

Animal Science 434

Spermatogenesis

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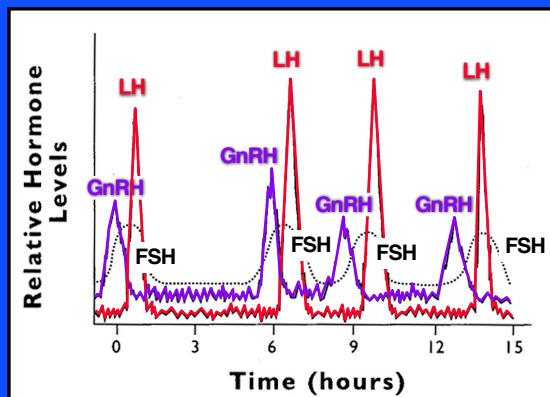
Production of Fertile Sperm

- hormonal regulation of the testis
- mitotic division of spermatogonia
- meiotic divisions of spermatocytes
- morphologic transformation of spermatids into spermatozoa

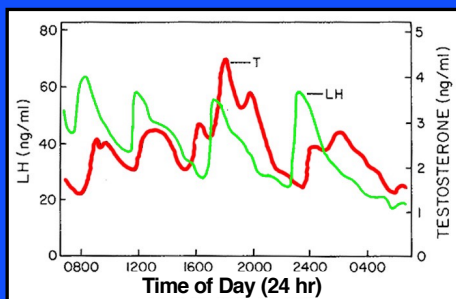
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Hormonal Regulation of the Testis

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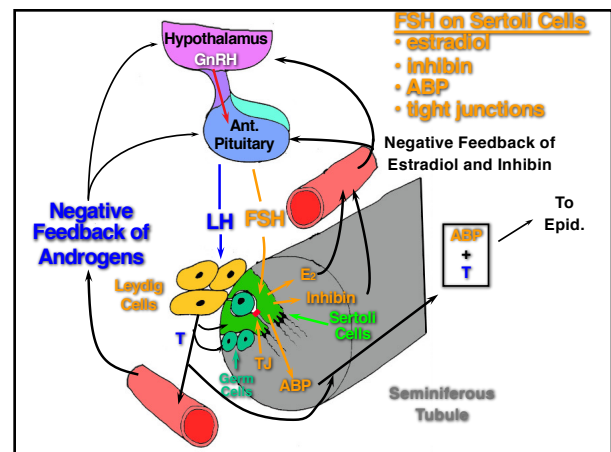


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Pulses are important !

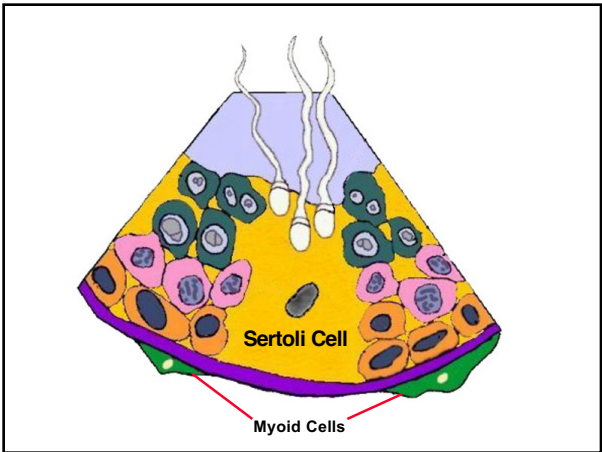
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Spermatogenesis

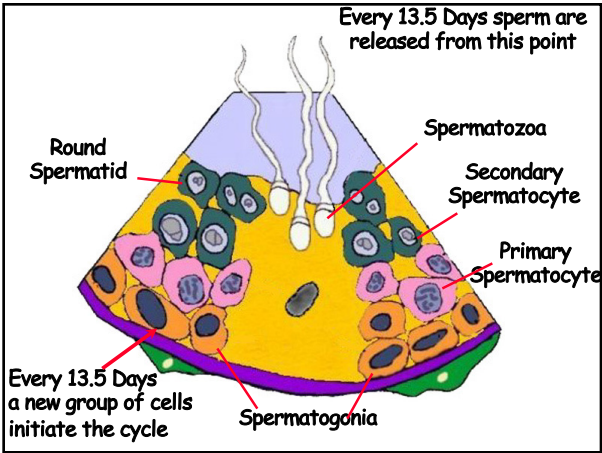
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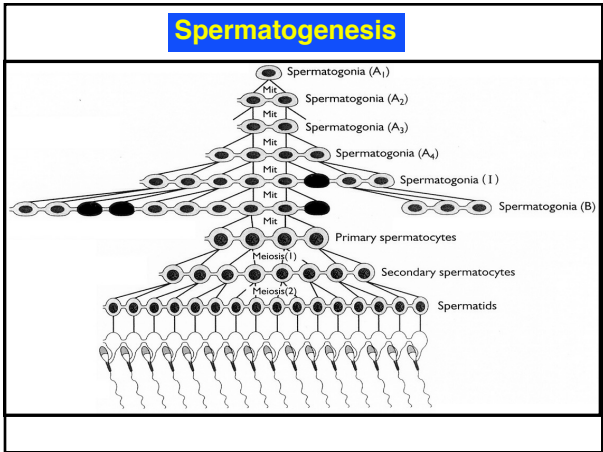
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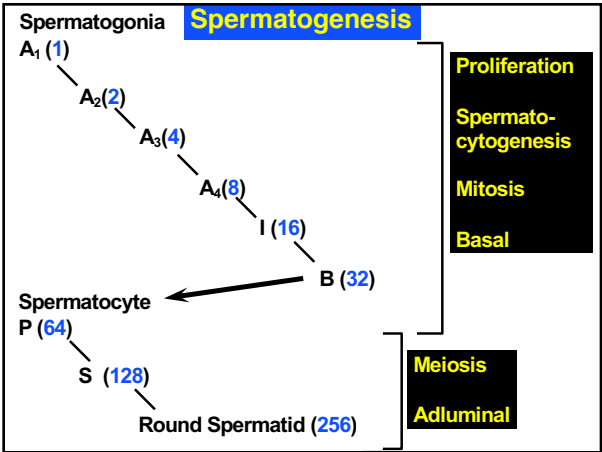
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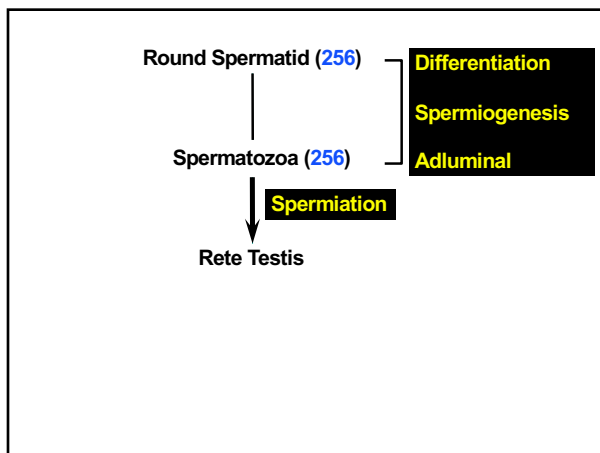
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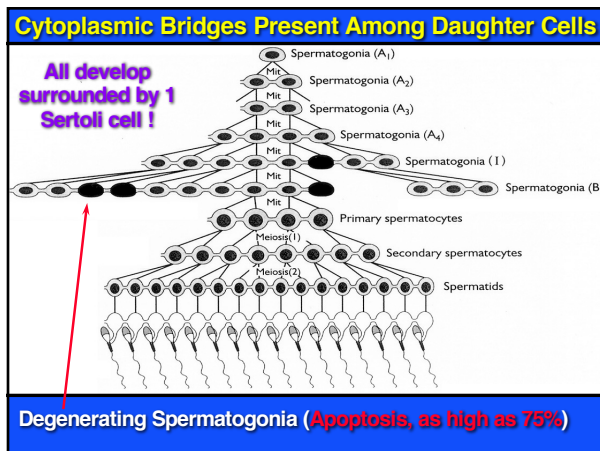


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Mitotic Divisions

- species dependent
 - between 2 and 6 divisions (4 to 64 potential daughter cells produced)
- classifications vary among species and investigators
 - A₁, A₂, A₃, A₄, B₁, B₂, P
 - A_d, A_p, B, P
 - A_s, A₀, A₁, A₂, I, B, P
- cytoplasmic bridges form between daughter cells

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Losses During Spermatogenesis (Boar)

Citation	Round Spermatids/ Sertoli Cell	% Loss
Theoretical	256	0
Franca et al., 2005	68	73.4%
Costa et al., 2013	21.5	91.6%
Parrish unpublished	30.4	88.1%

Most losses (approx. 90%) occur during Mitotic processes

- A, I, B Spermatogonia or Primary Spermatocyte

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Apoptosis/loss of Germ Cells

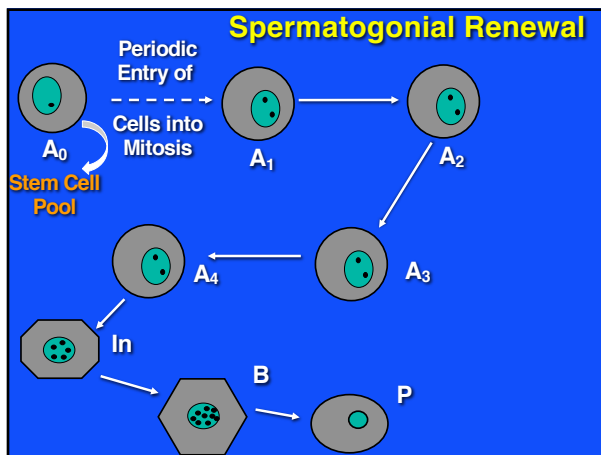
- Season
- Disease
- Trauma or heat
- Hormone levels
- Normal part of spermatogenesis

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Stem Cell Renewal

- To keep spermatogenesis going indefinitely
- Replenish testis incase of injury, trauma, or high heat

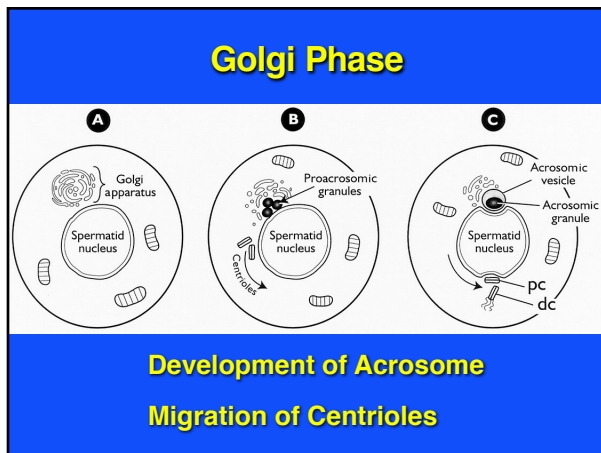
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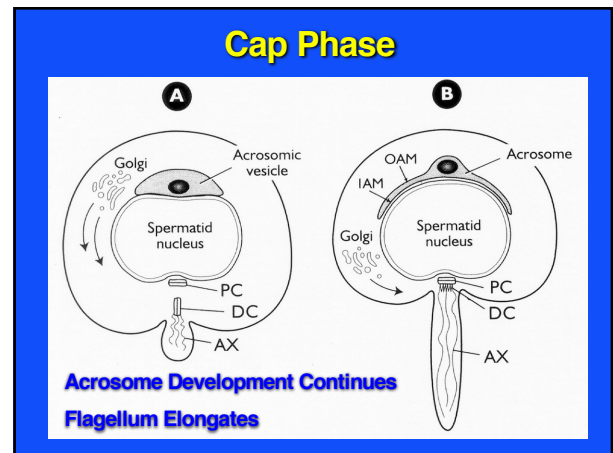
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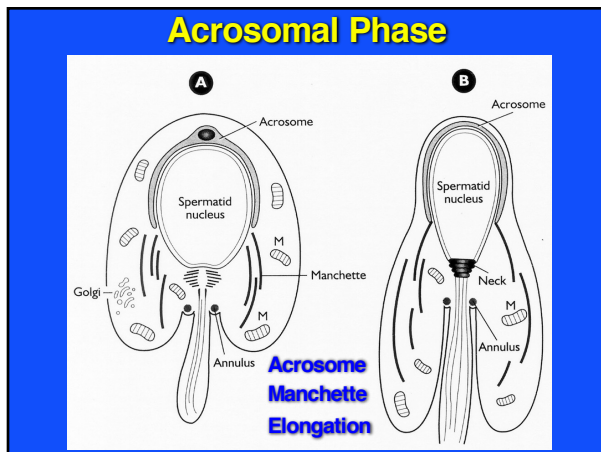
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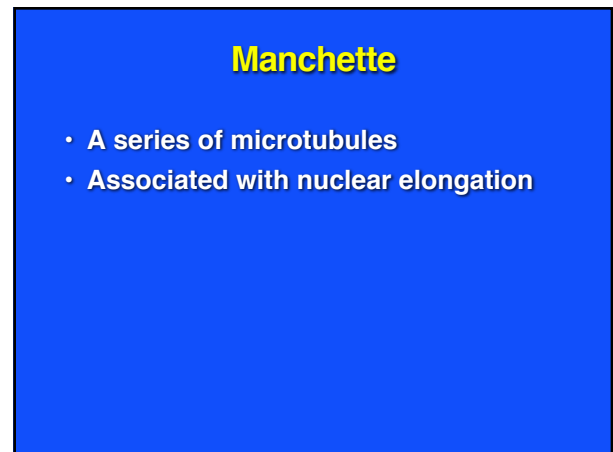
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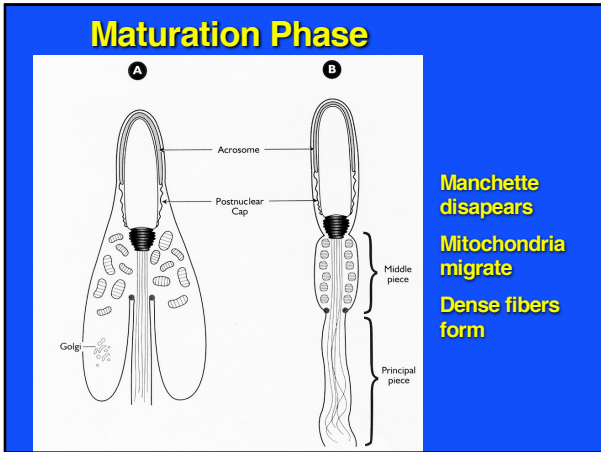
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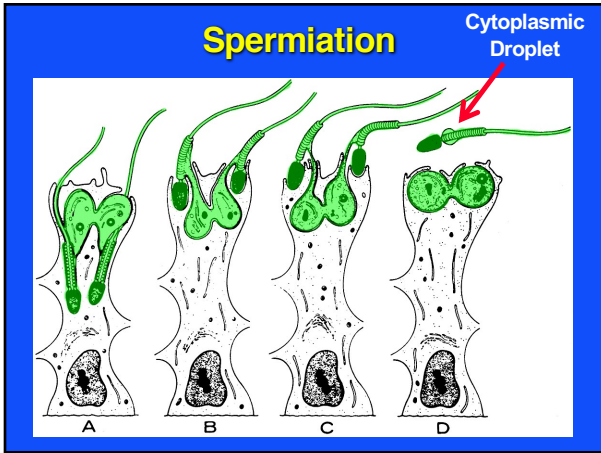
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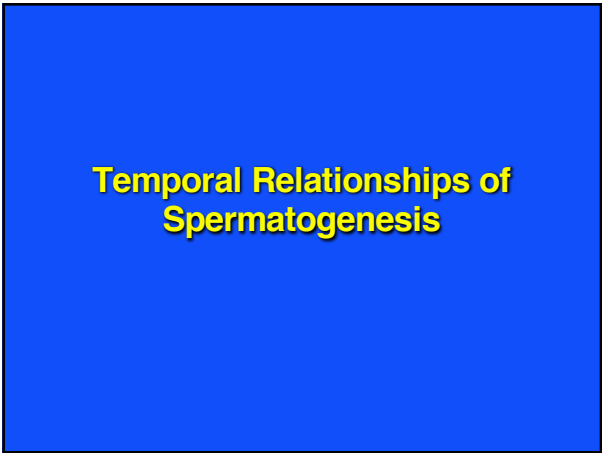
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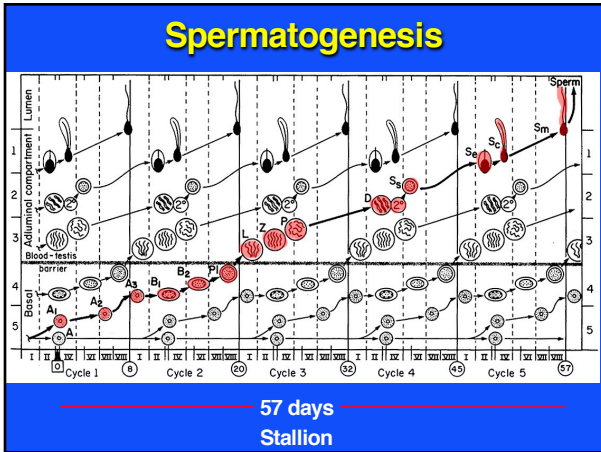
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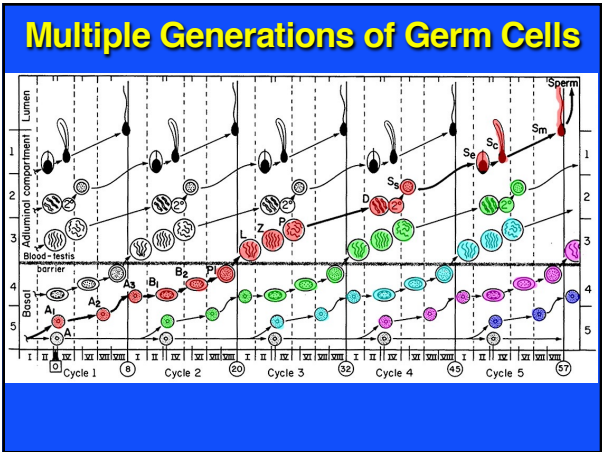
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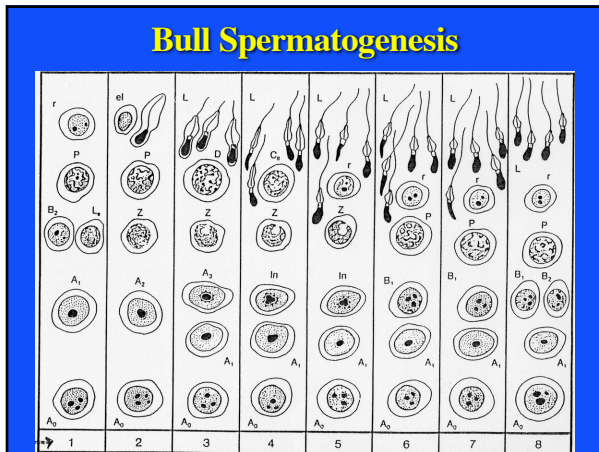
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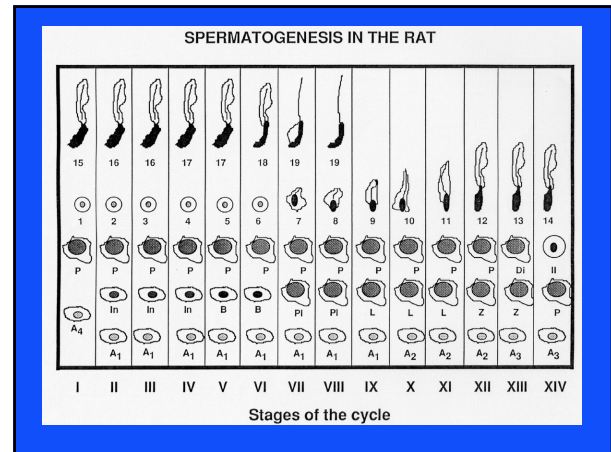
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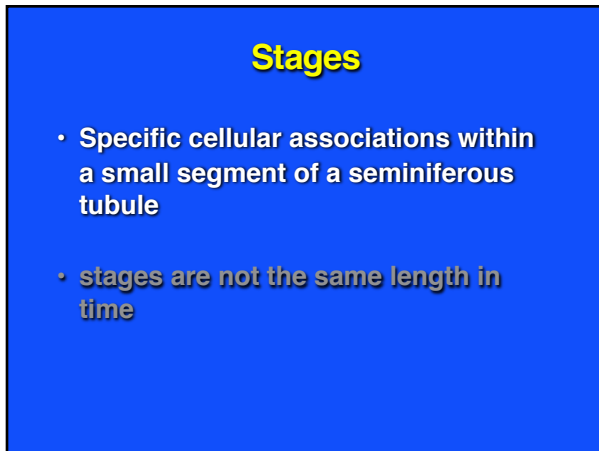
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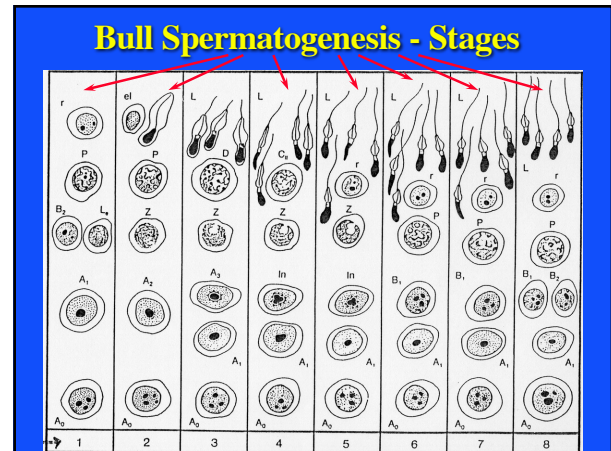
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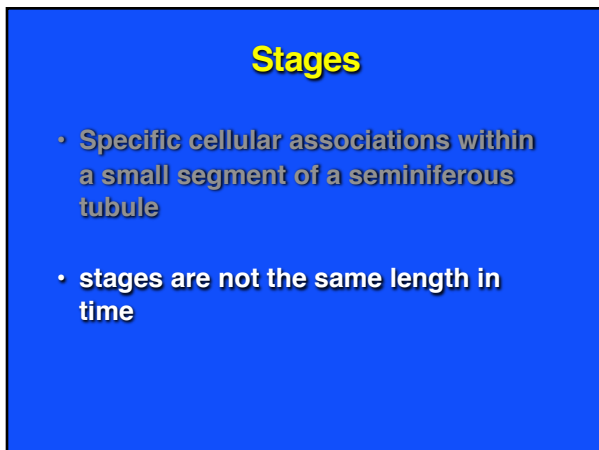
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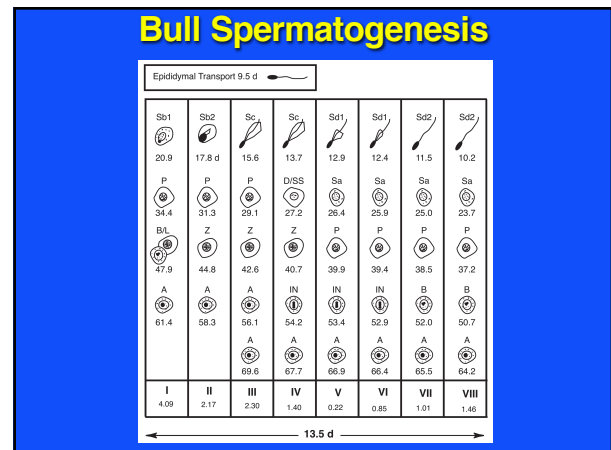
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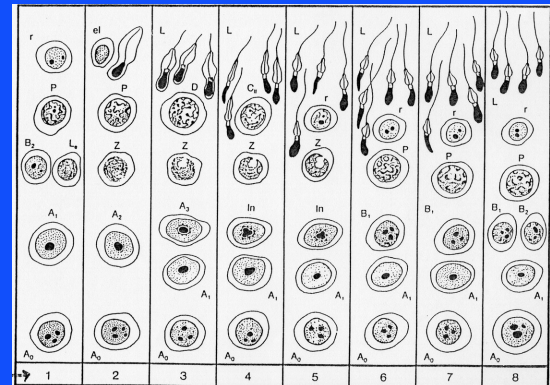
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Cycle

- progression through sequence of all stages

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Bull Spermatogenesis - Cycles



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Cycle

- progression through sequence of all stages
- 4.5 cycles to form spermatozoa
 - some species variation

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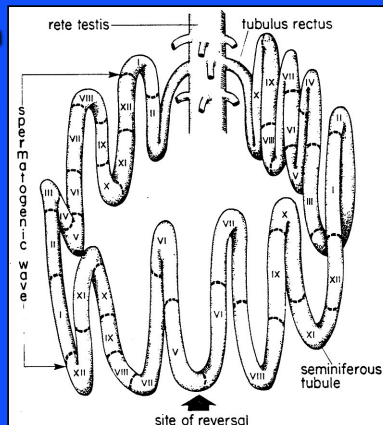
Duration of Spermatogenesis

	Bull	Ram	Boar	Stallion	Man
cycle (days)	13.5	10.4	8.3	12.2	16
Spermatogenesis	61	47	39	57	75

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Coordination of Stages Form Waves

- some portion of seminiferous tubule is always releasing sperm

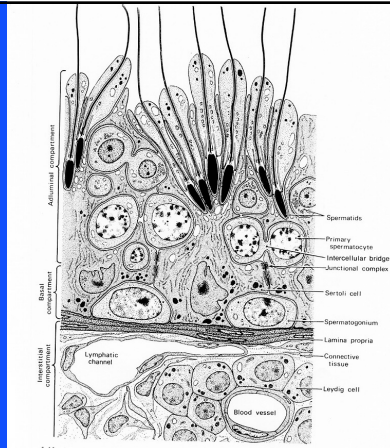


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Compartmentalization of Spermatogenesis and the Blood Testis Barrier

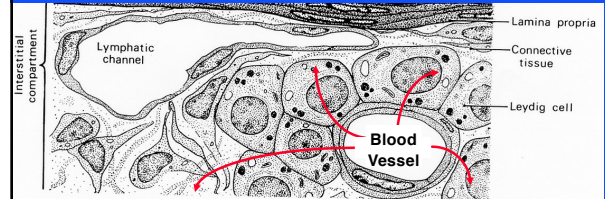
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Seminiferous Tubule and Interstitial Tissue



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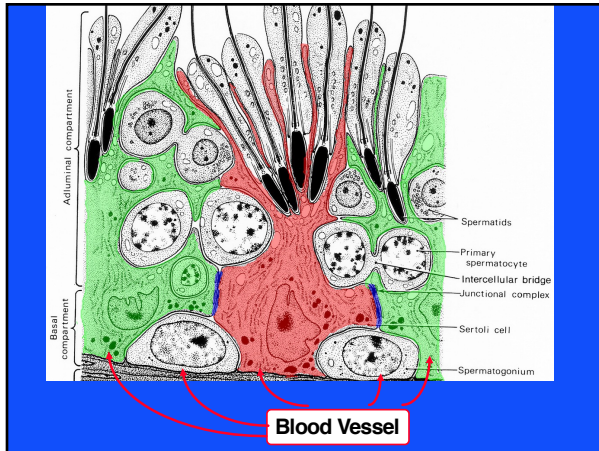
Interstitial Tissue



Vascular System Provides

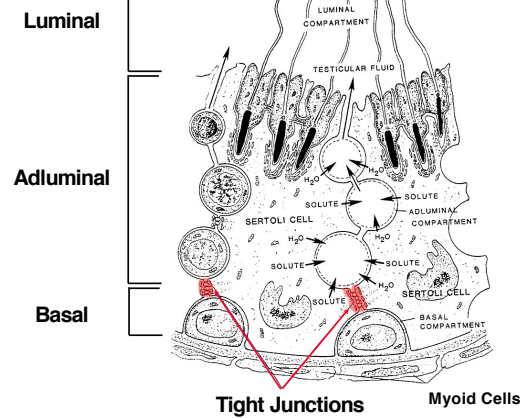
- Nutrients
- Oxygen
- Growth Factors
- Hormones

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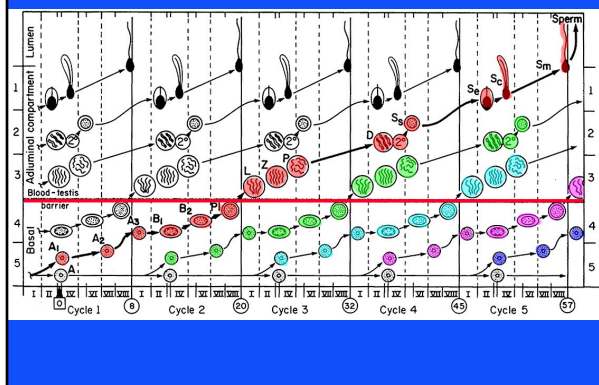
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Compartments



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Cycles and Stages



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Compartmentalization

- Basal
 - mitosis
 - spermatogonia (A, I, B)
 - primary spermatocytes
- Adluminal
 - meiosis
 - primary spermatocytes
 - secondary spermatocytes
 - spermatids
 - spermiogenesis
- Lumen
 - spermiation

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Quiz 13 a

- In what compartment of the seminiferous tubule do the following occur in:

Mitosis -

Meiosis -



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Quiz 13 a

- In what compartment of the seminiferous tubule do the following occur in:

Mitosis - **Basal**

Meiosis - **Adluminal**



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Blood Testis Barrier

- Sertoli cells and associated tight junctions
- first appears at puberty
- induced by FSH
- after puberty can be maintained by FSH and/or testosterone
- essential for meiosis !!!!!

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Tight Junction Role in Meiosis

- Sertoli cells can manipulate environment around 1° spermatocyte
 - Enters meiosis
 - Completes meiosis
- Destruction of TJ causes impairment of meiosis
 - Heat, heavy metals, endocrine disruptors, pesticides, lack of FSH or Testosterone

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Capacity for Sperm Production

Species	Testis Weight (gm)	Sperm/gm (X 10 ⁶)	DSP (X 10 ⁹)
Dairy Bull	650	18	10
Beef Bull	500	18	8
Ram	550	26	14
Boar	750	30	25
Stallion	165	18	3
Man	40	4	.045 - .2

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Variation in Sperm Production

- Testis Size
- Length of spermatogenesis
- Efficiency of spermatogenesis
 - mitotic division
 - degeneration of germ cells

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Apoptosis of Germ Cells

- Season
- Disease
- Trauma or heat
- Hormone levels
- Normal part of spermatogenesis

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Quiz 13 b

- What accounts for variation in sperm between males of different species?



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Quiz 13 b

- What accounts for variation in sperm between males of different species?

Testis size

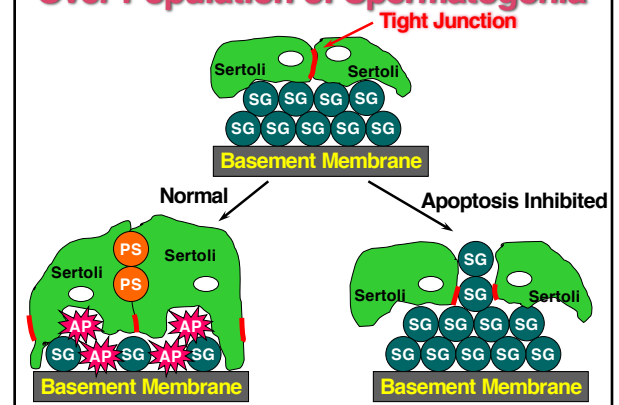
Length of spermatogenesis

Efficiency of spermatogenesis



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Over Population of Spermatogonia



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