

The Miracle of Biology

Most of us want and eventually will have children. After all, they are the miracle of life – a miracle that is not without its challenges. Pregnancy and delivery are sometimes difficult – in the United States, roughly one third of all pregnancies are unsuccessful. In the developing world, childbirth remains a leading cause of mortality for mother and child. It takes 14 to 17 hours to deliver the average first-born child – enough time to fly from Vancouver to Sydney. Yet the birth canal is only eight centimetres long. It is not surprising that women around the world request help during labor. Evolution has let us down, stuck between the compromise of a pelvis that must bear the weight of an upright stature and an opening through which babies are delivered; the middle ground has led to the difficulties women experience today. Nonetheless, most unassisted pregnancies are successful, but conception, pregnancy and fetal development remain delicate biological processes.

Although biology can be unkind, there is reason to rejoice – all biological processes, no matter where they may occur or how vital they may be, can be influenced, corrected or improved. After all, that is the premise behind modern science and as our understanding grows so do our possibilities. Simple interventions have led to incredible improvements, which is why pregnancy warrants healthy lifestyle choices and adequate nutrition. Folate supplementation and fortification has significantly reduced the rates of neural tube defects and saved countless lives and spared families from the agony of congenital malformations. Iron status is commonly

inadequate in pregnancy with deficiencies estimated to affect 20% of women in developed countries and 56% of mothers-to-be in the developing world.¹ According to the World Health Organization, iodine deficiency has left 20 million people worldwide with brain damage. The benefits go far beyond the prevention of deficiencies; one study has even shown that DHA supplementation during pregnancy improved IQ in four-year-old children. Unfortunately, the potential of optimal nutrition during pregnancy is still largely unknown but it is estimated that stem cells (generic cell that can specialize to form the various tissues of the body) undergo 47 cellular divisions from conception to adulthood but only five take place after birth. Without question, adequate or inadequate nutrition during pregnancy have lifelong consequences.

The beauty of pregnancy is universal; a parental joy forever remembered. It is truly miraculous that the union of two people can lead to the creation of a new being, in which traits of both parents are found. From one cell, a person grows, developing a unique physique and personality. Exceptional individuals that deepen our understanding, improve our circumstances, and leave a heritage of new values and possibilities. Individuals that have written the Declaration of Independence, sailed across oceans, built the pyramids of Giza, walked in space, developed modern medicine and grown into loving parents that would risk life and limb for their children.



There are also biological miracles; the achievements seen during gestation often initially seem unsurpassable and the growth of the fetus is at times unbelievable. Pregnancy is the truest testament to our capacity to adapt. The complexity of the tasks at hand combined with the high success rate relay the greatness of pregnancy. For 9 months, body systems meant to maintain homeostasis for one adjust to the growing needs of another. Maternal nutritional reserves ensure adequate fetal supply. From sperm and ovum an average six pound and 18 inches long baby is born. Within nine months, the fetus must develop and growth to the point where it is capable of

leaving the mother and maintaining its own life support systems. During this period, the uterus increases in weight by more than 20 times, blood volume increases by roughly 30% and respiration increases by approximately 20% - all to accommodate fetal needs. Gestation is a period during which the fetus is vulnerable and fetal needs take precedent over maternal requirements. For instance, if the mother's calcium intake is insufficient, calcium will be mobilized from the maternal skeleton to ensure adequate fetal accretion. A successful pregnancy depends on adequate nutrition. Regulatory agencies such as the World Health Organization, the US Institute of Health and Health Canada all make recommendations for safe and effective dietary goals during pregnancy.

Recommended Daily Intakes and Upper Tolerable Levels have been established for most vitamins, minerals and some of the other important nutrients throughout pregnancy and lactation.

Nutrition during Pregnancy and Fetal Programming

Nutritional deficiencies are common during pregnancy. Studies looking at nutritional markers demonstrate that inadequate nutrition is common and that the risk of insufficiencies increases as gestation progresses.² Even in women taking prenatal supplement formulas, deficiencies commonly develop.³

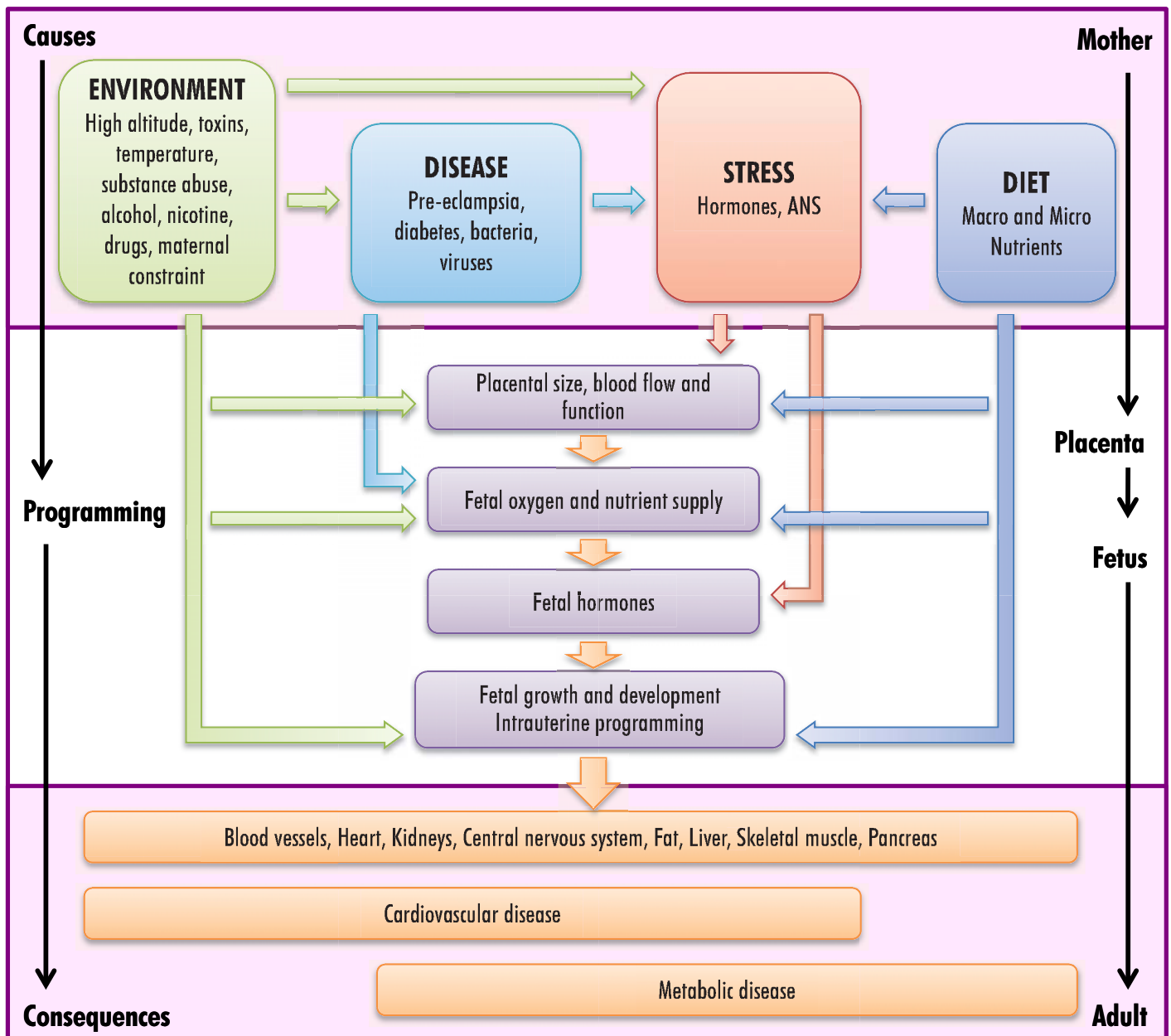


Figure 1. Fetal programming, its causes and consequences. Source: Adapted from Abigail, 2006



The fetus is dependant on the maternal supply of nutrients. During gestation, the maternal dietary intake is of utmost importance to support growth during the prenatal period. Epidemiological studies demonstrated that inadequate growth throughout gestation influences long-term health in the infant,⁴ leading to increases in Type 2 diabetes, hypertension and several other diseases later in life (see figure 1 and Box 1).⁵ This appears to be an adaptive mechanism. For example, in the case of Type 2 diabetes, if nutriture is insufficient during pregnancy, the fetus adapts by down regulating the expression of enzymes required for glucose metabolism, effectively reducing the need for glucose and increasing the chances of survival in a nutrient-poor environment. The process is known as fetal programming.⁶ Problems occur when glucose metabolism has been compromised in a high caloric environment. In such cases, fetal programming is counterproductive as an inability to use glucose effectively increases the risk of developing Type 2 diabetes later on in life. Although fetal programming remains poorly understood, the body of evidence pointing towards a link between gestational nutrition and adult health continues to grow.

Box 1. Adult Diseases Associated with Suboptimal Intrauterine Conditions

Source: Abigail (2006)

Physiological System	Disease
Cardiovascular System	Hypertension Coronary Heart Disease Stroke Atherosclerosis Coagulation disorders Pre-eclampsia
Metabolic System	Impaired glucose tolerance Insulin resistance Dyslipidemia Obesity Type 2 diabetes
Reproductive System	Polycystic ovary syndrome Early onset of puberty/menstrual cycles Early menopause
Respiratory System	Chronic obstructive pulmonary disease Asthma
Endocrine System	Hypercortisolism Hypothyroidism
Nervous System	Neurological disorders Schizophrenia Dementia
Skeletal System	Osteoporosis

Essential for the development of the memory centre of the brain