INTRODUCTION

Ever since the dawn of civilization, nothing fascinated mankind more than mysteries of existence of itself. Through the east went esoteric, the western world was drawn by exoteric, and the human body fascinated him more than anything else. Spurred by a passion for knowledge, he pressed for knowledge; he pressed his search as if convinced that omniscience was an attainable goal. In a created, finite world in which man is a microcosm, a person who delves deeply into a particular area of study necessarily ends up studying it in its entirety. He concentrated his efforts on unraveling the mysteries of structure and functions of individual organs. Most of the previous studies on the structure of the placenta are related to gross anatomy, comparison of weight with fetal birth weight or histological study. So, most of these studies are two dimensional.

Scanning electron microscopy of the placenta has a history of only twenty years. During that time, however, there have been dramatic advances in instrument technology coupled with the refinement of preparative techniques designed to reduce fixation artifacts to a minimum. As a result many of the early claims must be amended or suitably qualified. Much new data on the internal structure of the placental villus is also presented. By means of the partial digestion technique it is now possible to describe the three dimensional configuration of the various components of the villous tree.

In sheep, as well as humans, the first half of gestation is critical for proper fetal organogenesis and placental growth and vascularisation. Further, the structure of fetal blood vessels (stem arteries and veins, intermediate arterioles and venules, and terminal capillaries) in sheep and
humans are comparable, suggesting similarities in fetal placental vascular development. Vascular endothelial growth factor (VEGF), a potent angiogenic and permeability factor, is present in the cotyledon of the ovine placentome and is regulated by hypoxia and estrogen. It is probable that under-nutrition in the dam may impact placental vascularity and the transport of nutrients and oxygen to the growing fetus. Although several investigations have looked at a moderate and decreasing nutrient restriction during gestation in the ewe, none resulted in significant losses in maternal body weight or fetal weight during the restriction period. Further, none of these studies evaluated the impact of under-nutrition on placental (cotyledonary/caruncular) vascularity.

The objective of this study was to determine the chorionic plate vascular anatomy of the human placenta. Information regarding the origin and development of the micro vessels and their architecture during early placental formation is so far lacking. We therefore attempted to elucidate the architecture of fetal vascular systems in the human placenta. These classifying characteristics guarantee functions such as anchoring, substance exchange, and hormonal control; however, for a better understanding the exact 3-dimensional structural arrangement of both fetal and maternal compartments of the placenta needs to be determined (Faber & Thornburg, 1983; Mossman, 1987).

We have studied vascular architecture of the umbilical artery by using vascular corrosion cast technique. Placenta is the most accurate record of the infants' prenatal experience (K. Benirschke, 1981). After delivery if the placenta is examined minutely it provides much insight into the prenatal health of the baby and the mother. Appropriate growth and development of the placenta is essential for fetal growth and wellbeing, and indeed may be an important factor in determining adult health. As the
fetus grows, its demands increase and the capacity of the placenta to facilitate transfer between the fetal and maternal circulations increases as gestation progresses. The principal units for diffusional exchange of oxygen are the terminal villi, and these develop in the third trimester. It is thought that capillary growth within the villi drives the growth of these structures which are characterized by a high proportion of their volume being occupied by fetal capillaries and extreme thinning of the trophoblast and endothelial cell layers. In the first trimester the $P_{O_2}$ in the intervillous space is low and rises sharply at the start of the second.

The human placenta is classified by multiple separate cotyledons which display a villous interdigitation of fetal villi with maternal crypts of the complementary caruncles (Mossman, 1987; Leiser & Kaufmann, 1994; Wooding & Flint, 1994). The interhaemal barrier is epitheliochorial (Bjorkman, 1954, 1968) or synepitheliochorial (Wooding, 1992) because binucleated cells of the syncytial trophoblast fuse with the syncytium of the uterine epithelium. The blood flow interrelationship between the maternal and fetal vessel systems is a mixture of crosscurrent to countercurrent in the human which is regarded as an efficient type for trans-placental diffusional exchange, e.g. oxygen, when compared with other species (Faber & Thornburg, 1983; Dantzer et al. 1988).

The placenta is a highly vascularised organ. Therefore, its 3-dimensional structure can be demonstrated by micro vascular casts which reflect the shape of the whole or part of the organ, and include specific details such as the capillary architectural structure (Leiser et al. 1988). Filling of the placental vasculature by CABG and, after polymerisation of the CABG and tissue corrosion, its macroscopic visualisation can technically be advanced in 3 ways: treatment of maternal and fetal circulatory systems in common or each of the 2 systems separately.
(Leiser, 1985\textsuperscript{11}; Leiser et al. 1988\textsuperscript{10}). In the placentas of ruminants, e.g. goat (Leiser, 1987\textsuperscript{12}), sheep and cow (Leiser et al. 1997\textsuperscript{13}), and in human the technique of separate casting is technically easy and allows an impressive demonstration of the fetal villosity of the cotyledon. In this study we aimed to elucidate the 3-dimensional structure of the cotyledonary vasculature of the human placenta after delivery, which serves as a core for the shape of the whole fetal villosity. Method used is vessel corrosion casting with subsequent analysis by macroscopic examination and comparing those findings with previous studies.

Pregnancy complications like hypertension or gestational diabetes are reflected in the placenta in a significant way (both macroscopically and microscopically). It has been recorded that the maternal utero-placental blood flow is decreased in pre-eclampsia.