

Growth, Puberty, Sexual Maturity and Sexual Behavior

Puberty and Sexual Maturity

- **Male role in sexual reproduction**
 - ┌ Produce male gamete - Spermatogenesis
 - └ Transfer male gamete to female reproductive tract – male sexual behavior; drive (libido) and mating (erection, mounting, copulation)
- Complete sexual differentiation and Functional Gonads – at Birth
- Nature delayed ability to reproduce until animals have reached a certain level of development (**efficiency !!**)

- **Puberty** denotes the process of acquiring ability to reproduce
 - **Sexual maturity** refers to the stage wherein ability to reproduce has reached maximum capacity (**Breeding age**)
 - **Reproductive Senescence** (**menopause females; male climacteric**)
- Reproductive capacity changes throughout the life of an animal**

	Fetus	Newborn	Pubertal period	Adult life	Aging
Hypothalamus	↑ GnRH	↓ GnRH	↑ GnRH	↑ GnRH	↓ GnRH
A. Pituitary	↑ LH and FSH	↓ LH and FSH	↑ LH and FSH	↑ LH and FSH	↓ LH and FSH
Testes	↑ Androgens	↓ Androgens	↑ Androgens Spermatogenesis (low quality but	↑ Sperm Quality	↓ Androgens ↓ Sperm Quality

Cont ...

- Onset of puberty - onset of ability to reproduce
- **Many technical definitions**
 - Age at which male behavioral traits (sexual drive, erection and mounting) begin to express
 - Age at first ejaculation
 - Age when spermatozoa first appear in ejaculate ?
 - Age when ejaculate for first time holds fertile threshold number spermatozoa
 - Practically which do you think provides the most valid criteria for defining puberty?**

Cont ...

- **Age at onset of puberty**

- Varies between and within species (Male < Female ?)

- **Practical implication**

Early puberty – early sexual maturity - increased lifetime reproductive rate
Early semen collection from superior sires used in genetic improvement by AI

- **Breeding age** – subjective management

Table 6-1. Average Ages (Range) of Puberty in the Male and Female of Various Species

<u>Species</u>	<u>Male</u>	<u>Female</u>
Alpaca ²	2-3 yrs	1 yr
Bovine	11 mo (7-18)	11 mo (9-24)
Camel ²	3-5 yrs	3 yrs
Canine ¹	9 mo (5-12)	12 mo (6-24)
Equine	14 mo (10-24)	18 mo (12-19)
Feline	9 mo (8-10)	8 mo (4-12)
Llama ²	2-3 yrs	6-12 mo
Ovine	7 mo (6-9)	7 mo (4-14)
Porcine	7 mo (5-8)	6 mo (5-7)

Cont ...

- **Factors which determine onset of puberty (most studies focused on females) -**
 - Age is not a critical determinant
 - Threshold body size (more important than age)
 - Adequate energy availability is crucial (metabolic signals; glucose, leptin, etc)
 - Season of birth– **photoperiod** (in seasonal breeders), temperature and **feed availability** in non seasonal breeders

Sheep – short day breeders – lambs born in short day months have earlier puberty (5-6 months) in contrast to those born in long day months (10-12)
 - Management & Social cues** – presence of male hastens puberty in females (pheromones)
 - animals in large social groups reach puberty earlier than those in small groups

Cont ...

- Reproduction - non vital physiological activity - remains quiescent
- **In pre-pubertal neonates** - metabolic activity gives energy priority to maintenance of vital **physiologic functions and growth (uniform)** -
- **Pre -pubertal period**
 - } Energy consumption increases
 - } Body size increases
 - } Surface area relative to body size decreases
 - } Basic metabolic rate decreases
 - } Excess energy stored as fat and glycogen
- Hypothalamus is highly sensitive to negative feedback inhibition by steroids --- so it secretes low frequency and low amplitude GnRH pulses (**tonic !**)
 - low tonic gonadotropin (FSH/LH) secretion - no

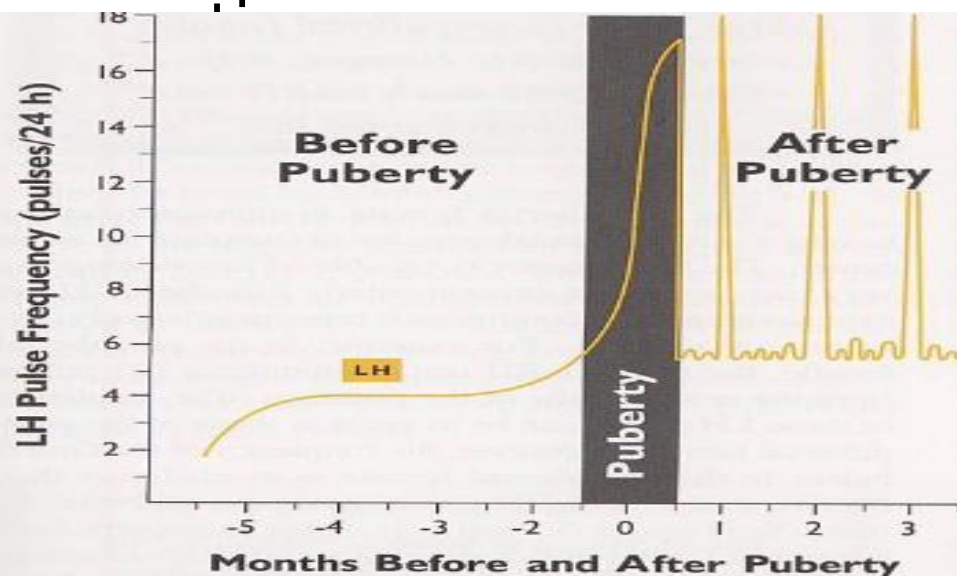
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- **Initiation of puberty**

- Trigger:** Hypothalamic sensitivity to NFB inhibition by testosterone decreases - **Why ? Previously discussed determinants**

- Gradual increased tonic GnRH secretion frequency and levels**

- Increased A. pituitary Gonadotropin (FSH and LH)**



Frequency of LH pulses (as a reflection of GnRH pulses) in heifers prior to the onset of puberty. Note the substantial time required (approximately 2 months-shaded area) for the pulse frequency to become high enough for puberty to be achieved. The variation in LH pulse frequency after puberty reflects the changes occurring during the estrous cycle. (Modified from Kinder *et al.* 1994)

Cont ...

- Improving Testosterone Secretion stimulates **accelerated** growth of the testes, ducts, accessory sex glands and the penis
 - └ The number and quality of spermatozoa gradually improves
 - └ The quality of accessory secretions gradually improves
- Testosterones action on the brain stimulates expression of male sexual behaviors
 - └ Drive and ability to mate (*Erection, Mounting, Intromission, Ejaculation*) gradually grow
- The testis does not reach its full size and sperm producing capacity until 1-2 years after puberty
- So sexual maturity expected at such interval from

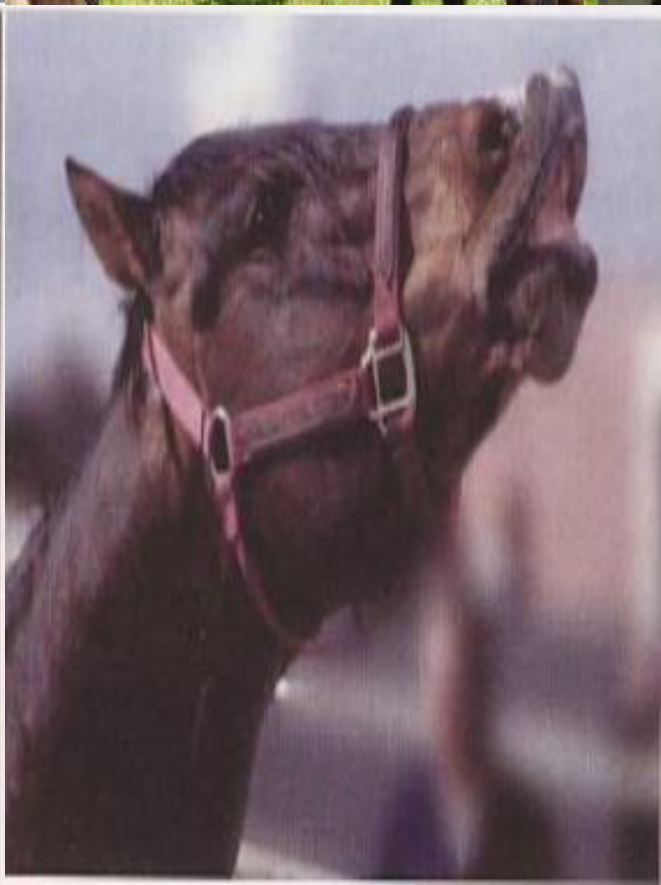
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- Testosterone being an anabolic hormone also affects other body parts - **Male secondary sexual characteristics** (distinguish the sexes and attract mate)
 - Accelerated skeletal and muscular development – development of male body form
 - Different fur and hair types start growing
 - Distinct coloration of hair, fur or plumage (*Puberee – to be covered with air*)
 - Hair growth and voice changes in man

Male Reproductive Behavior

- Highly evolved-increasing opportunity for copulation and pregnancy
- **Male reproductive behavior** - 3 phases
 1. **Precopulatory** : search for receptive female - courtship-sexual arousal-erection-penile protrusion, dribbling of accessory secretions
 2. **Copulatory** : Mounting – Intromission – Ejaculation
 3. **Postcopulatory** : Dismount – Refractory period – memory
- **Female reproductive behavior**: attractively- pre-receptivity-receptivity
- Controlled by **hypothalamus** in response to sensory inputs (**smell, vision, sound and touch**)
- Sexual behavior is programmed during embryonic sexual differentiation exposure to estradiol pro

Species	Search	Courtship	Consummation
<u>Bull</u>	Approach sexually active group of females testing for lordosis, flehmen	Nuzzling and licking of perineal region: chin resting, testing for lordosis	Penile protrusion with dribbling of seminal fluid with few spermatozoa, erection and attempted mounts
<u>Stallion</u>	Visual search, flehmen	High degree of excitement	Penile protrusion with no preejaculatory expulsion of seminal fluid
<u>Ram</u>	Sniffing and licking of ano-genital region, nudging ewe, flehmen	Neck outstretched and head held horizontally	Repeated dorsal elevation of scrotum, penile protrusion with no dribbling of seminal fluid
<u>Boar</u>	Moving among females	Nuzzling, grinding of teeth, foams at mouth	Penile protrusion, shallow pelvic thrusts, attempted mounting
<u>Dog</u>	Roaming around territory	Sniffing, licking of the vulva	Erection, protrusion of penis, mounting
<u>Tom</u>	Prowling	Biting queen on dorsal neck	Mounting

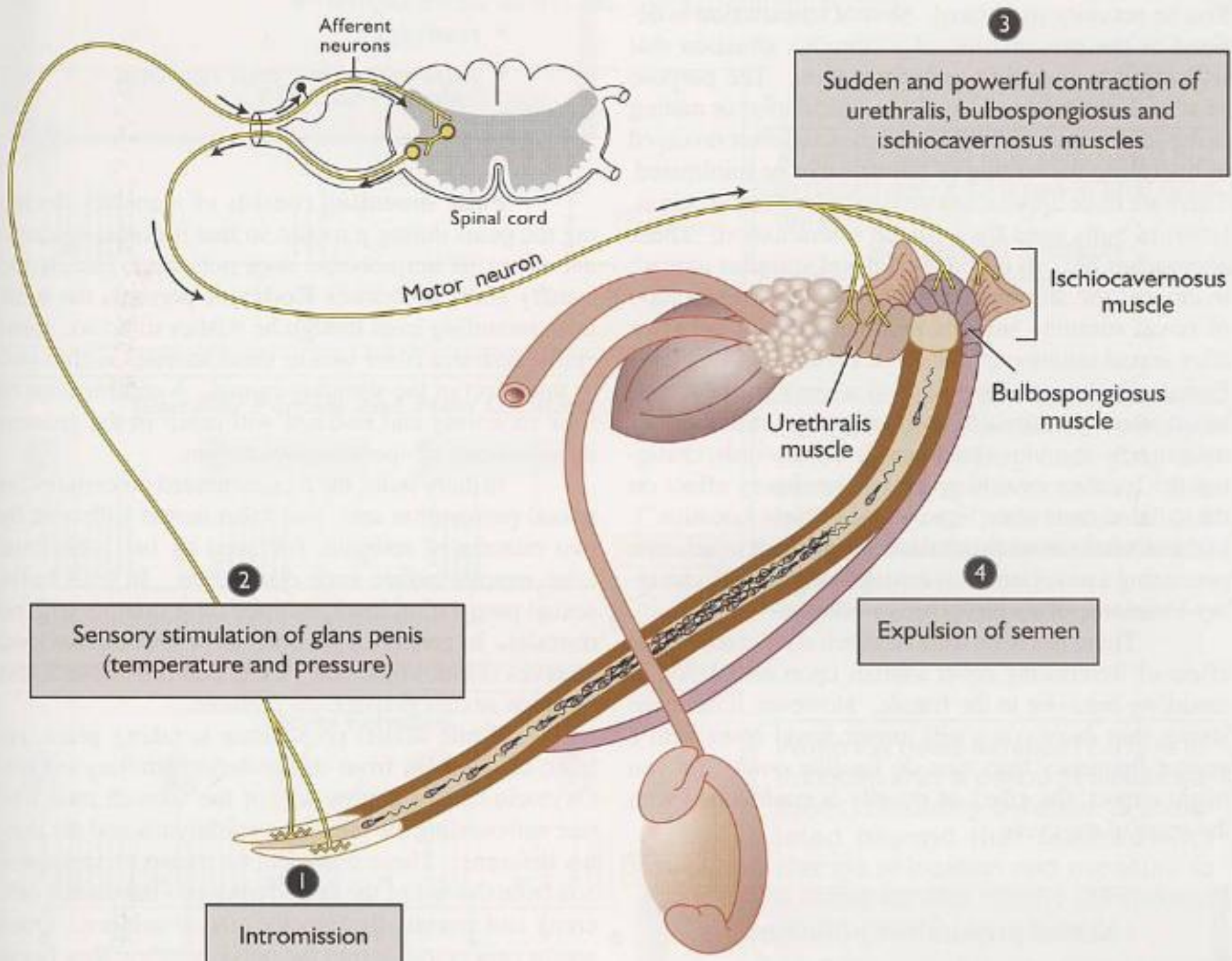





Libido

- **Libido** – describes sexual drive (level of Interest and motivation to mate)
- Sexual drive affected by **genotype** (inherently high libido – boar and dairy bulls)
- Effect of **hormone levels** not very critical
- Mating is a **learned process** – **experiences** can affect libido (practical consideration in handling bulls)
- **Assessment of libido - breeding soundness evaluation (?)**
- **The libido test** is an assessment of individual bulls' performance. In this test, a single pre-stimulated bull is introduced to one restrained

Cont ...

- Once a receptive female is found and adequate sexual foreplay has leads to full arousal the penis becomes erect and its free portion protrudes out of the perpetual enclosure (penile erection – described before)
- **Mating** –physical process of sexual intercourse or copulation
- *Duration* (*short*; bull, ram, buck and tom or *long*; dog, boar and camel)
- **Mounting** - positioning for subsequent events- immobilization in *different stances depends on species*
- **Intromission** - insertion of penis in to vagina
- **Ejaculation** - expulsion of semen from penis in to FRT
Sensory stimulation of glans penis (*warmth* (ram and bull) or *pressure* (boar, stallion)) – neural reflex – ischiocavernosus, urethralis, bulbospongiosus and



Mating pair	Duration of Copulation	Volume of Ejaculate (Range)	Site of Semen Deposition
	1 to 2 seconds (1 pelvic thrust with foreleg clasp)	.8 to 1ml (.1 to 2ml)	external cervical os
	1 to 3 seconds (1 pelvic thrust with foreleg clasp)	3-5ml (.5 to 12ml)	fornix vagina
	20 to 60 seconds (multiple pelvic thrusting, flagging of tail followed by inactive phase)	75-120ml	external cervical os but semen enters uterus at high pressure



5 to 20 minutes
(rapid pelvis
thrusting to en-
gage penis in
cervix) When
penis is en-
gaged, thrust-
ing stops and
ejaculation
commences
that is accom-
panied by som-
nolence)

200-250ml

cervix and
uterus



6-20 minutes,
extension of
neck, straining
of the body,
multiple ejacu-
lations per
copulation

3-8ml

Partly intrauter-
ine, partly intrac-
ervical, some in-
travaginal

