

**The Window of Opportunity: Pre-Pregnancy
to 24 Months of Age**

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The Window of Opportunity: Pre-Pregnancy to 24 Months of Age

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Preface

Extensive scientific information acquired over the past 5 decades has clearly demonstrated that human fetal development, pre- and postnatal growth, and subsequent expression of physiologic (normal) or pathologic (disease) states is largely a function of the inherited genetic constitution of the individual. But growing evidence suggests that developmental programming of fundamental life processes by early genetic imprinting on the expression of genes occurs by exposure to a diverse spectrum of nutrients, macromolecules, microbial agents and other cellular or soluble components present in the external environment.

The concept of the developmental origins of adult diseases emphasizes the importance of intrauterine and early life events in the etiology of human diseases, and offers explanations for the increasing prevalence of diseases such as obesity, hypertension, diabetes mellitus, atopic dermatitis, asthma, food allergies, systemic lupus, rheumatoid arthritis, and others. Although the precise mechanisms underlying the empirical findings of early programming of such disease states have only partly been elucidated, there is evidence to suggest that a critical 'window of opportunity' may exist in the human infant before and during pregnancy, and up to 24 months of age. Altered exposure to different environmental agents during this critical period may determine the nature of responses in the perinatal period, and the expression of specific diseases states in later life.

This workshop was organized to explore in some detail the nature and the eventual outcome of these complex interactions between the individual and the external environment, relative to this window of opportunity in the fetal and early neonatal period. The participants included many outstanding scientists who have proposed the concepts of such programming and other scholars in basic biology, epidemiology, microbiology and immunology who have made seminal contributions to this field.

Most presentations made at the workshop focused on the impact of perinatal growth, nutrition, environmental microflora, and host immune responses, on the outcome of health and disease in later life. The opening session provided a forum to discuss the basic biology of human growth and its relationship to cardiovascular and renal growth and disease, development of bone matrix, and genetic aspects of disease in later life. The second session concentrated on maternal nutrition before and during pregnancy, including the

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impact of under-nutrition and growth restrictions, maternal overweight and diabetes, neonatal overweight perinatal nutritional programming, nutrition in the first 6 months of life and their impact on growth and development in late infancy. The final session of the workshop considered in some detail the patterns of growth and host–pathogen interactions in tropical Africa, induction of antigen-specific immunity in the human neonate and infant, impact of fetal and perinatal viral and parasitic infections on later development of disease, effects of early exposure to environmental microbial flora on the immunologic homeostasis, subsequent immune responses and eventual disease outcome.

This publication includes the full text of the authors' presentations and the ensuing discussions. A comprehensive summary of the presentations and broad conclusions drawn during the deliberations is included under Concluding Remarks.

David J.P. Barker
Renate L. Bergmann
Pearay L. Ogra

Foreword

The 61st Nestlé Nutrition Workshop – Pediatric Program, entitled ‘The Window of Opportunity: Pre-Pregnancy to 24 Months of Age’, was held in Bali, Indonesia, in early April 2007. The importance of proper nutrition during pregnancy, lactation, and infancy for later health has been addressed from a number of different angles right from the origins of this workshop series. Indeed the very first Nestlé Nutrition Workshop in 1980 ‘Maternal Nutrition in Pregnancy – Eating for Two’, chaired by *John Dobbins*, focussed on the role of nutrition of the mother-to-be in the determination of fetal growth. Some years later, the 36th Nestlé Nutrition Workshop ‘Long-Term Consequences of Early Feeding’, chaired by *John Boulton*, *Zvi Laron* and *Jean Rey*, dealt mainly with the impact of nutrition during early infancy on health outcomes in later life, including mental development, obesity, cardiovascular disease and immune response. One presentation by *David Barker* addressed the long-term consequences of fetal growth and also raised the question of the potential importance of nutrition during pre-pregnancy for fetal development.

In 2004–2005, three Nestlé Nutrition Workshops covered various aspects of longer term health effects of nutrition during pregnancy, infancy and childhood:

- No. 55: The Impact of Maternal Nutrition on the Offspring
Chairpersons: *Gerard Hornstra*, *Ricardo Uauy* and *Xiaoguang Yang*
- No. 56: Feeding during Late Infancy and Early Childhood: Impact on Health
Chairpersons: *Olle Hernell* and *Jacques Schmitz*
- No. 57: Primary Prevention by Nutrition Intervention in Infancy and Childhood
Chairpersons: *Alan Lucas* and *Hugh Sampson*

In 2006, the United Nations Standing Committee on Nutrition, considering the double burden of undernutrition and obesity in many countries, proposed the intensification of efforts to improve nutrition at the local, national and global levels, with major ‘focus on the window of opportunity from pre-conception to around 24 months of age, the critical period when the foundation for life long health is set’. Thus with the observed alarming increases in nutrition-related conditions such as obesity, cardiovascular disease, diabetes, osteoporosis, allergy and other disorders of immune function, we felt it was timely to review current knowledge on the influence of nutrition during the critical period of pre-pregnancy through infancy on such conditions. Against this background, the chairpersons of this workshop, *David Barker*, *Renate Bergmann* and *Pearay Ogra*, designed a workshop program focussing on this window of opportunity, looking not only at

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conditions such as heart disease, obesity and diabetes, but also addressing the effects of early nutrition and growth on the development of immune function. We warmly acknowledge the excellent scientific program conceived by the chairpersons. We are also indebted to all the renowned speakers and experts who came from across the globe to review and debate this important topic.

Finally, we wish to thank and congratulate Dr. *Leilani Lestarina* and her team from Nestlé Nutrition Institute – Indonesia for their first class logistic support, allowing the workshop to take place under ideal conditions and the participants to experience the wonderful culture and hospitality of the Balinese.

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61st Nestlé Nutrition Workshop
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