PREFACE

by Claude Bouchard

It is an honor for me to be given the opportunity to contribute to this Festschrift recognizing the many accomplishments and the global legacy of Professor Robert M. Malina. Over the last 40 years, I have had the privilege of being able to observe from a front-row seat the numerous contributions made or spearheaded by Professor Malina, and this commentary is inspired by sustained contacts with him over these decades.

Anyone who has reviewed the curriculum vitae of RMM realizes that his research interests extend from human biology in the broad sense to exercise science, with a particular focus on growth and a variety of pediatric issues. His contribution to science spans a period of 50 years. He published his first research paper in 1962 in the *Journal of Bone and Joint Surgery* (Rarick et al., 1962). Since then, he has contributed to the advancement of knowledge in areas as diverse as the morphological growth of children; motor development and motor skills across the growing years; maturation, including age at menarche; skeletal age; growth and sports performance; the risk factor profile for common chronic diseases in children; and the role of social, cultural and economic circumstances as seen in developed and developing countries on growth and maturation.

Robert M Malina has published almost 400 peer-reviewed research papers and about 300 book chapters, technical papers, book reviews and other reports. He has also written several monographs and books. His publications have been cited more than 7,600 times in the world literature.
THE TIMING AND SEQUENCE OF GROWTH SPURTS IN DIFFERENT BODY DIMENSIONS DURING ADOLESCENCE

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INTRODUCTION

The adolescent spurt is a hallmark of somatic growth and maturation. Longitudinal research designs are required in order to understand the biological changes that occur during adolescence and to identify the parameters of the growth spurt (Malina, 1978; Shuttleworth, 1937; Tanner, 1962). The primary indicators of the adolescent growth spurt are age at peak height velocity (PHV), or the timing of the maximum rate of growth in stature, and the magnitude of the spurt, or PHV (cm/yr). This spurt is universally present in normally developing males and females; however, the timing and magnitude vary considerably among individuals and between sexes. Females attain PHV near age 12.0, approximately two years before males (Tanner, 1971), but the spurt is of greater magnitude in males. Age at PHV is used as a reference point for comparisons of size attained and rate of growth in other dimensions rather than chronological age (Beunen et al., 1988; Malina et al., 1988; Malina et al. 2004; Shuttleworth, 1937). Age at peak weight velocity (PWV) generally occurs approximately 0.3-0.9 years after PHV in females and 0.2-0.4 years after PHV in males (Beunen and Malina, 1988).

Many longitudinal analyses of adolescent growth and maturation are limited to the timing and magnitude of the growth spurts in stature and weight. Most body dimensions also exhibit growth spurts within about a two-year period. The timing and the magnitude of the spurts differ (Shuttleworth, 1937; Beunen et al, 1988; Malina et al., 2004; Satake et al., 1993, 1994), and there is considerable interindividual variability in the sequence in which the spurts in different dimensions occur (Stolz and Stolz, 1951; Satake et al., 1994). Studies of the sequence of spurts in several body dimensions are relatively few (Stolz and Stolz, 1951; Bielicki and Welon, 1973; Roche, 1974; Lindgren, 1978; Welon and Bielicki, 1979; Cameron et al., 1982; Satake et al., 1994), as are studies that have included aerobic capacity, particularly submaximal aerobic capacity or power output. Physical work capacity (PWC), or workload, at a heart rate of 170 bpm, or PWC_{170} is a common marker of submaximal aerobic capacity (Nudel, 1989), and is highly correlated with VO_{2}max (r=0.85 for adolescent males, mean age 14.2±0.9 years, Franz et al., 1984). Most of the limited, longitudinal data on submaximal work capacity have been treated in a cross-sectional manner; and there are fewer data available in females than in males (Armstrong and Welsman, 1994; Cunningham et al., 1984; Vanden Eynde et al., 1984).

The purpose of this study was to describe the timing and tempo of somatic growth