DEWHURST'S TEXTBOOK OF OBSTETRICS AND GYNAECOLOGY FOR POSTGRADUATES

EDITED BY

C.R. WHITFIELD

FOURTH EDITION

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This book is the fourth edition of
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Edited by Sir John Dewhurst

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PREFACE TO FOURTH EDITION

It has been a great privilege and considerable responsibility to follow Sir John Dewhurst as Editor of the textbook which he launched in 1972 and which, in its first three editions, has become established as a main reading source for many obstetricians and gynaecologists in training, and as a useful reference book for the established specialist. Happily, Sir John remains in the team of contributors, writing several chapters dealing with matters in which he is an acknowledged expert and renowned teacher. We are delighted that he has also agreed that his name should be given to the new title: that is our public tribute to him.

Our objective remains to provide a coherent and advanced account of obstetrics and gynaecology, of the related physiology and pathology on a knowledge of which clinical expertise must be built, and of the common ground shared with other closely associated specialties. As stated by Sir John in his preface to the first edition, some basic knowledge is assumed, and the text is not so much 'on how things are done, but on how correct treatment is chosen, what advantages one choice has over another, what complications are to be expected, etc'. Practical matters, including history taking and physical examination and also operative techniques, should be learned in outpatient clinics and at the bedside and in the labour wards and operating theatres. Reinforcement of this practical experience by reference to detailed descriptions of operative procedures (in obstetrics, gynaecology and relevant general surgery) in specialized textbooks is essential complementary reading for the trainee. Likewise, those training to be subspecialists must read extensively in the journals and textbooks dealing with their particular fields—gynaecological oncology or urology, fetal medicine or reproductive endocrinology and infertility.

Inevitably, as new knowledge is gained and new developments are made at an ever increasing pace, there must be substantial revision from one edition to another. Although we remain conscious of the need to remove outdated material, to minimize overlap and repetition between chapters, and to keep cost within an acceptable limit, some lengthening of the text has been unavoidable. New chapters have been added and others reorganized, and, while thanking retiring authors who have contributed so effectively to previous editions, we welcome several newcomers to the team. Their expertise reflects the need for those with very specialized knowledge to remain involved in teaching the great majority of obstetrician–gynaecologists who will practise as generalists, as well as in training a small number of intending subspecialists. Thus, Dr Knox Ritchie, formerly Senior Lecturer in Fetal Medicine in Belfast and now directing an obstetrical perinatology service in Toronto, brings to the team his experience in managing the high risk fetus and of operative obstetrics. The chapters by Professor Peter Howie of Dundee, by way of Glasgow and Edinburgh, include those on the coagulation and fibrinolytic systems and their disorders and on the puerperium, in which fields he has made important contributions. In taking over from Sir Rustam Feroze responsibility for the chapters dealing with gynaecological cancer, Mr Roger Peel draws on his experience of providing a referral service in Leeds, while Dr David Warrell of Manchester has taken over two chapters that reflect his particular knowledge of urological problems in obstetrics and gynaecology. Finally, because many obstetricians, especially in developing countries, must still practise without close paediatric support, a chapter on neonatal care has been provided by my academic partner at the Queen Mother's Hospital, Professor Forrester Cockburn.

I am of course most grateful to those who have so willingly updated their chapters from the preceding edition, some of them readily accepting additional commitments. Thus, Professor Shearman continues to be responsible for the chapters that relate to the broad field of reproductive endocrinology, now including those on contraception and infertility; besides taking over the chapter on hypertensive disorders

occurring in pregnancy, Professor Davey extends his contribution on normal pregnancy to include a section on obstetric care in undeveloped and developing communities; immunological disorders in pregnancy now have their own chapter, written by Professor Scott; Professor Beazley adds the third stage to his chapters on normal and abnormal labour; Professor Chamberlain adds a new chapter on the increasingly important topic of prepregnancy care and another that brings together well established and more recent methods for gynaecological diagnosis. The features and particular problems of multiple pregnancy also now have their own chapter, while the minor symptoms of pregnancy (so named by men) have, in the interests of space, been excluded from the chapter on miscellaneous disorders in pregnancy which is now given over almost entirely to the important TORCH and fetal alcohol syndromes and to the new potential threat posed by AIDS. Special thanks are due to Sir John Dewhurst, Sir Rustam Feroze and Mr David Morris for generously allowing considerable material from their earlier contributions to be used by others in preparing the corresponding chapters this time; and I have made use of the experience of my colleagues who provide a referral service for prenatal diagnosis (particularly Drs Whittle, McNay and Gilmore) for a new chapter on detection of the abnormal fetus. We are grateful to many others who have permitted us to use their already published illustrations, acknowledged in each case, and have helped in other ways. The unstinting support of my hospital colleagues, senior and junior, was indispensable in reducing other demands upon my time; and it is a great pleasure to record special thanks to my secretary, Mrs Helen Mackenzie, without whose patience and diligence my own chapters and the editorial task could not have been completed. I am also indebted to Blackwell Scientific Publications, particularly Mr Nigel Palmer and Ms Jane Starling, who also showed considerable patience and provided much useful advice.

C. R. Whitfield
Glasgow, 1986

PREFACE TO FIRST EDITION

Our purpose in writing this book has been to produce a compehensive account of what the specialist in training in obstetrics and gynaecology must know. Unfortunately for him, he must now know a great deal, not only about his own subject, but about certain aspects of closely allied specialities such as endocrinology, biochemistry, cytogenetics, psychiatry, etc. Accordingly we have tried to offer the postgraduate student not only an advanced textbook in obstetrics and gynaecology but one which integrates the relevant aspects of other subjects which nowadays impinge more and more on the clinical field.

To achieve this aim within, we hope, a reasonable compass we have assumed some basic knowledge which the reader will have assimilated throughout his medical training, and we have taken matters on from there. Fundamental facts not in question are stated as briefly as is compatible with accuracy and clarity, and discussion is then devoted to more advanced aspects. We acknowledge that it is not possible even in this way to provide all the detail some readers may wish, so an appropriate bibliography is provided with each chapter. Wherever possible we have tried to give a positive opinion and our reasons for holding it, but to discuss nonetheless other important v s; this we believe to be more helpful than a complete account of all possible opinions which may be held. We have chosen moreover to lay emphasis on fundamental aspects of the natural and the disease processes which are discussed; we believe concentration on these basic physiological and pathological features to be important to the proper training of a specialist. Clinical matters are, of course, dealt with in detail too, whenever theoretical discussion of them is rewarding. There are, however, some clinical aspects which cannot, at specialist level, be considered in theory with real benefit, examples of these are *how* to palpate a pregnant woman's abdomen and *how* to apply obstetric forceps. In general these matters are considered very briefly or perhaps not at all; this is not a book on *how* things are done, but on how correct treatment is chosen, what advantages one choice has over another, what complications are to be expected, etc. Practical matters, we believe, are better learnt in practice and with occasional reference to specialized textbooks devoted solely to them.

A word may be helpful about the manner in which the book is set out. We would willingly have followed the advice given to Alice when about to testify at the trial of the Knave of Hearts in Wonderland, 'Begin at the beginning, keep on until you come to the end and then stop'. But this advice is difficult to follow when attempting to find the beginning of complex subjects such as those to which this book is devoted. Does the beginning lie with fertilization; or with the events which lead up to it; or with the genital organs upon the correct function of which any pregnancy must depend; or does it lie somewhere else? And which direction must we follow then? The disorders of reproduction do not lie in a separate compartment from genital tract disease, but each is clearly associated with the other for at last part of a woman's life. Although we have attempted to integrate obstetrics with gynaecology and with their associated specialities, some separation is essential in writing about them, and the plan we have followed is broadly this—we begin with the female child *in utero*, follow her through childhood to puberty, through adolescence to maturity, through pregnancy to motherhood, through her reproductive years to the climacteric and into old age. Some events have had to be taken out of order, however, although reiteration has been avoided by indicating to the reader where in the book are to be found other sections dealing with different aspects of any subject under consideration.

We hope that our efforts will provide a coherent, integrated account of the field we have attempted to cover which will be to the satisfaction of our readers.

Sir John Dewhurst, 1972

CONTENTS

CHAPTER 1
NORMAL AND ABNORMAL DEVELOPMENT OF THE GENITAL ORGANS

SIR JOHN DEWHURST

An understanding of the manner in which the genital organs develop in the early embryo is clearly important for the gynaecologist. But it is also necessary to appreciate the reason why these organs develop differently in the two sexes. This chapter will open, therefore, with a brief outline of sexual differentiation which will be discussed more fully in Chapters 2 and 3.

Sexual development depends initially on the arrangement of the sex chromosome. Normal men have an XY sex chromosome arrangement and normal women an XX one. Sometimes, however, individuals are born with additional sex chromosomes and are XXY, XYY, XXYY, XXX, XXXX, etc., and others with a single X only; still others have different arrangements which need not concern us here but which are dealt with in greater detail later. Normally if a Y chromosome is present with one or more X chromosomes, testes will form in the early embryo and if two or more X chromosomes are present without a Y, ovaries form. If a single X chromosome is present alone, normal definitive gonadal tissue does not form and the gonads are represented by whitish streaks of tissue. It is likely that the effect of the Y chromosome in promoting testicular differentiation is concerned with a substance known as H–Y antigen which is thought to be the gene product of the male determining genes on the Y chromosome (Wachtel 1979).

The relationship between the differentiated gonad and the development of the other genital organs is, in summary, this. If testes form in the early embryo, that individual will develop male genital organs. If testes do not form, the individual will develop female genital organs whether ovaries are present or not. It may be concluded that the arrangement of the sex chromosomes normally determines the nature of the gonad, which in turn determines the differentiation of the other genital organs.

We will now turn our attention to how the genital organs develop.

THE DEVELOPMENT OF THE GENITAL ORGANS

Most embryological accounts agree on the principles of genital tract development as a whole, although different views are held on the development of the vagina.

The genital organs and those of the urinary tract

Fig. 1.1. Section of a 3.5 mm (28 days old) human embryo stained with alkaline phosphatase. The picture shows the primitive gut marked 'G' above which is the root of the mesentery. Above this again on either side is the intermediate mesoderm in which the genital organs develop. Germ cells are stained black and seen on either side of the primitive gut. (By courtesy of Dr Jan E. Jirasek, Dr Joe Leigh Simpson and Academic Press Inc.)

arise in the intermediate mesoderm on either side of the root of the mesentery, beneath the epithelium of the coelom (Fig. 1.1). The pronephros, a few transient excretory tubules in the cervical region, appears first but quickly degenerates. The duct which begins in association with the pronephros persists and extends caudally to open at the cloaca, connecting as it does so with some of the tubules of the mesonephros shortly to appear. The duct is called the mesonephric (Wolffian) duct. The mesonephros itself, the second primitive kidney, develops as a swelling bulging into the dorsal wall of the coelom of the thoracic and upper lumbar regions. The mesonephros in the male persists in part as the excretory portion of the male genital system; in the female a few vestiges only survive (Fig. 1.2). The genital ridge in which the gonad of each sex is to develop is visible as a swelling on the medial aspect of the mesonephros; the paramesonephric (Müllerian) duct, from which much of the female genital tract will develop, forms as an ingrowth of coelomic epithelium on its lateral aspect (10 mm C.R. length; 5–6 weeks). The ingrowth forms a groove and then a tube and sinks below the surface.

DEVELOPMENT OF THE UTERUS AND FALLOPIAN TUBES

The two paramesonephric (Müllerian) ducts then extend caudally until they reach the urogenital sinus, at about 9 weeks; the blind ends project into the posterior wall of the sinus as the Müllerian tubercle (Fig. 1.3). At the beginning of the third month the Müllerian and Wolffian ducts and mesonephric tubules are all present and capable of development (Fig. 1.2[a]). From this point onwards in the female there is degeneration of the Wolffian system and marked growth of the Müllerian system (Fig. 1.2[b]). In the male the opposite occurs (Fig. 1.2[c]). The lower ends of the Müllerian ducts come together in the mid-line

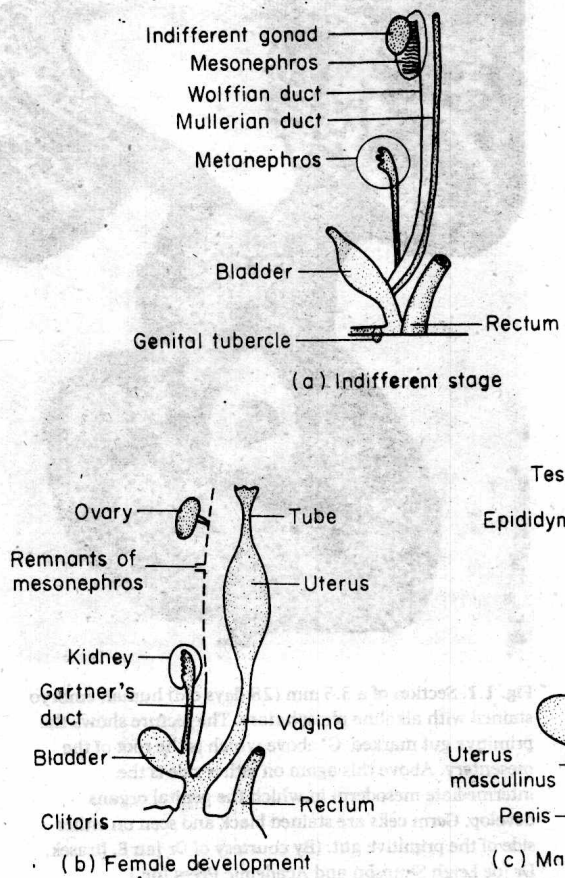

Fig. 1.2. Diagrammatic representation of genital tract development. (a) Indifferent stage. (b) Female development. (c) Male development. (By courtesy of Ballière Tindall.)

and fuse and develop into the uterus and cervix; the cephalic ends of the duct remain separate to form the Fallopian tubes. The thick muscular walls of the uterus and cervix develop from proliferation of mesenchyme around the fused portions of the ducts.

DEVELOPMENT OF THE VAGINA

There is difference of opinion about the precise events in vaginal development. At the point where the paramesonephric ducts protrude their solid tips into the dorsal wall of the urogenital sinus as the Müllerian tubercle (30 mm stage; 9 weeks; Fig. 1.3) there is a marked growth of tissue from which the vagina will ultimately form. Koff (1933) describes the formation of paired sinovaginal bulbs as posterior evaginations of the urogenital sinus; there is also stratification of the cells lining that part of the sinus, and this obliterates the Müllerian tubercle. The sinovaginal bulbs, which become solidified by further epithelial proliferation, fuse with the lower end of the Müllerian ducts to form the vaginal plate (Fig. 1.4[a]). This plate quickly grows in all dimensions, greatly increasing the distance between the cervix and the urogenital sinus. Later, the central cells of this plate break down to form the vaginal lumen (Fig. 1.4[b]).

According to Koff, approximately the upper four-fifths of the vagina is formed by the Müllerian ducts and the lower fifth from the urogenital sinus by the growth of the sinovaginal bulbs. He regards the hymen as being totally derived from the sinus epithelium. Vilas (1932) and Bulmer (1957) and others hold a different view. They believe that the sinus upgrowth extends up to the cervix, displacing the Müllerian component completely, the vagina being thus derived wholly from the endoderm of the urogenital sinus. It seems certain that some of the vagina is formed from the urogenital sinus, but it is not certain whether the Müllerian component is involved or not. See also Chapter 3 page 26.

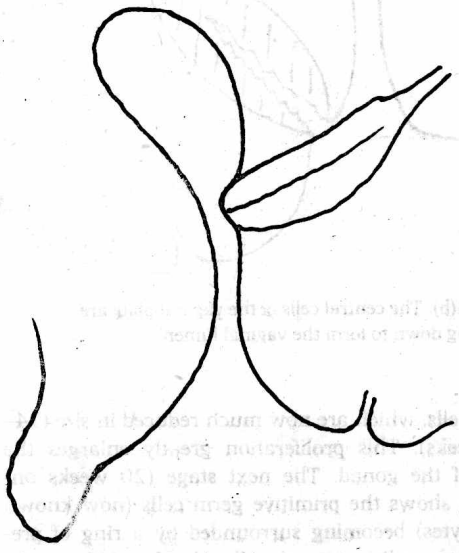

Fig. 1.3. Paired paramesonephric ducts protruding into the urogenital sinus as the Müllerian tubercle at 9 weeks of intrauterine life.

THE DEVELOPMENT OF THE EXTERNAL GENITALIA

The primitive cloaca becomes divided by a transverse septum into an anterior urogenital portion and a posterior rectal portion. The urogenital portion of the cloacal membrane breaks down shortly after division is complete (15 mm C.R. length). The urogenital sinus develops further into three portions (Fig. 1.5). There is an external, expanded, phallic part, a deeper, narrow, pelvic part between it and the region of the Müllerian tubercle, and a vesico-urethral part connected superiorly to the allantois. Externally in this region the genital tubercle forms a conical projection around the anterior part of the cloacal membrane. Two pairs of swellings, a medial pair (the genital folds) and a lateral pair (genital swellings) are then formed by proliferation of mesoderm round the end of the urogenital sinus. Development up to this time (50 mm C.R. length; 10 weeks) is the same in the male and the female. Differentiation then occurs. The bladder and urethra form from the vesico-urethral portion of the urogenital sinus and the vestibule from the pelvic and phallic portions (Fig. 1.5). The genital tubercle enlarges only slightly and becomes the clitoris. The genital folds become the labia minora and the genital swellings enlarge to become the labia majora. In the male greater enlargement of the genital tubercle forms the penis. The genital folds fuse over a deep groove formed between them to become the penile part of the male urethra. The genital swellings enlarge, fuse and form the scrotum.

The final stage of the development of the clitoris or penis and the formation of the anterior surface of the bladder and the anterior abdominal wall up to the umbilicus is the result of growth of mesoderm extending ventrally round the body wall on each side to unite in the mid-line anteriorly.

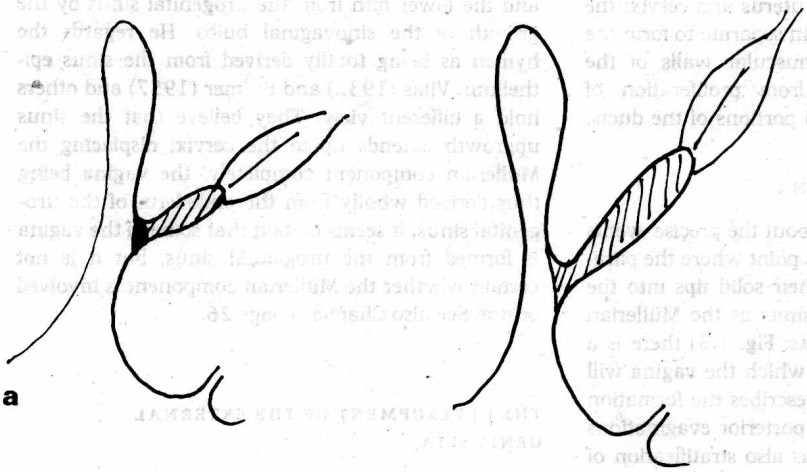

Fig. 1.4(a). On the left the earliest development of the vaginal plate is seen. The sino vaginal bulbs with which the lower portion of the Müllerian ducts fuse are indicated in black and the developing vaginal plate is hatched. On the right further development of the vaginal plate is shown displacing the lower end of the Müllerian ducts cranially.

DEVELOPMENT OF THE GONADS

The primitive gonad is first evident in embryos of 5.5–7.5 mm C.R. length (5 weeks). According to Gillman (1948) the gonad is of triple origin from the coelomic epithelium of the genital ridge, the underlying mesoderm and the primitive germ cells which come from an extragenital source (see below).

The gonad forms as a bulge on the medial aspect of the mesonephric ridge. Its histological appearances are alike in the early stages, whether it is to be testis or ovary. There is a proliferation of cells in and beneath the coelomic epithelium of the genital ridge. By 5 or 6 weeks these cells are seen spreading as ill-defined cords (sex cords) into the ridge, breaking up the mesenchyme into loose strands. Primitive germ cells are distinguishable as much larger structures, lying at first between the cords and then within them.

The differentiation of the testes is evident at about 7 weeks by the disappearance of germ cells from the peripheral zone and gradual differentiation of remaining cells into fibroblasts and later into the tunica albuginea. The deeper parts of the sex cords give rise to the rete testis, the seminiferous and straight tubules. The first indication that the gonad will become an ovary is failure of these testicular changes to appear. The primitive ovary passes first into the stage of differentiation and growth, and later into that of follicle formation. The sex cords below the coelomic epithelium develop extensively, with many primitive germ cells evident in this active cellular zone (Fig. 1.6). The epithelial cells in this area are known as pregranulosa cells. The active growth phase then follows, involving the pregranulosa cells and the

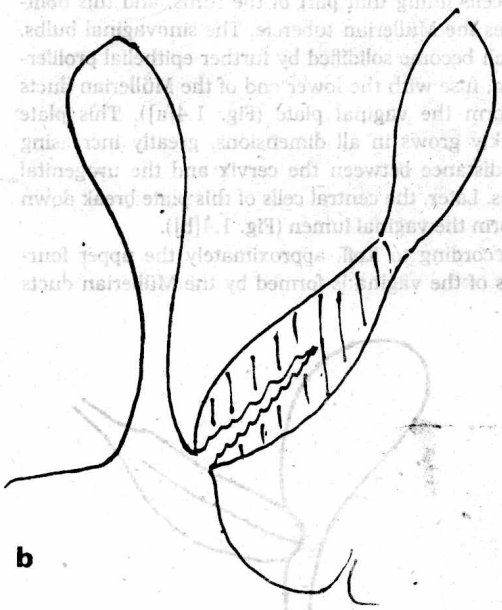

Fig. 1.4(b). The central cells of the vaginal plate are breaking down to form the vaginal lumen.

germ cells, which are now much reduced in size (14–16 weeks). This proliferation greatly enlarges the bulk of the gonad. The next stage (20 weeks onwards) shows the primitive germ cells (now known as oocytes) becoming surrounded by a ring of pregranulosa cells; stromal cells, developed from the ovarian mesenchyme, later surround the pregranulosa cells, now known as granulosa cells, and follicle

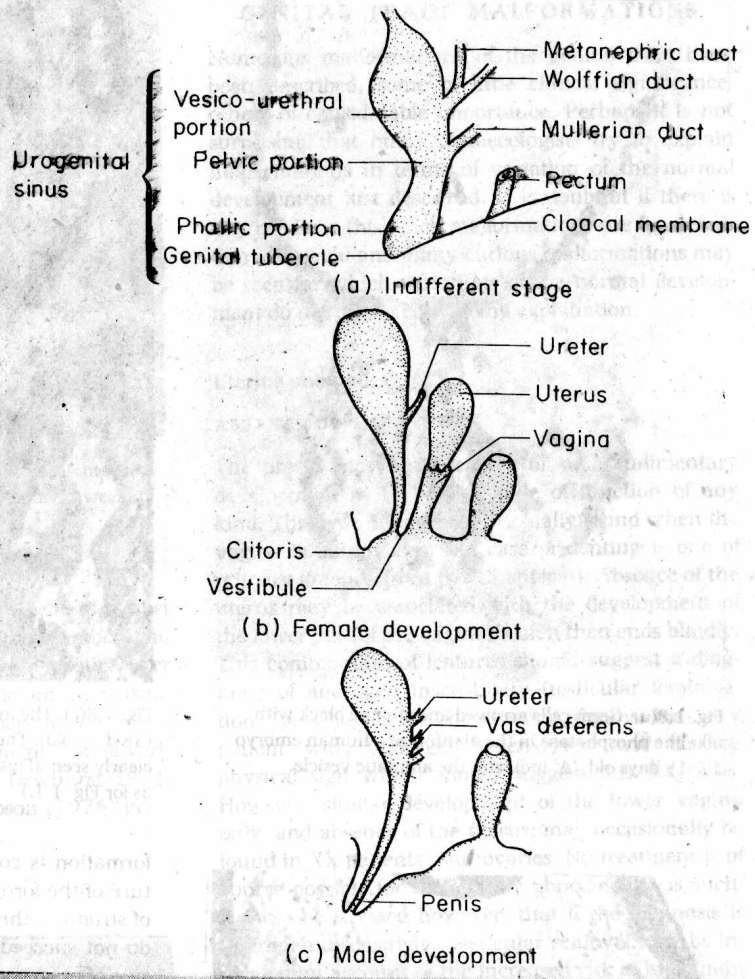

Fig. 1.5. Diagrammatic representation of lower genital tract development.
(a) Indifferent stage.
(b) Female development.
(c) Male development. (By courtesy of Ballière Tindall.)

Fig. 1.6. Detail of immature ovary showing small epithelial cells (pregranulosa cells) and larger germ cells. (By courtesy of Dr J. Pryse-Davies.)

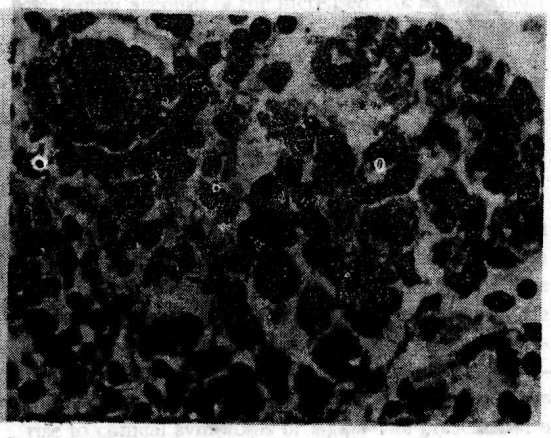

Fig. 1.7. A later ovary (31 weeks) showing a well formed primary follicle (top left) and a germ cell (centre right) which is not yet completely surrounded by granulosa cells.

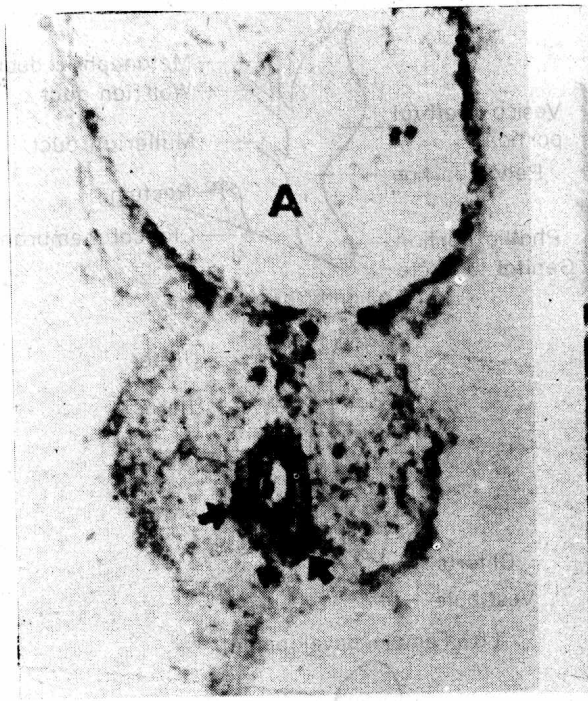

Fig. 1.8(a). Germ cells arrowed and stained black with alkaline phosphatase in the allantois of a human embryo 17–19 days old. 'A' indicates the amniotic vesicle.

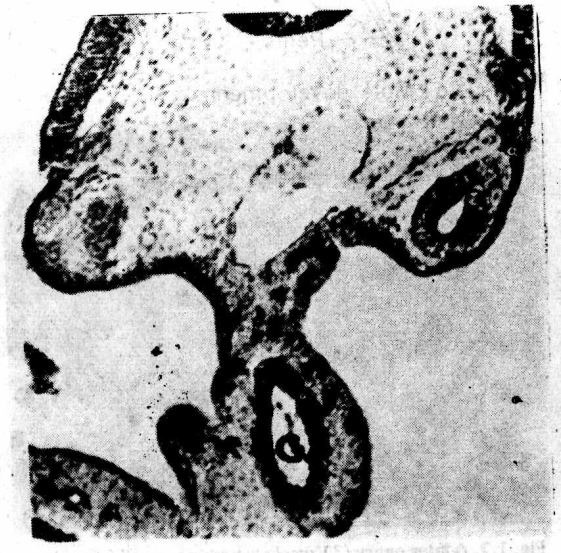

Fig. 1.8(b). Germ cells migrating to the genital ridge area in a 4 mm human embryo (see also Fig. 1.1).

Fig. 1.8(c). The indifferent gonad in a 9 mm human embryo (38 days old). The darkly stained primitive germ cells are clearly seen. (Figs. 1.8(a), (b), and (c) by kind permission as for Fig. 1.1.)

formation is complete (Fig. 1.7). An interesting feature of the formation of follicles and the development of stroma is the disintegration of those oocytes which do not succeed in encircling themselves with a capsule of pregranulosa cells.

It is now generally accepted that the germ cells arise in the endoderm before the formation of the mesoderm of the lateral plate and somite formation (Pinkerton *et al.* 1961). Pinkerton and his colleagues described germ cells as migrating along the endoderm of the yolk sac, into the gut, through the mesenchyme at the root of the mesentery and into the primitive gonad (Fig. 1.8 [a], [b] and [c] and Fig. 1.1). Rapid proliferation of germ cells follows, until they become surrounded by granulosa cells as described above and become oocytes. Mitotic division, by which the germ cells have been increasing in numbers, then ceases and they enter the first stage of meiosis.

The number of oocytes is greatest some time during pregnancy, and thereafter declines. Baker (1963) found that the total population of germ cells rose