

Overview

The genital system consists of: (a) **a pair of gonads (testes or ovaries)**, (b) **duct system of gonads that carries the germ cells**, and (c) **external genital organs**. The genital system develops from the following three sources:

- Intermediate mesoderm
- Part of cloaca
- Celomic epithelium covering the intermediate mesoderm.

Sex differentiation is a complex process that involves many genes, including some that are autosomal. The key to sexual dimorphism is the Y chromosome, which contains the *SRY* (sex-determining region on Y) gene. The *SRY* gene encodes for a protein called testis determining factor (TDF). The presence of TDF leads to development of male genital organs. As the indifferent gonad develops into the testis, the Leydig and Sertoli cells differentiate to produce testosterone and Mullerian inhibiting factor (MIF). This results in phenotypically male embryo. In the absence of the TDF, testosterone, and MIF, the indifferent gonad will develop into ovary and embryo will be phenotypically female (figure 1 flowchart).

Development of Gonads

The gonads develop from following three sources:

1. Intermediate mesoderm
2. Celomic epithelium covering the intermediate mesoderm
3. Primordial germ cells.

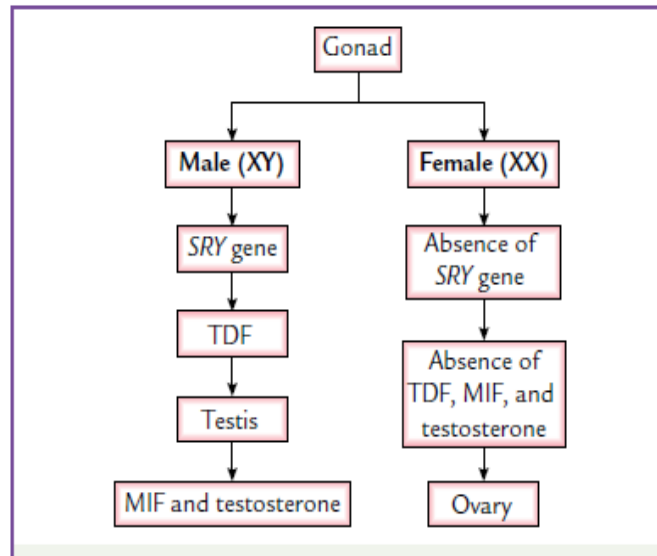


Figure (1) flowchart illustrate genetic basis of phenotypical differentiation of testis and ovary.

Indifferent stage of gonads (in both male and female embryos)

- 1- The dorsal mesodermal epithelium proliferates, thus forming a pair of longitudinal genital (gonadal) ridges medially to the mesonephric ridge; the mesenchyme condenses below these ridges.
- 2- The genital ridges are formed.
- 3- In weeks, primordial germ cells migrate into these genital ridges from the yolk sac via the dorsal mesentery of the hindgut.
- 4- Upon arriving into the gonads, the primordial gonocytes induce further differentiation of the gonads
- 5- The epithelium of genital ridge proliferates and epithelial cells penetrate the underlying mesenchyme, thus forming primitive epithelial sex cords connected to the surface.

Testis

- 1-under the influence of the *SRY* gene coding the testis-determining factor, the testis differentiates from the indifferent gonad.

2- the primitive sex cords continue to proliferate and penetrate deeper into the medulla; in next weeks, the cords separate from the coelom epithelium and become independent as a network of medullary cords.

3- the testis cords develop into supporting (sustentacular) cells of Sertoli, which surround the primordial germ cells and give rise to the seminiferous tubules.

4- interstitial cells of Leydig differentiate from the mesenchyme of the gonadal ridge; these lie between the testis cords; later, the Leydig cells produce androgens (e.g., testosterone)

Ovary

1- the primitive sex cords dissociate into irregular cell clusters; later on, these clusters disappear, being replaced by vascular stroma of the ovarian medulla

2- in the next weeks, the surface epithelium of the ovary proliferates, giving rise to a second generation of cortical cords; the cortical cords penetrate the mesenchyme

3- later, the secondary cords split into isolated clusters, which surround each oogonium with a layer of epithelial follicular cells

4- together, each oogonium surrounded by the follicular cells constitute a primordial follicle the oogonia proliferate by mitotic cell divisions, thus giving rise to approx. 4 million of primordial follicles by prenatal months

5- at any stage, the follicles degenerate by a process named atresia _ at birth, approx. 1- 2 millions of primordial follicles are present; further reduction of numbers of follicles results in approx. 200 000 follicles in puberty.

Male genital ducts

- the mesonephric ducts are stimulated by the testosterone from the Leydig cells cranial and caudal mesonephric tubules regress and disappear; caudal mesonephric ducts differentiate into the efferent ductules of testis.

- the cranial part of the mesonephric duct may persist as the appendix of the epididymites the middle part of the mesonephric duct gives rise to the

epididymic duct; the caudal part of the mesonephric duct obtains three smooth muscle layers, thus differentiating into the ductus deferens.
- seminal vesicles originate as buds from the mesonephric duct.

Development of Genital Ducts in Female

The genital ducts in female develop from **paramesonephric ducts**. The paramesonephric duct develops lateral to mesonephric ducts by a vertical invagination of celomic epithelium (Fig. 21.10).

The paramesonephric duct is divided into three parts:

- (a) cranial vertical part,
 - (b) middle horizontal part
 - (c) caudal vertical part.
- the paramesonephric ducts form:

1. Uterine tubes
2. Uterus
3. Upper part of vagina.

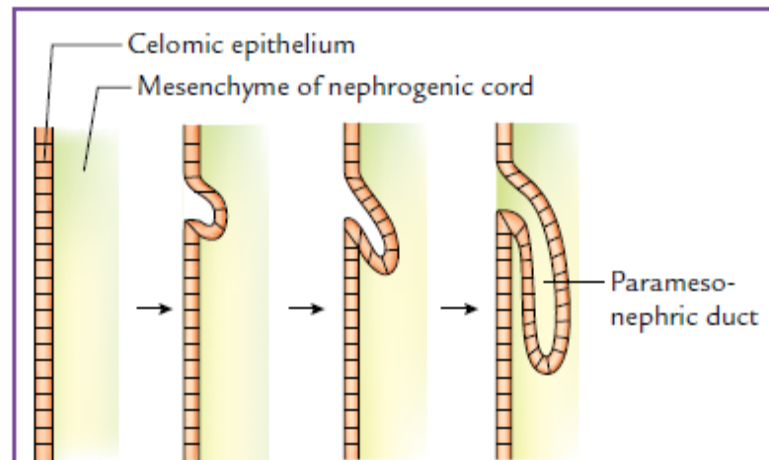


Fig. 21.10 Stages of development of paramesonephric ducts.