted the use of painful procedures including breathing tubes, suction tubes, feeding tubes, monitor electrodes, heel lancing, and loud alarms. He shared that murderer Edward Harris gestated in an abused mother, and was shunted for hydrocephalus as an infant while paralyzed with curare and able to see, hear, and feel the procedures (Chamberlain, 1995). These studies clearly indicate that prenatal and early life experiences all contribute to neural development and long-lasting ANS response patterns and that early experiences impact maternal infant bonding, later affiliative social behaviors, and pair bonding. This knowledge can guide future prenatal and birthing practices. Conclusion: Potential Opportunities for Enhancing PPR and for Preventing and Mediating the Harmful Effects of Threat Perception The role of heart-focused emotions is measurably important in facilitating affiliative bonding and in preventing and reversing the harmful effects of ongoing threat perception. Several institutions already have curricula to teach heart-focus based systems of emotional self-management. Biofeedback, Cognitive Behavioral Therapy, and cognitive refraining tools are often included in programs teaching emotional and physiological self-management skills. The HeartMath Institute in Santa Cruz, California has three different programs focused on three different areas of social involvement (Childre, 1999). They have one program geared for educators, one for mental health practitioners, and one for corporations. Bhat and Bhat (1999) have a clinic in Concord, California where they use heart-focused emotions, and lifestyle changing skills to treat stress disorders including coronary artery diseases. Ornish et al. (1990) developed programs involving social support and meditation to treat heart disease. Violence is intimately associated with fear and anger. Violence is a behavioral consequence of threat perception. Violence to the self shows up in the health-care system as lifestyle-related illnesses, psychosocial diseases, and addictions. Violence to others shows up in social structures of home, school, workplace and jail. Lifestyle changes that incorporate skills and habits that have been shown to increase processes of emotional and physiological self-management may also assist in the process of achieving physiological and emotional resilience. These skills encourage social connection and support. An understanding of the origins and significance of threat perception and PPR can provide motivation to use already existing knowledge and skills and perhaps to develop new tools to prevent and mediate the effects of ongoing threat perception to enhance PPR. Teaching emotional self-management and affiliative behavior skills to children, adults, and adolescents should be a high priority in addressing current problems in

education, health, and social well being. Addressing the emotional, mental, and physical welfare of pregnant mothers, prenates, and birthing babies with similar sensitivity and awareness should be of high priority in efforts to prevent many of these problems from occurring. Offering emotional self-management skills in public health, educational, and prenatal classes as part of a national self-health program available to all adults and children might theoretically be of significant value in facilitating PPR and in improving health, education, and social well-being. Work schedule changes that support parent-child bonding and family time can facilitate the development of social skills and associated restorative physiological responses. Research associating the effects of prenatal and birth events with later mental and physical health outcomes does exist and has been slow to be recognized by the media. More research concerning the mechanics of maternal-infant bonding and the pathways through which bonding and bonding interruptions affect ANS function and subsequent social and physical development is needed. Research exploring early histories of children diagnosed with autism, ADD, and developmental delays may reveal, as yet unknown, information concerning the origins of these conditions. Parasympathetic dominant response patterns may be found to underlie autoimmune diseases such as fibromialgia and chronic fatigue (Scaer, 2001), while SNS dominant responses are already being linked with cardiovascular diseases (Bhat &Bhat, 1999). More research on the long-range effects of threat perception and the mechanisms and pathways through which ANS dysregulation evolves into disease processes would likely be beneficial in both physical and psychosocial disease prevention efforts. References REFERENCES Barker, D. (1995). Exposure to invasive procedures in neonatal intensive care unit admissions. Archives of Disease in Childhood: Fetal and Neonatal Edition, 72(1), F47-48. Barker, D. (2001). Birthweights, maternal cardiovascular events, and Barker hypothesis. The Lancet, 357(9273), 1990-1991. Barker, D., Eriksson, J., Forsen, T., Tuomilehto, J. &Osmond, C. (2001). Early growth and coronary heart disease in later life: Longitudinal study. British Journal of Medicine, 322, 949-953. Barker, D., Gluckman, P., &Robinson, J. (1995). Conference report: Fetal origins of adult disease. Placenta, 16(3), 317-320. Benson, H. (1975). The relaxation response. New York: Avon Books. Bhat, N., &Bhat, K. (1999). Anger control using biofeedback: A clinical model for heart patients. Biofeedback Newsmagazine, 27(4), 15-17. Bower, G. (1992). How might emotions affect memory. In S. Christianson (Ed.), Handbook of emotion and memory. Hillsdale, NJ: Lawrence Erlbaum. Bowlby, J. (1977). The making and breaking of affectional bonds: I. Etiology and psychopathology in the light of attachment theory. British Journal of Psychiatry, 130, 201-210. Cannon, W. (1932). The wisdom of the body. New York: W.W. Norton. Cantin, M., &Genest, J. (1986). The heart as an endocrine gland. Clinical Investigative Medicine, 9, 319-327. Cantin, M., &Genest, J. (1986b). The heart as an endocrine gland. Scientific American, 254, 76. Chamberlain, D. (1987). The cognitive newborn: A scientific update. British Journal of Psychotherapy, 4(1), 30-71. Chamberlain, D. (1995). What babies are teaching us about violence. Pre- and Perinatal Psychology Journal, 10(2), 57-74. Cheek, D. (1974). Sequential head and shoulder movements appearing with age-regression in hypnosis to birth. American Journal of Clinical Hypnosis, 16, 261-266. Cheek, D. (1975). Maladjustment patterns apparently related to imprinting at birth. American Journal of Clinical Hypnosis, 18(2), 75-82. Childre, D., &Martin, H. (1999). The HeartMath Solution (1st ed.). San Francisco: HarperSanFrancisco. Coplan, J., Andrews, M., &Rosenblum, L. (1996). Persistent elevations of cerebrospinal fluid concentrations of corticotrophin-releasing factor in adult nonhuman primates exposed to early-life stressors: Implications for the pathophysiology of mood and anxiety disorders. Proceedings of the National Academy of Science USA, 93, (1,619-1,623). Coplan, J., Rosenblum L., &German J. (1995). Primate models of anxiety: Longitudinal perspectives. Pediatric Clinicians of North America, 18, 727-743. Costello, R. (Ed.). (1993). The American Heritage College Dictionary (3rd ed.). Boston, New York: Houghton Mifflin Company. Courchesene, E., Chisum, H., &Townsend, J. (1994). Neural activity-dependent brain changes in development: implication for psychopathology. Developmental Psychopathology, 6, 697-722. Cox, T. (1978). Stress. Baltimore, MD: University Park Press. Damasio, A. (1999). The feeling of what happens. Orlando, FL: Harcourt. David, H., Dytryeh, Z., Matefeek, Z., &Schuller, V. (1988). Born unwanted: Developmental effects of denied abortion. New York: Springer. DePietro, J. (1996).

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