PLACENTAL TRANSFER OF DRUGS

ESSAY

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Of Requirements For The
Master Degree of Anaesthesiology

By

ABD EL-SALAM MOHAMED MANSOUR
M. B., B. Ch.

Supervised By

Prof. Dr. MOHAMED HAMED SHAKER
Professor of Anaesthesiology

And

Dr. NAHED SALAH EL-DIN OMAR
Lecturer of Anaesthesiology

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

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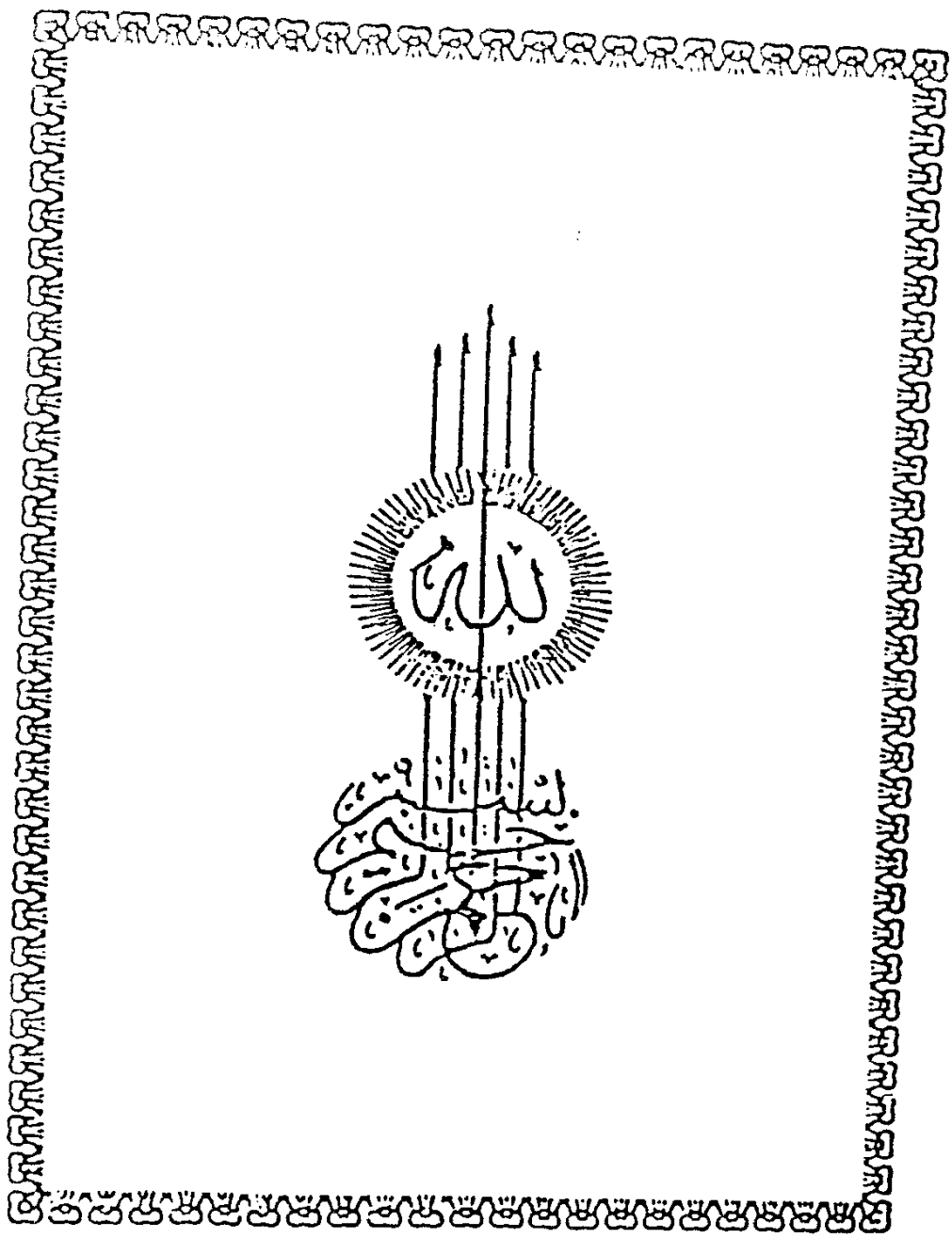

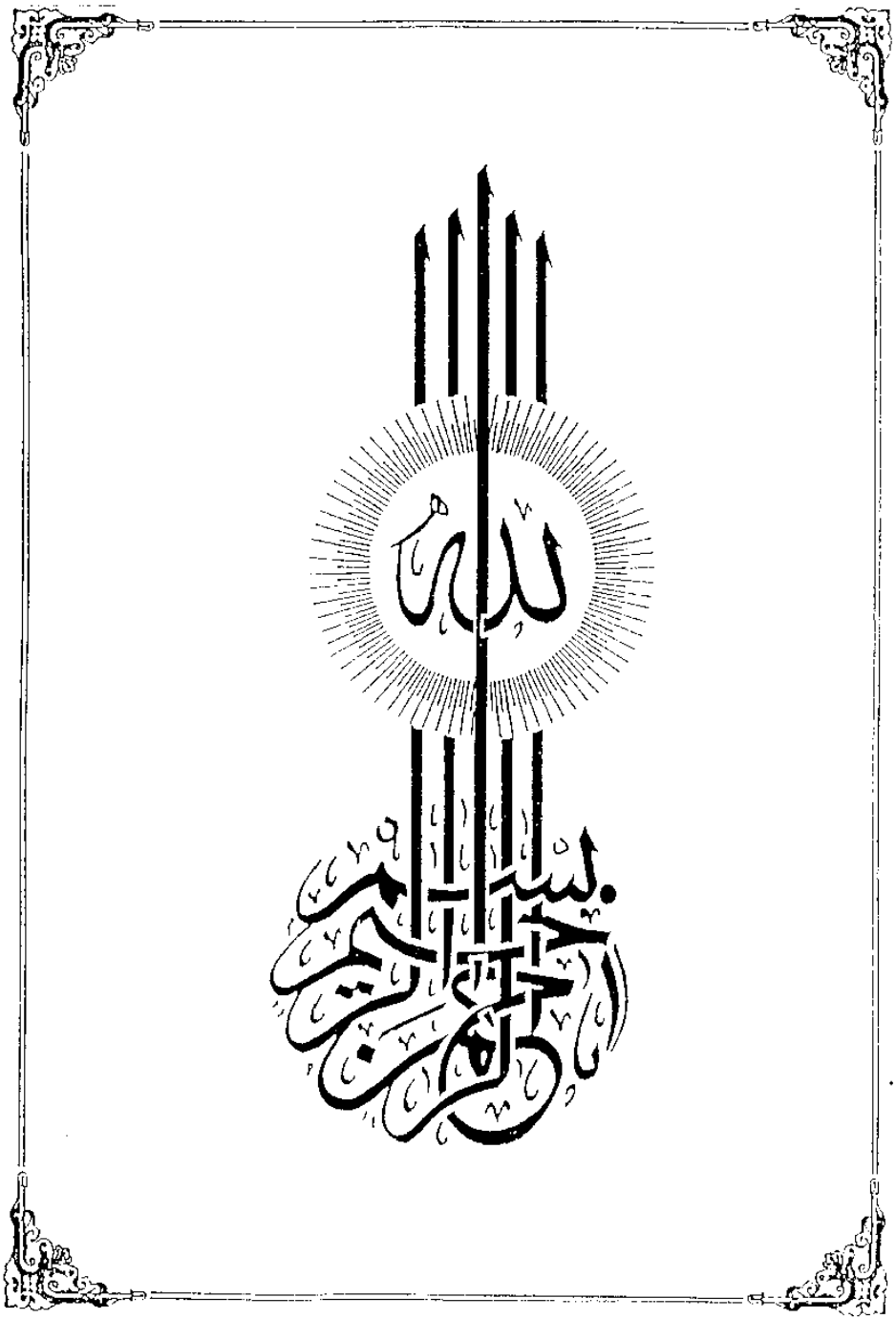

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INTRODUCTION

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Drugs administered to the pregnant mother may have a profound effect on the foetus soon to be newborn since the thalidomide catastrophe.

While it appears unlikely that drugs administered at term to alleviate pain and anxiety in parturient will have teratogenic effect on foetus, yet there is no doubt that most of our anaesthetic agents can have a profound consequence on the newborn.

As anaethesiologists we must be aware of the potential dangers to the newborn associated with medication we administer to the parturient.

We also must be familiar with means to avoid and to minimize these dangers.

So, in this essay we will try to shed the light on the passage of drugs across the placenta, their distribution and ultimate removal from foetal tissues and factors affecting this process. Equally important are the parturient anatomic features of maternal circulation, placenta and the foetal circulation as well as haemodynamics and pharmacokinetic events that occur within them.

ANATOMY AND HISTOLOGY OF THE PLACENTA

The Placenta

Anatomy and Histology :-

The human placenta is described as a villous haemochorial type (Crawford, 1980).

The placenta is composed of maternal or decidual plate and foetal or chorionic plate (Fig. 1).

I- Maternal or decidual plate :

The decidua is the endometrium of the pregnant uterus. It is due to the effects of the progesterone following ovulation, preparing the endometrium for implantation and nutrition of the blastocyst. It consists of 3 parts (Fig. 2):-

1- Decidua basalis :

It is the portion of the decidua directly beneath the site of implantation.

2- Decidua capsularis :-

It overlies the developing ovum and separates it from the uterine cavity.

3- Decidua vera or parietalis :-

It lines the remainder of the uterus. By the 4th month of pregnancy, and with the fusion of

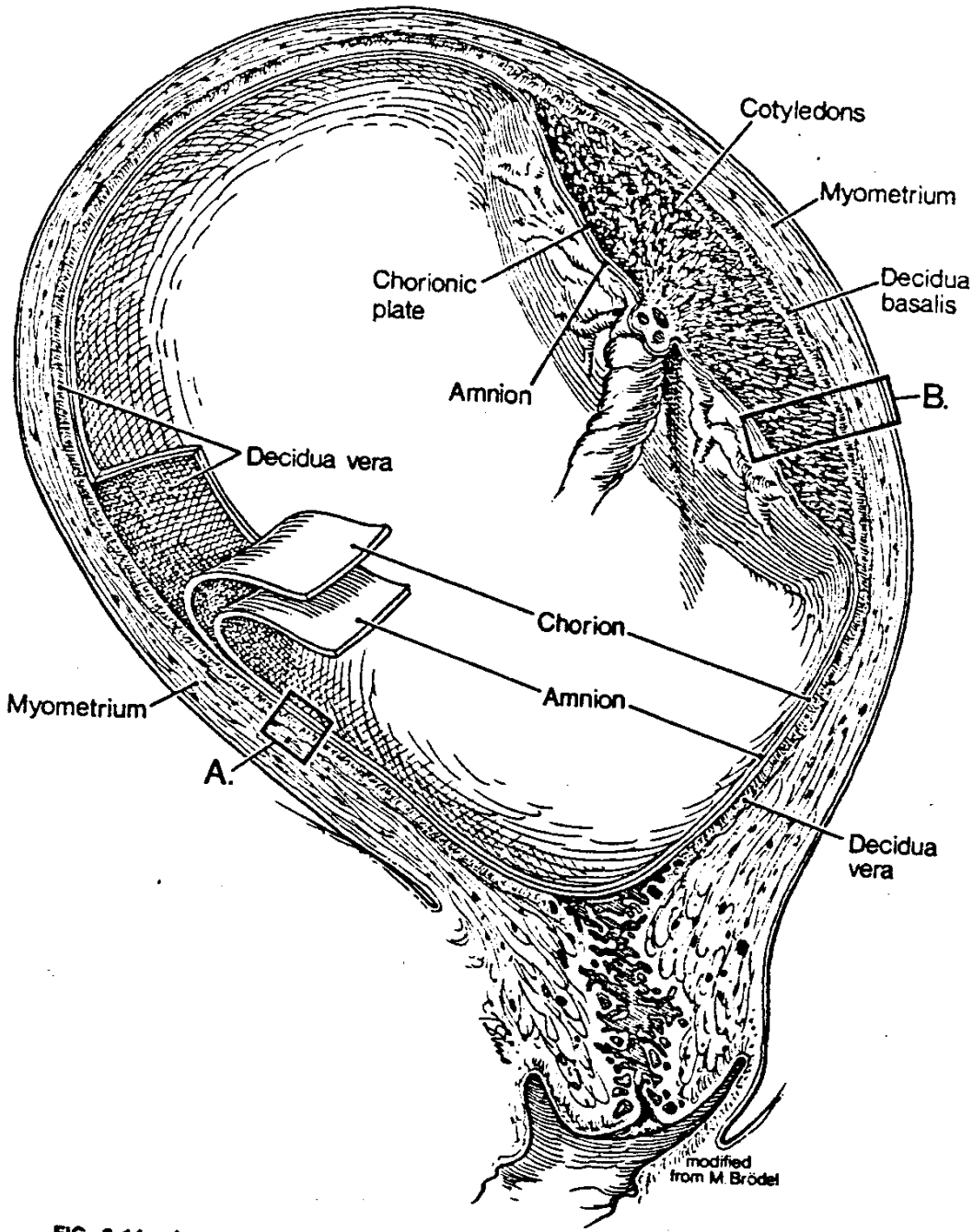

FIG. 6-14. A pregnant uterus showing normal placenta in situ. **A.** Location of section shown in Figure 6-15. **B.** Location of section shown in Figure 6-16.

FIG.(1). Pritchard and Macdonald, 1980 .

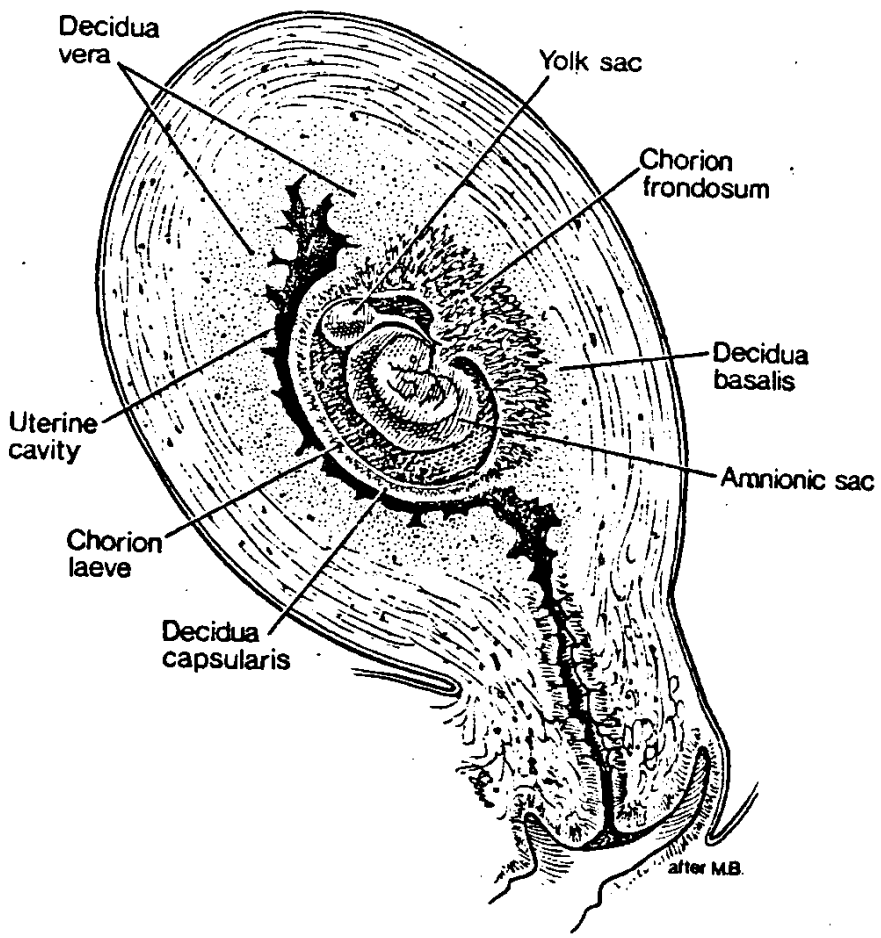

FIG. 6-7. More advanced stage of pregnancy, showing atrophic chorion laeve and chorion frondosum (chorionic villi) proliferating into decidua basalis.

FIG.(2). Pritchard and Macdonald, 1980 .

capsularis and vera, the uterine cavity is obliterated.

The decidual plate of the placenta (Fig. 3) is composed of :-

1- Zona Compacta :- a surface or compact zone.

2- Zona Spongiosa :- a middle or spongy zone with glands and numerous small blood vessels. These two layers together form zona functionalis.

3- Zona basalis :-

The basal zone which remains after delivery and gives rise to new endometrium (Pritchard and Macdonald, 1980).

II- Foetal or Chorionic Plate :-

It is formed of chorion frondosum. It lies opposite the decidua basalis. The chorion is the outer layer of the fertilised ovum and villi arise from it. They are of 3 types (Fig. 4-1, 4-2)

1- Primary Villi :- These are cytotrophoblastic cell columns.

2- Secondary Villi :- The mesoderm can be seen within the cytotrophoblastic cell columns.

3- Tertiary Villi :- results from the vascularisation of these secondary villi (Clayton et al., 1966).

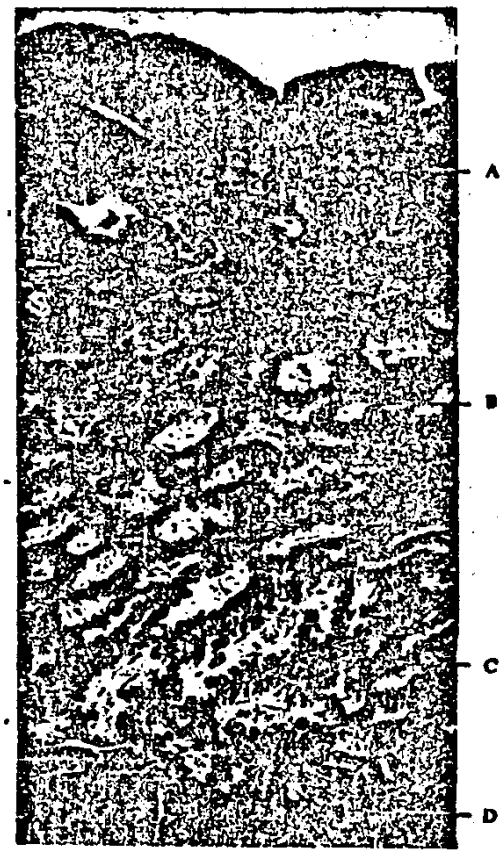

FIG. 6-8. Early decidua vera (parietalis). A, compact layer (see Fig. 6-9); B, spongy layer; C, uterine glands just above the basal layer; D, myometrium. (Compare with Figs. 2 through 5 in Chap. 4)

FIG.(3). Pritchard and Macdonald, 1980 .

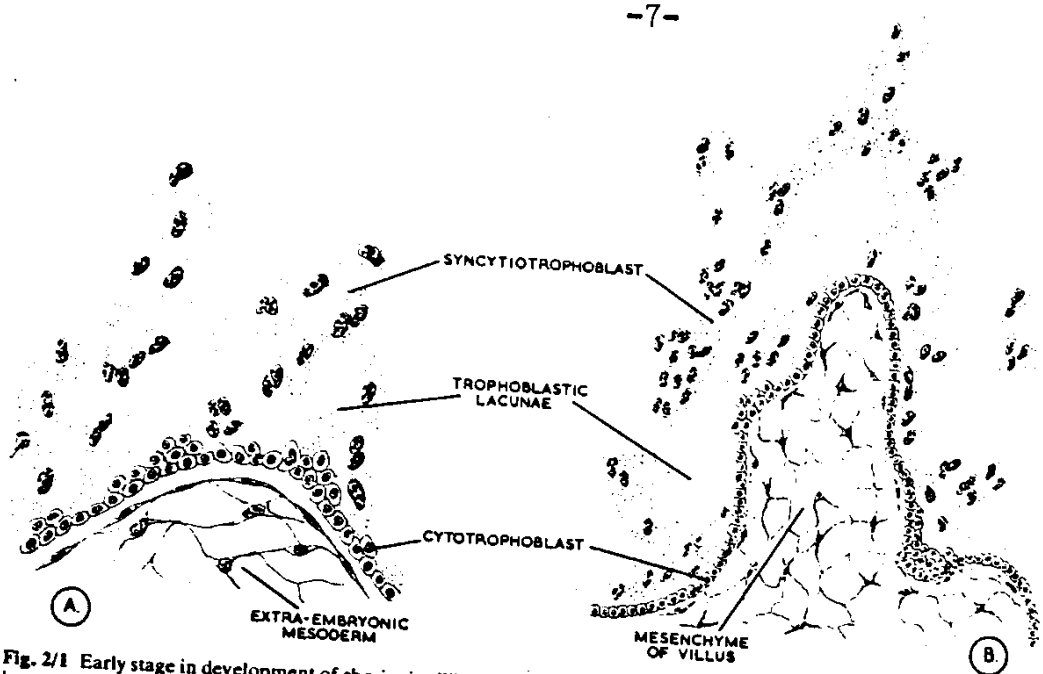

Fig. 2/1 Early stage in development of chorionic villi. (A) The trophoblast projection has occurred with the development of lacunae, and much intermingling with maternal tissue, which for clarity is not shown. No mesoblastic core has yet entered the villus. (B) The mesoblastic core is now developing within the villus (redrawn from Patten. *Tend. Act. Gyn. et Obstet.* 1959, Beauchemin, Montreal)

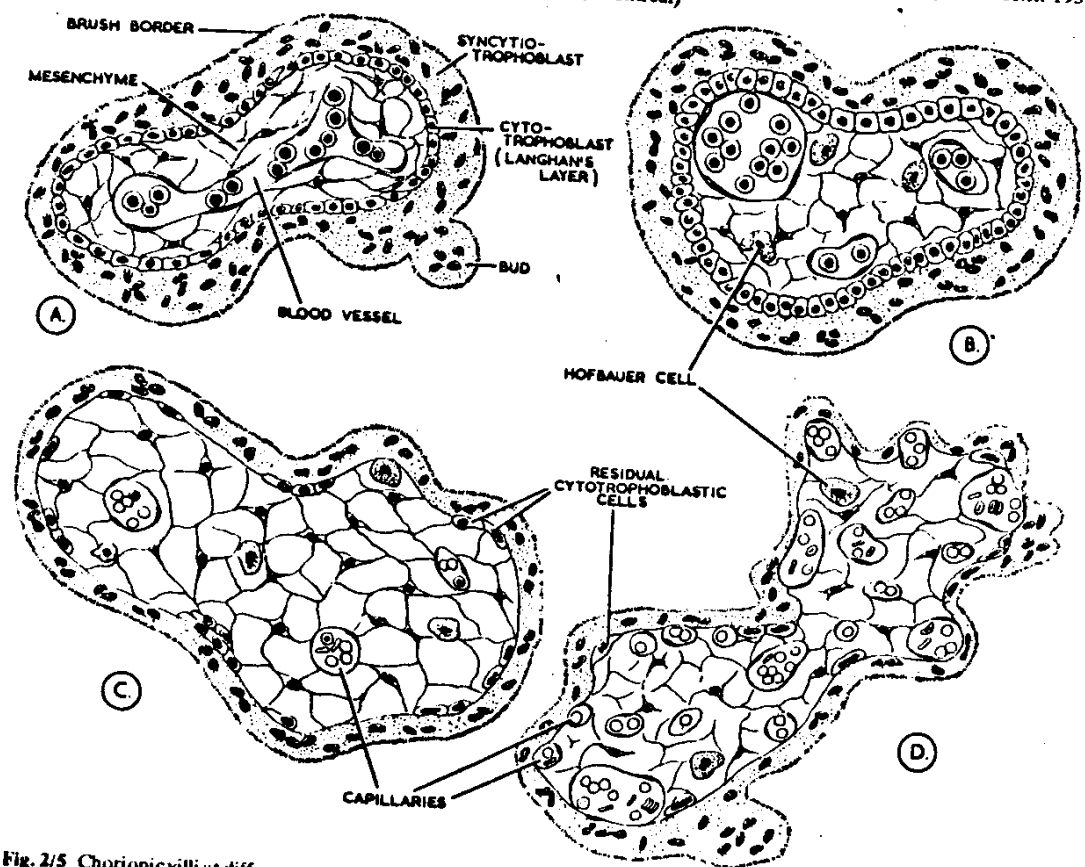

Fig. 2/5 Chorionic villi at different ages (×350). (A) 4 week embryo; (B) 6½ week embryo; (C) 14th week placenta; (D) Term placenta (redrawn from Patten (1959))

FIG.(4-1). Derek , 1982.

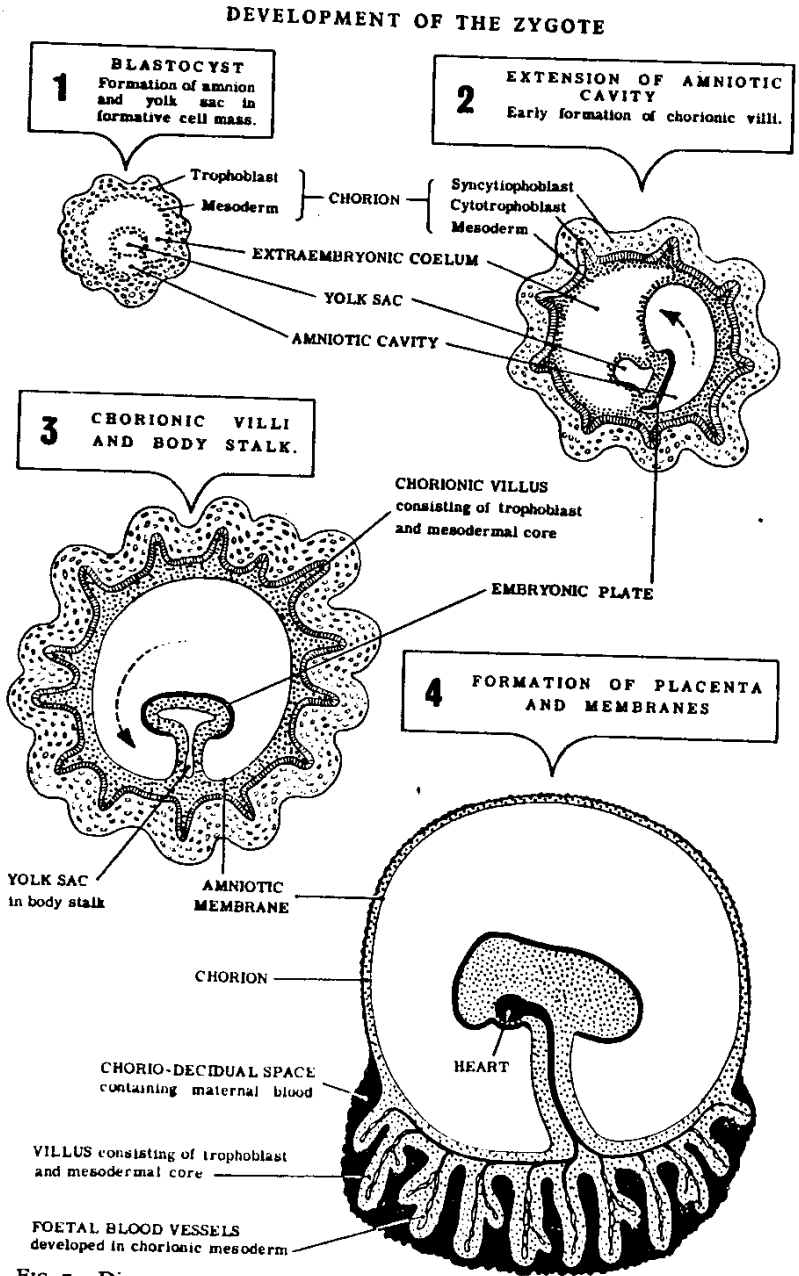

FIG. 7. Diagrams to show the formation of the placenta and fœtal membranes.

FIG. (4-2). Percival et. al., 1966.