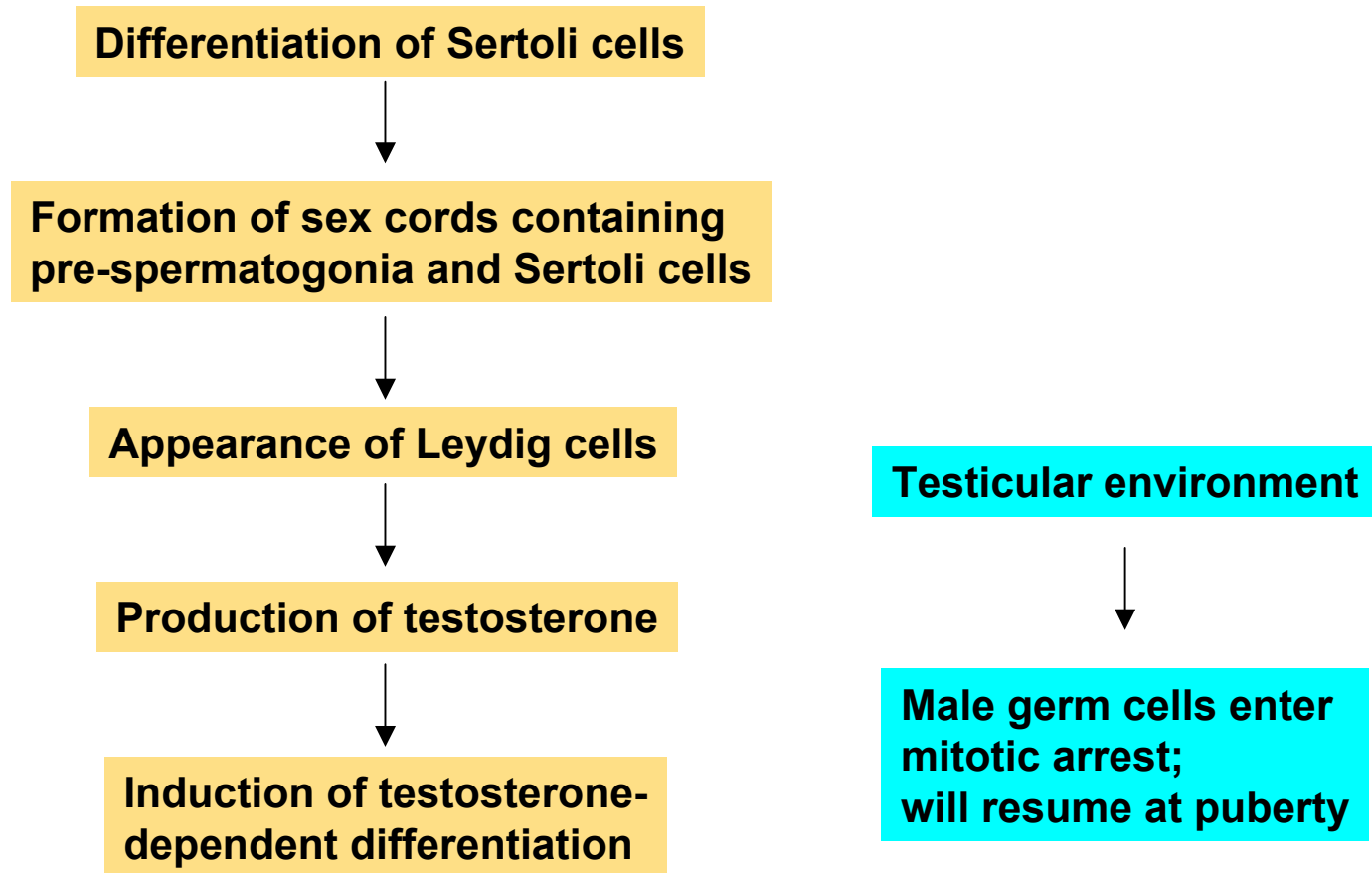
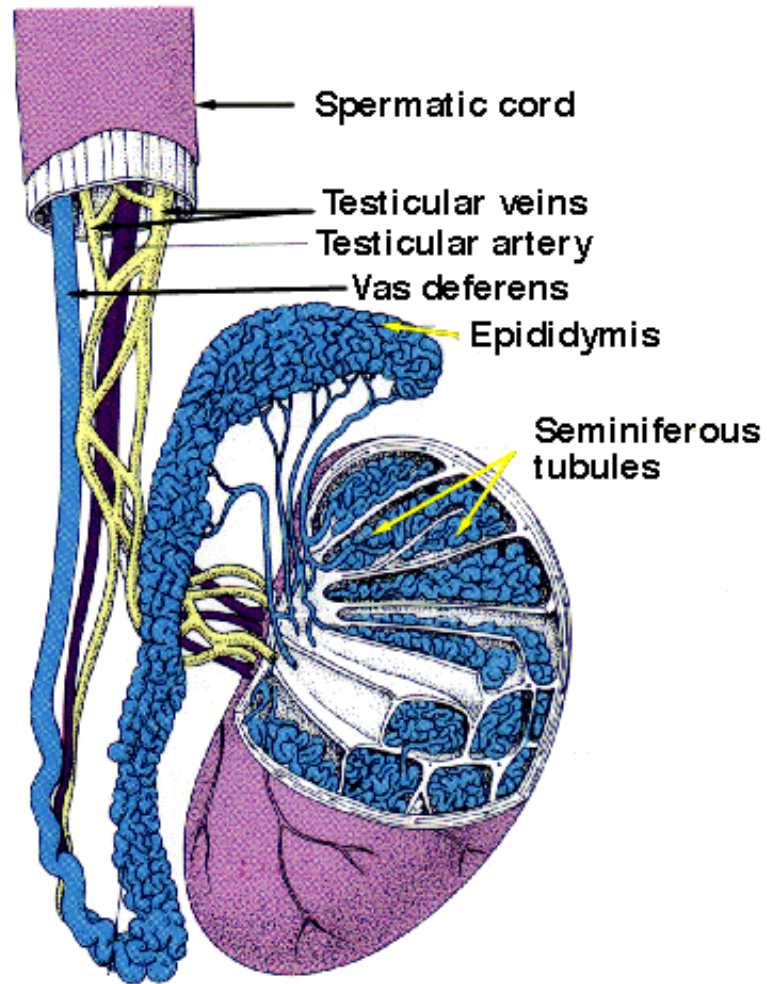


Spermatogenesis

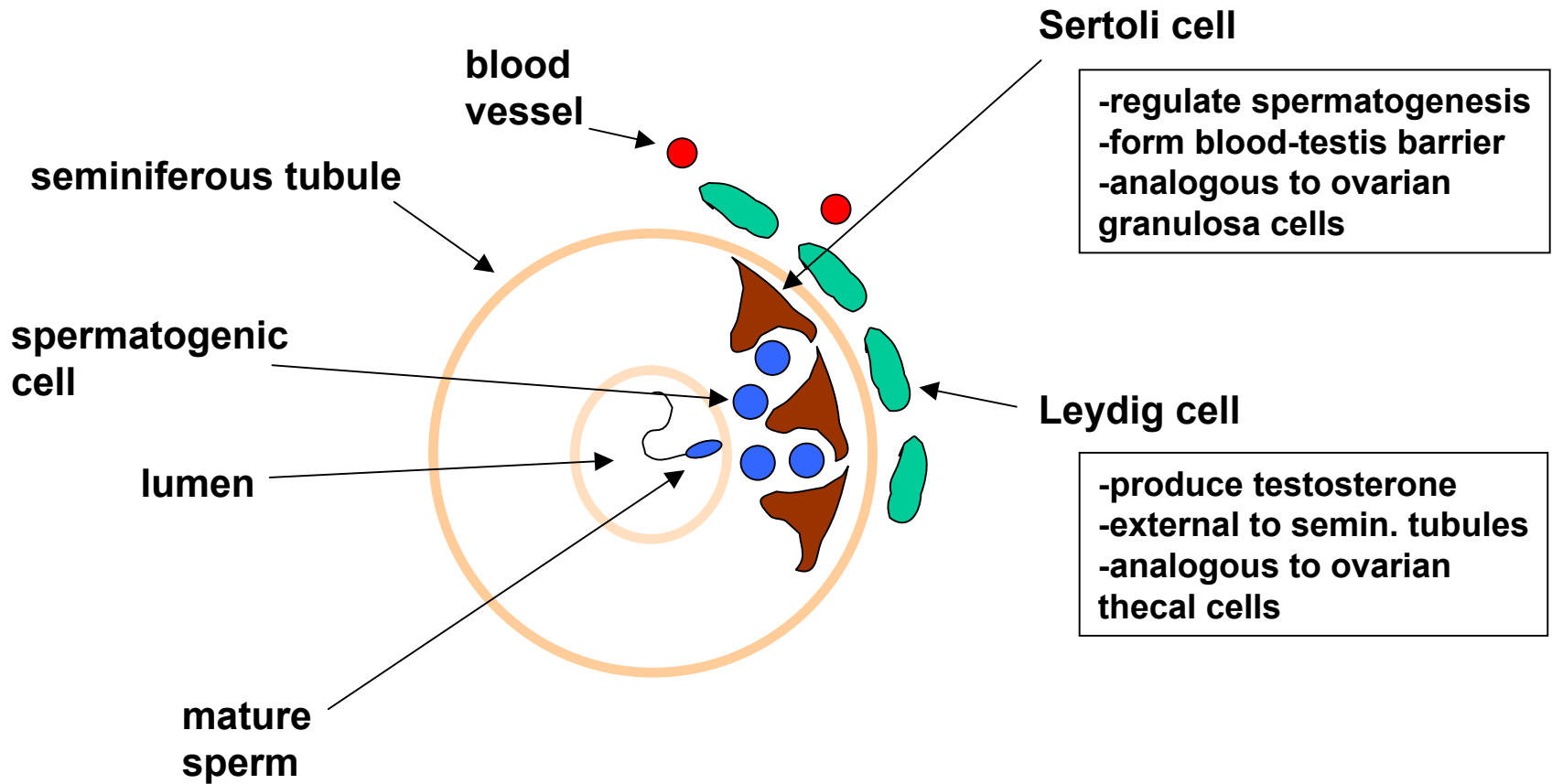
Development of the testis



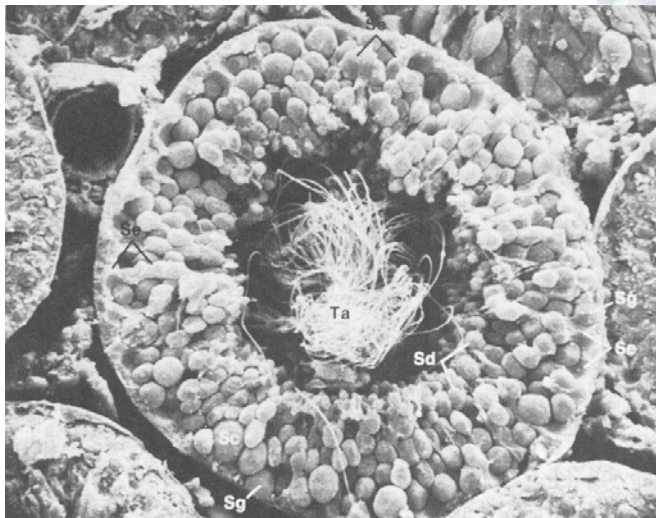
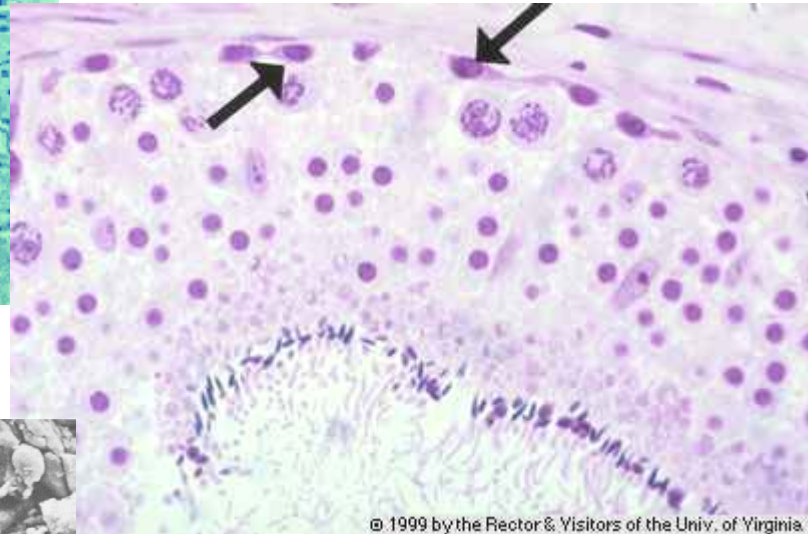
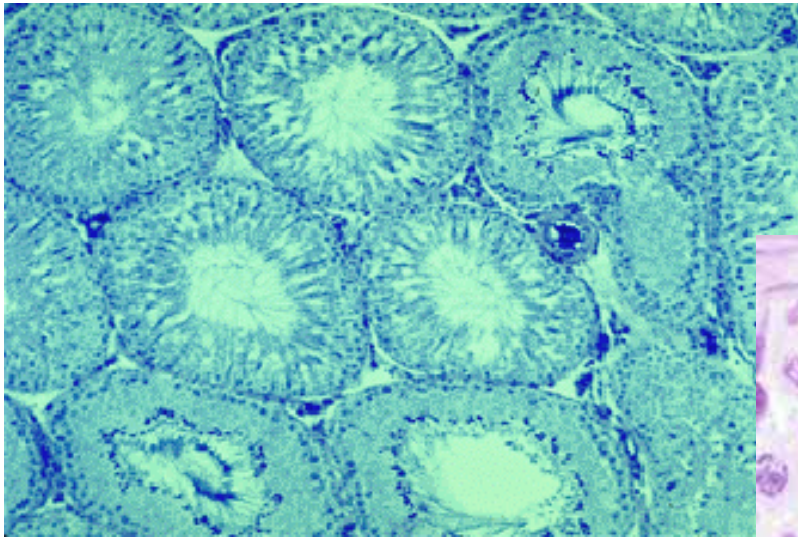
Anatomy of the testis



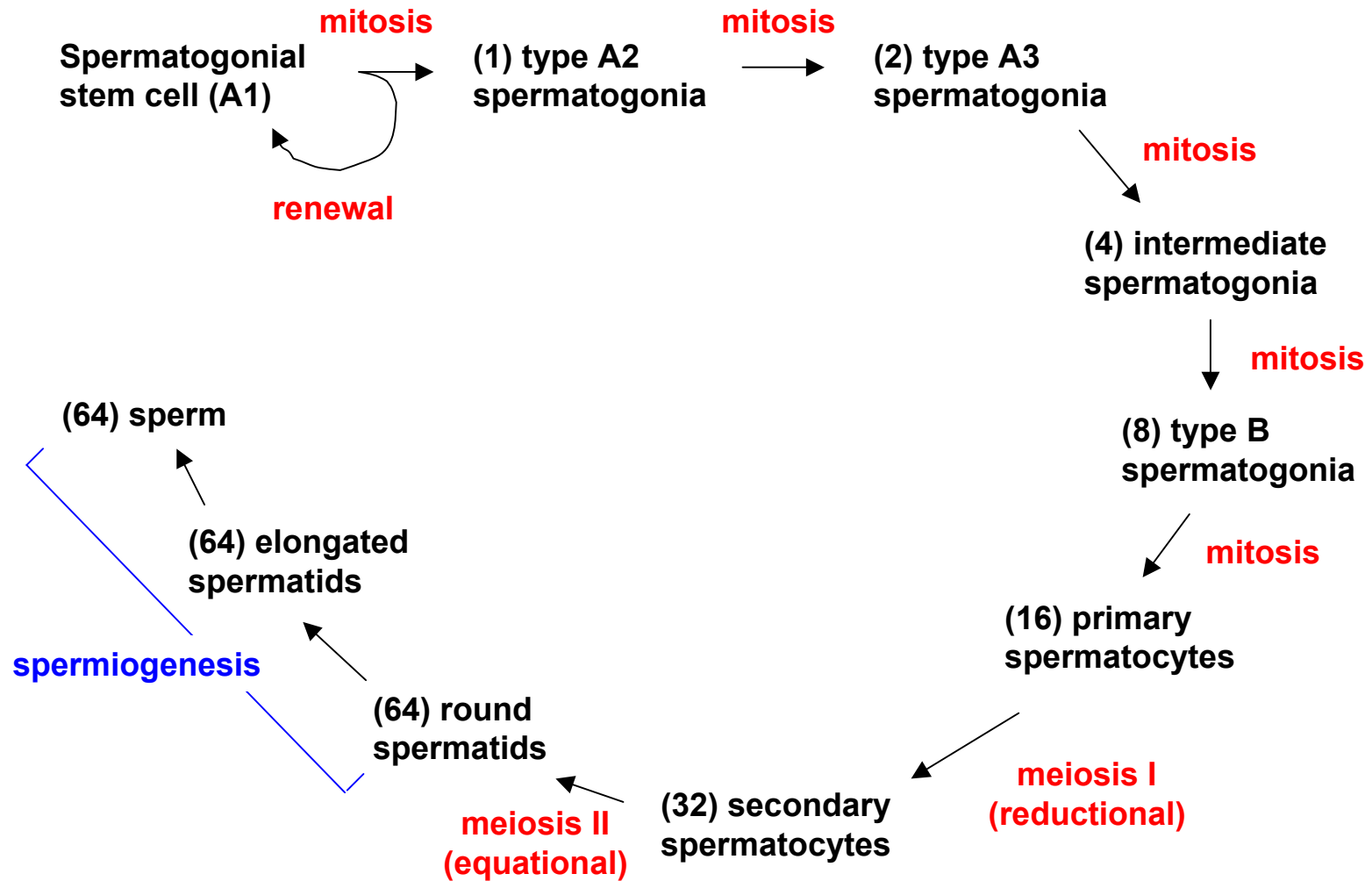
The seminiferous tubule



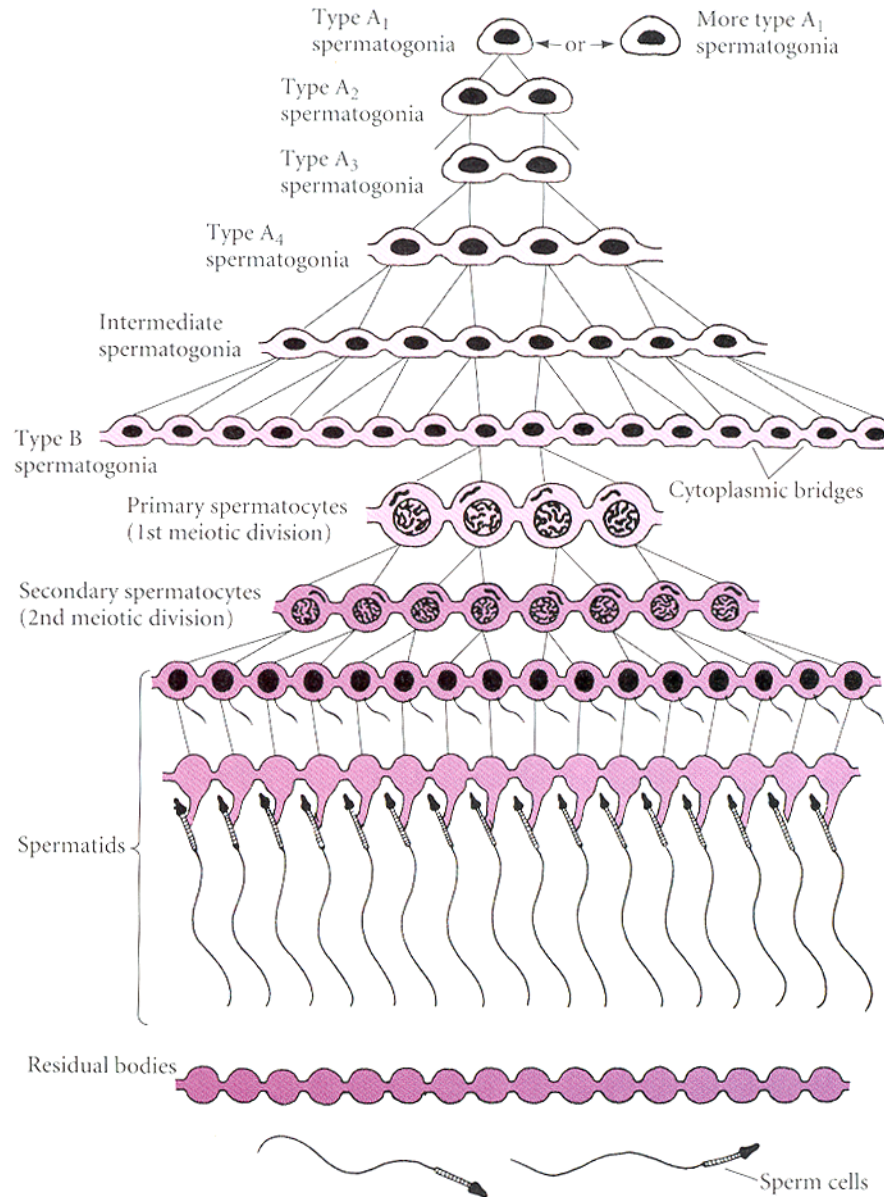
The seminiferous tubule



Spermatogenesis



Spermatogenesis



Spermatogenesis: post-meiotic differentiation

Spermiogenesis

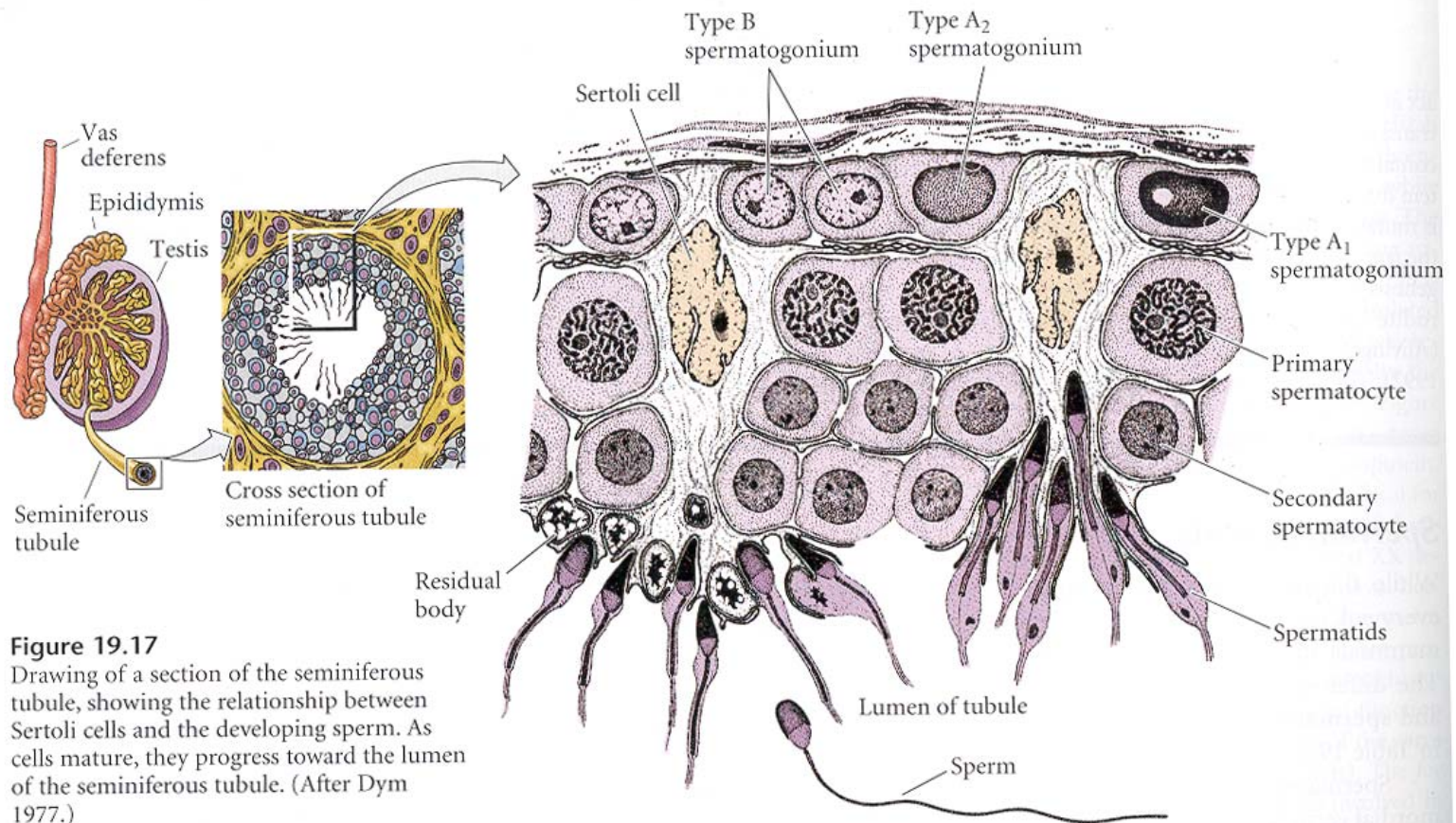
The period of spermatogenesis following the completion of meiosis and during which the sperm acquires its mature shape

Essentially all cytoplasm is discarded

Specialized structures of sperm (eg, acrosome, tail) are elaborated

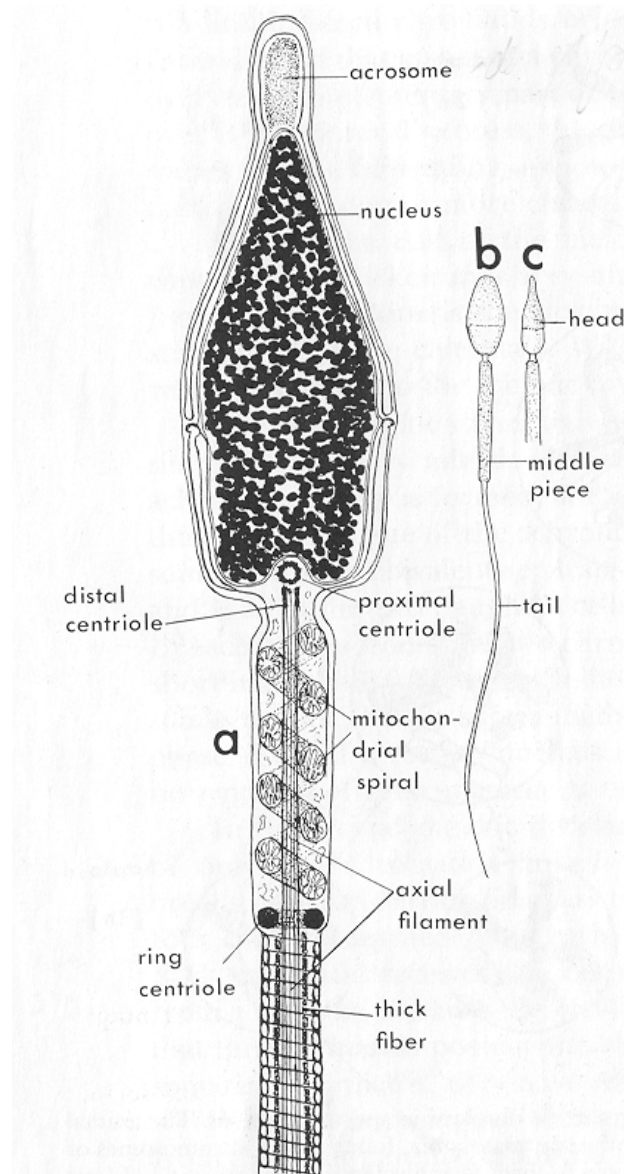
Divided into 'steps' according to sperm morphology

Spermatogenesis: luminal progression during differentiation



N.B. Blood-testis barrier

Anatomy of the sperm



Major elements of the sperm

Acrosome

- Covers anterior half of nucleus**
- Derived from Golgi**
- During fertilization, outer membrane fuses
with plasma membrane releasing acrosomal contents**
- Contains numerous enzymes typical of lysosomes**
 - acrosin - inactive proacrosin converted to
active form by acrosome reaction**
 - hyaluronidase - breaks down matrix surrounding egg**

Major elements of the sperm

Nucleus

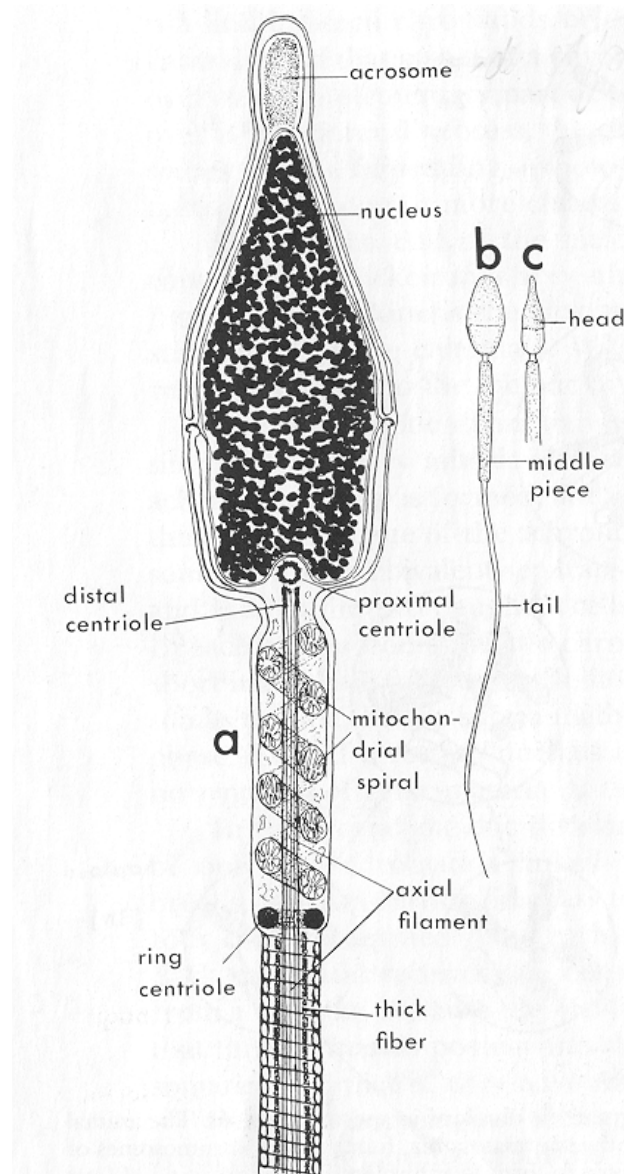
- Extremely condensed DNA
 - <5% of somatic volume, non-nucleosomal
- Transcriptionally inactive
- Histones mainly replaced by protamines
 - sperm-specific basic proteins
 - rich in arginine and cysteine
- Surrounded by perinuclear theca
 - resembles nuclear lamina
 - function unknown

Major elements of the sperm

Tail

- 55 um long in humans (sperm is 60 um)**
- microtubules arranged in 9 + 2 structure typical of axonemes**
- contains α - and β -tubulin, kinesin, dynein**

Anatomy of the sperm



Chromatin remodelling during spermatogenesis

Histones



Occurs in early spermatids (post-meiotically)

TP knockouts

- sire small litters**
- show abnormalities in chromatin and motility**
- produce sperm containing protamines**

Transition proteins



Occurs in late spermatids

Protamine knockouts (heterozygotes) are infertile

Why should this be as the gene is transcribed post-meiotically?

Protamines

Control of gene expression during spermatogenesis

**Numerous genes are transcribed at one stage of spermatogenesis;
mRNAs are translated at a subsequent stage**

Control mediated by sequences in 5'- and 3'-untranslated regions

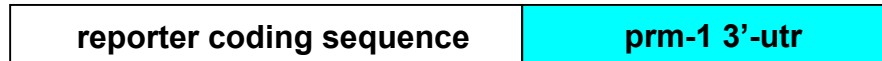


Protamine-1 gene studied as model of translational control

**Transcribed in step-7 spermatids, translated in step-13 spermatids
Therefore, mRNA is translationally repressed between steps 7 and 13**

Control of gene expression during spermatogenesis

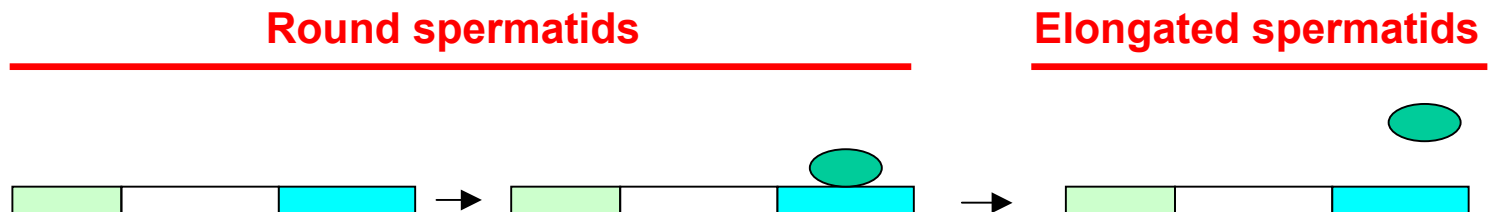
Reporter construct fused to 3'-utr of protamine-1 gene



**Translation of reporter is repressed in round (early) spermatids;
activated in elongated (late) spermatids**

Specific mutations in 3'-utr sequences cause premature translation

MODEL



Spermatogenesis: summary

Early testis development - Sertoli and Leydig cells

Anatomy of the testis

Stages of spermatogenesis

**Arrangement of cells in the seminiferous tubules
and luminal progression during spermatogenesis**

Parts of the sperm - acrosome, nucleus, tail

Chromatin remodelling - histones, transition proteins, protamines

Post-transcriptional control of gene expression