

## Impact Of Maternal Prenatal Stress On Growth Of The Offspring

"[F]or those who are entering the field or who want to broaden their perspective, I believe that this Handbook is indispensable. More than just a contribution to the field, the Handbook may well become a classic."--PsycCRITIQUES "The editors fully achieved their goal of producing a state-of-the-science stress reference for use by investigators, educators, and practitioners with clinical and health interests."--Psycho-Oncology "This is an important book about the scientific study of stress and human adaptation. It brings together both empirical data and theoretical developments that address the fundamental question of how psychosocial variables get inside the body to influence neurobiological processes that culminate in physical disease." From the Foreword by David C. Glass, PhD Emeritus Professor of Psychology Stony Brook University Edited by two leading health psychologists, The Handbook of Stress Science presents a detailed overview of key topics in stress and health psychology. With discussions on how stress influences physical health-including its effects on the nervous, endocrine, cardiovascular, and immune systems-the text is a valuable source for health psychologists, as well as researchers in behavioral medicine, neuroscience, genetics, clinical and social psychology, sociology, and public health. This state-of-the-art resource reviews conceptual developments, empirical findings, clinical applications, and investigative strategies and tools from the past few decades of stress research. It represents all major approaches to defining stress and describes the themes and developments that characterize the field of health-related stress research. The five sections of this handbook cover: Current knowledge regarding the major biological structures and systems that are involved in the stress response Social-contextual contributions to stress and to processes of adaptation to stress, including the workplace, socioeconomic status, and social support The concept of cognitive appraisal as it relates to stress and emotion psychological factors influencing stress such as, personality, gender, and adult development The evidence linking stress to health-related behaviors and mental and physical health outcomes Research methods, tools, and strategies, including the principles and techniques of both laboratory experimentation and naturalistic stress research

This book provides an overview of fetal psychobiological research, focusing on brain and behavior, genetic and epigenetic factors affecting both short and long-term development, and technological breakthroughs in the field. These focal points intersect throughout the chapters, as in the challenges of evaluating the fetal central nervous system, the myriad impacts of maternal stressors and resiliencies, and the salience of animal studies. It also discusses specific monitoring and assessment methods, including cardiotocography, biomagnetometry, 4D ultrasound, in utero MRI, and the KANET test. Spanning

assessment, identification, and pre- and postnatal intervention, the book weighs the merits of standardized evaluations and argues for more integrative research in the future. Included in the coverage: Effects on the fetus of maternal anxiety, depression, and stress during pregnancy. Clinical and experimental research in human fetuses and animal models. Observational research including the use of behaviors in developing tests to assess fetal health. Fetal auditory processing and implications for language development. Fetal effects of prenatal exposure to selective SRI antidepressant exposure. Structural and functional imaging of the prenatal brain. The effects of alcohol exposure on fetal development. Fetal Development: Research on Brain and Behavior, Environmental Influences, and Emerging Technologies is an essential resource for researchers, clinicians and related professionals, as well as students in a wide range of fields such as developmental psychology, pediatric and obstetrical medicine, neuroscience, nursing, social work, and early childhood education.

This is the first book dealing with fetal pain and its consequences and with pain in premature babies. The volume gives an overview of the current knowledge in this field. An international team of renowned specialists evaluates neonatal and fetal pain from the different points of view, and possible consequences of pain – even psychological – on the brain. This book will be an invaluable resource for professionals and for post-graduate students in all disciplines.

The clinical syndrome of preeclampsia is due to vasospasm, endothelial dysfunction, and altered red cell zeta potential. It is a culmination of multiple etiologies and pathophysiologies modified by epigenetics and the human immune system. Since the etiology and pathogenesis of preeclampsia are segregated and multifactorial, there is no single clinical, biophysical, or biochemical marker that can predict all types of this condition. This book provides a set of tentative specific prediction markers that can be used to identify different subtypes of preeclampsia, classify pathogenesis, categorize treatment, and identify early signs of complications.

Osteoporosis is one of the most important health conditions affecting aging humans (? 60 years in age), particularly women in North America and Europe (Jordan and Cooper, 2002). One of the risk factors for osteoporosis is not attaining the maximum peak bone mass density for which an individual has the genetic potential. This risk factor is ascribed to poor environmental conditions and is irreversible (Cooper et al., 2009). Individuals who do not attain peak bone mass are at a significant disadvantage when aging sets in, with its accompanying loss of bone mass density. This places them at a higher risk for osteoporosis. Psychological stress has been demonstrated to predispose pre-menopausal women to osteoporosis (Eskandari et al., 2007). Considering that environmental factors acting in pre-natal life have been known to influence adult health (Barker, 1995a, b, c, d; Gluckman et al., 2005), I hypothesized that psychological stress during pregnancy could result in high levels of cortisol that would affect bone formation in the fetus. This would compromise early bone development of the

fetus and diminish the potential for attaining peak bone mass density in young adults, and therefore be associated with a higher risk for osteoporosis later in life. To test this hypothesis I induced immobilization stress to pregnant Wistar rats at different gestational stages: Group 1 mothers were stressed during gestation week 1 (GW1), Group 2 during gestation week 2 (GW2), Group 3 during gestation week 3 (GW3); the Control Group was not stressed in any week. During gestation I monitored dams' cortisol hormone levels through fecal sampling, food intake, and maternal weight gain. After birth the pups were raised in a stress-free environment with adequate access to food and water and minimal human handling. Different sets of pups were euthanized at 4, 8, 12 and 16 weeks old. At necropsy the tibia was removed and fixed in 10% phosphate buffered formalin at 4°Celsius for 24 hours. The proximal part of the tibia (1 cm from the proximal end) was dehydrated in graduated series of ethanol and embedded in methyl methacrylate. Longitudinal sections, 4- $\mu$ m thick were obtained using Leica 2165 Microtome (Leica, Heidelberg, Germany) with a tungsten carbide knife and placed on 2% gelatinized slides. The sections were stained using Von Kossa method with McNeal's tetrachrome counterstain. Bone histomorphometry was performed using semi-automated image analysis (Bioquant Image Analysis Corporation, Nashville, TN, USA) linked to a microscope to assess the size of the growth plate, trabecular total tissue area, trabecular bone area, trabecular bone perimeter, osteoblast surface, osteoid surface, erosion surface and number of osteoclasts. The means and standard deviations were calculated for all outcome variables. Statistical differences between the stressed groups and control group were analyzed using t-test, F-test and Tukey-Kramer Honestly Significant Difference test (JMP. 2008. Version 8. SAS Institute Inc., Cary, NC). Linear regression analysis was performed to establish the relationship between stress in utero and indicators of bone development in offspring born to stressed mothers (StataCorp. 2009. Stata; Release 11. Statistical Software. College Station, TX: StataCorp LP). P values equal to or less than 0.05 were considered significant. The mean cortisol hormone levels in controls were consistently lower than those of all stressed groups. However, cortisol levels in the control group were found to increase over the duration of the pregnancy. The animals stressed in gestation week 1 had the highest cortisol hormone levels and were significantly different from controls during gestation week 1 (GW1 = 3.72 $\mu$ g/g, controls = 1.66 $\mu$ g/g, difference = 2.06 $\mu$ g/g), followed by those stressed in gestation week 2 (GW2 = 3.34 $\mu$ g/g, controls during GW2 = 1.73 $\mu$ g/g, difference = 1.62 $\mu$ g/g) and those stressed in gestation week 3 (GW3 = 3.36 $\mu$ g/g, GW3 controls = 2.38 $\mu$ g/g, difference = 0.98 $\mu$ g/g). During the pregnancy period, stressed animals consumed 3 grams (12.5%) less food per day compared to the controls. It was noted that on the day before delivery, all the animals (stressed and controls) increased their food intake, almost doubling their norm. The pregnant dams that were stressed during weeks 1 and 2 of their pregnancies gained significantly less weight over the duration of the pregnancy (GW1 = 263.03

grams, GW2 = 277.64 grams) than did those stressed in week 3 or in the control group (GW3 = 315.40 grams, controls = 311.46 grams). The average number of pups born to females stressed in weeks 1 and 2 was greater (13 and 14 respectively) than for the controls or those stressed in week 3 (11 and 12 respectively). Both male and female offspring born to mothers stressed in GW3 were heavier compared to all the other groups, but the weight difference was not statistically significant. Histological analysis was done on the offspring born to the dams stressed in gestation week 3 and the control group only. The decision to initially focus on GW3 offspring was based on the fact that this is the week during which rats' bones mineralize. Data collection for the histology phase of the project was very time-intensive. As such, the other experimental groups will be studied at a later date and the results reported elsewhere. Histological analysis showed that males have larger bones compared to females starting at the age of 8 weeks for both offspring groups. Controlling for sex, there was no significant difference in trabecular total tissue area or the trabecular bone perimeter between the GW3 offspring and control offspring. The GW3 offspring had a higher bone formation rate as indicated by their higher trabecular bone area at the age of 8 weeks (GW3 = 2.16mm<sup>2</sup>, controls = 1.27mm<sup>2</sup>), higher number of osteoblasts, which are the bone forming cells, at the age of 12 weeks (GW3 = 21.66mm, controls = 12.14mm) and a bigger area of the osteoid surface, which is the collagen matrix laid down by osteoblasts that eventually calcifies to form the bone, at the age of 8 weeks (GW3 = 4.98mm, controls = 1.92mm) and 12 weeks (GW3 = 5.50mm, controls = 0.99mm). There was no significant difference in bone resorption rate between the two groups. The control offspring had a thicker upper zone of the growth plate, consisting of resting and proliferative chondrocytes, at the age of 4 weeks (GW3 = 302.83mcm, controls = 210.29mcm) and 8 weeks (GW3 = 195.73mcm, controls = 123.56mcm). This project confirms that stress during pregnancy has negative consequences on both the mother and the offspring. The caloric intake in the mother is reduced, potentially due to the excess cortisol that alters the hypothalamic control of food intake. As a result, the mother does not accrue as many nutrients to support the growing fetuses. Having been nutrient-restricted and exposed to high cortisol levels in utero, the offspring appear to be born with an altered metabolism that results in faster growth and higher weight gain compared to controls. The positive effect of this fast growth is that the offspring born to stressed mothers ended up with a higher bone volume compared to the control offspring. This study also shows that exposure to high cortisol levels in utero negatively affects the growth plate in offspring. Growth plate analysis showed that at the age of 4 weeks, control offspring had a significantly thicker area of resting and proliferative chondrocytes in the growth plate compared to GW3 offspring. Therefore, the negative effect of prenatal stress was evident in the upper zone of the growth plate even at the age of 4 weeks when the seemingly catch-up growth is expected to have occurred in all measured aspects of bone development. This seems to be the most sensitive

part of bone development in relation to prenatal cortisol exposure. In conclusion, given the negative effects of prenatal stress on the mother and offspring as noted above, this research shows that osteoporosis may have some fetal-origin roots influenced by maternal stress (and elevated cortisol levels). Healthy bones in adulthood require a healthy start. The growth plate is the center for bone growth and any adverse effects during early development would eventually affect the entire skeletal development. A likely result of not attaining the maximum peak bone mass density for which an individual has the genetic potential is a higher risk for osteoporosis.

This book offers a state-of-the-art overview of the vital relationship between human microbiota and infant and child health. Renowned clinical-experimental experts in this field discuss the development of microbiota during early life and review the environmental inputs that affect the developing infant's gut microbiota, such as early diet and (postnatal) medical interventions. They further describe the interplay between gut microbiota and functional systems of the body, from the immune system to the central nervous system. The book discusses a range of infant and childhood diseases that are associated with microbial changes or dysbiosis, such as gastrointestinal disorders, allergic diseases, autoimmune disorders and respiratory disorders. Additionally mechanisms by which microbial dysbiosis may influence behaviour in infants are discussed. Other topics include the use of current tools in molecular microbiology for microbiota-related research and clinical practice. In the management of particular paediatric disorders, the potential of microbial manipulation with pre- and probiotics during infancy and childhood is increasingly being investigated. This book presents the evidence supporting their use in practice and reviews safety aspects. *Microbiota in health and disease: from pregnancy to childhood* has the ambition to provide the reader with an overview of the most recent and stunning advances in the field of infant and child microbiota and their role in health, disease and prevention. As such, it is an excellent resource for health care professionals, students and researchers in the field of life sciences.

*Human Reproductive Genetics: Emerging Technologies and Clinical Applications* presents a great reference for clinicians and researchers in reproductive medicine. Part I includes a brief background of genetics and epigenetics, probability of disease, and the different techniques that are being used today for analysis and genetic counseling. Part II focuses on the analysis of the embryo, current controversies and future concepts. Part III comprises different clinical scenarios that clinicians frequently face in practice. The increasing amount of genetic tests available and the growing information that patients handle makes this section a relevant part of the fertility treatment discussion. Finally, Part IV concludes with the psychological aspects of genetic counseling and the role of counselor and bioethics in human reproduction. Provides an essential reference for clinicians involved in reproductive medicine Builds foundational knowledge on new genetic tests coming into the clinical scenario for physicians involved with

patients Assembles critically evaluated chapters that cover basic concepts of genetics and epigenetics and the techniques involved, including preimplantation genetic testing, controversies, and more

The Oxford Handbook of Perinatal Psychology is the most comprehensive resource to date for scholars, students, and clinicians on the emotional and psychological experiences associated with childbirth. The volume describes the typical biological, emotional, and psychosocial changes associated with childbearing as well as various domains of pathology. Chapters on normal psychosocial and biological changes associated with childbearing provide a sound knowledge base from which to interpret research on specific aspects of emotional and psychological maladjustment during this time. Chapters on special issues orient readers to the vast array of contextual factors that affect new parents' experiences during the transition to parenthood. The Handbook covers a broader base of research relevant to perinatal psychology than any other published work to date, focusing not only on parental wellbeing, but also on fetal and infant wellbeing. Readers will gain an understanding of what happens during the perinatal period, why it happens, and options for intervention when expected events go awry.

The increasing prevalence of preterm birth in the United States is a complex public health problem that requires multifaceted solutions. Preterm birth is a cluster of problems with a set of overlapping factors of influence. Its causes may include individual-level behavioral and psychosocial factors, sociodemographic and neighborhood characteristics, environmental exposure, medical conditions, infertility treatments, and biological factors. Many of these factors co-occur, particularly in those who are socioeconomically disadvantaged or who are members of racial and ethnic minority groups. While advances in perinatal and neonatal care have improved survival for preterm infants, those infants who do survive have a greater risk than infants born at term for developmental disabilities, health problems, and poor growth. The birth of a preterm infant can also bring considerable emotional and economic costs to families and have implications for public-sector services, such as health insurance, educational, and other social support systems. Preterm Birth assesses the problem with respect to both its causes and outcomes. This book addresses the need for research involving clinical, basic, behavioral, and social science disciplines. By defining and addressing the health and economic consequences of premature birth, this book will be of particular interest to health care professionals, public health officials, policy makers, professional associations and clinical, basic, behavioral, and social science researchers.

Significant disparities in childhood asthma rates exist across racial and socioeconomic backgrounds. Evidence links in utero exposure to maternal psychological stress with childhood wheezing and asthma, but mechanisms for this association remain poorly elucidated. Furthermore, pregnant women facing high adversity are often missing from clinical trials limiting available data to examine potential relationships between maternal stress and childhood respiratory health. We report results from secondary analyses of data from the Vitamin C to Decrease Effects of Smoking in Pregnancy on Infant Lung Function (VCSIP) study. VCSIP is a randomized double-blind controlled trial of vitamin

C supplementation (500mg/daily) during pregnancy to decrease some of the harmful effects of tobacco smoke on offspring pulmonary function, measured at 3 months of life. First, we describe associations between prenatal maternal hair cortisol concentration (HCC) and any report of childhood wheeze through 12 months of age among 158 women facing high adversity and who smoke cigarettes. Hairs from a subset of 33 nonsmokers were available to examine the effect of smoking on HCC. Second, we report VCSIP study procedures, descriptive statistics of recruitment and retention, and provide a 4 - Step plan to recruitment and retention of pregnant women from marginalized populations into randomized clinical trials.

**Abstract:** Previous studies find prenatal stress to relate to negative health in mothers and their children. Health behaviors such as exercise, proper nutrition, and relaxation have been found to reduce stress in non-pregnant populations, yet few studies have investigated the effect of these behaviors on prenatal stress. The current study examined the impact of exercise, nutrition, and relaxation on perceived stress, anxiety, and cortisol reactivity to a stress task in pregnant women. We hypothesized that women who exercised, had better eating habits, and engaged in relaxation would have reduced perceived stress, anxiety and more adaptive cortisol responses. Our results suggest an adaptive effect of exercise, and maladaptive effect of fat consumption on prenatal cortisol responses, but no association between health behaviors and perceived stress or anxiety. These findings contribute to our understanding of the relationship between health behaviors and stress during pregnancy, and may be useful for prenatal health interventions.

Various lines of research in animals and humans indicate that prenatal stress can have long-lasting effects on biological and psychological processes of the offspring. In particular, prenatal stress is associated with long-term disturbances in HPA axis function. Moreover, prenatal stress in animals is linked with anxiety in later life. Likewise, in humans, gestational stress has a significant impact on emotional problems of the offspring. However, to date, there have been no studies investigating the effects of prenatal glucocorticoid exposure on psychological, endocrine, and autonomic responses to a standardized psychosocial stress test in children aged 10 years. Furthermore, studies investigating the effects of prenatal glucocorticoids on anxiety in children aged 10 years as assessed by self-report as well as maternal and paternal rating are lacking. In particular, knowledge is lacking about healthy children born after the 34th week of gestation without complications (e.g. oxygen administration because of respiratory distress syndrome) as well as with no other physical diseases or disabilities after birth. In addition, to date, the long-term effects of prenatal glucocorticoid exposure in children who are healthy and show no disparities in their level of development are poorly understood. In a cross-sectional study design, a total sample of 135 children was examined. The Glucocorticoids+Tocolytics (GC+TOC) group was characterized by tocolytic treatment of the children's mothers due to signs of preterm labor during the second trimester of pregnancy. In addition, the pregnant women received glucocorticoid treatment (betamethasone) in order to accelerate fetal lung maturation in case of preterm birth. The Tocolytics (TOC) group consisted of children whose mothers also had signs of preterm labor during the second trimester of pregnancy. These mothers, like the mothers of the GC+TOC group, were administered tocolytic treatment, but did not receive glucocorticoid treatment. In both of these groups,

only pregnant women were included with no other reasons (e.g. premature rupture of membranes) for tocolytic treatment than preterm labor as reported in medical records. The CONTROL group consisted of children whose mothers experienced a complication-free pregnancy. Data 1: To investigate the psychological, endocrine and autonomic responses to a standardized psychosocial stress test for children (TSST-C) was applied. Psychological parameters using self-report questionnaires (EWL-KJ and PASA) as well as salivary cortisol and heart rate were measured during the experiment. Group comparisons revealed differences in psychological (control expectancies and stress appraisal) and in biological (salivary cortisol) parameters in children who were prenatally exposed to glucocorticoids as compared to both control groups. Data 2: The effects of prenatal glucocorticoid exposure on anxiety in children as assessed by themselves and their mothers and fathers were examined. Self-report questionnaires measuring anxiety were filled in by the children (SCAS-D and EWL-KJ). Mothers and fathers completed questionnaires measuring anxiety and emotional stability in their children (HiPIC). With respect to self-reported anxiety as well as anxiety and emotional stability as assessed by the fathers, significant differences between the three groups were revealed in group comparisons. Moreover, we found a child-father agreement in anxiety ratings. Prenatal glucocorticoid exposure is associated with an altered psychological and biological stress reactivity in response to a psychosocial stress test even in healthy 10-year-old children. Moreover, children who were prenatally exposed to glucocorticoids showed higher anxiety values and were described as less emotionally stable than the control groups.

presented in the Introduction (Chapter 1). The focus of Chapter 1 is twofold: (1) to present the research foundations for the psychophysiological correlates of prenatal psychosocial adaptation and the seven prenatal personality dimensions with progress in labor and birth outcomes, and particularly (2) to present the theory underlying the seven dimensions of prenatal psychosocial adaptation, which are further analyzed in the following seven chapters. Chapters 2–8 present a content analysis of the interview responses to the seven significant prenatal personality dimensions that are predictive of pregnancy adaptation, progress in labor, birth outcomes, and postpartum maternal psychosocial adaptation, and they include: (1) Acceptance of Pregnancy, (2) Identification with a Motherhood Role, (3) Relationship with Mother, (4) Relationship with Husband, (5) Preparation for Labor, (6) (Prenatal) Fear of Pain, Helplessness, and Loss of Control in Labor, and (7) (Prenatal) Fear of Loss of Self-Esteem in Labor. There is no other comparable comprehensive, in-depth, prenatal personality research or empirical and content analysis of pregnancy-specific dimensions of maternal psychosocial adaptation to pregnancy.

The Origins of Schizophrenia synthesizes key findings on a devastating mental disorder that has been increasingly studied over the past decade. Advances in epidemiology, translational neuroscience technology, and molecular and statistical genetics have recast schizophrenia's neurobiological nature, identifying new putative environmental risk factors and candidate susceptibility genes. Providing the latest clinical and neuroscience research developments in a comprehensive volume, this collection by world-renowned investigators answers a pressing need for balanced, thorough information, while pointing to future directions in research and interdisciplinary collaboration. The book, featuring a foreword by Robert Freedman, M.D., thoroughly

examines these topics from the vantage points of epidemiologic, clinical, and basic neuroscience approaches, making it an essential resource for researchers in psychiatry, psychology, and neuroscience and for clinical mental health professionals. Recent advances in our understanding of the human brain suggest that adolescence is a unique period of development during which both environmental and genetic influences can leave a lasting impression. To advance the goal of integrating brain and prevention science, two areas of research which do not usually communicate with one another, the Annenberg Public Policy Center's Adolescent Risk Communication Institute held a conference with the purpose of producing an integrated volume on this interdisciplinary area. Presenters/chapter contributors were asked to address two questions: What neurodevelopmental processes in children and adolescents could be altered so that mental disorders might be prevented? And what interventions or life experiences might be able to introduce such changes? The book has a 5-part structure: biological and social universals in development; characteristics of brain and behavior in development; effects of early maltreatment and stress on brain development; effects of stress and other environmental influences during adolescence on brain development; and reversible orders of brain development. The twenty chapters include contributions from some of the most well-known researchers in the area.

**Background:** Low birth weight (LBW) is a persistent public health challenge and one of the leading causes of death in the first year of life among non-anomalous infants in the United States. Existing literature suggest an association between prenatal stress and LBW. However, evidence from individual studies has not been consistent. **Objectives:** The purposes of the study are to examine the effect of stressful life events (SLE) on LBW and to further explore difference in effect across racial/ethnic groups to provide evidence to guide service and policy development at the Maternal, Child and Family Health Division (MCFH). **Methods:** Using the Pennsylvania 2009 Pregnancy Risk Assessment Monitoring System (PRAMS) data merged with electronic birth records, we conducted a retrospective cohort analysis of a sample of 858 women who delivered a live infant in Pennsylvania. We weighted and quantified maternal reported SLE in categories, tertiles, SLE domains (financial, emotional, traumatic, and spouse-related), and SLE domain categories. The main outcome was LBW. **Results:** Maternal stress was significantly associated with increased risks of LBW in all women. Financial stress was independently associated with LBW among Non-Hispanic Black mothers. While, spouse-related stress was significantly associated with LBW among Non-Hispanic White mothers. We found no significant interaction effect between race/ethnicity and maternal stress on LBW. **Conclusions:** Maternal stress has an effect on infant birth weight, and the effect may be different across racial/ethnic groups. Since MCFH serves primarily African American mothers, policies and programs that will target financial problems are crucial in improving birth outcomes in this population.

Prenatal stress is thought to confer unique and enduring impairments in postnatal functioning in children (Van den Bergh, Mulder, Mennes, & Glover, 2005). Although prenatal stress is thought to have pervasive and lasting effects on children, few human studies have formally tested putative mechanisms or mediators conferring such effects. The existing literature on prenatal stress is clouded by interchanging definitions of prenatal stress between maternal psychological symptoms experienced in pregnancy and maternal stressful experiences during pregnancy. This study examined the effects

of maternal prenatal depression and stressful events on children's adjustment in 306 preschool-age children and their mothers assessed across 4 time points. Multiple assessment methods were implemented, including neuroendocrine indicators of HPA activity, neuropsychological assessment of executive control, as well as the utilization of maternal and teacher-report questionnaire data. Using longitudinal modeling and multi-method assessments, the current study explored the unique effects of prenatal and postnatal psychological symptoms and the prenatal and postnatal experience of stress on preschooler's social competence and total problems. Putative mediators, including children's diurnal cortisol and executive functioning, were tested as potentially conferring the effect of prenatal stress. Sex differences in these relations were examined. Prenatal and postnatal maternal mood and stressful experiences were not related to children's diurnal cortisol (morning level or slope). There were trends of higher prenatal mood symptoms and prenatal stressful experiences predicting lower initial levels of preschooler's executive control. There was a trend for higher prenatal alcohol exposure predicting greater growth in executive control. Postnatal maternal mood and prenatal and postnatal stressful experiences did not predict executive control. Higher postnatal mood symptoms predicted lower social competence and higher mother-report total problems. There was a trend for higher prenatal mood symptoms to predict lower mother-report social competence. Greater prenatal exposure to medications predicted higher mother-report total problems. Greater prenatal exposure to alcohol predicted higher teacher-report total problems. Greater postnatal stressful experiences predicted higher mother-report total problems and lower mother-report social competence. Higher initial levels of executive control predicted higher social competence and lower total problems per teacher report. Greater growth in executive control predicted higher social competence and lower total problems by teacher report. There was no support for mediated relations. There was no evidence of child sex differences in these relations or evidence of differences in pathways predicted by prenatal maternal mood symptoms versus prenatal stressful experiences. The sample and study design afford the unique opportunity to evaluate two forms of prenatal stress, prenatal mood symptoms and prenatal stressful experiences, in a longitudinal framework. Prenatal medication and alcohol exposure were related to behavioral outcomes in the preschool period. Postnatal mood and stressful experiences related to mother report of adjustment. Study findings highlight potential targets for intervention for mothers in pregnancy that may promote long-term regulation and adjustment in children.

The development of the brain and nervous system is shaped not just by a genetic program, but also by the effects of multiple environmental stimuli. There are currently no book-length treatments of perinatal neurodevelopment. The proposed book seeks to fill this gap by presenting a collection of chapters from leading experts in the field. It is intended to be comprehensive and will cover all aspects of neurodevelopmental programming in lab animals and in human subjects. The third section of the book will look at ways of translating insights we have garnered from animal studies to human and clinical studies. The primary audience for this work is basic researchers interested in the effects of perinatal imprinting on the development of the nervous system and associated diseases.

This work is concerned with a group of proteins which were originally considered to be

an esoteric phenomenon but which have now been shown to play critical roles both in normal and stressed cells as well as being involved in a variety of human diseases. It is the purpose of this work to give a comprehensive view of these proteins and their various aspects. After an introductory chapter providing an overview of these proteins, the work is divided into four main sections each of which deals with one important aspect of these proteins. Thus, the first section contains a series of chapters which describe individual stress proteins and their roles in particular biological phenomena. Evidently, the induction of these proteins by elevated temperature or other stresses is their defining feature and the second section of this book therefore considers the regulation of stress protein gene expression both by stressful stimuli such as elevated temperature or ischaemia and by non stressful stimuli such as cytokines.

Based on the presentations given by well-known specialists at a recent multidisciplinary conference of developmental psychobiologists, obstetricians, and physiologists, this book is the first exhaustive attempt to synthesize the present scientific knowledge on fetal behavior. Utilizing a psychobiological analytic approach, it provides the reader with an overview of the perspectives, hypotheses, and experimental results from a group of basic scientists and clinicians who conduct research to elucidate the role of fetal behavior in development. Experimental and clinical as well as human and animal data are explored via comparative developmental analysis. The ontogeny of fetal spontaneous activity -- via the maturation of "behavioral states" -- and of fetal responsiveness to sensory stimulation is studied in detail. Results are provided from studies of embryonic/fetal and newborn behavior in chicks, rats, sheep, primates, and humans. Knowledge of fetal behavior is crucial to the obstetrician, neonatologist, developmental psychologist, and even the future parents, in order to follow and assess the gradual development of spontaneous responsive movements of the fetus. While assessing this important information, this text also examines the neuro-behavioral events taking place during the fetal period as an aid to understanding normal and pathological life span development.

This rich resource provides a thorough overview of current knowledge and new directions in the study of the biological, psychological, social, and cultural factors that affect health, health behavior, and illness. Chapters review the latest theories and research with an emphasis on how research is translated into behavioral medicine interventions. Featuring contributions from top researchers and rising stars in the field, authors provide a theoretical foundation; evaluate the empirical evidence; and make suggestions for future research, clinical practice, and policy. The handbook reflects the latest approaches to health psychology today, including: Emphasis throughout on the socio-cultural aspects of health, including socioeconomic status, gender, race/ethnicity, sexual orientation, and age/developmental stage A new section on emerging areas in health psychology, including behavioral genomics, military veterans' health, and digital health Coverage of prevention, interventions, and treatment in the applications section An expansion of the biopsychosocial model across several levels of analysis, including cultural, macro-social, and cellular factors Sustained emphasis on translating research into practice and policy The handbook considers the intersections of concepts (behavior change), populations (women's and sexual minority health), cultural groups (African American, Asian American, and Latino), risk and protective factors (obesity, coping), and diseases (cancer, diabetes, HIV), making it essential reading for scholars of health

psychology, public health, epidemiology, and nursing. Novices to the field appreciate the accessibly written chapters, while seasoned professionals appreciate the book's deep, cutting-edge coverage.

In this first compendium in the growing literature of behavioral teratology, readers will discover an easy-to-access, concise presentation that covers a huge range of subjects. The book synthesizes important findings that help explain why prenatal events may result in abnormal behavior and learning disabilities later in life. It goes further to examine the role of prenatal perturbations in conditions as varied as dyslexia, schizophrenia, fetal alcohol syndrome, and autism.

This book examines the complex impact of parenting stress and the effects of its transmission on young children's development and well-being (e.g., emotion self-regulation; executive functioning; maltreatment; future parenting practices). It analyzes current findings on acute and chronic psychological and socioeconomic stressors affecting parents, including those associated with poverty and cultural disparities, pregnancy and motherhood, and caring for children with developmental disabilities. Contributors explore how parental stress affects cognitive, affective, behavioral, and neurological development in children while pinpointing core adaptation, resilience, and coping skills parents need to reduce abusive and other negative behaviors and promote optimal outcomes in their children. These nuanced bidirectional perspectives on parent/child dynamics aim to inform clinical strategies and future research targeting parental stress and its cyclical impact on subsequent generations. Included in the coverage: Parental stress and child temperament. How social structure and culture shape parental strain and the well-being of parents and children. The stress of parenting children with developmental disabilities. Consequences and mechanisms of child maltreatment and the implications for parenting. How being mothered affects the development of mothering. Prenatal maternal stress and psychobiological development during childhood. Parenting Stress and Early Child Development is an essential resource for researchers, clinicians and related professionals, and graduate students in infancy and early childhood development, developmental psychology, pediatrics, family studies, and developmental neuroscience.

Paul presents an in-depth examination of how personalities are formed by biological, social, and emotional factors.

How to prevent and manage low birth weight Growth and nutrition during the fetal period and the first 24 months after birth are important determinants of development in early childhood. Optimal nutrition and health care of both the mother and infant during these first 1000 days of an infant's life are closely linked to growth, learning potential and neurodevelopment, in turn affecting long-term outcomes. Children with low birth weight do not only include premature babies, but also those with intrauterine growth restrictions who consequently have a very high risk of developing metabolic syndrome in the future. Epidemiology, epigenetic programming, the correct nutrition strategy and monitoring of outcomes are thus looked at carefully in this book. More specifically, two important nutritional issues are dealt with in depth: The first being the prevention of low birth weight, starting with the health of adolescent girls, through the pre-pregnancy and pregnancy stages and ending with lactation. The second point of

focus concerns the nutritional follow-up and feeding opportunities in relation to dietary requirements of children with low birth weight.

Major depression is a severe and prevalent brain disorder with a high disability burden, hence the push for effective treatments. Antidepressants have been around since the 1950s, and although current medications are much more effective than early ones, there is still much room for improvement. "Real" antidepressants, defined as those that "repair" or "improve" the depression-causing mechanism in the brains of depressed patients, have yet to be identified. This book presents current research on depression and antidepressants, including use of antidepressants in alcohol use disorders and pregnancy, treatment-resistant depression, and development of potential new medications. What psychological and environmental forces have an impact on health? How does behavior contribute to wellness or illness? This comprehensive volume answers these questions and others with a state-of-the-art overview of theory, research, and practice at the interface of psychology and health. Leading experts from multiple disciplines explore how health and health behaviors are shaped by a wide range of psychological processes and social-environmental factors. The book describes exemplary applications in the prevention and clinical management of today's most pressing health risks and diseases, including coronary heart disease, depression, diabetes, cancer, chronic pain, obesity, sleep disturbances, and smoking. Featuring succinct, accessible chapters on critical concepts and contemporary issues, the Handbook integrates psychological perspectives with cutting-edge work in preventive medicine, epidemiology, public health, genetics, nursing, and the social sciences. This volume offers an overview of the latest research on perinatal adaptation among women who have faced trauma, loss and/or adversity, both in childhood and/or as an adult, and describes the varied trajectories of adaptive and maladaptive coping that follow. The range of outcomes considered span from health-limiting (e.g. mental illness, substance use, unhealthy life style behaviours) to health-promoting (e.g. resilience and posttraumatic growth). These outcomes are examined both in relation to mothers' experience of motherhood and parenting, and with regard to their children's lives. Interpersonal trauma, experienced in childhood and/or adulthood, can have a profound effect on how women experience the transition into motherhood – from pregnancy, to childbirth, and postpartum caregiving. Women across the globe are exposed to high rates of interpersonal violence, and face the physical and emotional consequences of such events. The shift into motherhood is an emotionally evocative period in a woman's life, entailing not only challenges, but also the potential for healing and growth. Individual chapters will present state-of-the-art research, and will also highlight the voices of women who have personally experienced trauma, illustrating the effects on their experiences as mothers. Throughout the book, the consistent emphasis is on clinical implications and on ways that providers can create a context for healing and growth with the help of

current evidence-based and promising treatment methods.

Among the earliest volumes of this monograph series was a report by Lester Sontag and colleagues, of the esteemed Fels Institute, on the heart rate of the human fetus as an expression of the developing nervous system. Here, some 75 years later, we commemorate this work and provide historical and contemporary context on knowledge regarding fetal development, as well as results from our own research. These are based on synchronized monitoring of maternal and fetal parameters assessed between 24 and 36 weeks gestation on 740 maternal-fetal pairs compiled from eight separate longitudinal studies, which commenced in the early 1990s. Data include maternal heart rate, respiratory sinus arrhythmia, and electrodermal activity and fetal heart rate, motor activity, and their integration. Hierarchical linear modeling of developmental trajectories reveals that the fetus develops in predictable ways consistent with advancing parasympathetic regulation. Findings also include: within-fetus stability (i.e., preservation of rank ordering over time) for heart rate, motor, and coupling measures; a transitional period of decelerating development near 30 weeks gestation; sex differences in fetal heart rate measures but not in most fetal motor activity measures; modest correspondence in fetal neurodevelopment among siblings as compared to unrelated fetuses; and deviations from normative fetal development in fetuses affected by intrauterine growth restriction and other conditions. Maternal parameters also change during this period of gestation and there is evidence that fetal sex and individual variation in fetal neurobehavior influence maternal physiological processes and the local intrauterine context. Results are discussed within the framework of neuromaturation, the emergence of individual differences, and the bidirectional nature of the maternal-fetal relationship. We pose a number of open questions for future research. Although the human fetus remains just out of reach, new technologies portend an era of accelerated discovery of the earliest period of development.

This book examines the complex impact of prenatal stress and the mechanism of its transmission on children's development and well-being, including prenatal programming, epigenetics, inflammatory processes and the brain-gut microbiome. It analyzes current findings on prenatal stressors affecting pregnancy, including preconception stress, prenatal maternal depression, anxiety and pregnancy specific anxieties. Chapters explore how prenatal stress affects cognitive, affective, behavioral, and neurobiological development in children while pinpointing core processes of adaptation, resilience, and interventions that may reduce negative behaviors and promote optimal outcomes in children. This complex perspective on mechanisms by which early environmental influences interact with prenatal programming of susceptibility aims to inform clinical strategies and future research targeting prenatal stress and its cyclical impact on subsequent generations. Key areas of coverage include: Epigenetic effects of prenatal stress. Intergenerational transmission of parental early life stress. The microbiome-gut-brain axis and the effects of prenatal stress on early

neurodevelopment. Gestational stress and resilience. Prenatal stress and children's sleeping behavior. Prenatal Stress and Child Development is an essential resource for researchers, professors, and graduate students as well as clinicians, therapists, and related professionals in infancy and early childhood development, maternal and child health, developmental psychology, pediatrics, social work, child and adolescent psychiatry, developmental neuroscience, and related behavioral and social sciences and medical disciplines. Excerpt from the foreword: "I would make the plea that in addition to anyone with an interest in child development, this book should be essential reading for researchers pursuing "pre-clinical, basic science models of neurodevelopment and brain health".... This book provides what in my mind is the most advanced compilation of existing knowledge and state-of-the-art science in the field of prenatal psychiatry/psychology (and perhaps in the entire field of prenatal medicine). This volume can brilliantly serve to focus future directions in our understanding of the perinatal determinants of brain health." Michael J Meaney James McGill Professor of Medicine Translational Neuroscience Programme Adjunct Professor of Paediatrics.

Interest in the mind-body connection has grown in recent years, with accumulating evidence showing that the gut microbiome can alter behavioral, neural, and psychological outcomes. This publication brings together a group of international experts who are investigating the microbiome and its potential to contribute to the causes and treatment of mental illness. The contributions are not aimed solely at specialists in clinical and experimental neuroscience. They cover a range of key topics, including the role of the microbiome in mental health and specific psychiatric disorders that occur across the lifespan, interactions with the immune system, diet, and pharmacological interventions. Furthermore, the microbial metabolite production and the potential for psychobiotic interventions that target the microbiome to improve mental health outcomes are discussed. This book is unique in its focus on the mechanisms and consequences of the activities of gut microorganisms in mental health and illness, providing expert insight into the current state of the art and important future directions for this emerging area of research. Additionally, it provides an excellent knowledge base for newcomers and a refresher for researchers and clinicians working in the fields of neuroscience, psychology, or psychiatry.

This volume offers the most comprehensive coverage on fetal programming. Chapters are written by authors of international and national standing, leaders in the field and trendsetters. The clinical relevance of the current research is emphasized in each chapter, which also contains key points, key words, and concise summaries for ease of learning. Fetal programming affects conditions in the immediate postnatal period, as well as in later life and adulthood. These conditions include cardiovascular disease, frank hypertension, stroke, dyslipidemia, coagulopathy, increased insulin resistance-metabolic syndrome, type-2 diabetes, leukemia, testicular cancer, prostate cancer, breast cancer,

polycystic ovary syndrome, precocious puberty, impaired immune function, renal disease, lung disease, and osteoporosis. Neuropathologies, behavioral and mental deficiencies, schizophrenia, and depression have also been reported in adults who were exposed to nutritional inadequacies in utero. *Diet, Nutrition and Fetal Programming* provides an overview on the effects of fetal programming on disease, and comprehensive looks at maternal nutrition factors and fetal programming effects on brain and behavior, and physiology and disease. It also provides an in depth look at specific nutrient restrictions and supplements on physiology and disease, the effects of maternal disease on fetal programming, mechanisms of programming, and a special section on the international aspects and policies on fetal programming.

This volume collects the state-of-the-art applications of psychological theory to the interactions among the mind, the nervous system, and the immune system, including applications drawn from affective science, developmental psychology, behavioral neuroscience, and clinical psychology.

This edition of this comprehensive reference combines a strong scientific base with a clinical focus to address the principal disorders of bone and mineral metabolism, including osteoporosis, kidney stone formation, abnormal serum mineral levels, Paget's disease, and other conditions. The contributors examine normal bone structure and mineral metabolism throughout the life cycle, explain the mechanisms underlying each disorder, and provide succinct guidance on evaluation and management.

Volume 12 of the world-renowned *Trophoblast Research* series, devoted to placental science.

Early life experience can impact lifelong health; one of the earliest potentially adverse experiences is in-utero exposure to maternal stress, anxiety or depression. This project examined whether maternal social, economic and mental health stressors have an impact on a child's diagnosis of autism spectrum disorder (ASD) and whether these stressors can modify the risk of ASD from environmental exposures. First, we investigated whether the maternal economic and mental health stressors have independent effects on child's neurodevelopmental outcome. Data from the CHARGE (Childhood Autism Risks from Genetics and the Environment) Study, a population-based case-control study, were used to examine whether maternal periconceptional and prenatal exposures and experiences were associated with increased risk of ASD in the child. Specifically, maternal inability to pay for basic needs (food, housing, medical care and heating) and maternal prenatal psychological distress were explored for their association with the child's ASD diagnosis. Our data showed that both financial hardship and maternal mood disorders during pregnancy were associated with increased risk of child ASD. Secondly, we explored the effects of maternal stressors to determine if they modified or acted synergistically with environmental chemical exposures to alter a child's developmental diagnosis. Neighborhood level environmental exposures and sociodemographic factors

were obtained from the California Communities Environmental Health Screening Tool, a methodology developed by Office of Environmental Health Hazard Assessment that identifies California communities that are disproportionately burdened by multiple sources of pollution and socioeconomic disadvantage. Geographic based relative measures of seven environmental exposures, five indicators of the effects of pollution, and seven population characteristics and socioeconomic factors, create percentile scores for all of California's census tracts. Findings suggest Air quality measures are associated with ASD risk, and that this risk varies based on maternal mental state. Finally, we examined the interaction between the maternal prenatal experience and residential proximity to agricultural application of organophosphate pesticides for their effects on risk for ASD in the offspring. This study identified financial hardship as an amplifier of the association between organophosphate pesticide exposures during pregnancy and offspring ASD. These results add to the existing evidence highlighting the importance of studying the co-exposure of social and environmental exposures affecting children at early developmental stages. In this investigation, we have shown that maternal mental health financial hardship are potential environmental risk factors for ASD, and that these experiences amplify the effect of air pollution and pesticide exposures. These findings have relevance for public health and provide hope for strategies that can reduce risk factors for this devastating diagnosis. Strategies may involve maternal child health interventions, poverty reduction programs and attention to environmental toxins.

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