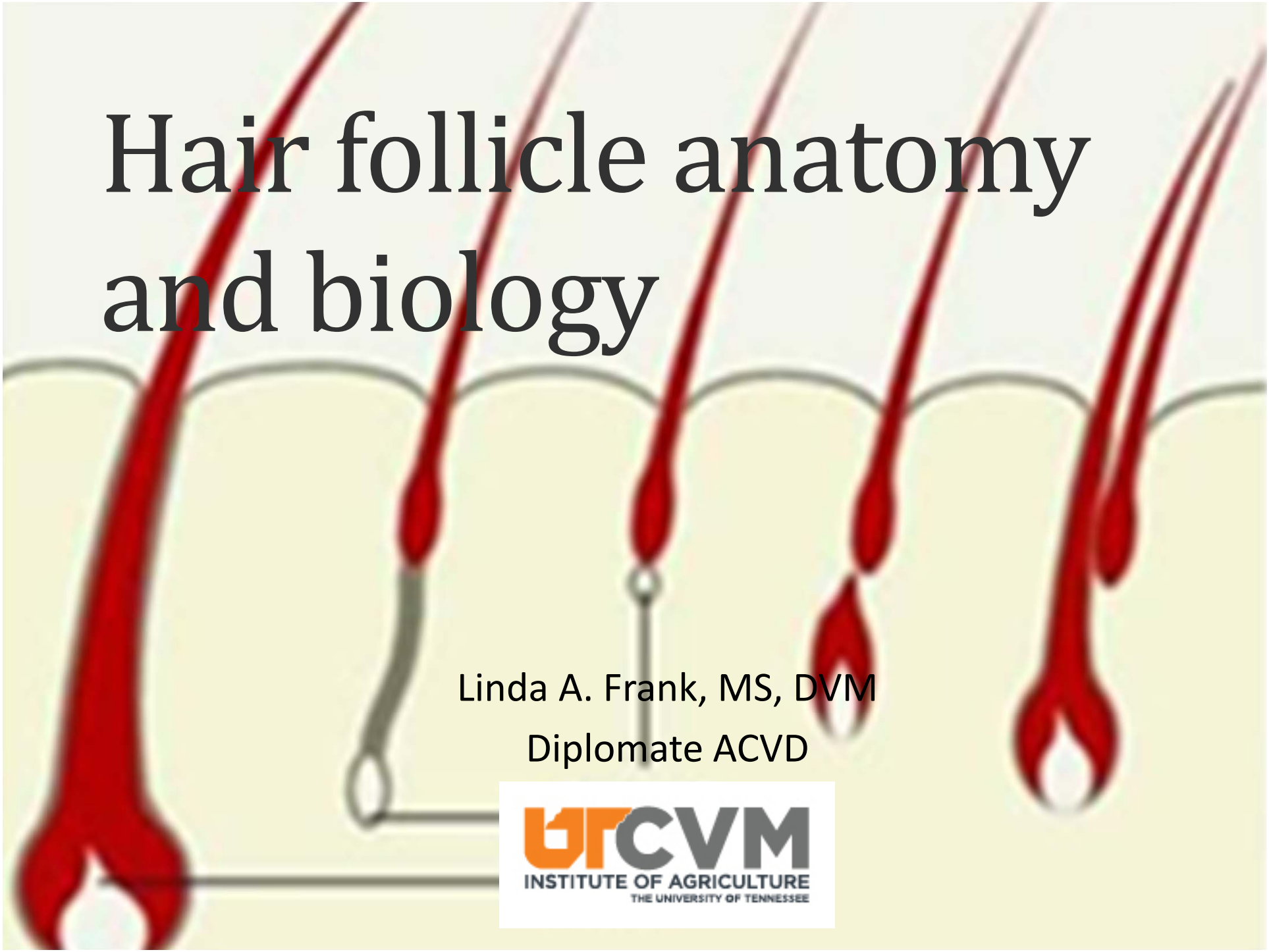
Hair follicle anatomy and biology



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Topics to be covered

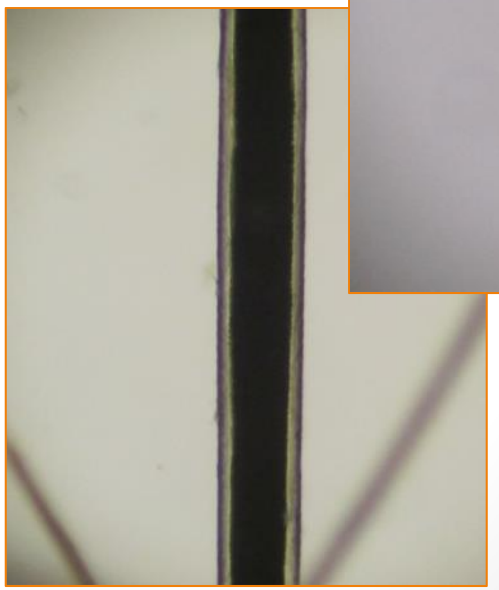
- Hair follicle structure
- Hair cycle
- Molecular control
- Hormonal control
- Immunology
- Selected non-inflammatory alopecias

Hair follicle structure

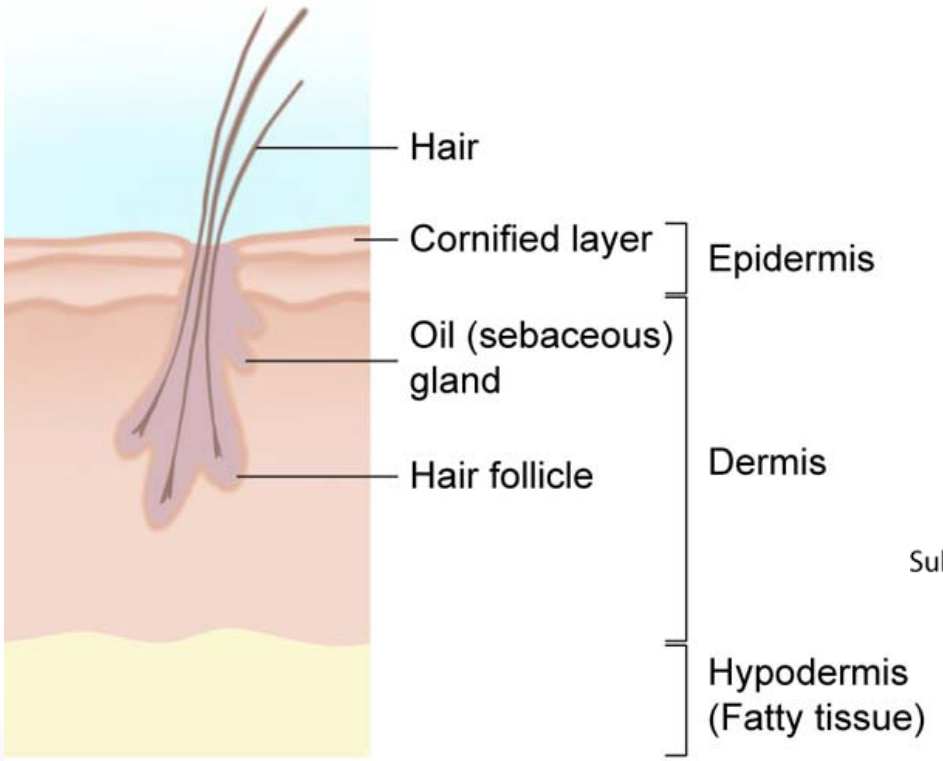
Definitions

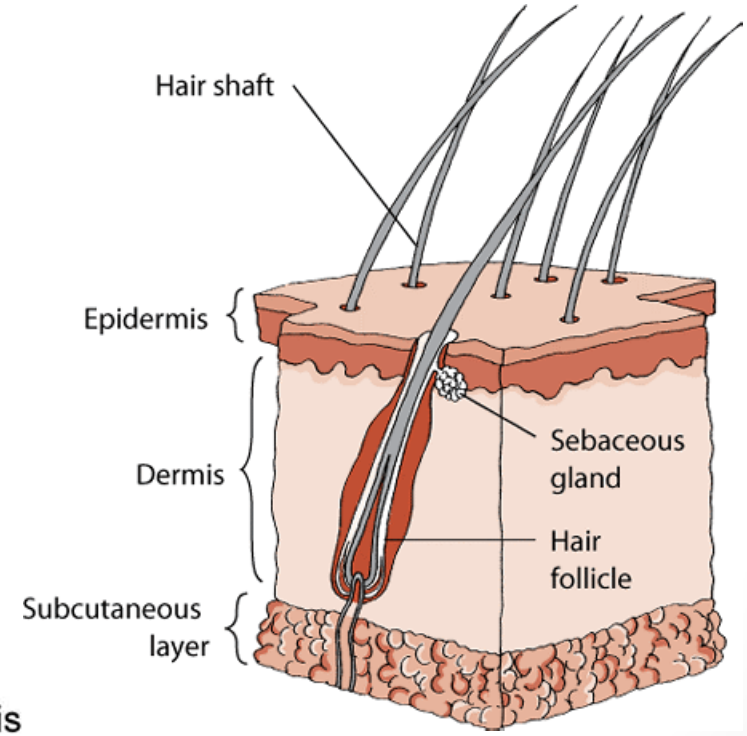
- Nonmedullated hairs
  - Lanugo hairs – prenatal
  - Vellus hairs
  - Wool

- Medulated hairs
  - Primary
  - Secondary

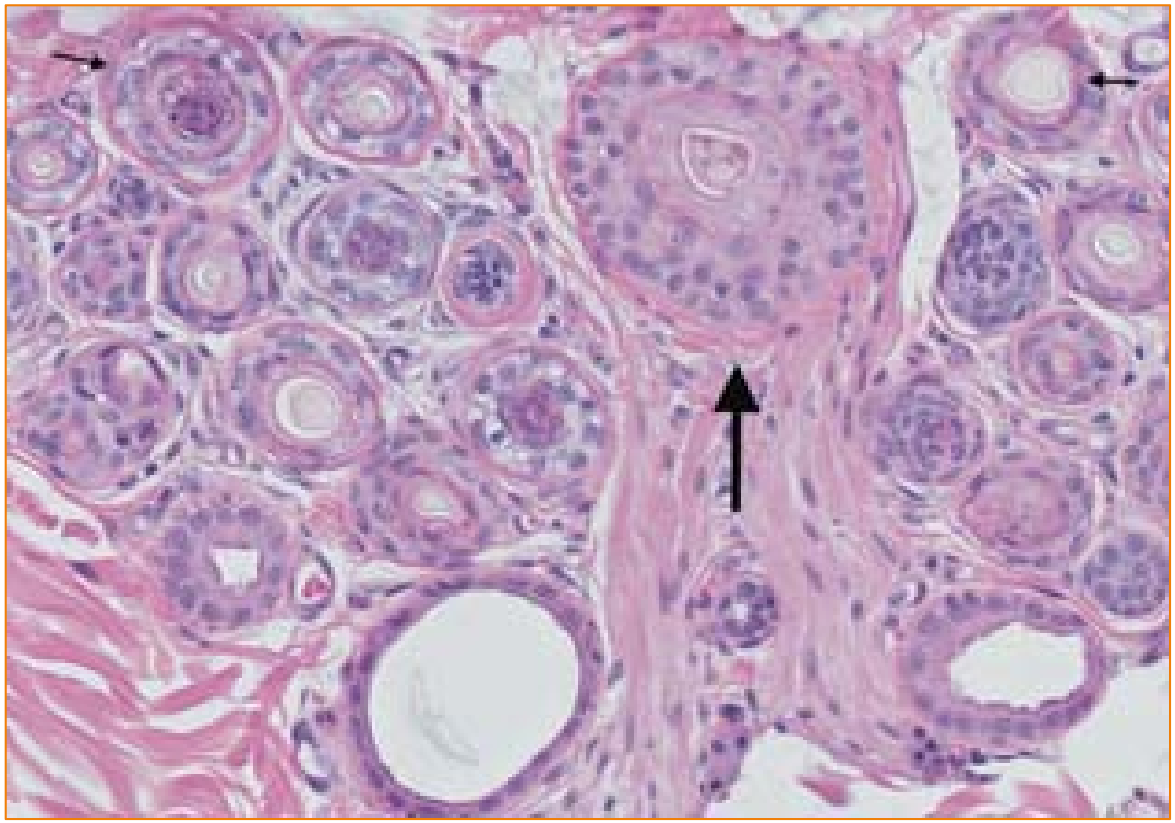


Simple vs compound follicles





Compound follicle (Sphynx)



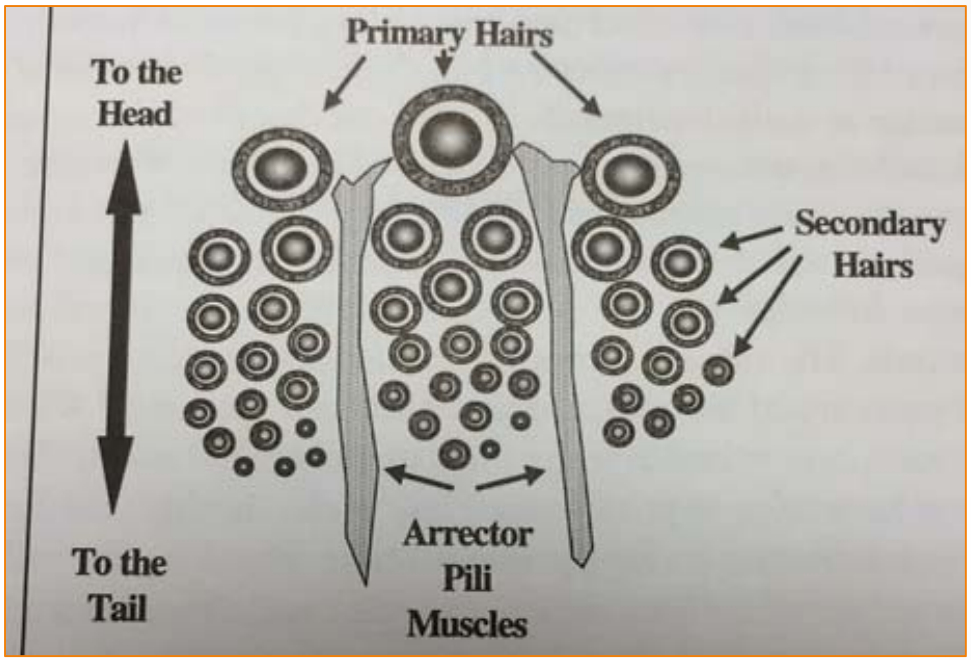
Genovese DW, et al. *Vet Dermatol* 2014; 25: 523.

Simple vs compound follicles

- Simple follicles
  - Omnivores
  - Herbivores
  - May have new anagen hair and old telogen hair occupying same follicle
    - Llamas have 2-3 hairs
- Compound follicles
  - Carnivores
  - Sheep

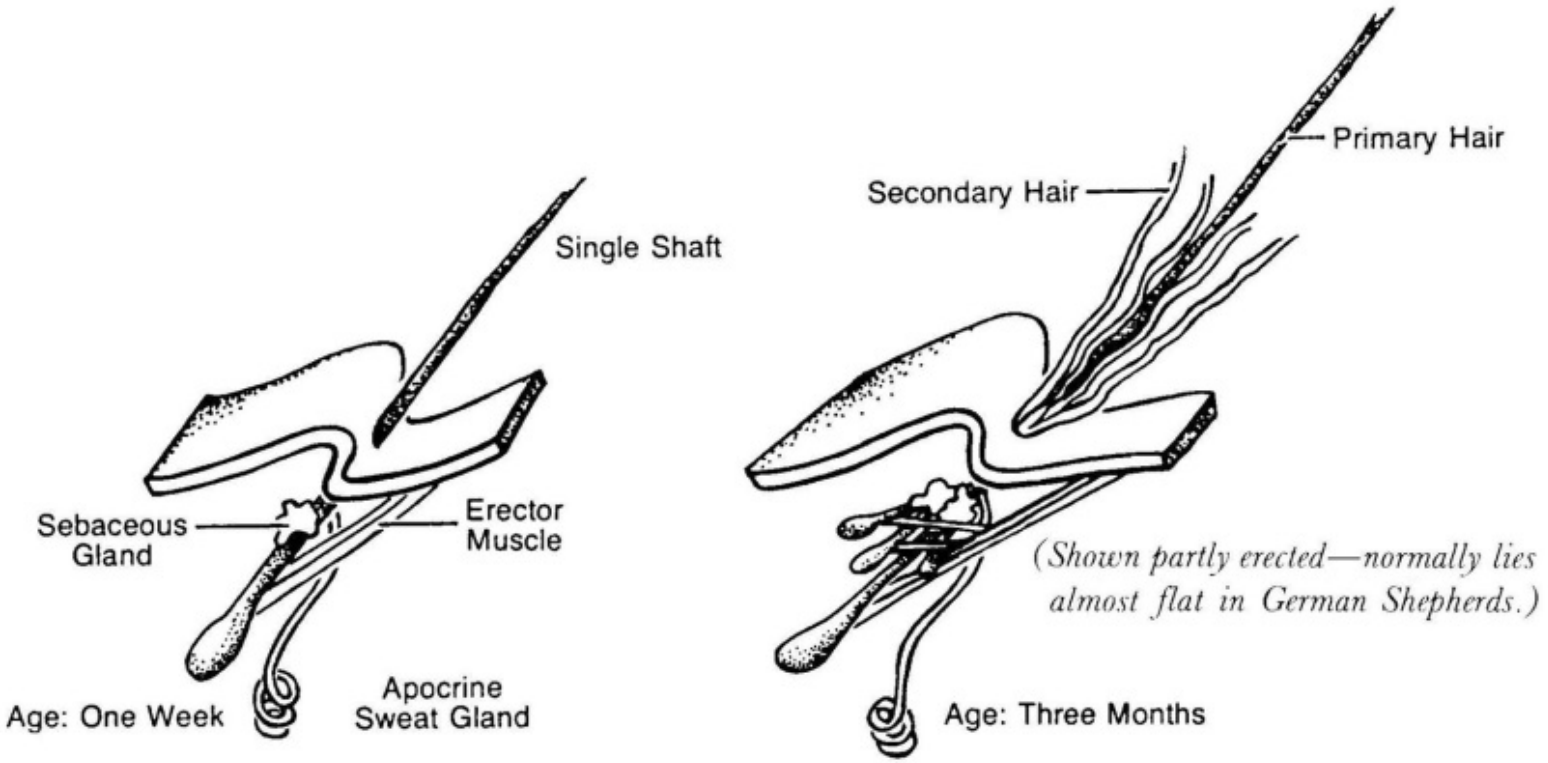
Follicular unit

- Grouping of 1-6 compound follicles



Important factoid

- Puppies do not “lose” their puppy coats, they gain adult coats!



Hair Follicles. Accessory hairs develop as the puppy gets close to 3 months old, at which time there are two to five secondary hairs around each primary hair. At six months there are five to fifteen in each follicle bundle, further grouped in clusters of three in irregular rows, 100 to 300 bundles per square centimeter.

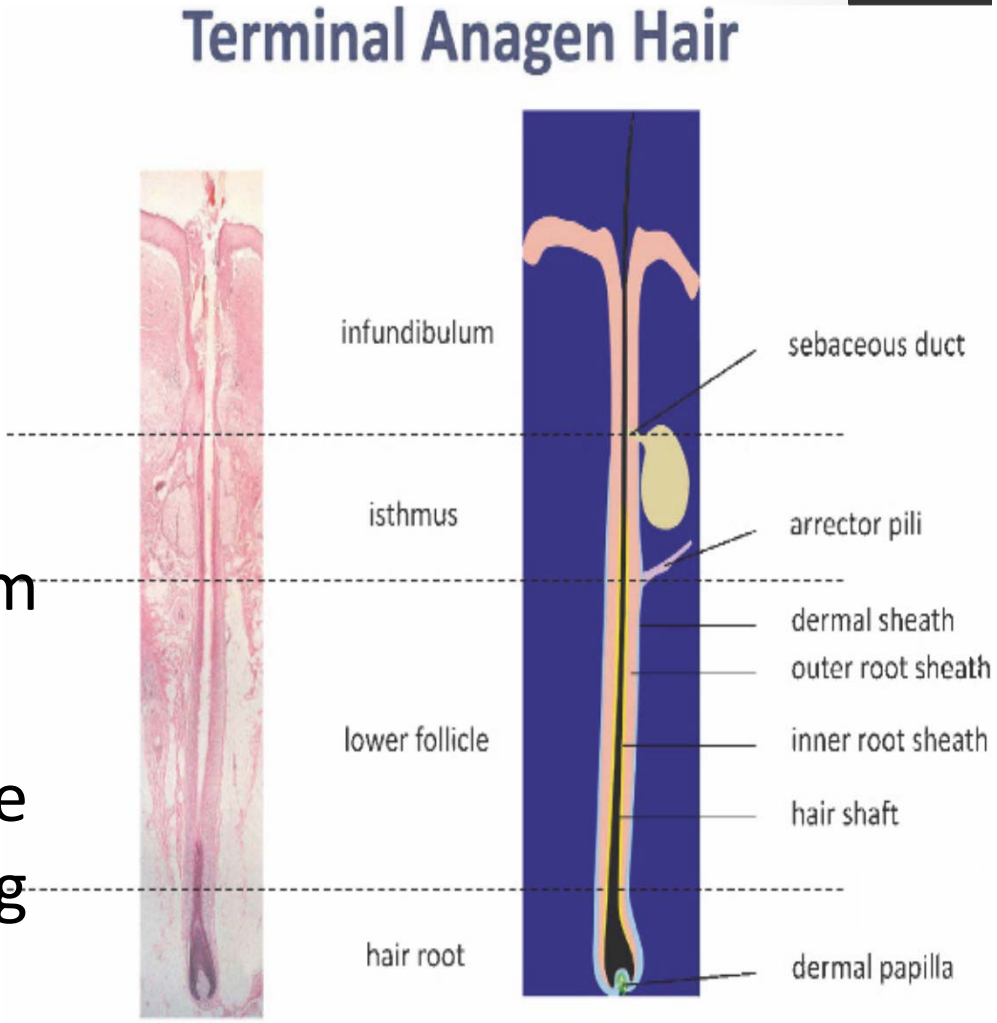
Adult coat

- Increased numbers of hair shafts
- Increased diameter of hair shafts
- Decrease in curvature of hair shaft

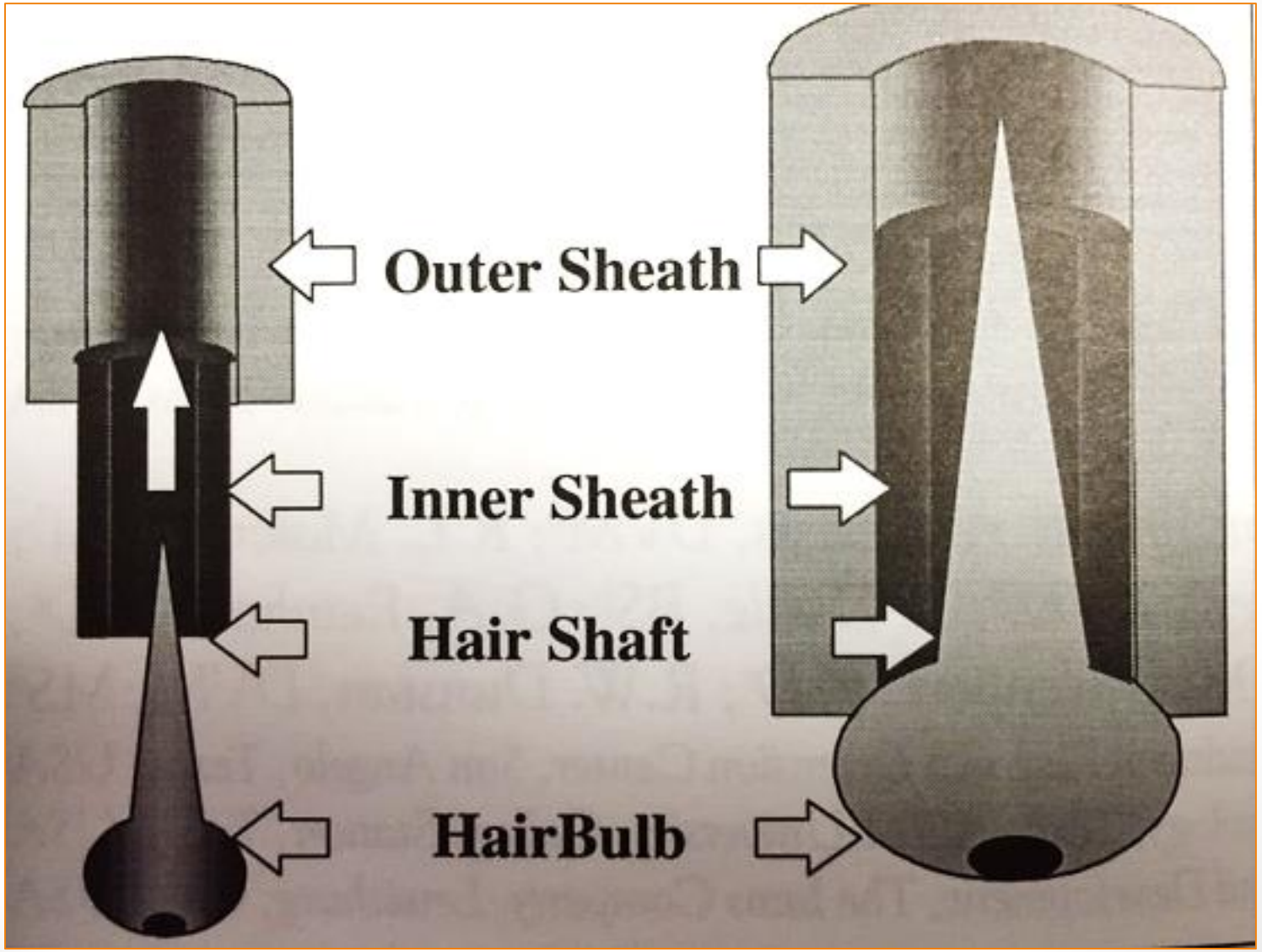
Microscopic anatomy of the hair follicle

Hair follicle divisions

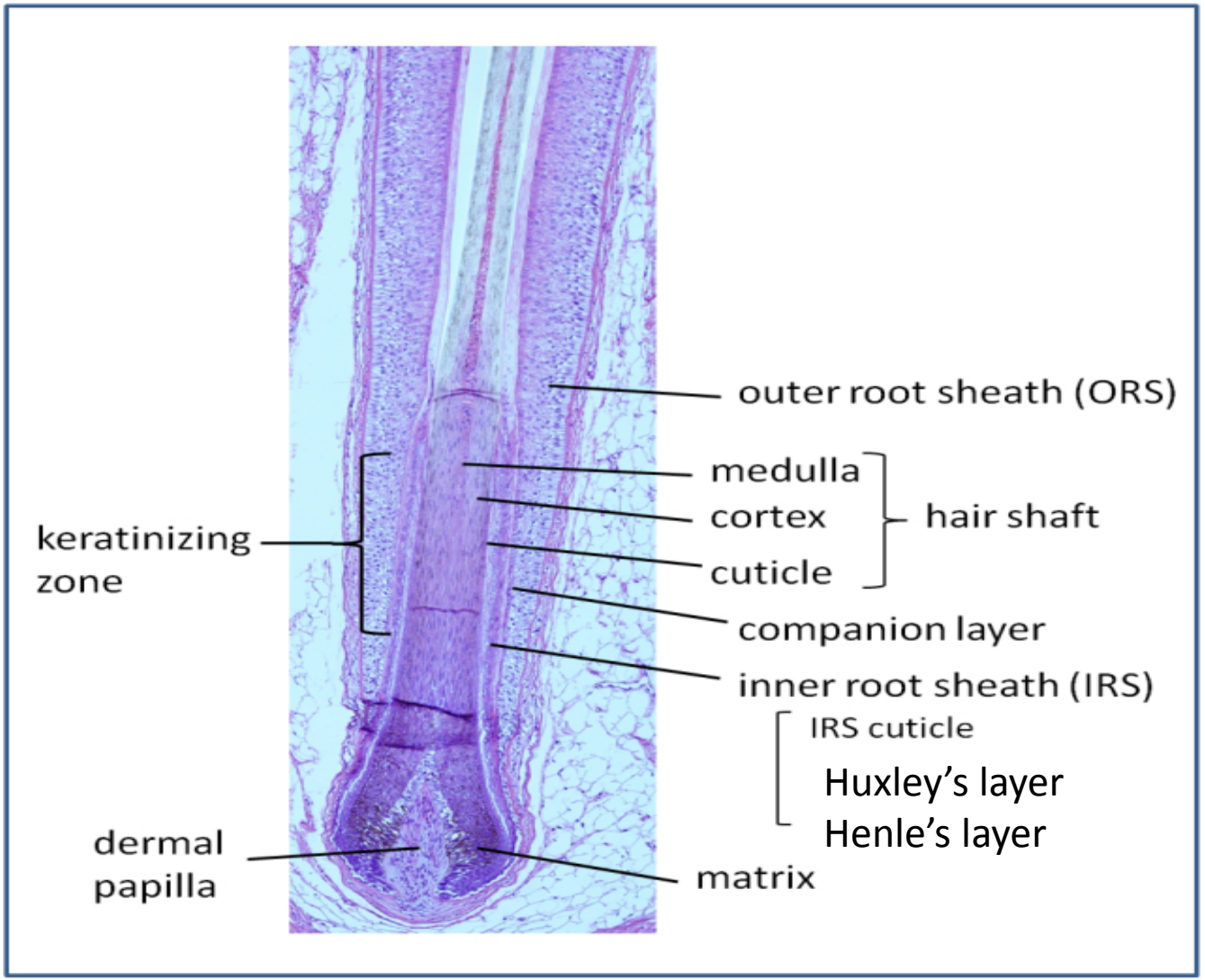
- Upper follicle
- Lower follicle
- Hair bulb
- Bulge region
  - Location of follicular stem cells
  - Diffusely restricted to the isthmus region in the dog



Microscopic anatomy

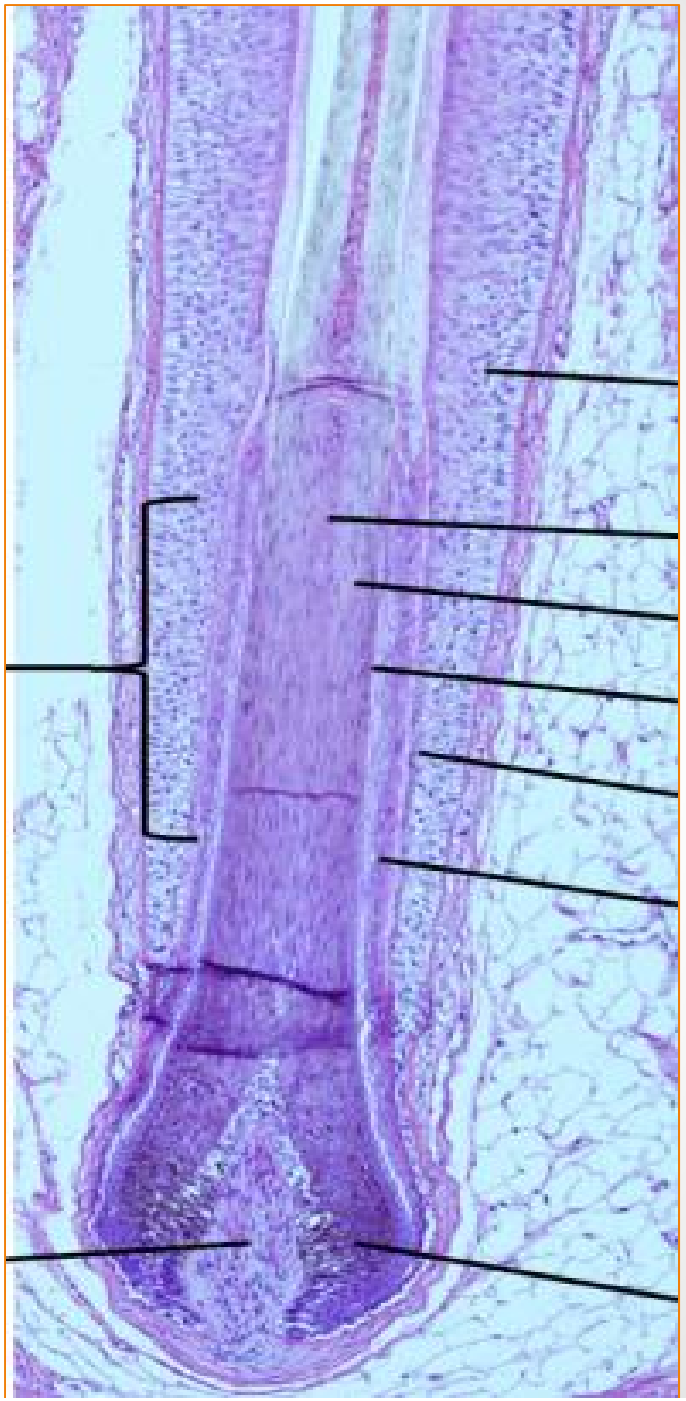


Microscopic anatomy

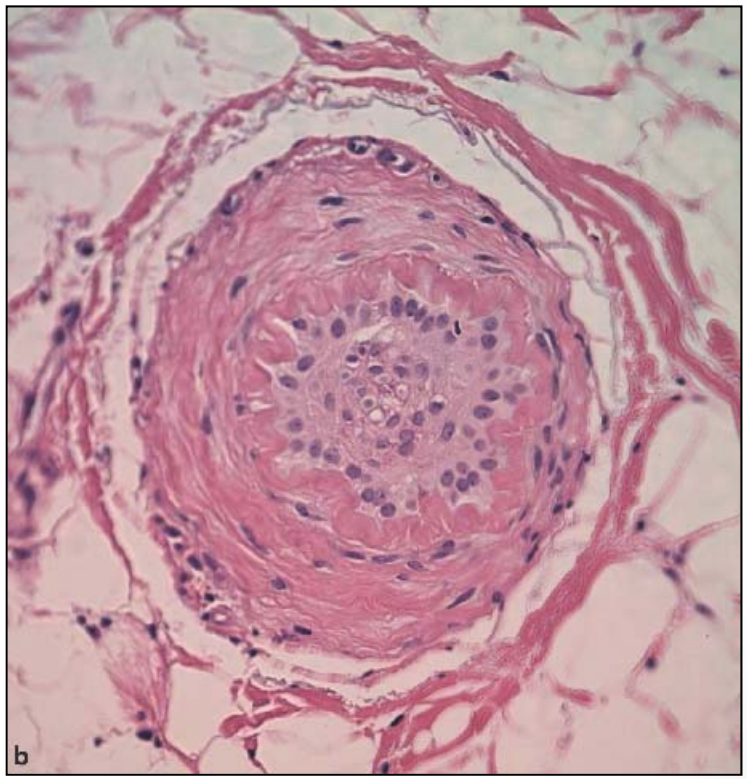


Outer root sheath

- Keratinizes via trichilemmal keratinization
- Contains abundant glycogen
- Covered by hyaline membrane

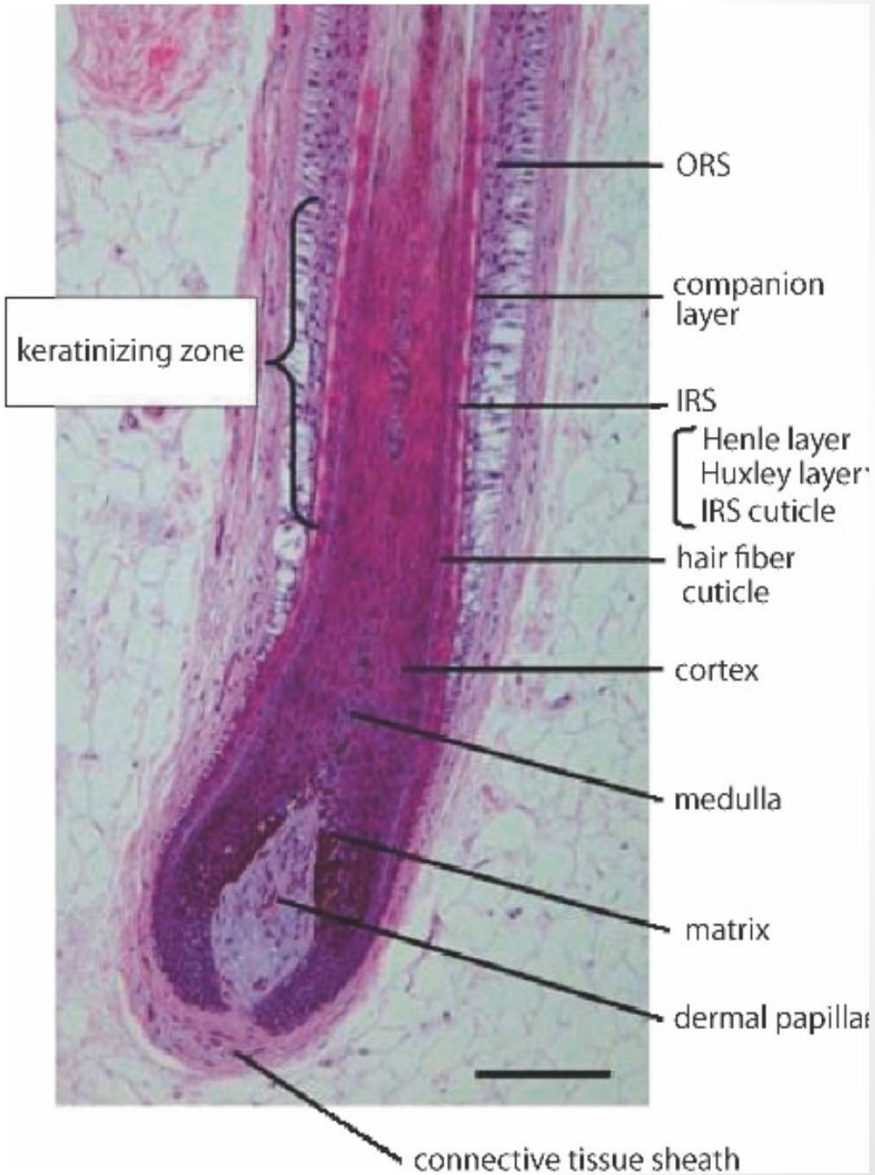


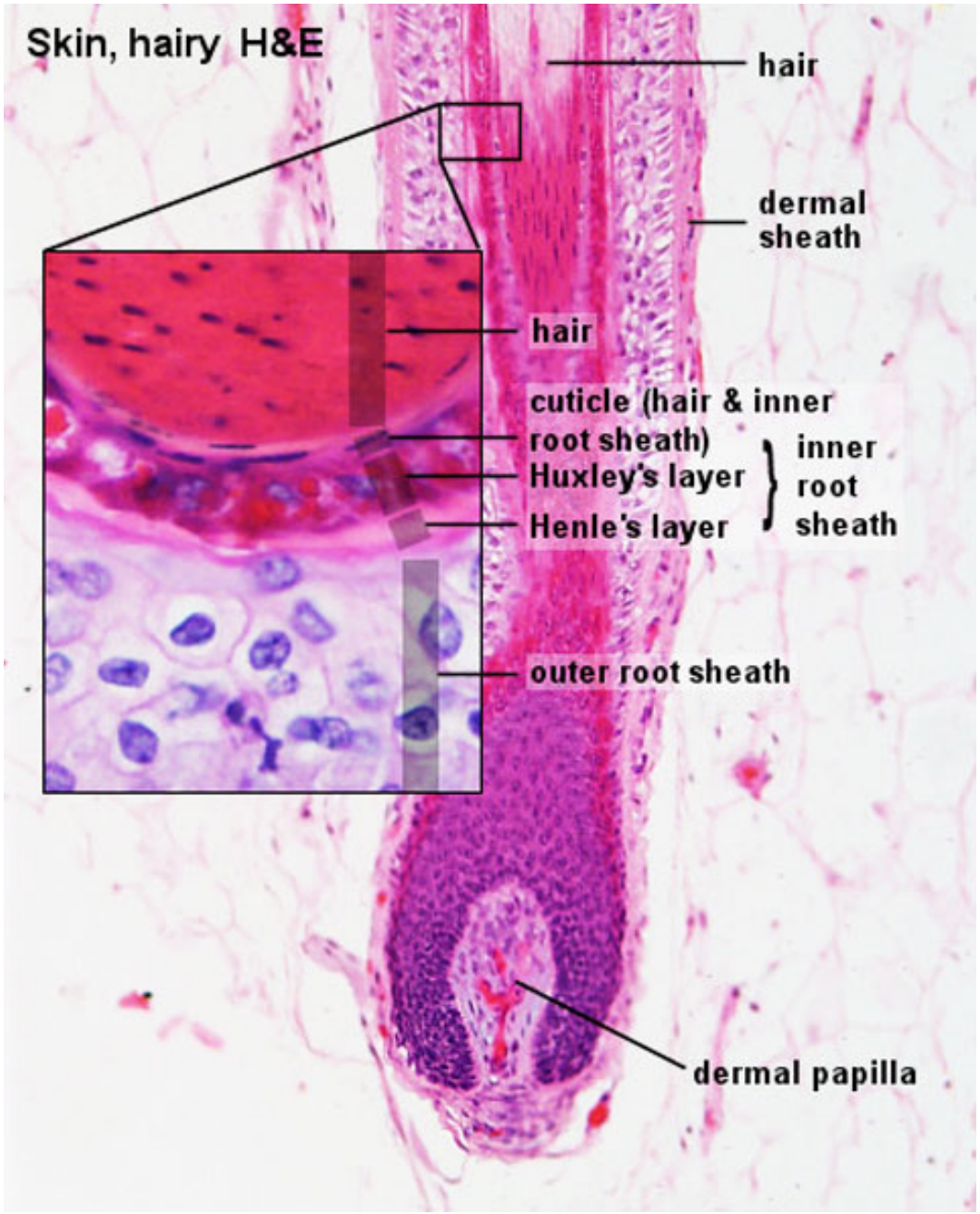
- Folds of hyaline membrane into ORS



Inner root sheath

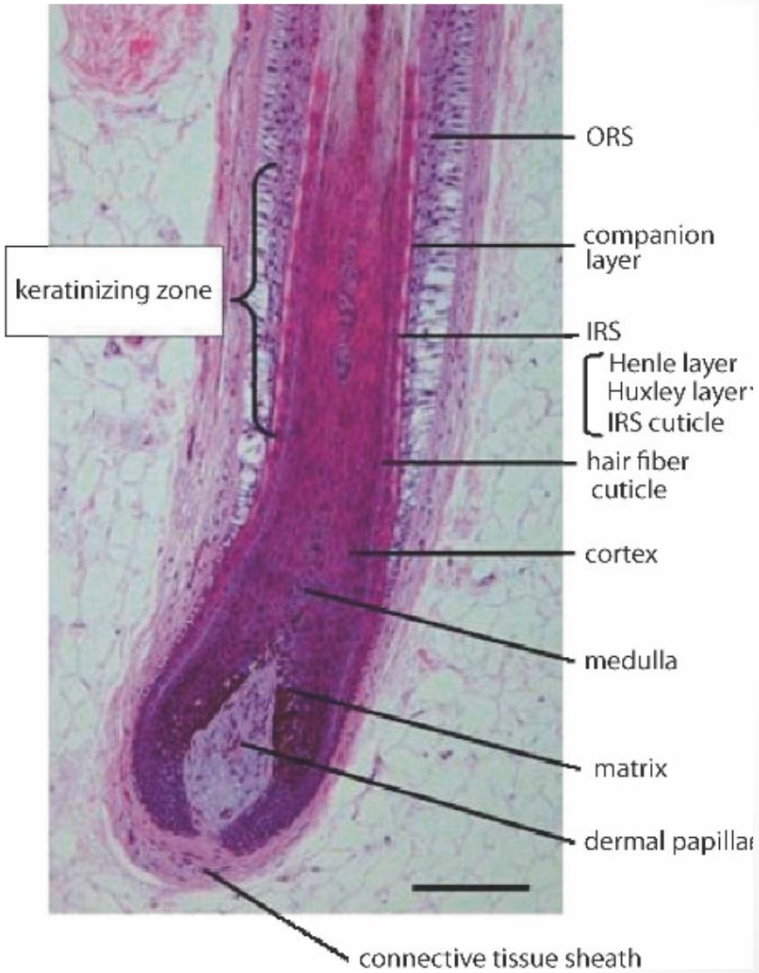
- Extends to isthmus
- Determines hair shape
- Consists of
  - Companion layer
  - Henle layer
  - Huxley layer
  - IRS cuticle




Skin, hairy H&E
hair
dermal sheath
hair
cuticle (hair & inner root sheath)
Huxley's layer
Henle's layer
inner root sheath
outer root sheath
dermal papilla

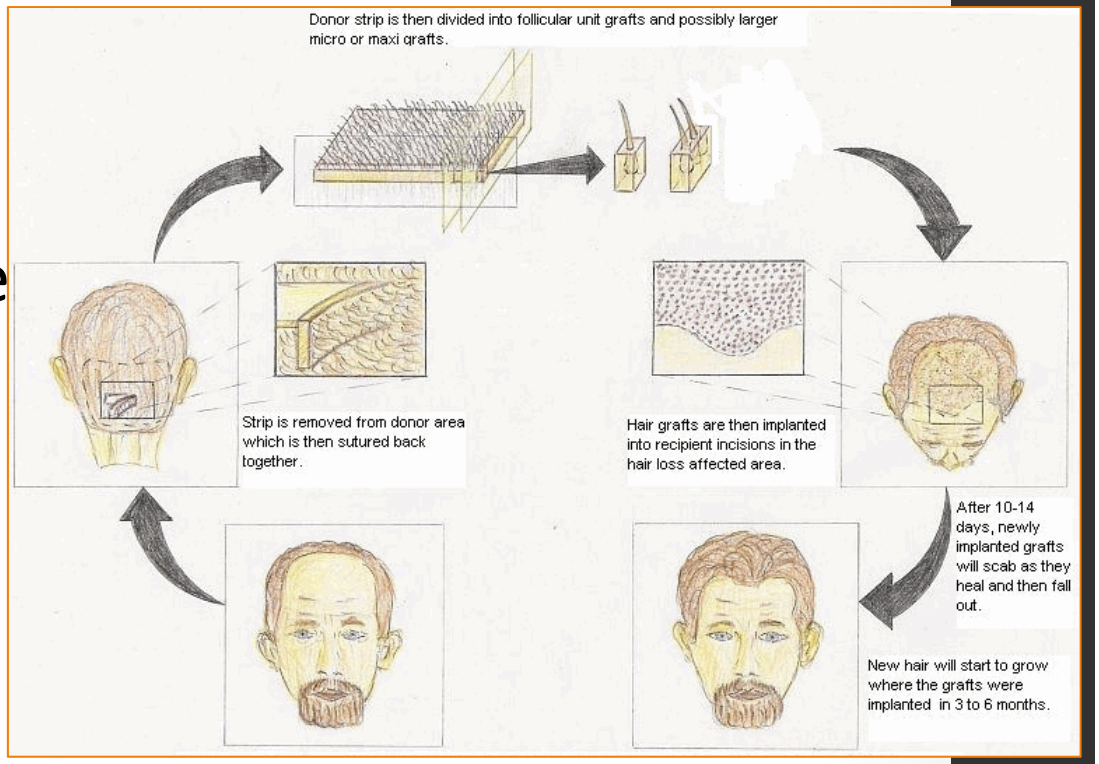
Hair shaft

- Consists of the cuticle, cortex, medulla
- Dependent on Lef-1 transcription factor
- BMP receptor type 1a also critical for matrix cell differentiation

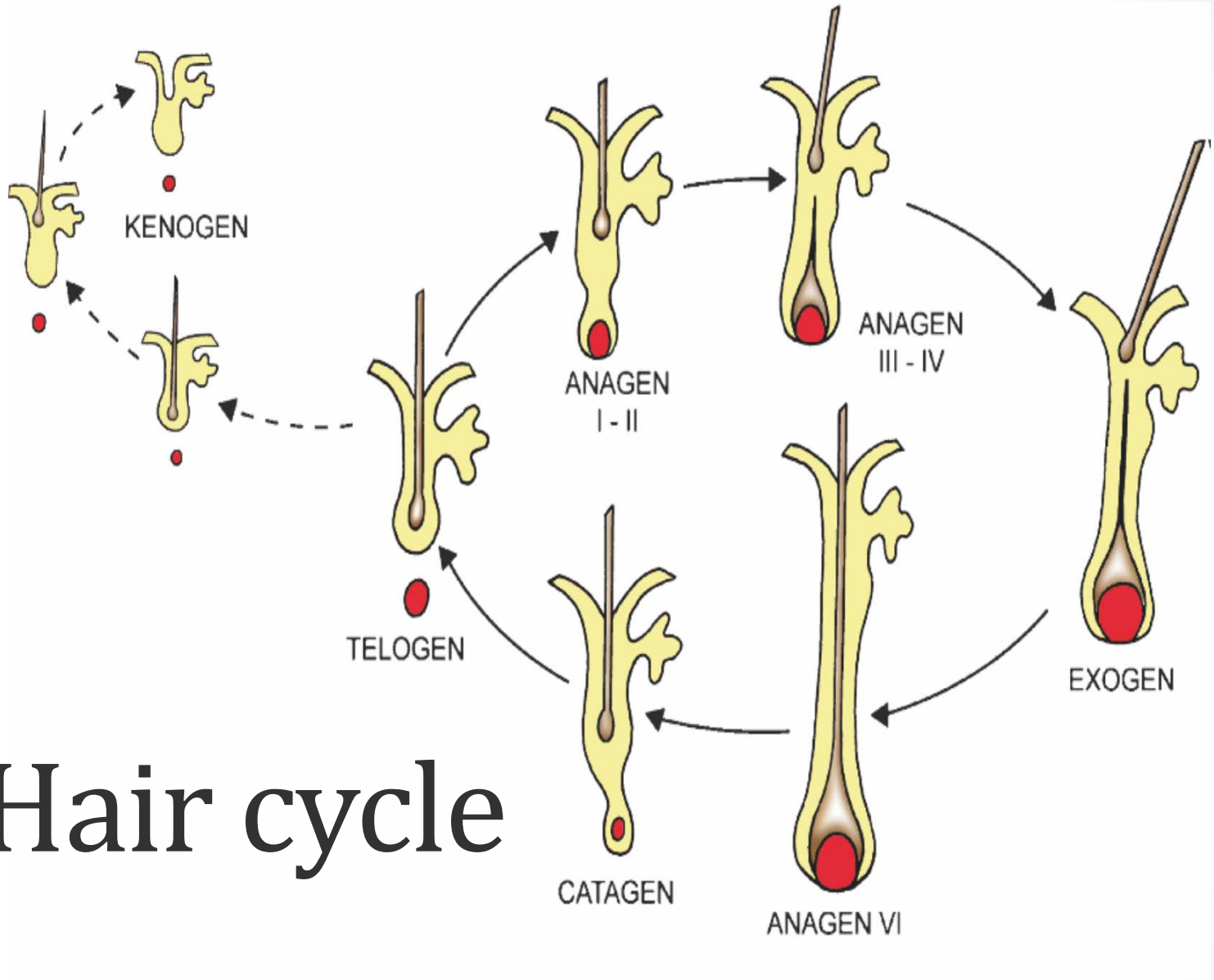


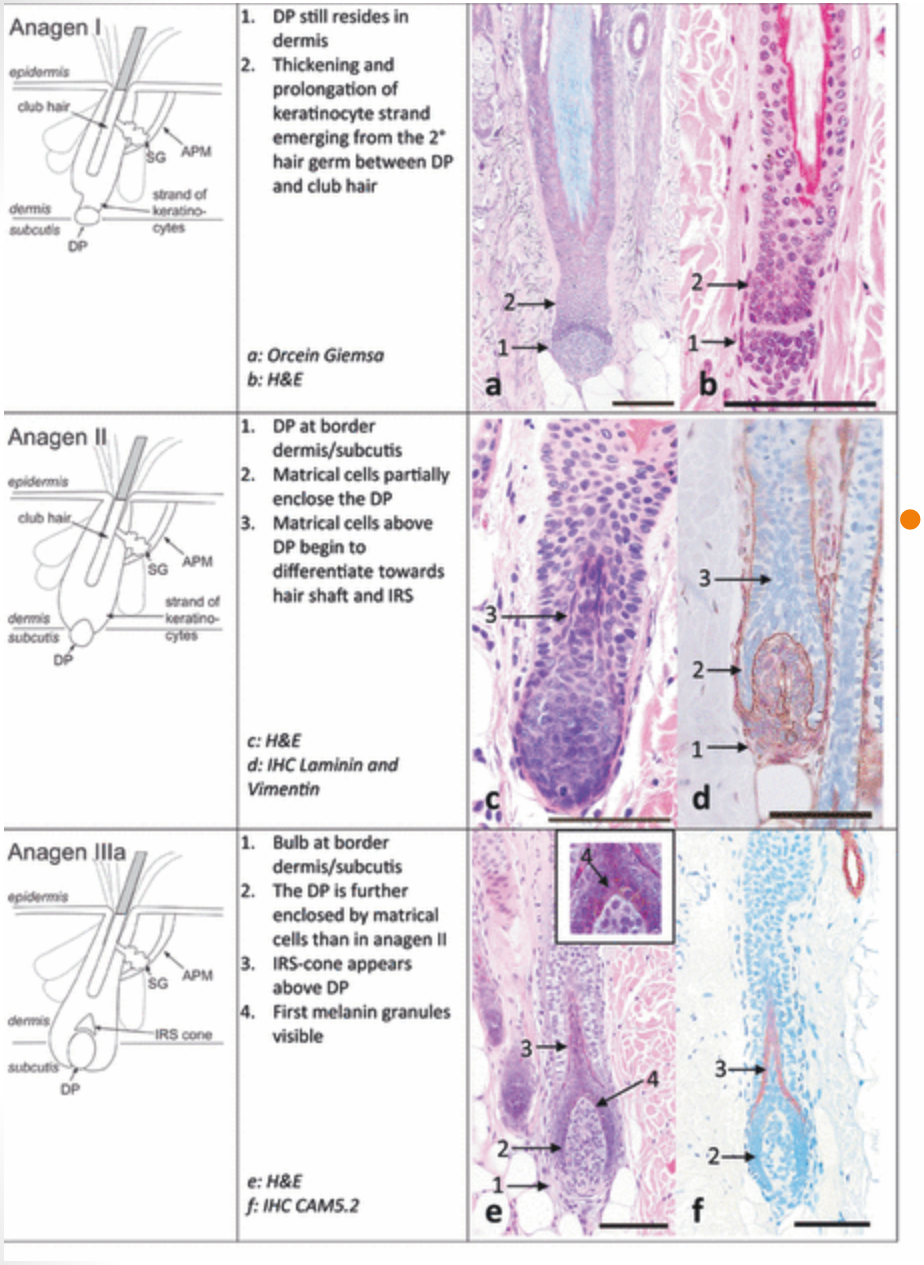
Dermal papilla

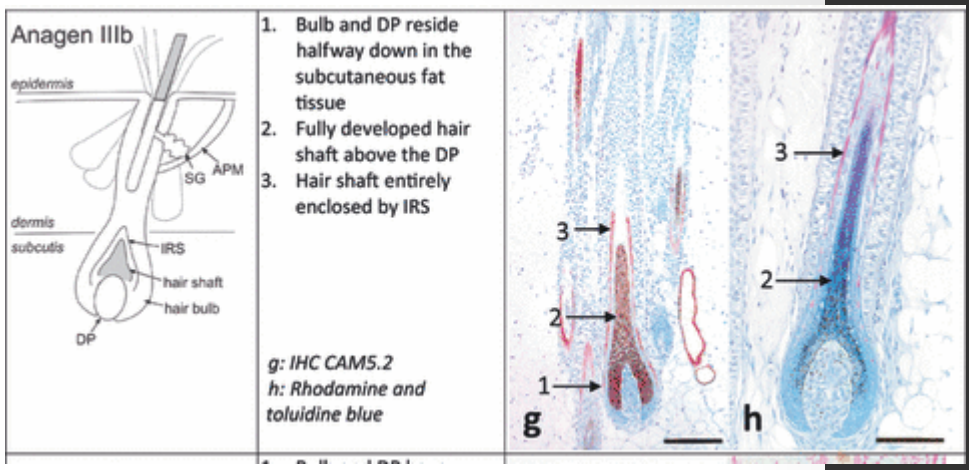
- Powerful inductive properties
- Production of soluble growth factors
  - Act in paracrine manner



Hair cycle

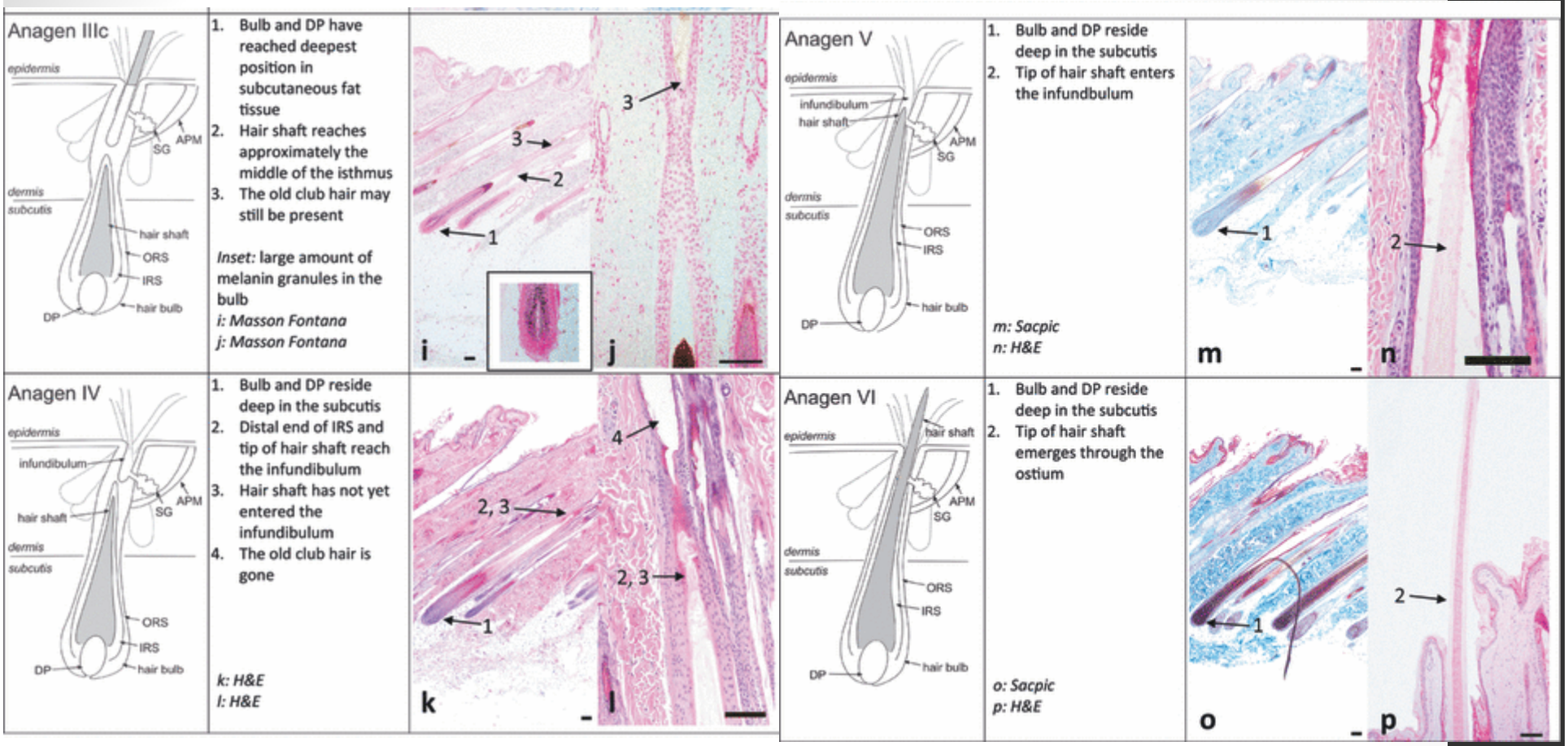

KENOGEN
ANAGEN
I - II
ANAGEN
III - IV
EXOGEN
TELOGEN
CATAGEN
ANAGEN VI





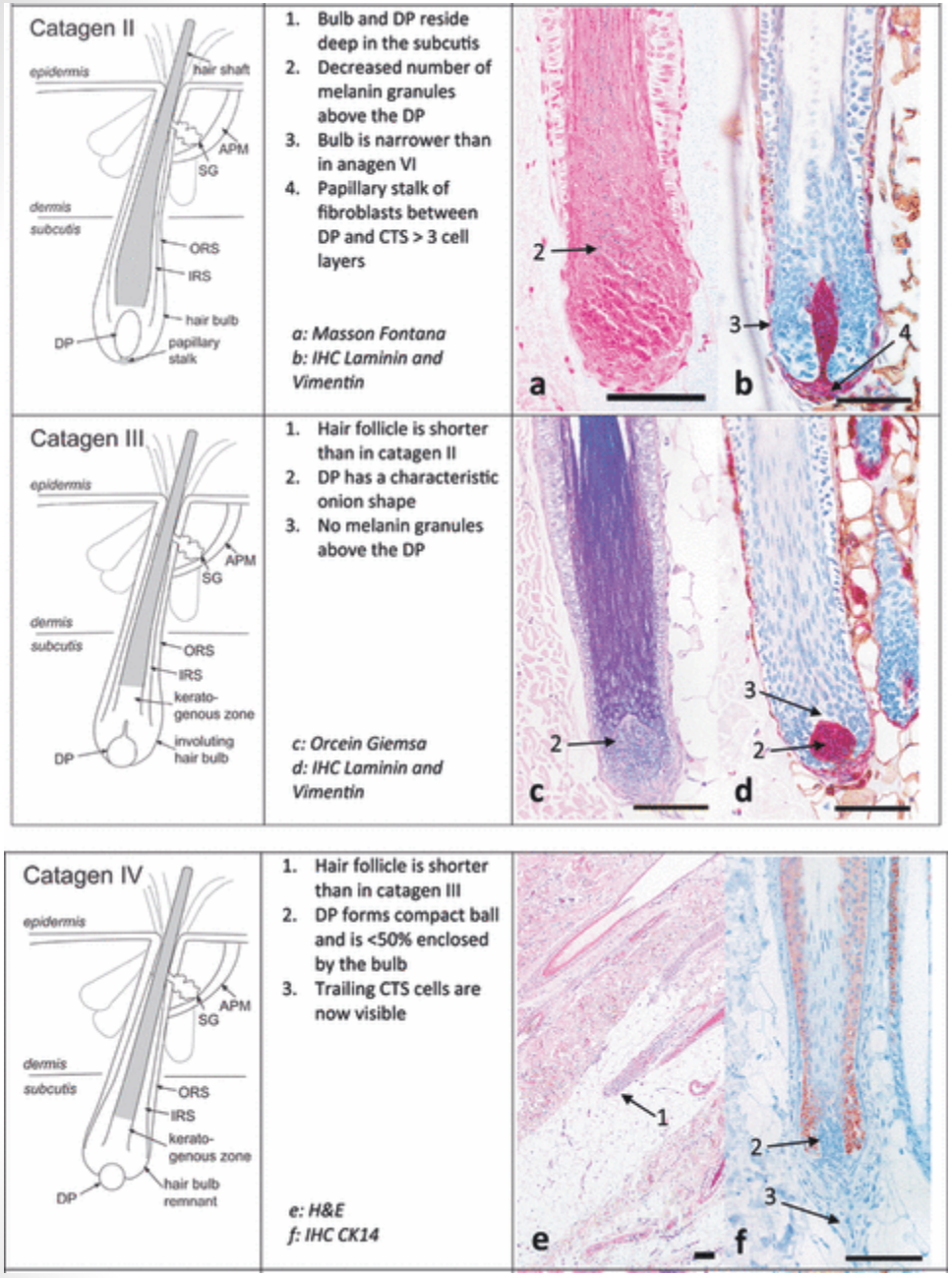
- Early anagen
  - Onset of growth
  - Movement of the DP into SC
  - Melanin production in bulb
  - DP becomes enclosed
  - Hair shaft formation
  - Hair reaches 2/3's of follicle

Müntener T et al. *Vet Dermatol* 2011;22:383.



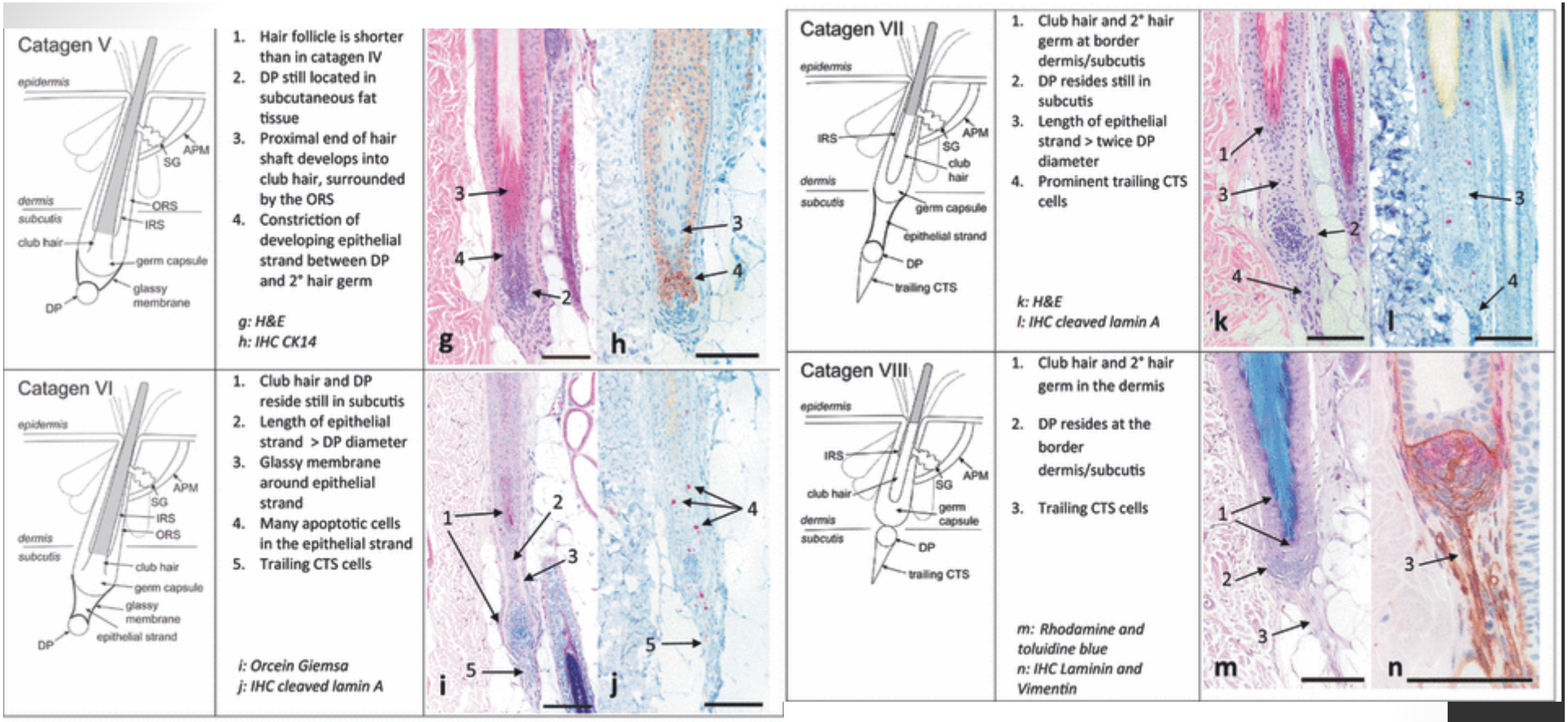
- Late anagen
  - DP fully enclosed
  - DP in SC
  - Hair reaches surface
  - Loss of club hair

Müntener T et al. *Vet Dermatol* 2011;22:383.



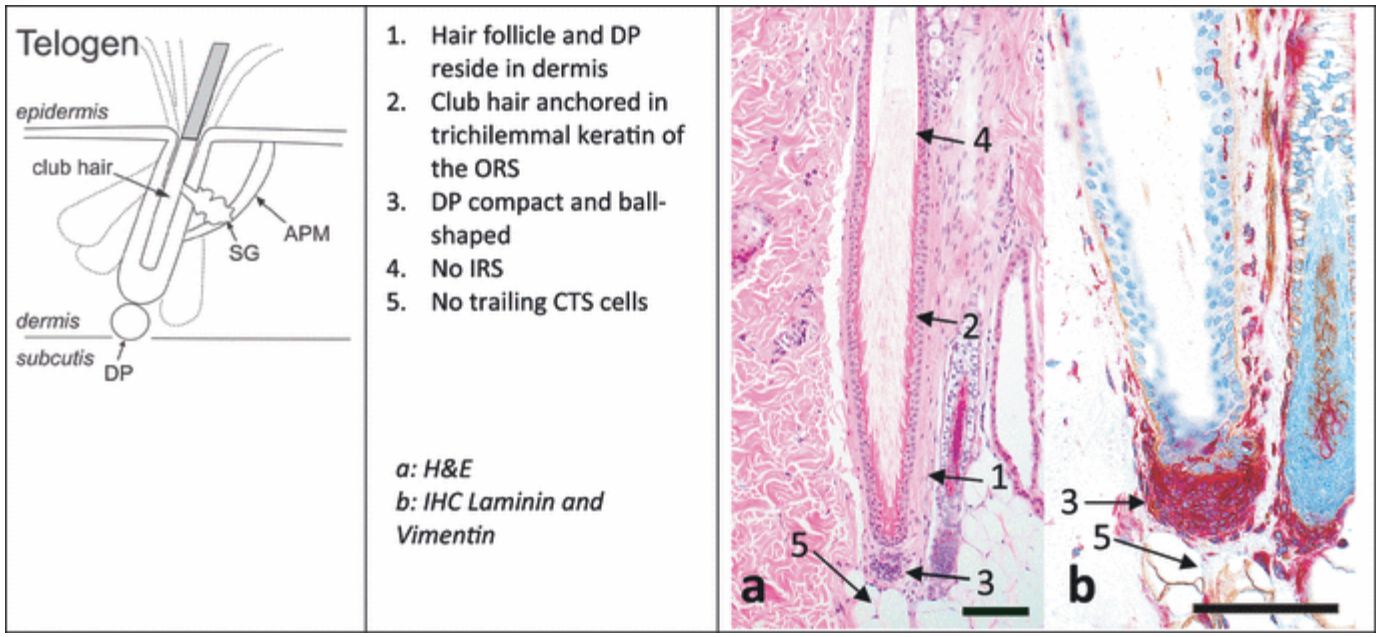
- Early catagen
  - DP moves upward
  - Mitotic activity stops
  - Apoptotic keratinocytes
  - Pigmentation stops
  - Trailing CTS visible

Müntener T et al. *Vet Dermatol* 2011;22:383.



Müntener T et al. *Vet Dermatol* 2011;22:383.

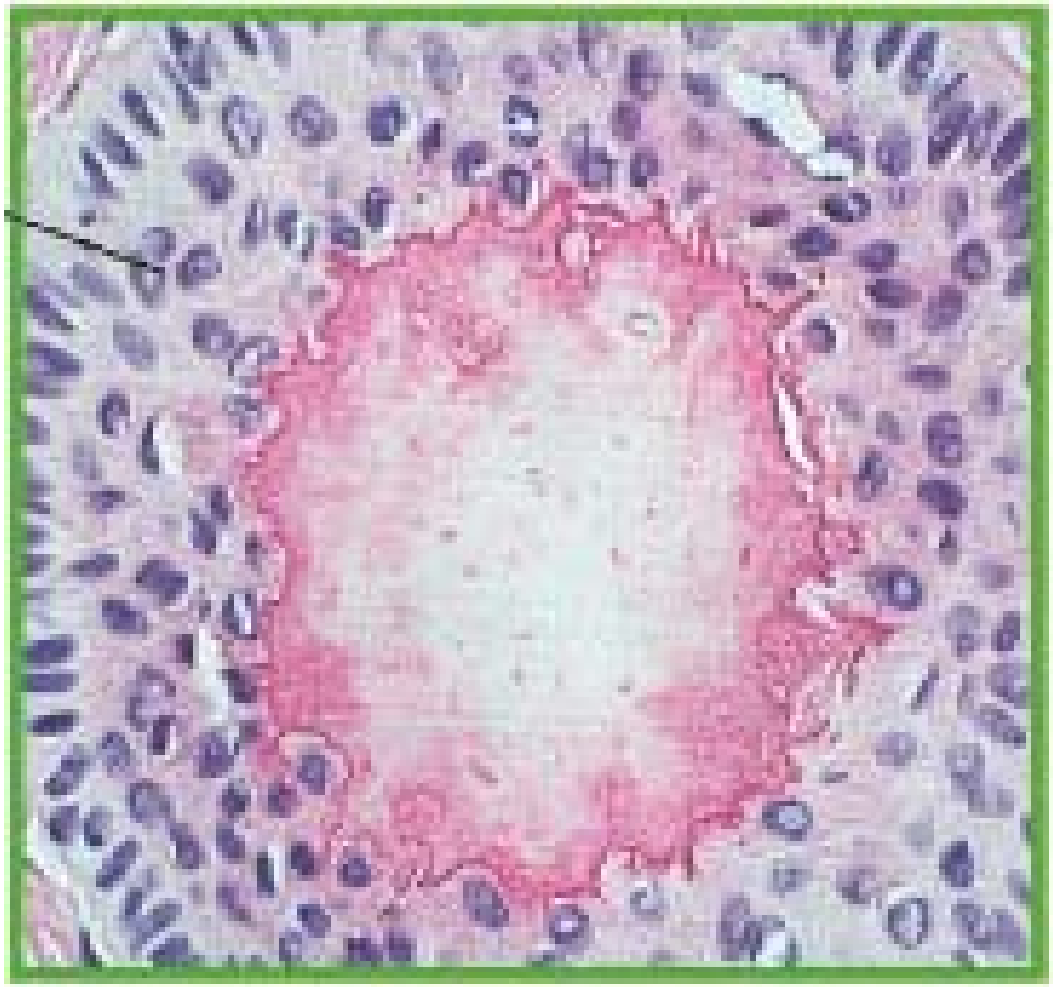
- Late catagen
  - Hair follicle shortened
  - Club hair formed
  - DP in dermis
  - Diminished trailing CTS



- Telogen
  - Hair follicle and DP in dermis
  - Club hair firmly anchored
  - No IRS
  - No trailing CTS

Müntener T et al. *Vet Der*matol 2011;22:383.

Telogen hair



Telogen club

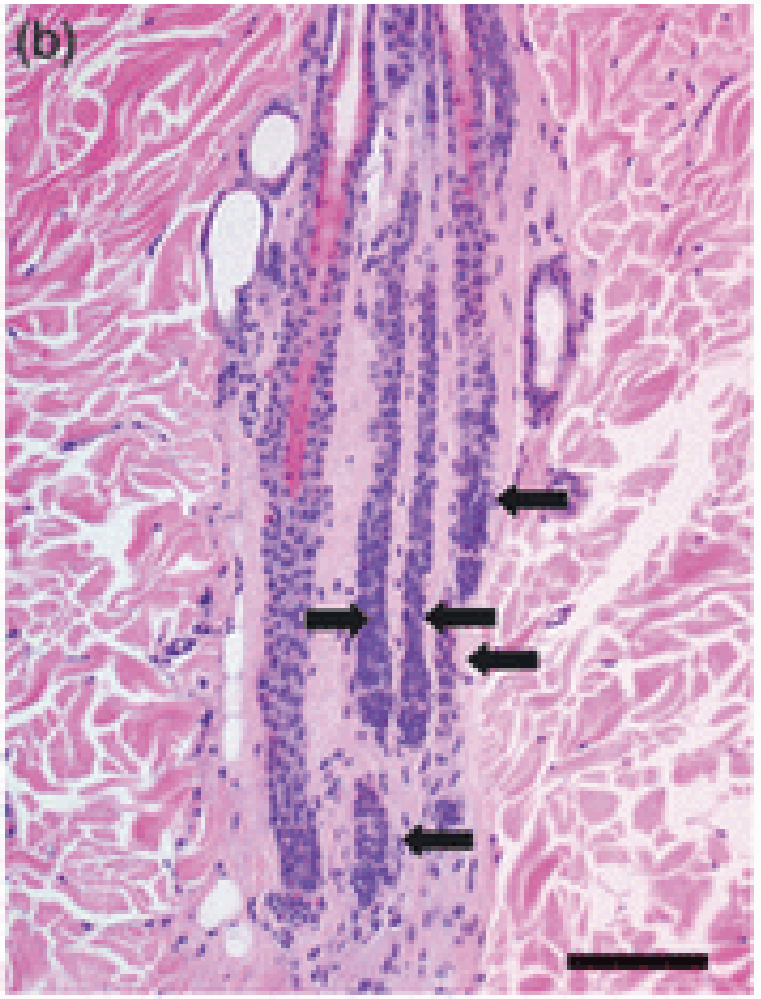
Exogen (shedding)

- Timing of release varies
- Early exogen
  - Hairs actively retained
- Late exogen
  - Hairs ready to shed

- Link between desquamation and shedding
  - Benefit of anti-seborrheic shampoos?

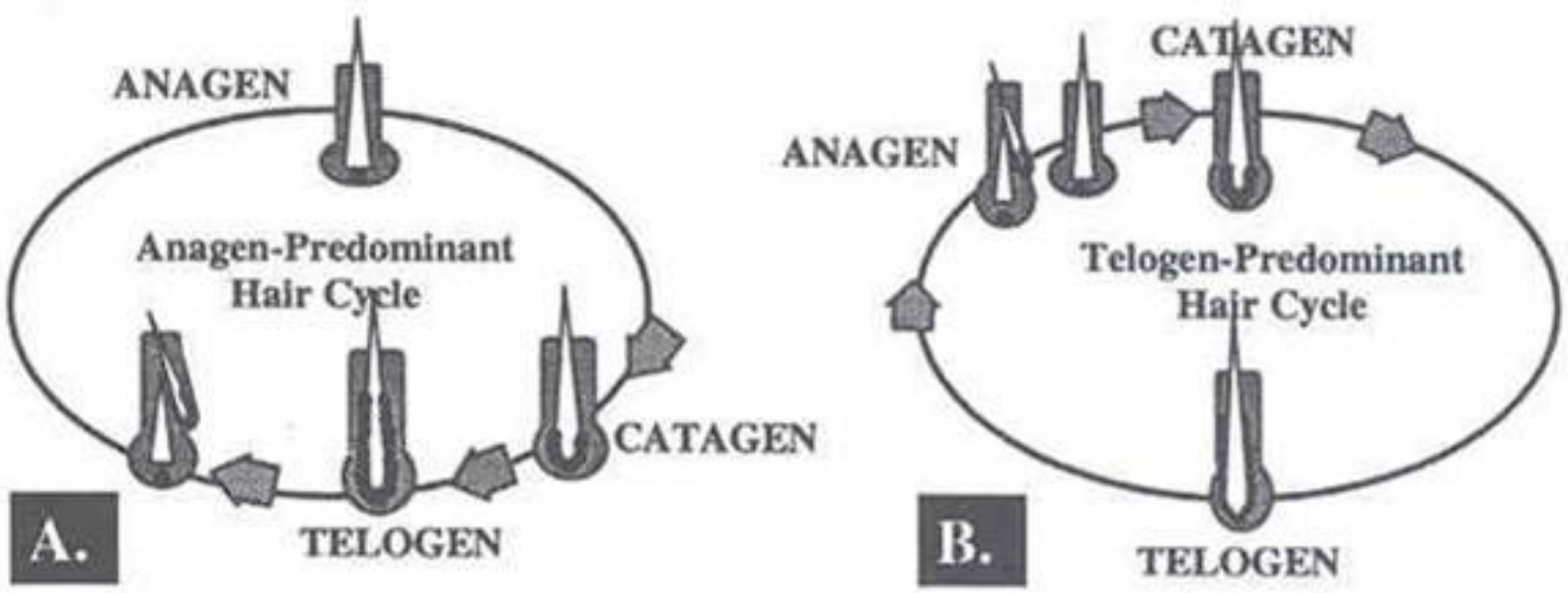
Kenogen

- Empty follicle after exogen
- Denotes a prolonged telogen state
- Not always pathologic
- ORS with no luminal cornified debris



Müntener T et al. *Vet Dermatol* 2012;23:206.

Anagen vs telogen predominant cycle



Credille KM et al. The role of nutrition on the canine hair follicle: a preliminary report. In: Recent Advances in Canine and Feline Nutrition, 2000.

Anagen predominant cycle

- Humans have 85% of follicles in anagen
  - Only 15% in telogen
- Poodles have 98% of follicles in anagen
  - Only 2% in telogen

Telogen predominant cycles

- Malamutes have 59% of hair follicles in telogen and 32% of the follicles in kenogen
  - Only 9% of follicles are in anagen
- Beagles have 59% of hair follicles in telogen and 20% in kenogen
  - Only 21% of follicles are in anagen

Telogen predominant cycle

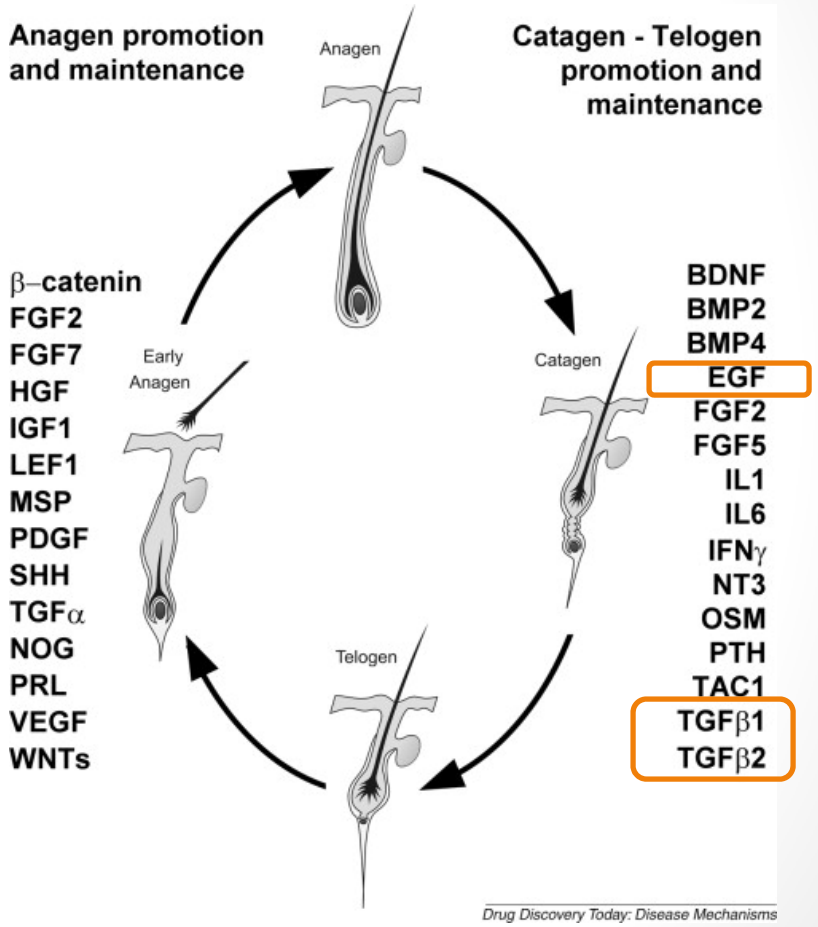
- Ratios were similar when multiple body sites were sampled

Diaz SF et al. *Vet Dermatol* 2004;15:225-229.

Molecular control of the hair cycle

Promotors of catagen/telogen

- EGF
  - Induces catagen in sheep
  - Mice that lack EGFR do not terminate anagen
- TGFβ1
  - Induces premature catagen
  - TGF-β1 knockout mice have delayed catagen onset

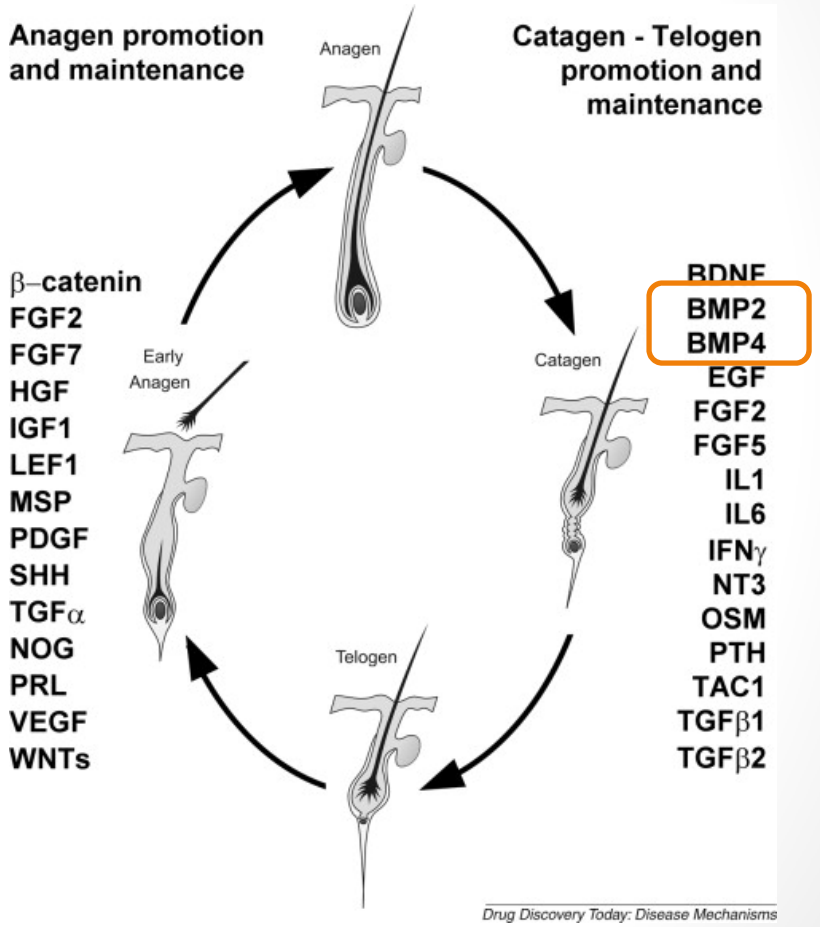


Promotors of catagen/telogen

- Fibroblast growth factor 5 (FGF5)
  - Terminates anagen
  - Deletion in mice results in angora-like

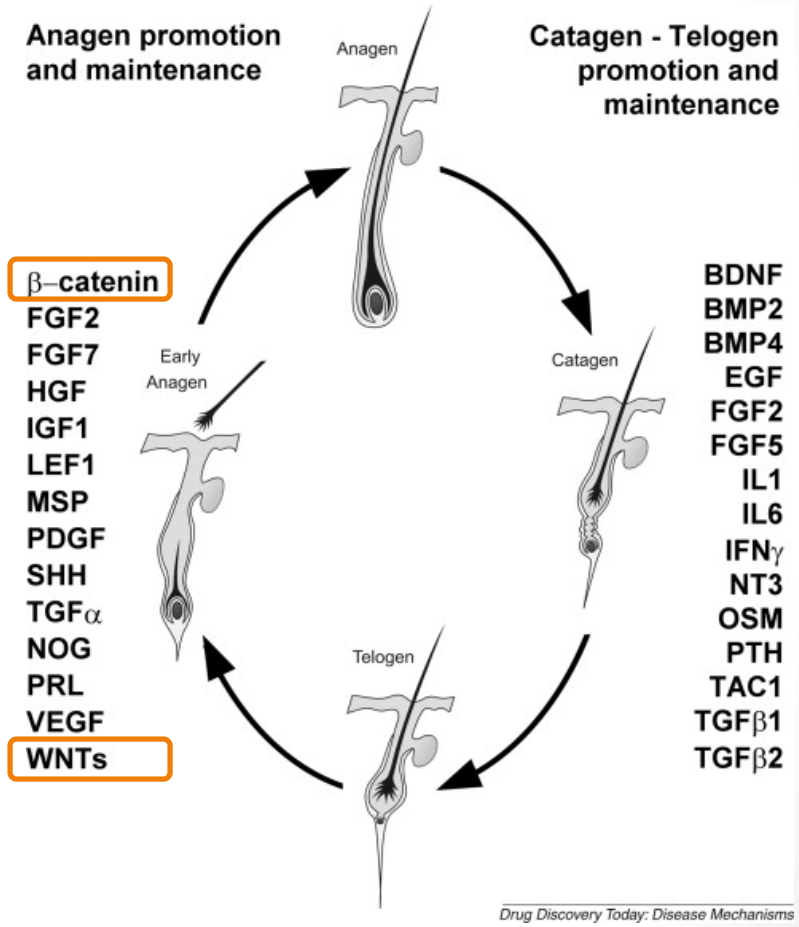
Promotors of catagen/telogen

- Bone morphogenic protein (BMP) signaling
  - Member of TGF family
  - Essential for differentiation of IRS and hair shaft
  - Maintains hair in telogen/prevents anagen initiation
  - Modulated by noggin



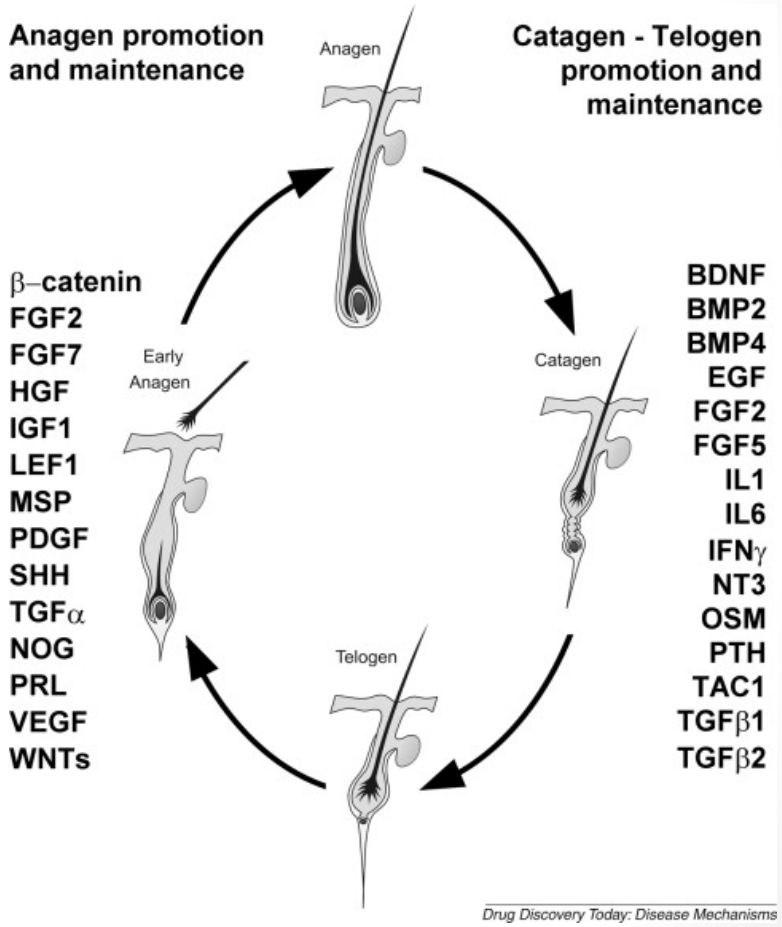
Promoters of anagen

- Primary initiators of new hair cycle and anagen onset involve Wnt/β-catenin signaling pathway interaction
  - Differentiation of stem cells into hair follicle keratinocytes



Promotors of anagen

- KGF
  - Produced by anagen papilla
  - Receptor is FGFR2
- IGF-1
  - Maintains hair follicle growth
- Sonic hedgehog (Shh)
  - Critical for hair follicle morphogenesis
  - Critical for anagen induction



Role of Vitamin D receptor

- VDR knockout mice
  - Smaller
  - Severe alopecia
- Important for stem cells in bulge region
- Interacts with Wnt
- Interacts with Shh

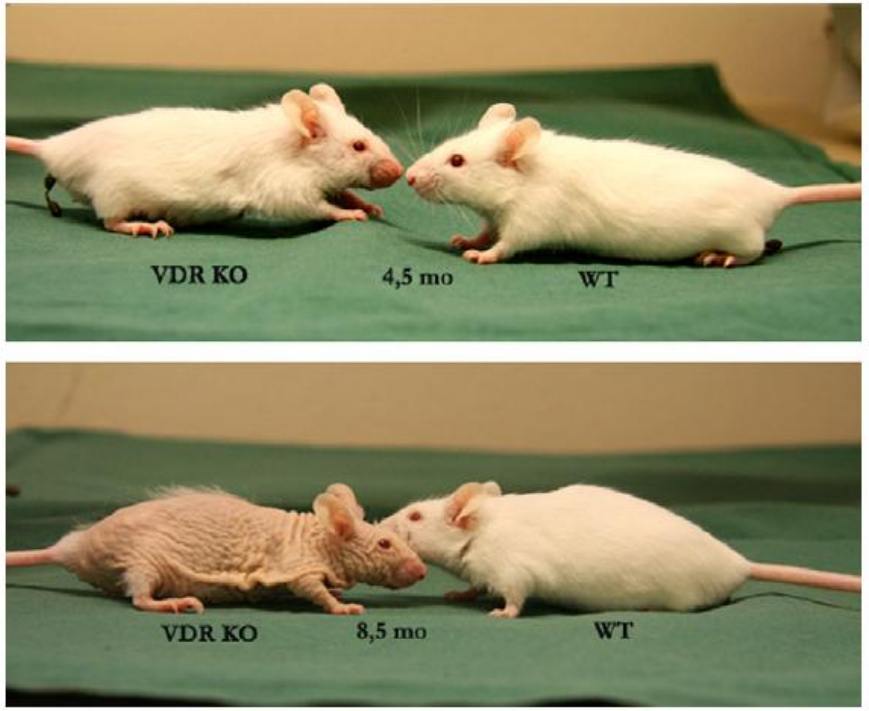
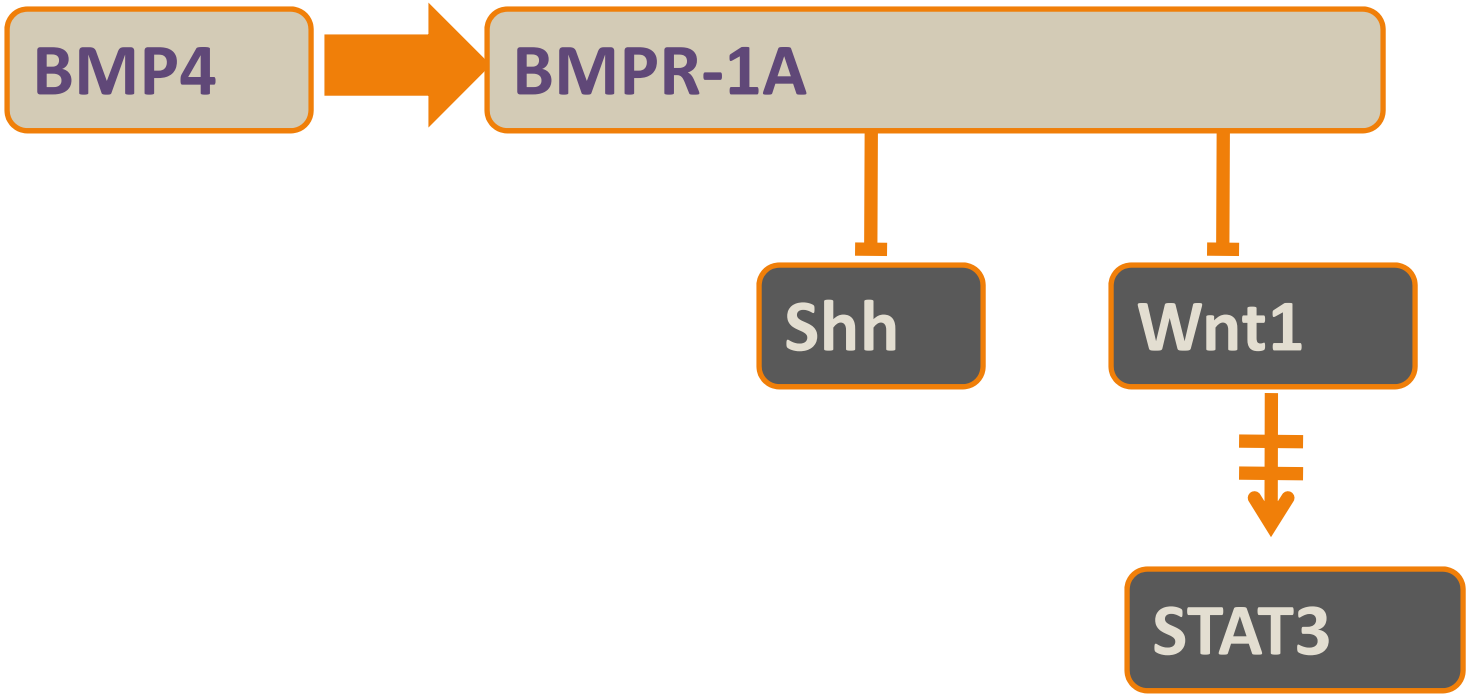


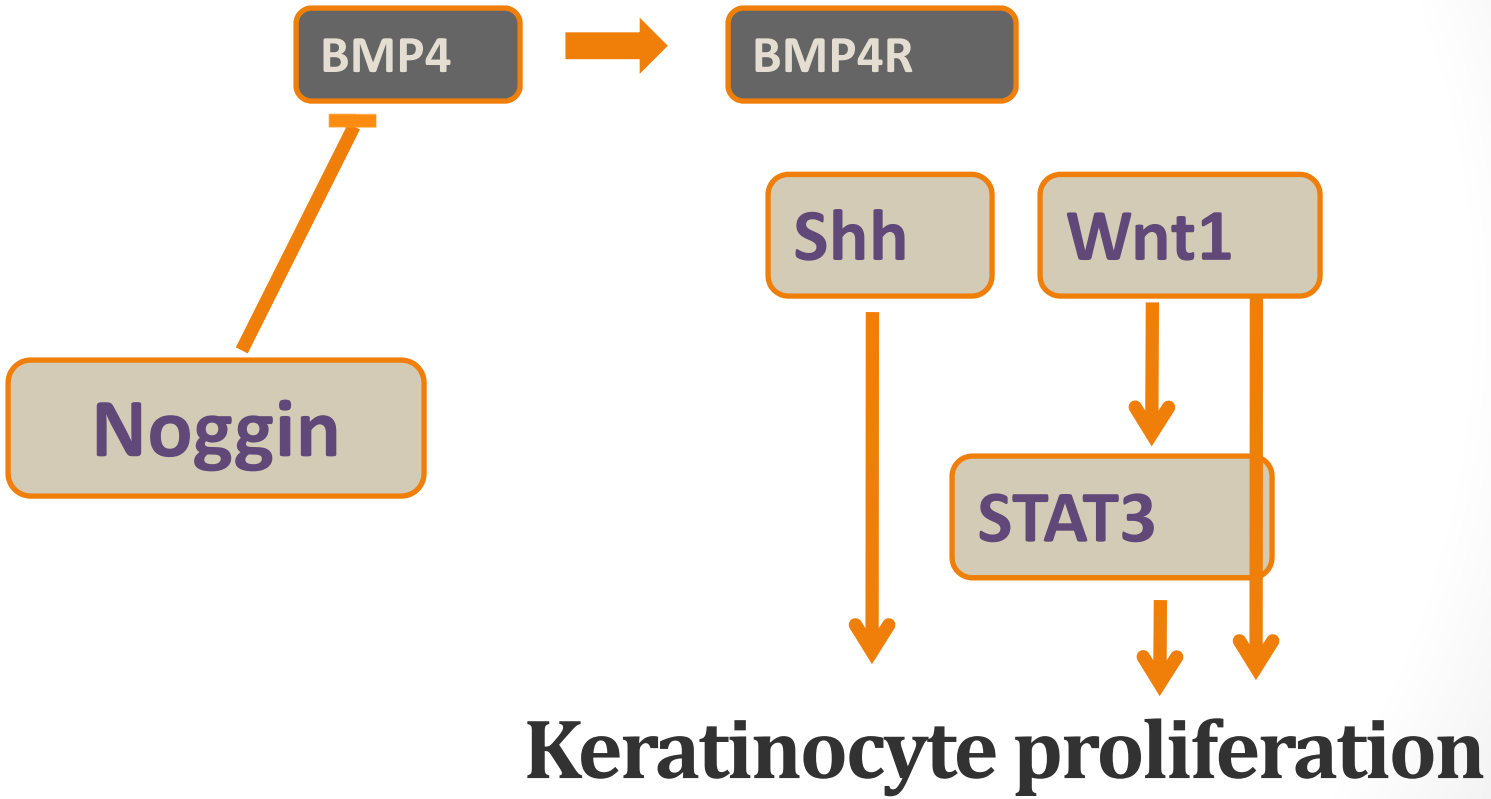
Fig. 2. Phenotype of VDR knockout mouse (KO) compared to wildtype littermate (WT; NMRI background strain) at the age of 4.5 (top) and 8.5 (bottom) months.

Telogen Hair



(signal transducer and activator of transcription 3)

Anagen Hair


BMP4
BMP4R
Noggin
Shh
Wnt1
STAT3
Keratinocyte proliferation

Trauma/wounding

- Causes anagen induction
  - Proinflammatory cytokines
  - Decrease of BMP4
- Refractory telogen
  - No anagen induction

Day of skin wounding

42 Days following healing of wound

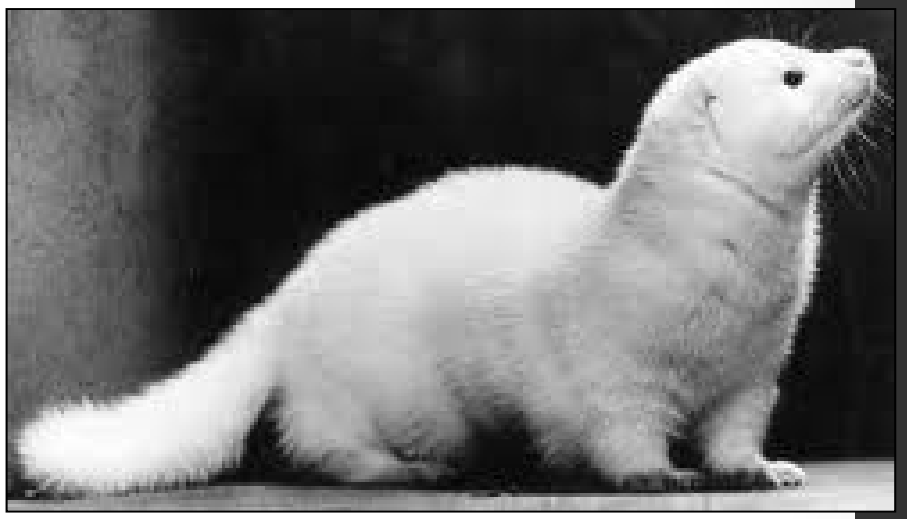
Hormonal Control

Seasonal control

- Pineal gland
  - Neuroendocrine transducer
  - Day length is the most important influence
  - Melatonin inversely related to day length
  - Melatonin and prolactin influence reproductive development and function

Prolactin

- Prolactin stimulates shedding in sheep and mink
- Seasonal increases in prolactin during spring induce anagen in Cashmere goats
- Mouse model – prolactin led to catagen
  - Induction of apoptosis in hair matrix keratinocytes
  - Inhibition of proliferation of hair matrix keratinocytes



Foitzik K et al. *J Invest Dermatol* 2009;129:1071-1087.

Melatonin in dogs

- Influences reproductive development via gonadotropin release
  - Significantly decreased estradiol, testosterone, and DHEAS in intact female Beagles
  - Significantly decreased estradiol and 17OHP in intact male Beagles
- No effect on sex hormone concentrations in neutered dogs.
- No effect on thyroid or adrenocortical activity

Melatonin and hair growth

- May affect hair growth via increased concentrations of GH or IGF-1
- Blocks estrogen receptors in human breast cancer cells
  - Induce anagen via estrogen receptor pathway?

Melatonin and hair growth

- Hair follicle can synthesize melatonin
- Melatonin receptor is expressed in hair follicle
  - Down-regulates hair follicle keratinocyte apoptosis in mice
  - Down-regulates ERα expression in mice
- Topical application of melatonin had no effect on hair growth in clipped Husky dogs

Thyroid hormones and hair

The effects of thyroid hormones on skin of beagle dogs

- Euthyroid, hypothyroid untreated, hypothyroid treated beagles were studied over 10 months

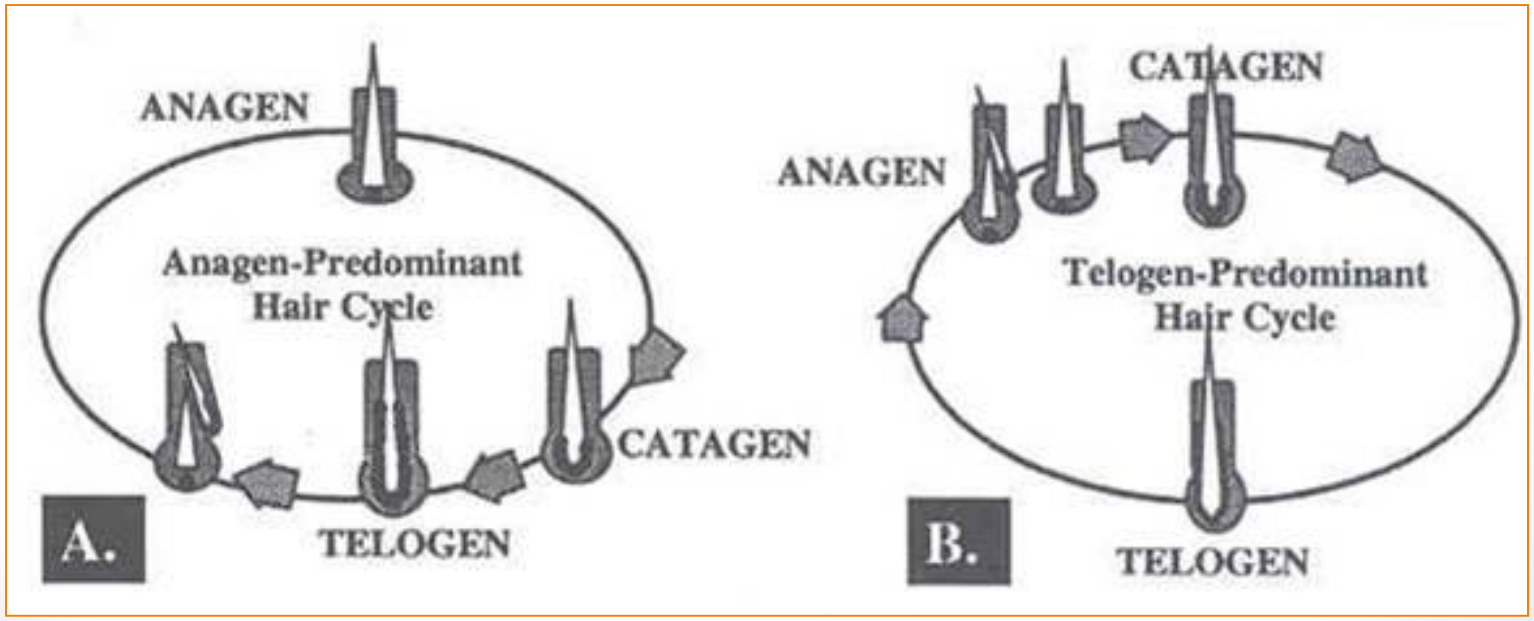
Credille KM et al. *J Vet Int M*ed 2001;15:539.

The effects of thyroid hormones on skin of beagle dogs

- Hypothyroid beagles **DID NOT** develop symmetrical alopecia
- Some developed **seborrhea**, 2 developed **alopecia over the nose bridge**
- Hairs **DID NOT** regrow after clipping

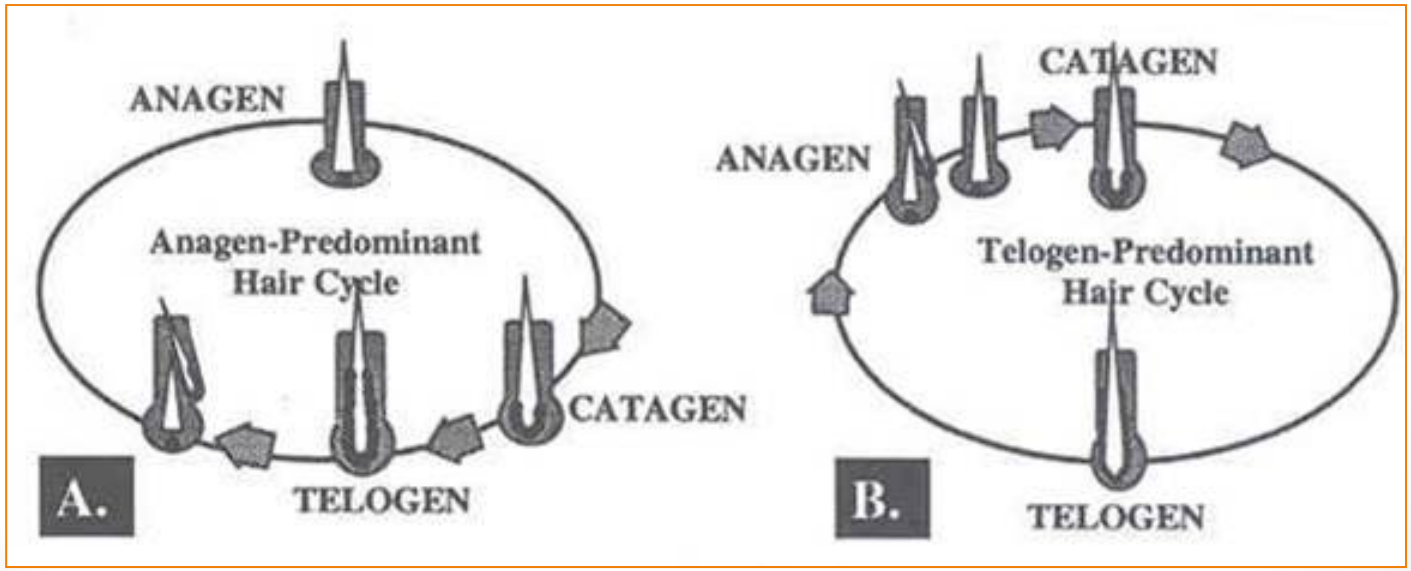
The effects of thyroid hormones on skin of beagle dogs

- Histopathology
  - All groups had predominance of follicles in telogen
  - No difference in size of adnexal glands
  - Flame follicles occasionally seen in all groups



The effects of thyroid hormones on skin of beagle dogs

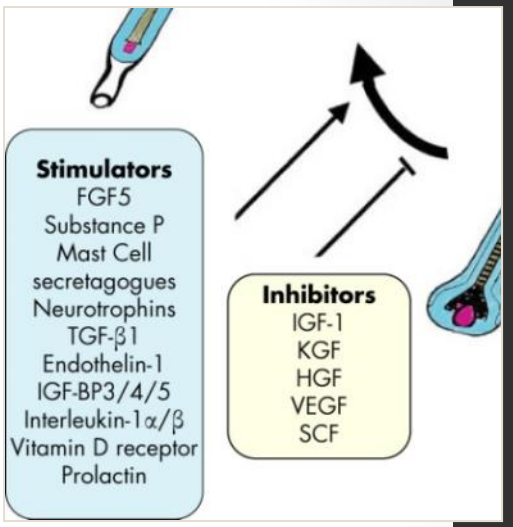
- Morphometric evaluation
  - Increase in kenogen and decrease in anagen follicles in untreated hypothyroids
  - Treated hypothyroid had **more** hairs in anagen than controls



Thyroid hormones and hair

- Thyroid hormones
  - Accelerate follicular activity
    - General metabolic stimulus

Thyroid hormones and hair



- Thyroid hormones
  - Accelerate follicular activity
    - General metabolic stimulus
    - Directly affecting hair growth
      - T4 up-regulates human hair matrix keratinocytes
      - T3 and T4 down-regulate apoptosis, preventing catagen
      - T3 and T4 prolong anagen *in vitro* possibly via down-regulation of TGFβ (key anagen-inhibitory growth factor)

Glucocorticoids and hair

Corticosteroid effect on hair growth

- Suppress anagen and induce catagen in mice

Effect of steroids on hair growth

Hormone	Follicle growth
Betamethasone	2.61
Prednisone	3.94
Hydrocortisone	3.71
Progesterone	5.45
Dihydrotestosterone (DHT)	6.13
Estradiol	5.80
Aldosterone	5.88

Corticosteroid effect on hair growth

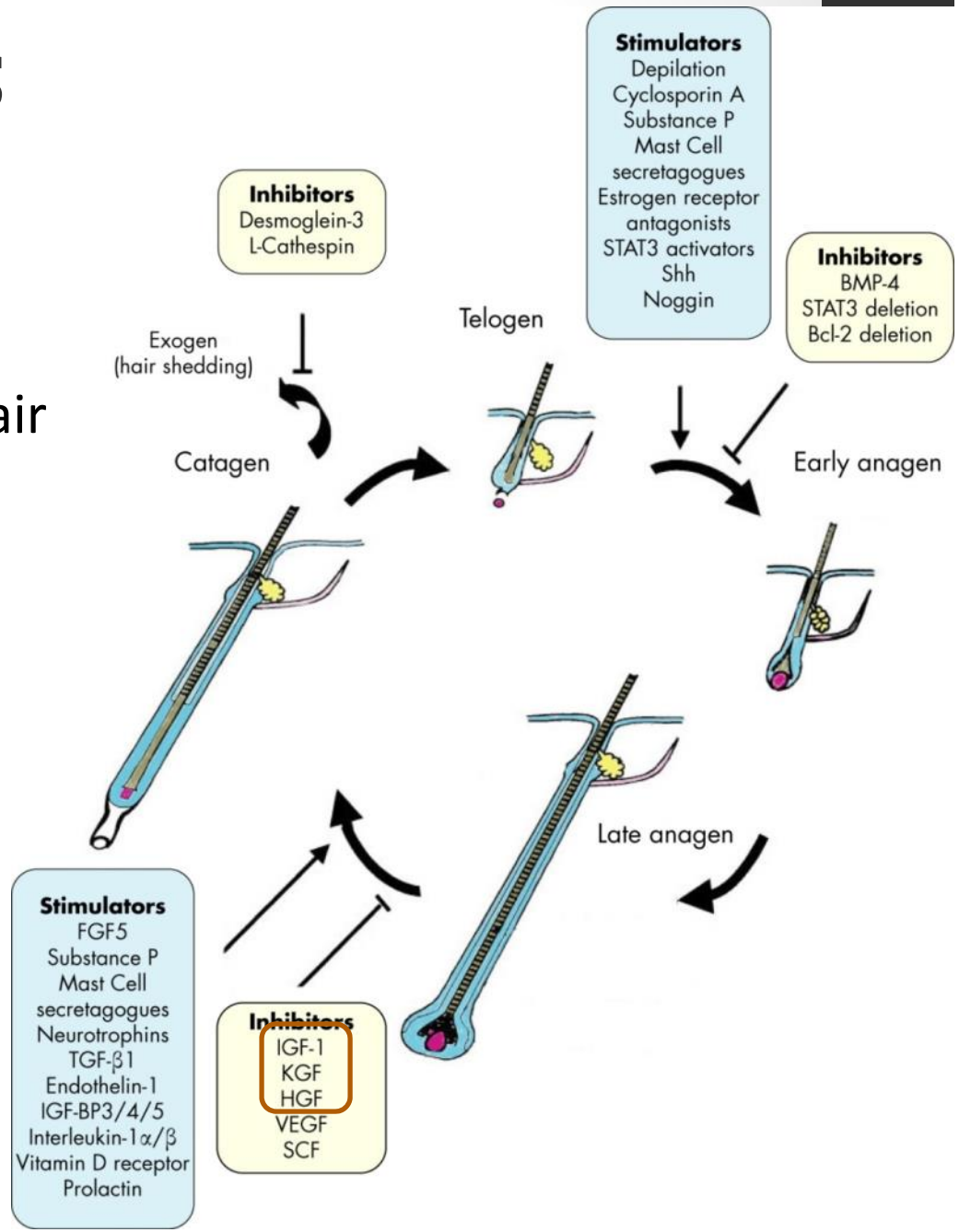
- Blocks trauma-induced anagen

Trauma-induced anagen

- Suspends rather than prevents anagen induction
  - Application of steroid, then stimulus for anagen induction
  - No anagen as long as steroid is present
  - Withdrawal of steroid results in resumption of anagen growth

Glucocorticoids

- Block KGF and HGF
  - Both important in anagen hair growth
- Inhibit IGF-1



Glucocorticoids and estrogen receptor

- Human cultured dermal papilla
  - Reduce ER alpha
  - Increase aromatase expression
- Influence hair cycle through estrogen receptor modulation?

Progesterone and hair

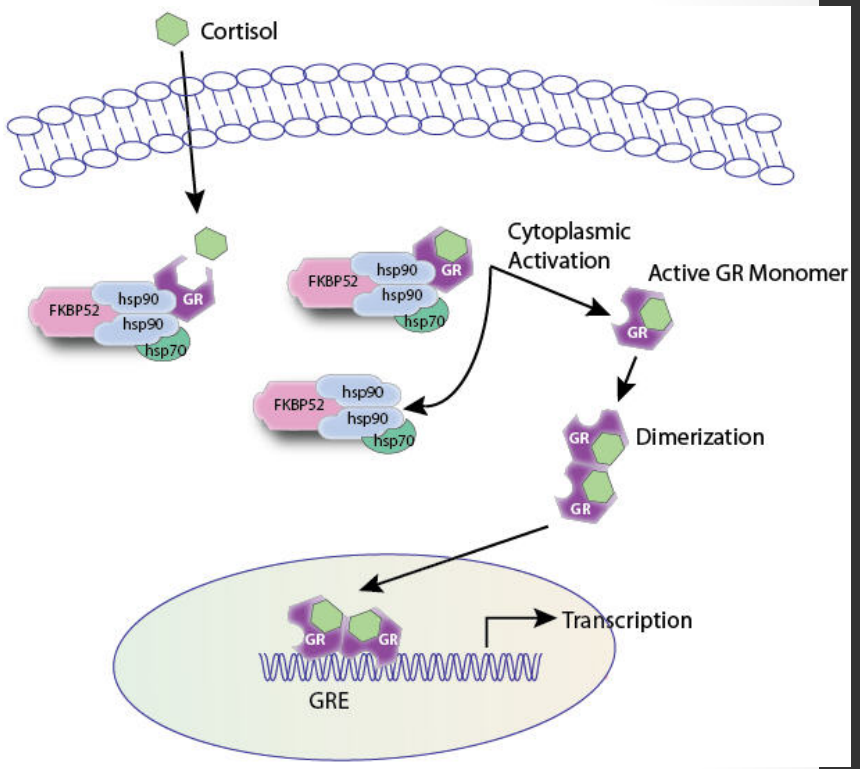
Progesterone and hair

- All progestins have
  - Corticoid
  - Anti-corticoid
  - Androgenic
  - Anti-androgenic

- Suppression of hypothalamic-pituitary-adrenal axis reported in people, dogs, cats.

Progesterone and hair

- Binds to glucocorticoid receptor
  - Medroxyprogesterone > Proligestone > Progesterone in dogs



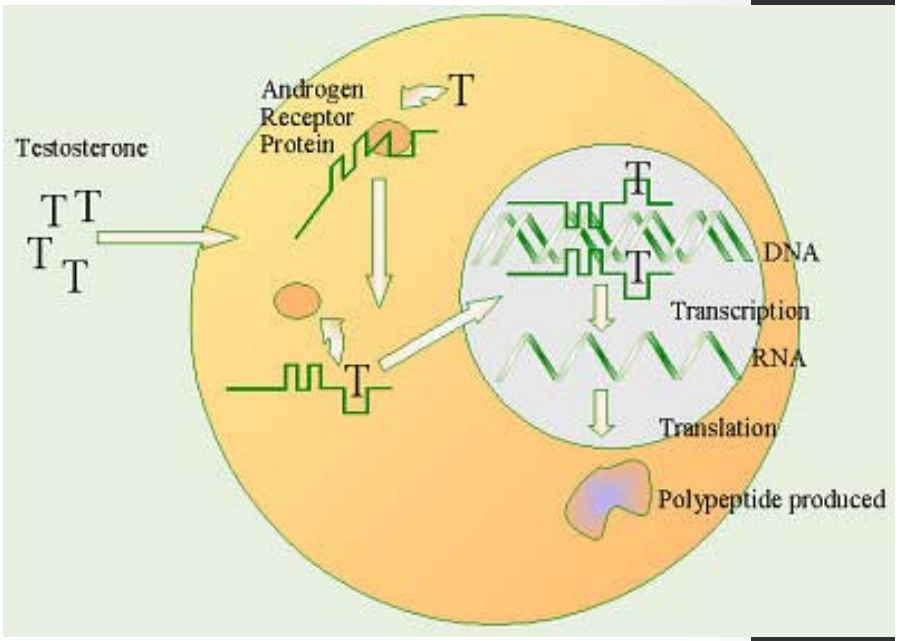
Progesterone and hair

- Dermal papilla and fibroblasts from canine hair follicles produce cortisol following incubation with progesterone *in vitro*
  - More pronounced from head
  - Significance is unknown

Bamberg E, et al. Vet Dermatol 2005;16:153-155.

Progesterone and hair

- Cross-reacts with testosterone
  - Androgenic
  - Anti-androgenic
    - Blocks receptor
    - Negative feedback on the pituitary
      - Cyproterone acetate and drospirenone formulated with this in mind



Endocrine profiles of progestins

Type of Progestin	Anti-androgen	Androgen	Anti-mineral	Glucocort
Cyproterone acetate	++	0	0	+
Spironolact	++	0	++	0?
Drospirenone	+	0	+	0
Medroxyprog	±	±	0	+
Progesterone	±	0	+	±

Zouboulis CC et al. Sexual hormones in Skin. Horm Metab Res 2007; 39:85.

Estrogen and hair

Estrogen effects on hair and skin

- Estrogen inhibits hair growth in mice, rats, and dogs (1942)
- Estrogen decreases size of sebaceous glands and epidermal thickness in mice and rats (1943)
- Likely to have species variations
  - Prolongs anagen in pregnant women
  - Inhibitory effect on human non-balding scalp hair growth in vitro

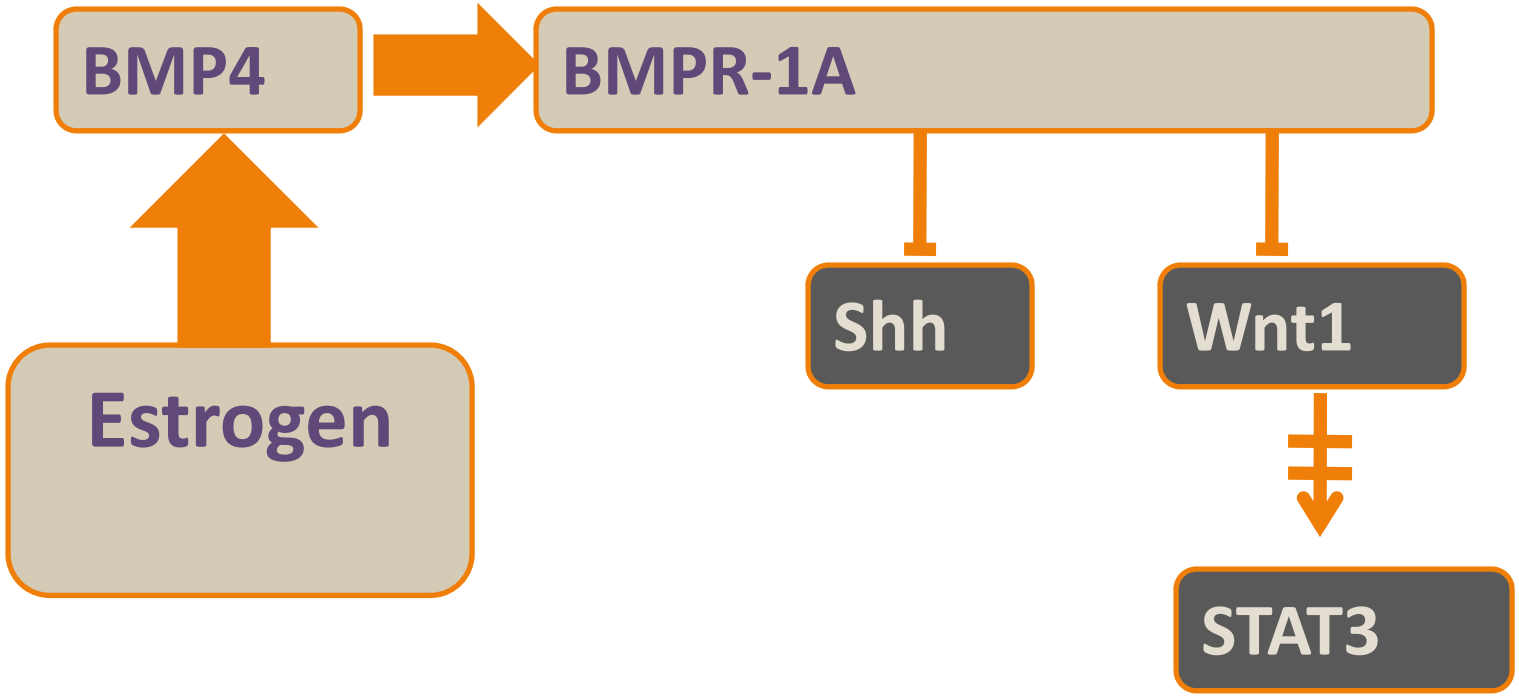
Estrogen receptor pathway

- Regulates anagen-telogen hair follicle transition in mice
  - Topical estradiol inhibits anagen
  - Blocked by estrogen receptor antagonist

- Antagonist accelerates anagen once anagen has been initiated by endogenous signals

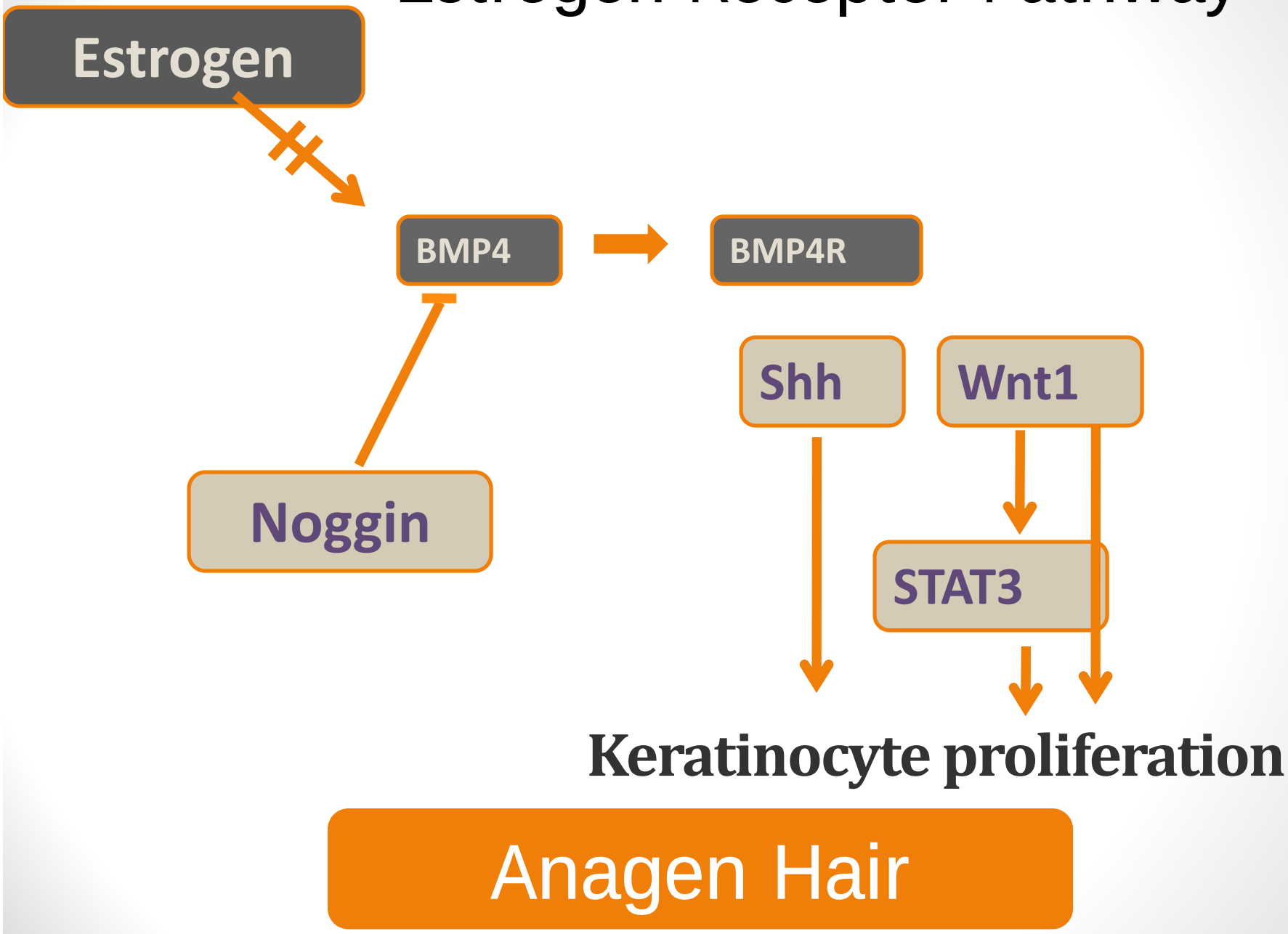
Oh and Smart. Proc Natl Acad Sci USA 1996; 93: 12525.

Estrogen Receptor Pathway



Telogen Hair

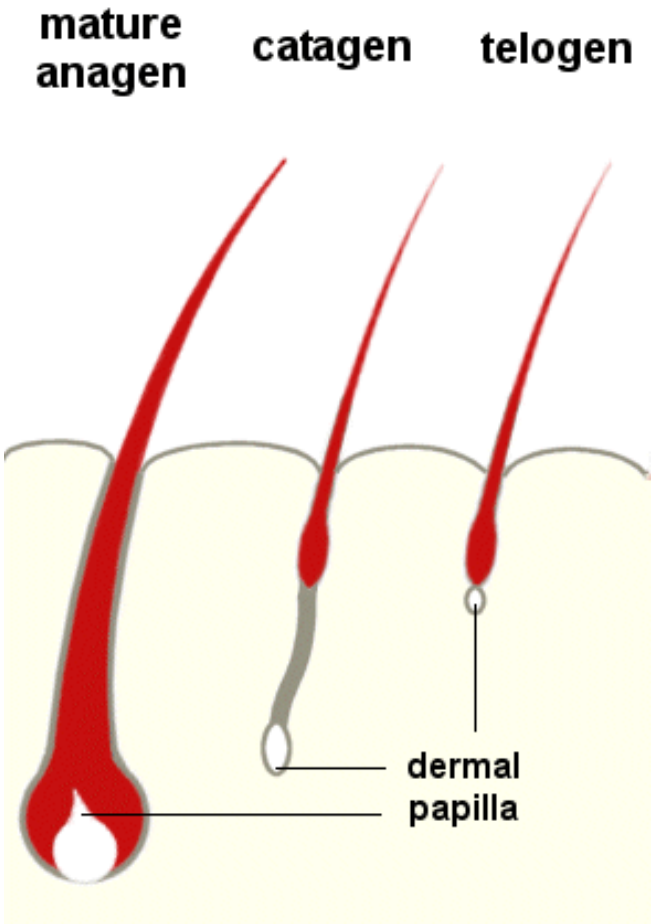
Estrogen Receptor Pathway



Effect of estrogen on hair growth

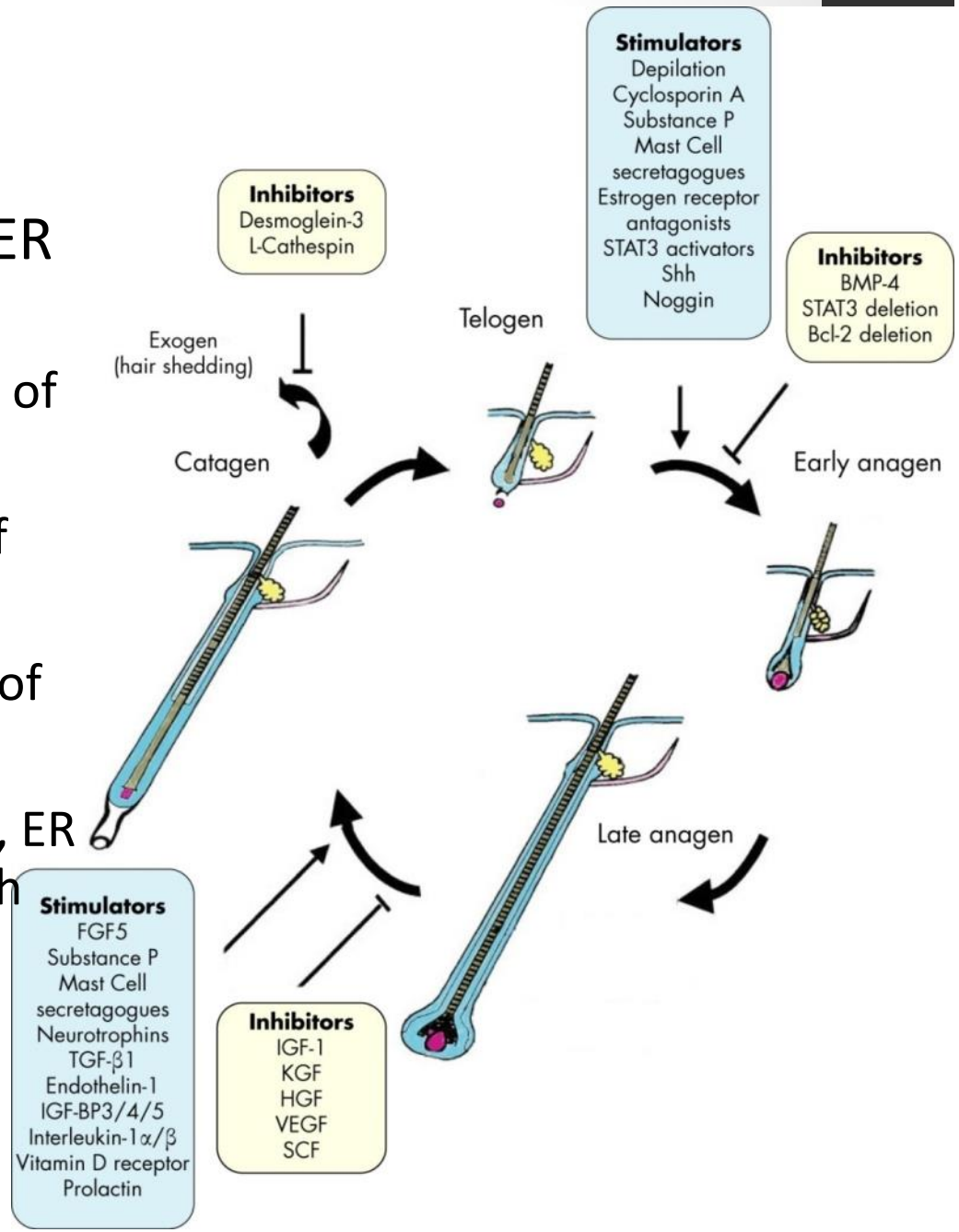
- Shortens anagen
- Promotes catagen via ERα
- Lengthens telogen phase
- Inhibits telogen to anagen transition

- Not essential for normal hair growth



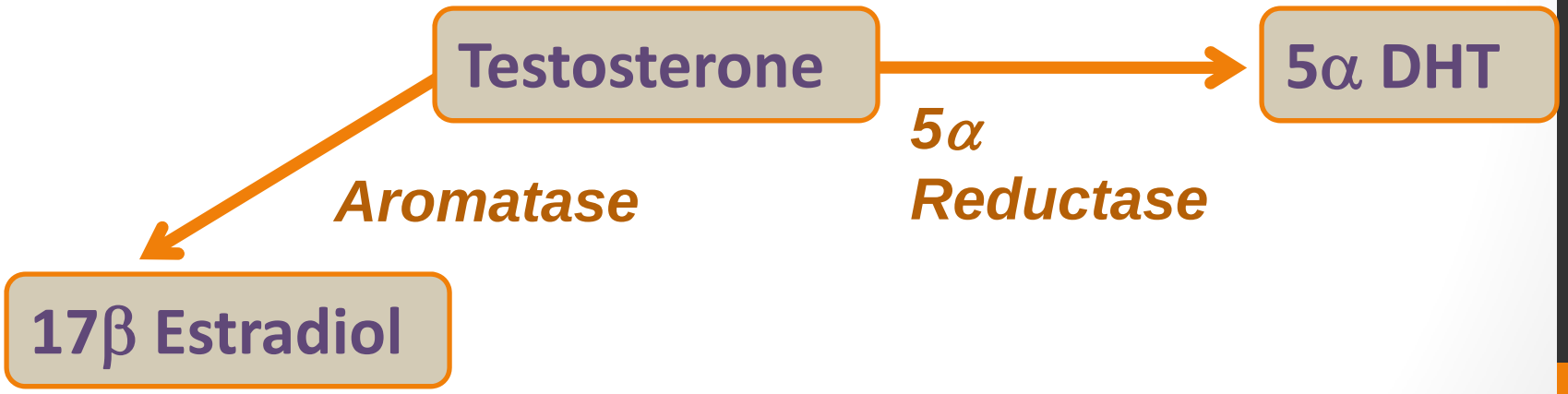
"Cross-talk"

- Between growth factors and ER
  - Growth factors (IGF-1, EGF, TGF alpha) regulate phosphorylation of ER
  - Estrogen regulates expression of these growth factors
  - Suggesting these are mediators of estrogen action
  - Even in the absence of estrogen, ER can be activated by these growth factors



Effect of estrogen on human hair

- Stimulate scalp hair growth
  - Possibly through anti-androgenic effects
  - Or strong expression of ERβ and not ERα



Spay-induced coat changes

- 15 dogs monitored for 1 year post-spaying
  - All dogs showed increase in anagen hairs
  - Only 3 dogs showed coat changes
  - FSH and LH increased post-spaying
    - LH receptors decreased
  - Hair diameter not measured
  - No age matched controls

Reichler IM et al. Vet Dermatol 2008; 19: 77-87.

Spay-induced coat changes

- 24 spayed dogs with side effects of spaying
  - 14 with coat changes
- Treated once with GnRH analogue SQ
- Assessed 8-16 weeks later
- Results
  - Improved coat (less wool hair, shinier) in 11/14
  - Effect lasted at least 6 months
  - Increase in percentage of catagen follicles
  - Decrease in FSH and LH in all 24 dogs

Reichler IM et al. Vet Dermatol 2008; 19: 77-87.

Spay-induced coat changes

- Telogen hairs more rapidly shed in spayed females
  - Estrogen implants helped retain the telogen hair
  - Neither castration nor testosterone had any effect

Ebling FJG. The hormonal control of hair growth. In: Organos CE, Happle R, eds. Hair and Hair Diseases. New York:Springer-Verlag 1990: 267-99.

Androgens and hair

Hyperandrogenism and alopecia

Dogs do not have androgen responsive follicles

- Do not grow hair in the presence of testosterone
- Do not lose hair in response to testosterone

Androgens and hair in dogs

- Canine hair follicles do not produce DHT from testosterone

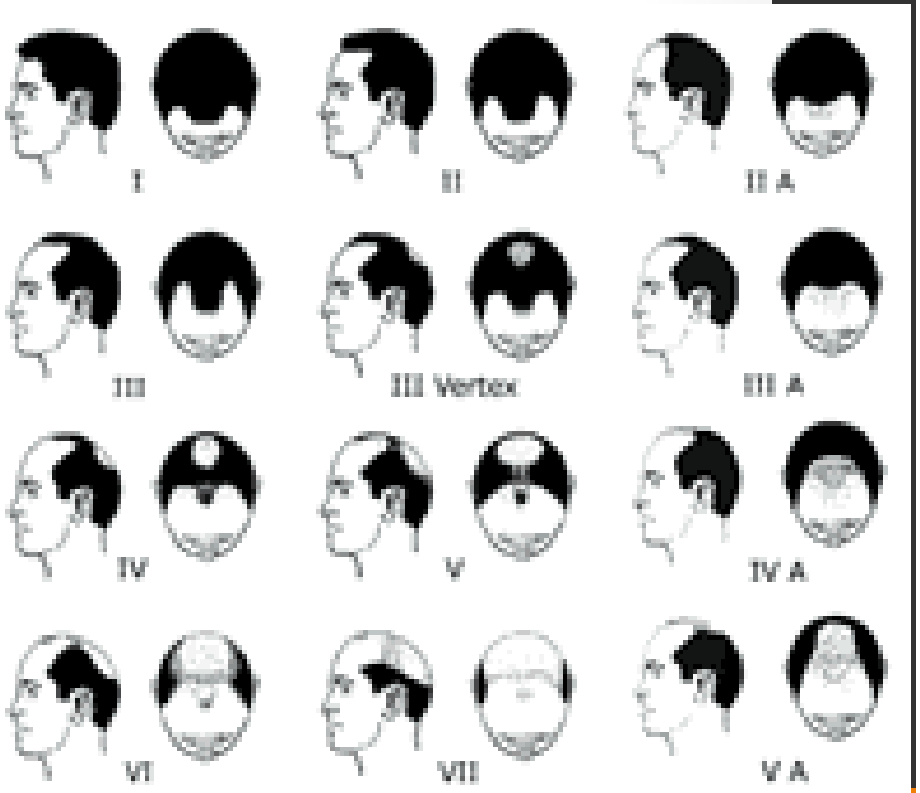
  Bamberg et al. *In vitro* metabolism of dehydroepiandrosterone and testosterone by canine hair follicle cells. Vet Dermatol 2004; 15: 19.

- Growth of canine hair follicles in vitro
  - No clear dose-dependent effect of sexual steroids (testosterone or estradiol) on daily growth

  Robia et al. J Vet Med A 2003; 50: 225.

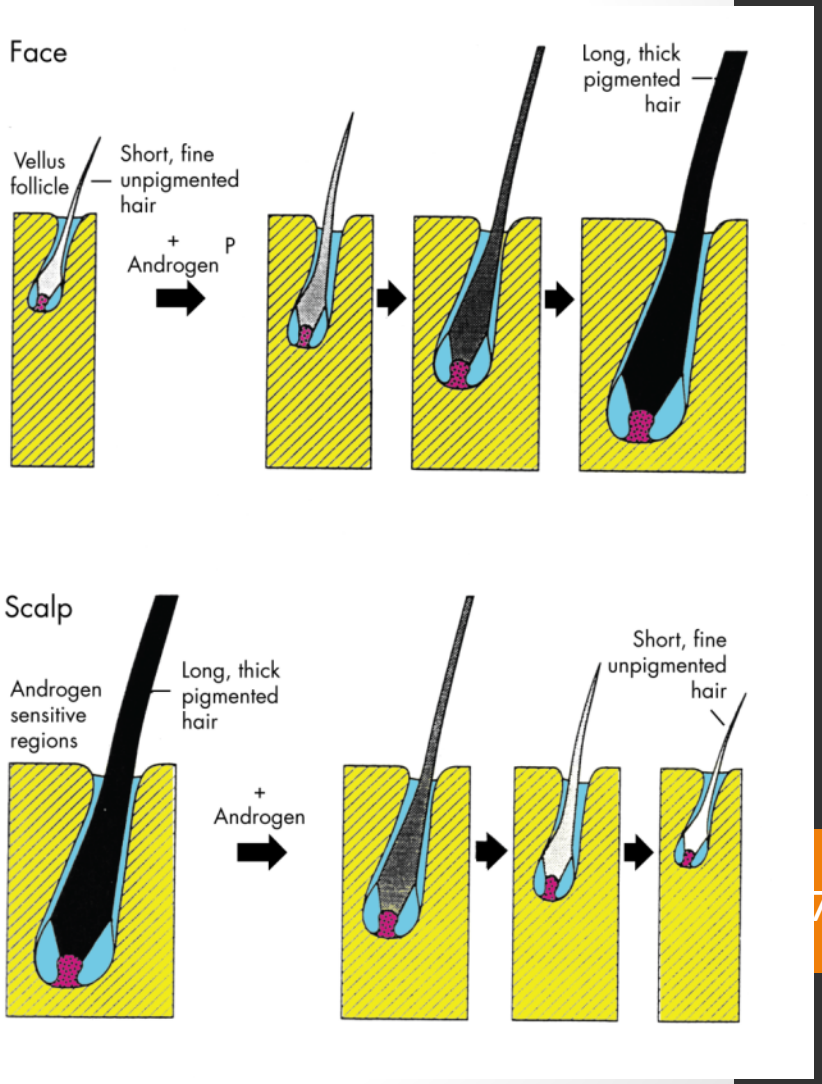
Androgens and hair in people

- Not fundamental to hair growth
- Increase hair growth except for eyelashes and scalp
- Critical to hair patterning
  - More androgen receptors



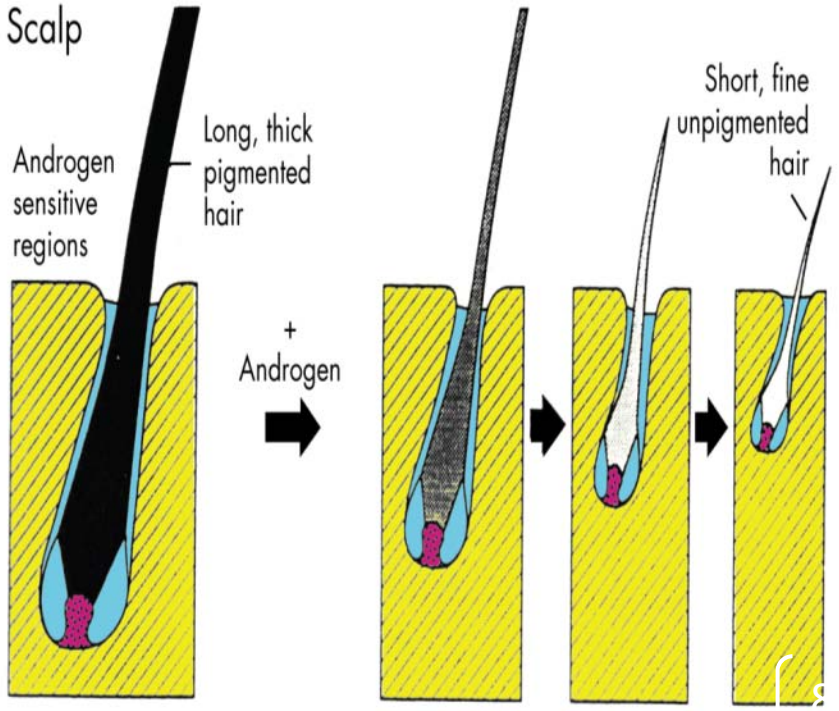
Androgens and hair in people

- Androgen sensitive follicles
  - Must express androgen receptors
  - Must convert testosterone to dihydrotestosterone (DHT)



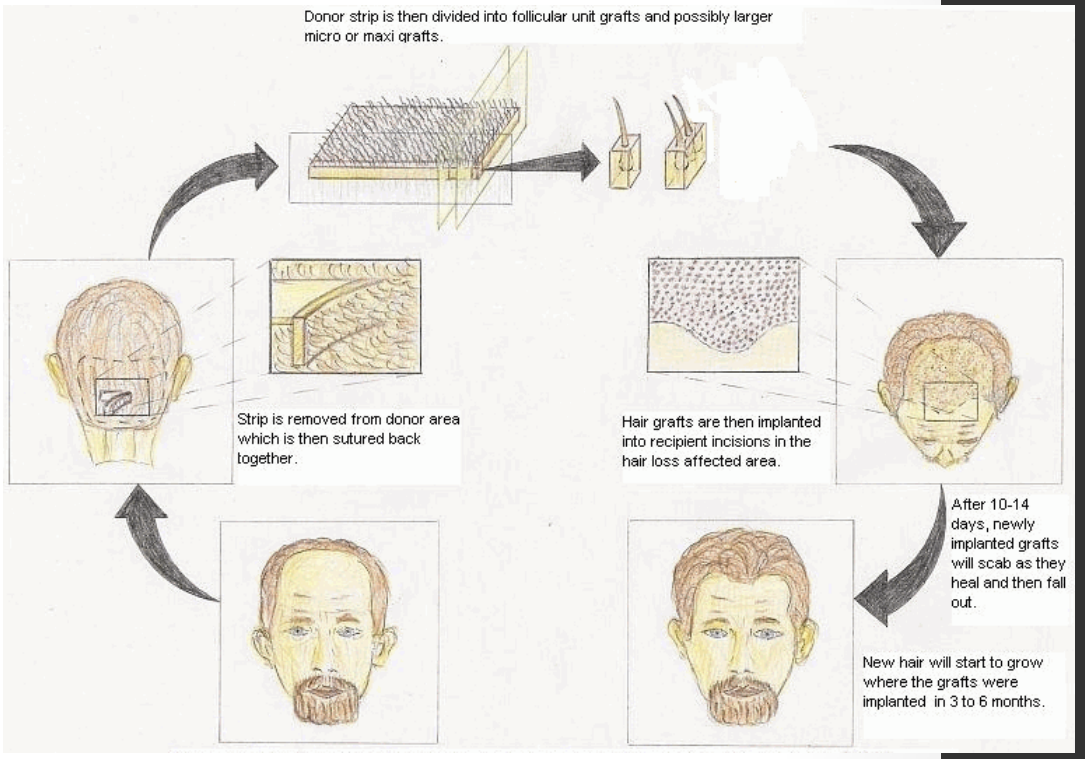
Androgens and hair in people

- Male scalp hair follicles
  - Become miniaturized
  - Shortened anagen
  - Mediated through DHT production



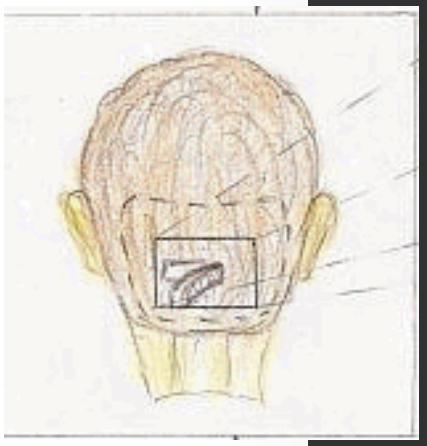
Androgens and hair in people

- Control of hair response to testosterone in dermal papilla
- Transplantation of normal hairs to balding areas retain site-specific behavior



Androgens and hair in people

- Regions that do not experience androgenic balding have higher aromatase levels




SOME MEN WILL TRY ANYTHING TO HIDE A BALD SPOT!

Immunology of the hair follicle

Immunology of the hair follicle

- High density of APCs in upper portion of hair follicle
- Lower follicle
  - Immune privilege
    - Low numbers APCs
    - Suppressed MHC II antigen presentation
    - Absence of MHC I in ORS and matrix cells
    - Expression of immunosuppressive mediators {αMSH, TGFβ1 and ACTH} may contribute
    - Bulb devoid of lymphatics and has special extracellular matrix
  - Hair cycle dependent manner

Selected diseases of the hair follicle and cycle

Telogen defluxion (effluvium)

- Acute telogen defluxion
  - Our classic telogen defluxion
- Immediate telogen release
  - Terminates telogen retention
- Chronic telogen defluxion
  - Increased telogen shedding for 6 months or more
  - Self-limiting disorder

Telogen defluxion

Acute telogen defluxion

- Hair loss 1-3 months after stressful incident or illness

From: Small Animal Dermatology Color Atlas (M. Austel)

Role of substance P

- Neuropeptide stored in perifollicular nerve endings
- Mouse model
  - Sound stress resulted in abrupt cessation of anagen
    - Increased apoptosis in the hair follicle resulting in premature catagen
    - Increased perifollicular macrophage clusters
    - Increased mast cell degranulation
  - Duplicated with substance P injection
  - All of the above can be counteracted by specific SP receptor antagonists

Arck PC, et al. Am J Pathol 2003;162:803-814.

Anagen defluxion

- Anagen phase interrupted
- Hair loss within 7-14 days
  - Immediate anagen release – normal bulb
  - Dystrophic form – abnormal bulb
- Hair regrowth in 3-4 months

Immediate telogen release?

Congenital hypotrichosis

Congenital hypotrichosis

- Reduction in number of hair follicles formed

Or

- Hair follicles formed at normal density
  - Fail to regenerate following second or third catagen

Follicular dysplasia

- Abnormal hair development
- Density of hair is normal
- Structural changes
  - Fragile
  - Malformed

Mexican hairless dog

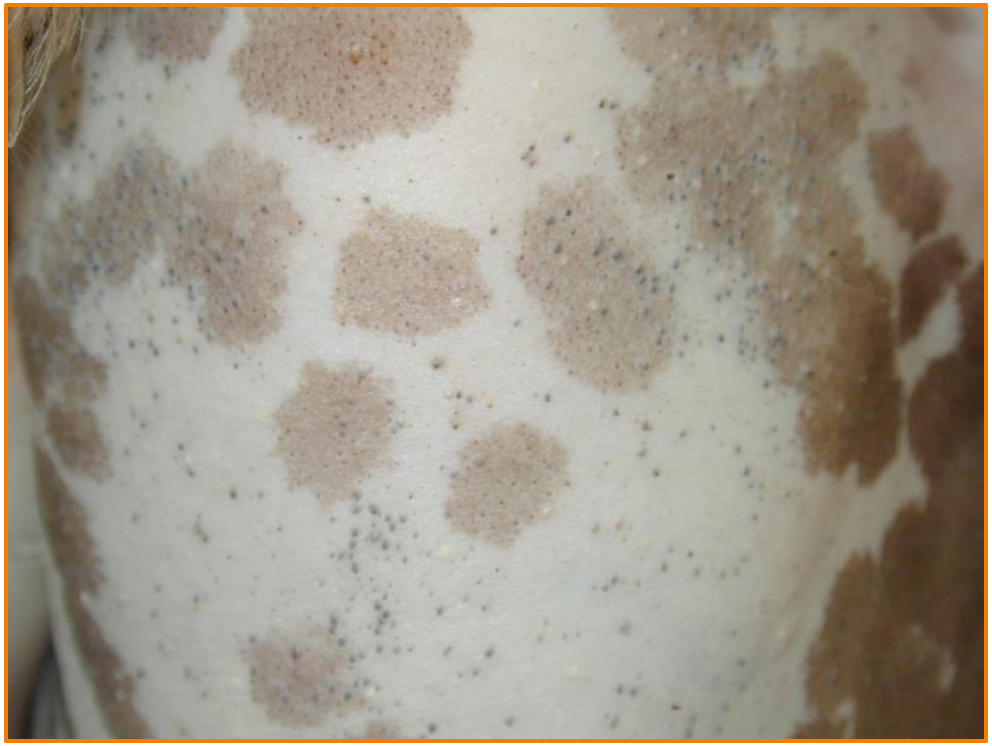
- Autosomal dominant (Hm)
- Associated with other ectodermal defects
- Initially normal density of hair follicles that cannot produce hairs
- Likely undergo atrophy with time
- Comedones are prominent

Chinese crested dog

- Autosomal dominant (hr)
  - Prenatally lethal when homozygous
- Follicles – simple, deformed, dysplastic
- Comedones prominent
- Sebaceous and sweat glands functioning
- Dentition abnormalities

Wiener DJ, et al. *Vet Dermatol* 2013; 24: 274.

Chinese crested dog

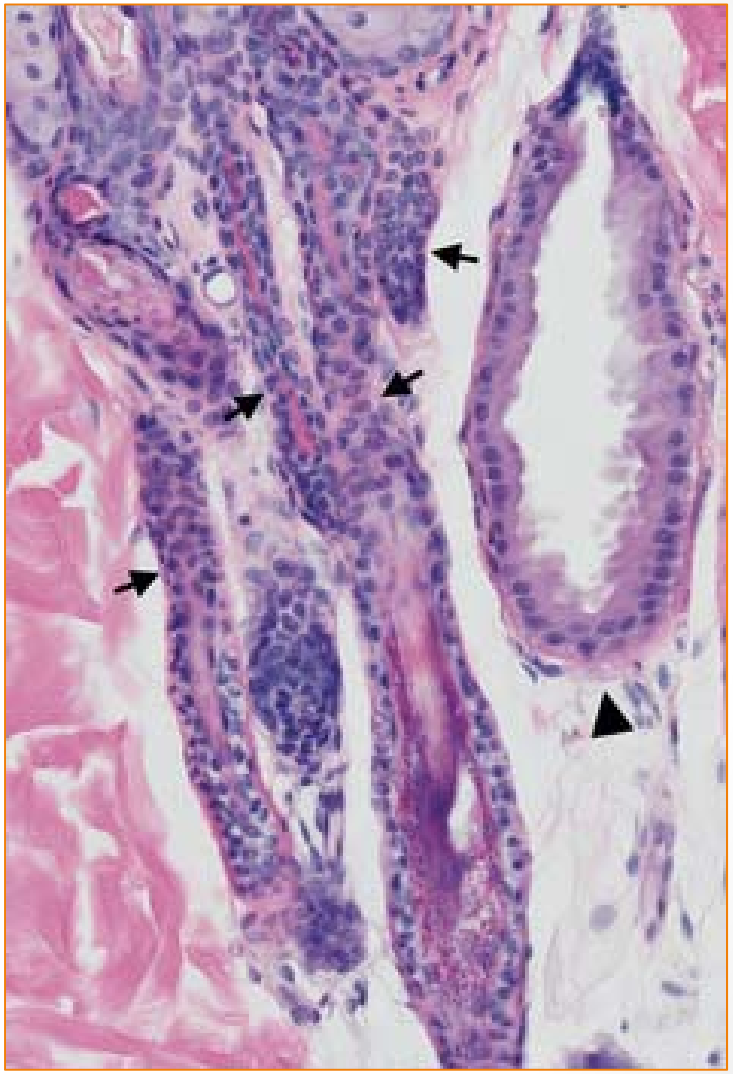


Sphynx cat

- Related to Devon rex
- Autosomal recessive (hr)
  - Mutation in keratin 71 gene
  - Type II keratin in IRS

Sphynx cat

- Histopath changes
  - Hairs primarily in anagen
  - Fragile hair shafts
  - Follicles often bent or curved
  - Increased kenogen
  - Hair follicle density and follicle group size similar to normal

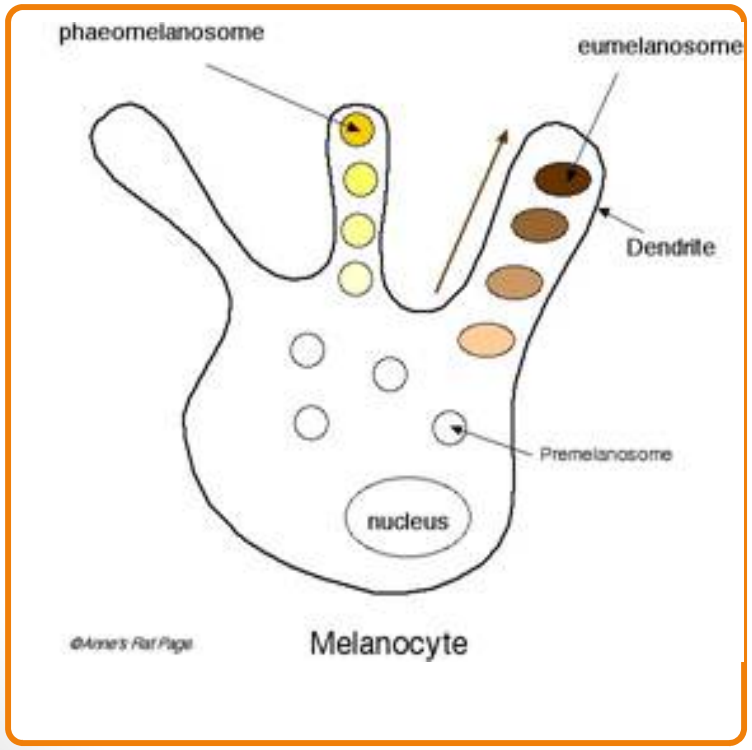


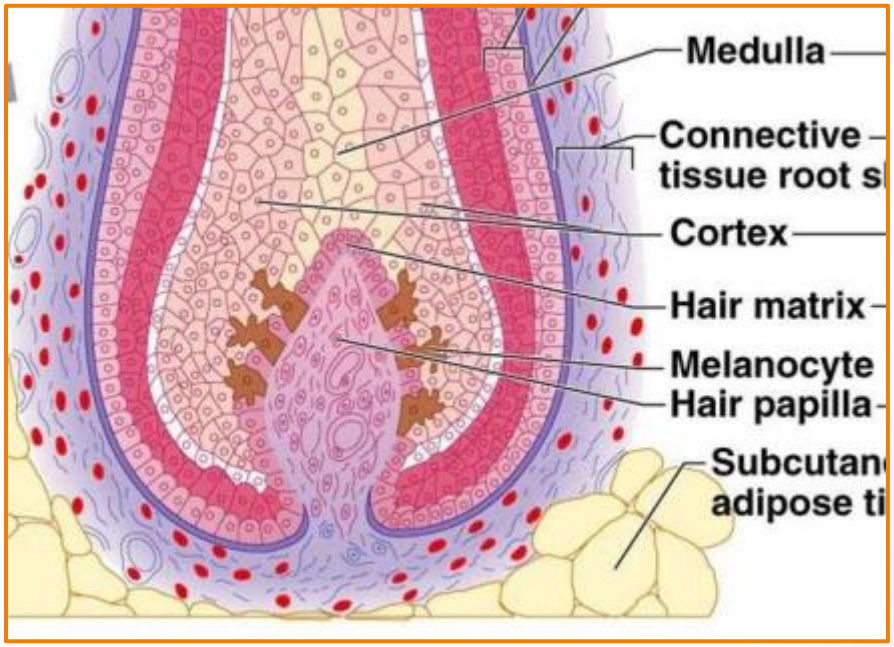
Genovese DW, et al. *Vet Dermatol* 2014; 25: 523.

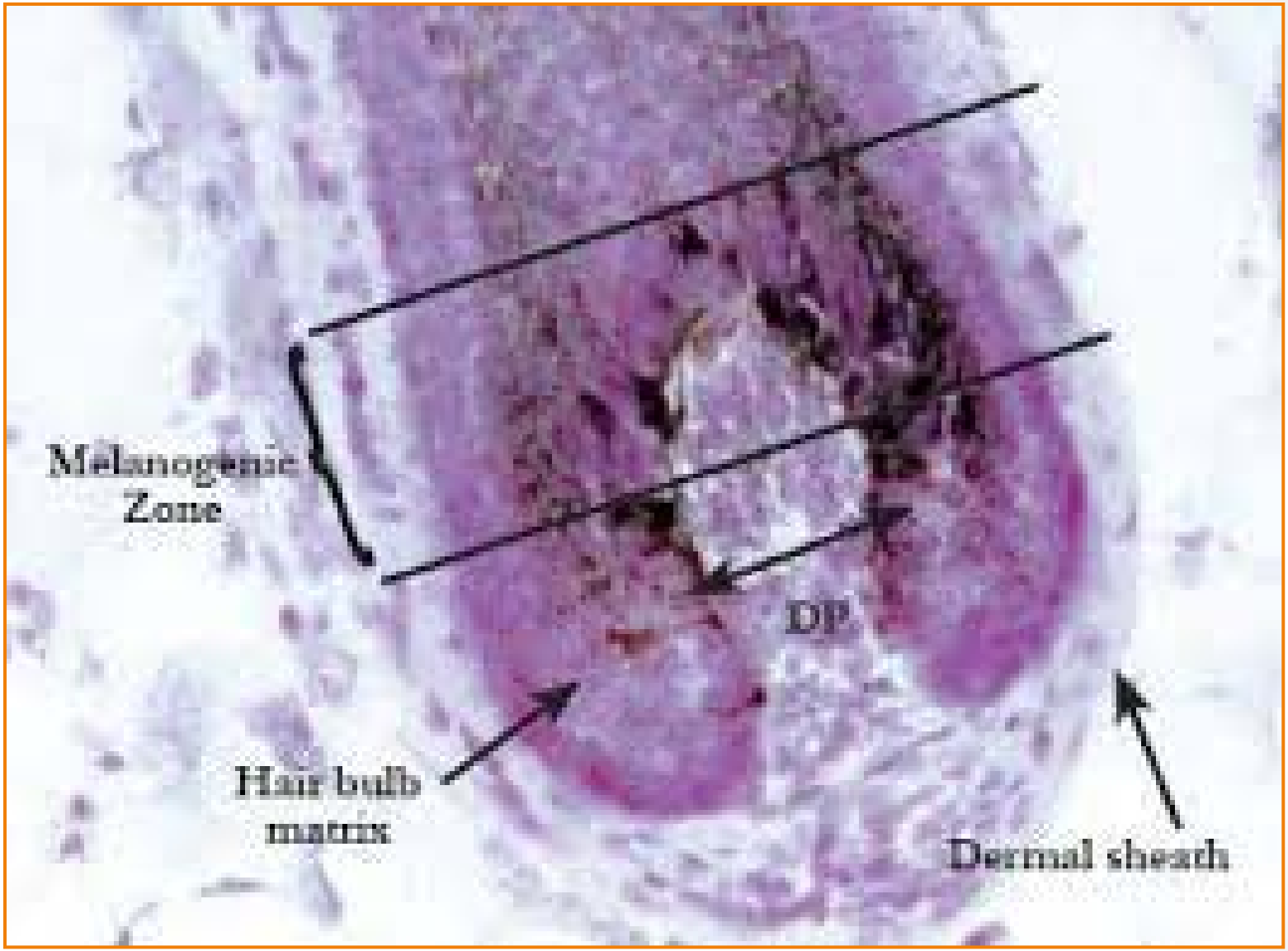
Color linked follicular dysplasias

Hair pigmentation

- Occurs during anagen
  - Melanosomes migrate and are transferred into hair matrix

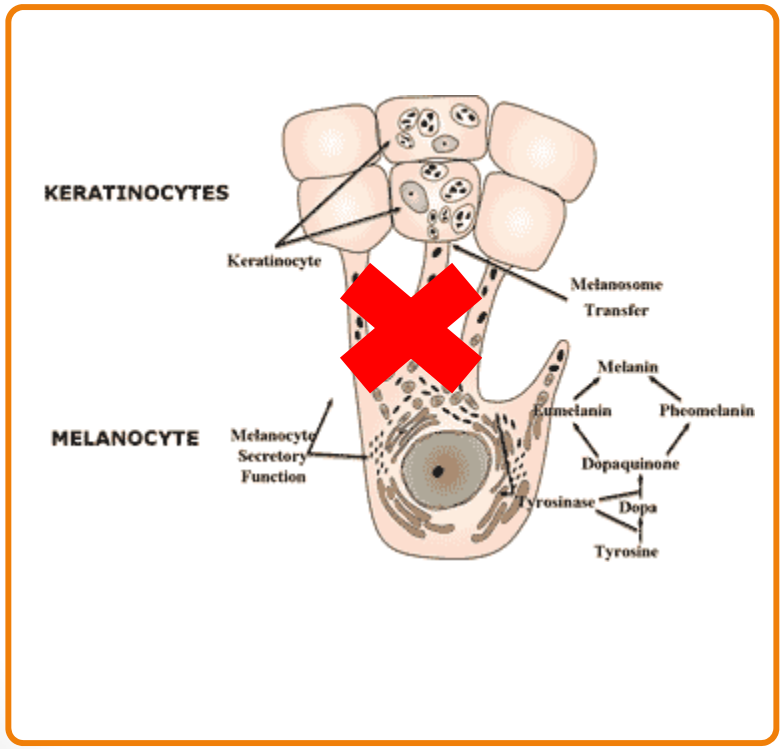


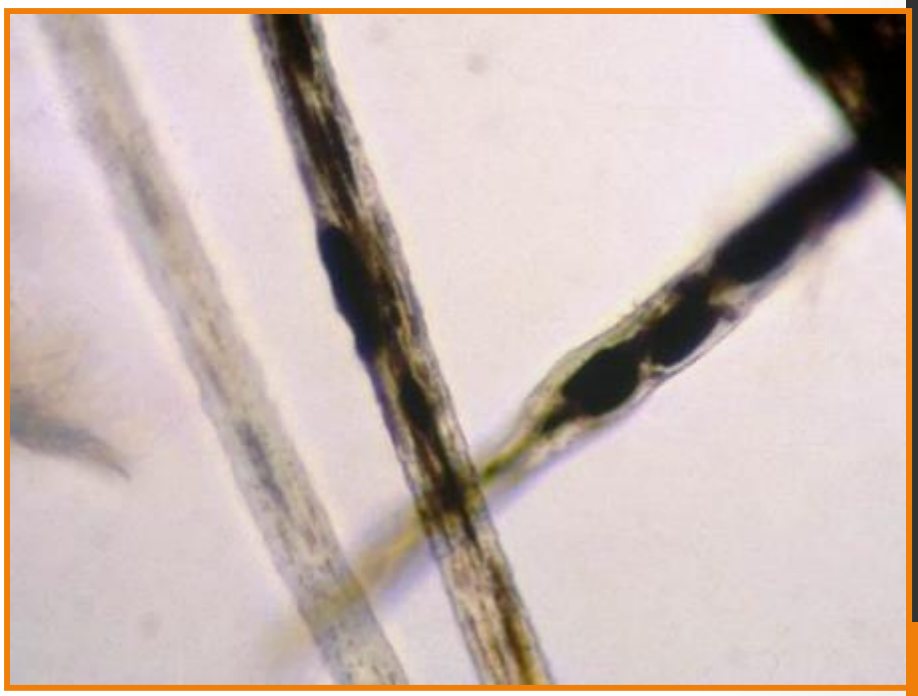



Melanogenic
Zone
DP
Hair bulb
matrix
Dermal sheath

Color linked follicular dysplasias

- Defect in melanosome migration/transfer
  - Neuroectodermal defect
  - Possibly linked to melanophilin gene





Color linked follicular dysplasias

- Pathomechanism of alopecia
  - Unknown
  - Theories include
    - Increased fragility of hair shaft with subsequent plugging of follicle
    - Hair cycle arrest secondary to melanin release

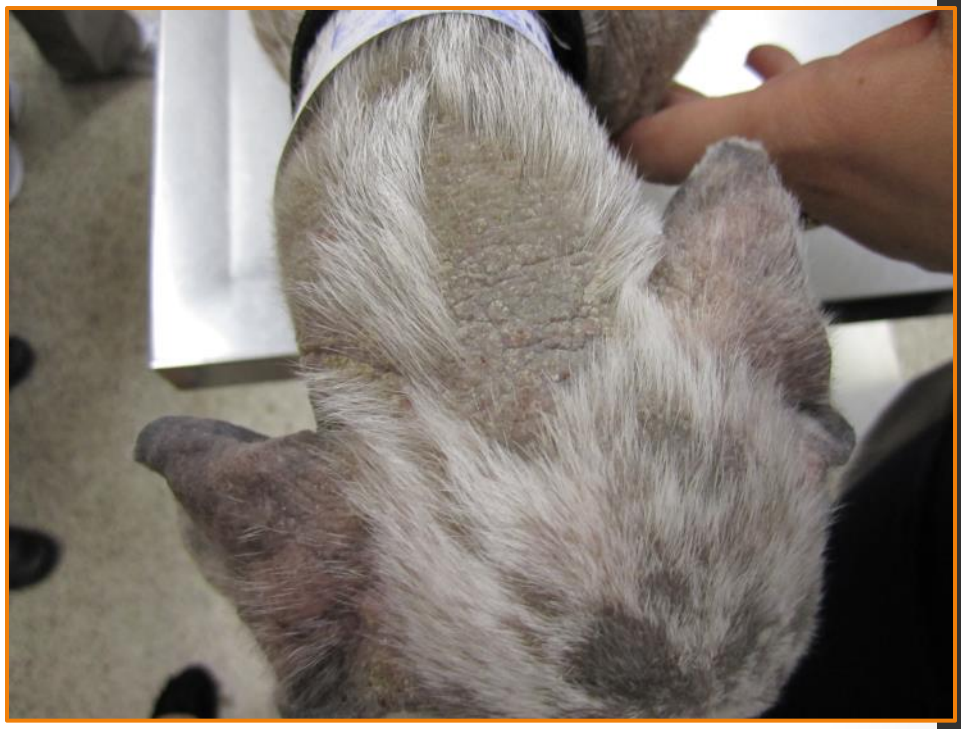
Color linked follicular dysplasias

- Color dilution alopecia
- Black hair follicular dysplasia
- Age of onset
  - Within the first 3 years of life
  - Black hair follicular dysplasia may start earlier and be more severe sooner

Color restricted alopecia

Even pigs!

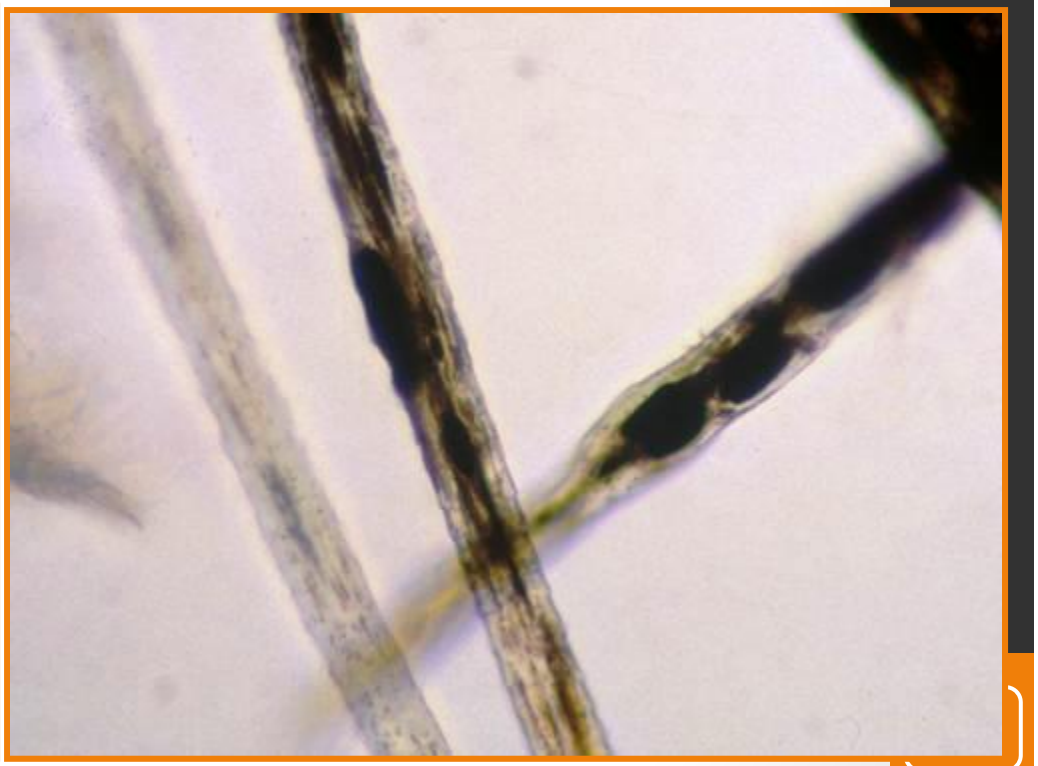
Pyoderma/seborrhea



2 months post-treatment

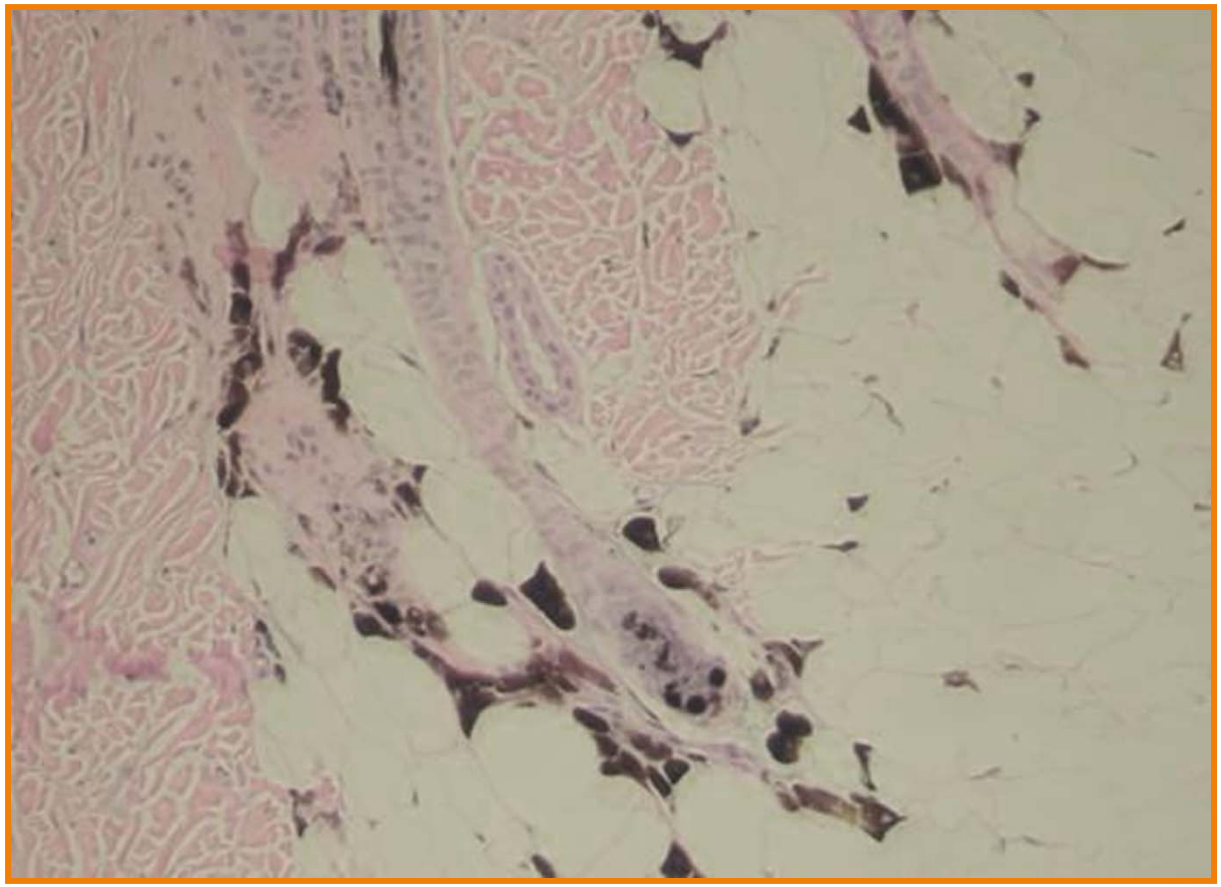
Trichogram

- Melanosome aggregates
  (not helpful with black hair follicular dysplasia)



Histopathology

- Melanin clumping within hair shaft and periadnexally



Follicular dysplasia of Weimaraners

- Similar to color dilution
- Histopathologic changes milder
  - Increased size and number of melanin aggregates
  - Crater defects of hair shaft
  - Dermal melanophages seen less frequently

Follicular lipidosis

- Described in Rottweilers
- Develops in first few months
- Affects mahogany colored areas only
- Associated with lipid vacuoles in hair follicle matrix cells

White hair follicular dysplasia?

Hair cycle abnormalities

Hair cycle abnormalities

- Endocrine dermatoses
- Patterned alopecias
- Cyclic flank alopecia
- Alopecia X
- Post-clipping alopecia

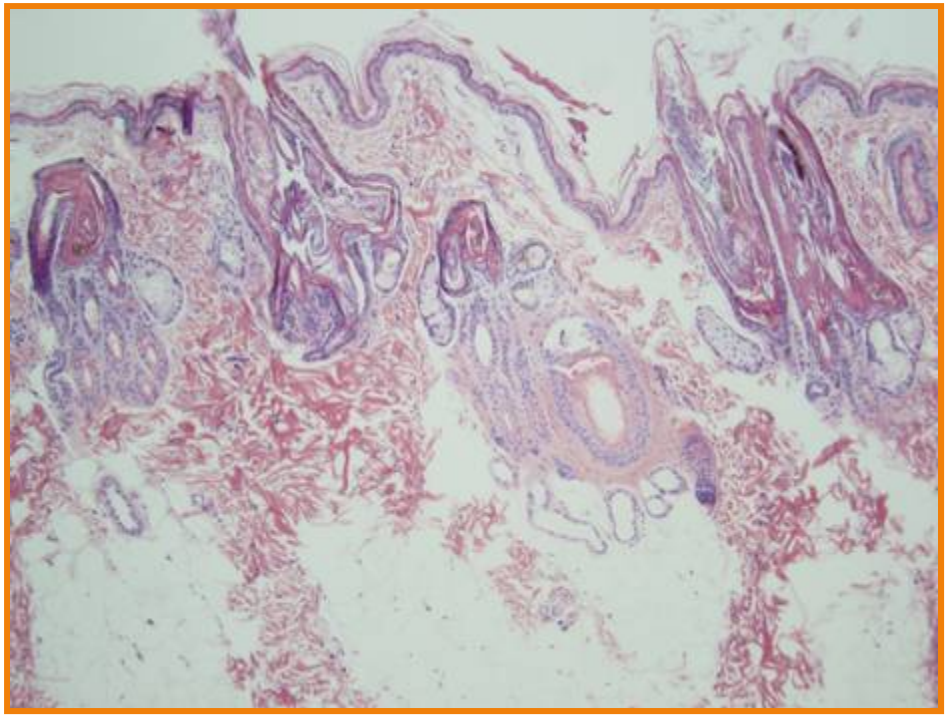
Why suspect hair cycle disorders?

- Non-inflammatory alopecia
- Usually sparing head and distal extremities

Why suspect hair cycle disorders?

- Evidence of failure to cycle
  - Hairs are dull, dry, brittle
  - Hair fails to grow after clipping
- Pigmentary changes
- Seborrhea/comedones

Histological characteristics



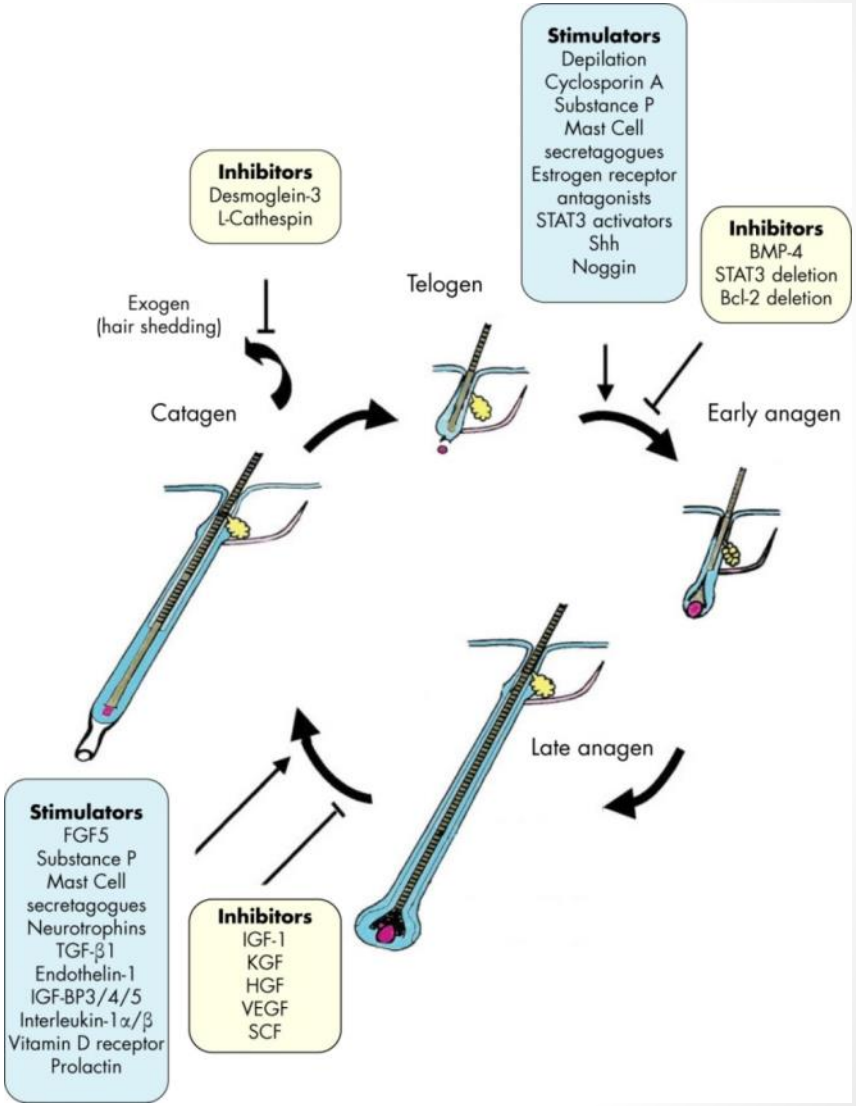
- Hyperkeratosis
- Follicular dilation
- Follicular atrophy
- Telogen hairs
- Kenogen hairs
- Epidermal melanosis
- Epidermal atrophy

"No features consistently differentiate these conditions"

Müntener T et al. *Vet Dermatol* 2012;23:206.

Alopecia

- Lack of anagen induction
- Impaired anagen promotion
- Premature catagen induction



Patterned alopecia (of various breeds)

- Tardive hypotrichosis
  - Start less than 1 year of age and progresses
- Age of onset may be older for certain breed-related conditions
- Many syndromes are represented

Pinnal alopecia

- Primarily dachshunds
- May also affect Yorkshire terriers
- Born with normal coat
- Alopecia progressive but restricted to pinnae
- Some develop alopecia of the nose bridge

Pinnal alopecia

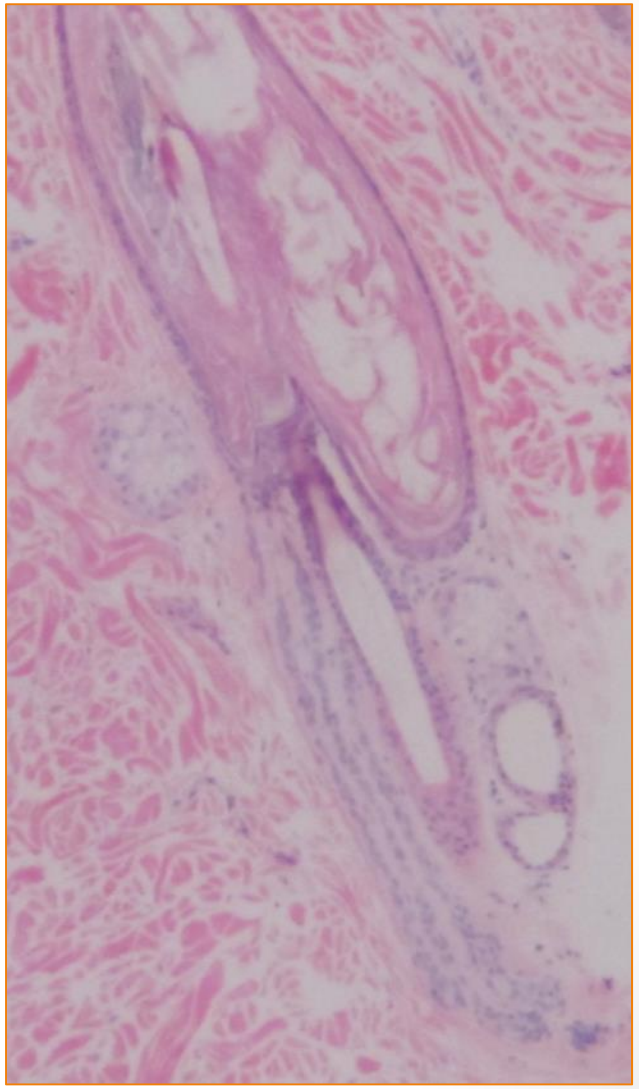
Ventral and caudal alopecia

- Alopecia begins around 6 months of age and progresses
- Primarily seen in dogs with short/fine coats
  - Dachshunds
  - Boston Terriers
  - Boxers

Ventral and caudal alopecia

Patterned alopecia

- Histopathology
  - Non-inflammatory alopecia
- Treatment
  - Some have responded to melatonin
  - Anecdotal response to finasteride



Caudal thigh alopecia of Greyhounds

- Similar to ventral alopecia described?
  - Short fine coat
- Probable hair cycle abnormality
- Does not respond to thyroid hormone supplementation or melatonin

Patterned alopecia of Portugese water dogs, American and Irish water spaniels

Clinical signs

- Age of onset – 1-6 years
- Alopecia involves saddle and/or flank, ventral neck, caudal thighs
- May wax and wane initially before becoming permanent
- Hair regrowth has altered texture
  - Fine and straight

Cerundolo R et al. *Vet Dermatol* 2000;11:107.

Histological findings

- Abnormal clumping of melanosomes
- Follicular keratosis
- Follicular atrophy

- No hair regrowth at biopsy sites!

Cerundolo R et al. Vet Dermatol 2000; 11: 107.

Treatment

- 7/16 Irish Water Spaniels showed coat improvement on fish and corn dry diet
  - Most still ultimately develop permanent alopecia
- No other treatments reported to help

Cerundolo R et al. *Vet Dermatol* 2000; 11: 107.

Alopecia of Chesapeake Bay retrievers

- Breed is related to Irish Water Spaniels
- Develop alopecia that resembles alopecia of water spaniels

Courtesy of Dr. Elizabeth May

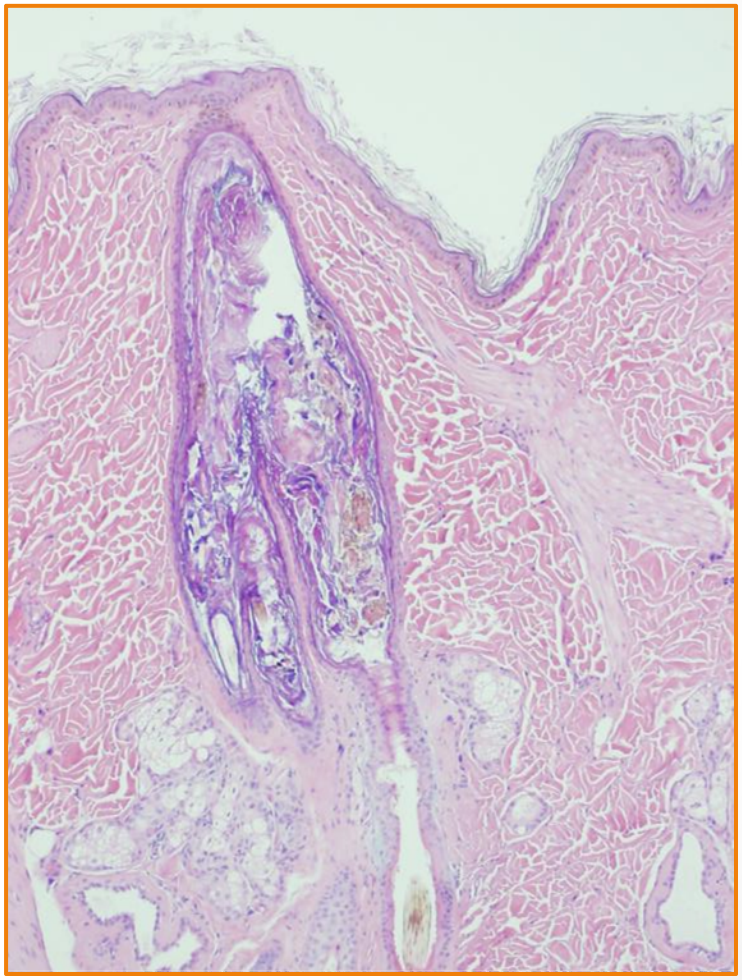
Alopecia of Chesapeake Bay retrievers

- Alopecia may begin at less than 1 year of age
- Usually affects dogs between 1.5-4

Courtesy of Dr. Elizabeth May

Alopecia of Chesapeake Bay retrievers

- Histopathology
  - Dilated follicles
  - Follicular keratosis
  - Abnormal pigmentation
  - Abnormal hair shafts
- No response to melatonin or L-thyroxine



Courtesy of Dr. Elizabeth May

Cyclic flank alopecia

- Seasonal truncal alopecia
- Hair loss usually occurs in winter or spring (short daylength)
- Problem seems to be worse up north
- Does not always happen every year
- Does not always regrow

Cyclic flank alopecia

- Breed predispostions
  - Airedale
  - Boxer
  - English bulldog
  - French bulldog

Cyclic flank alopecia

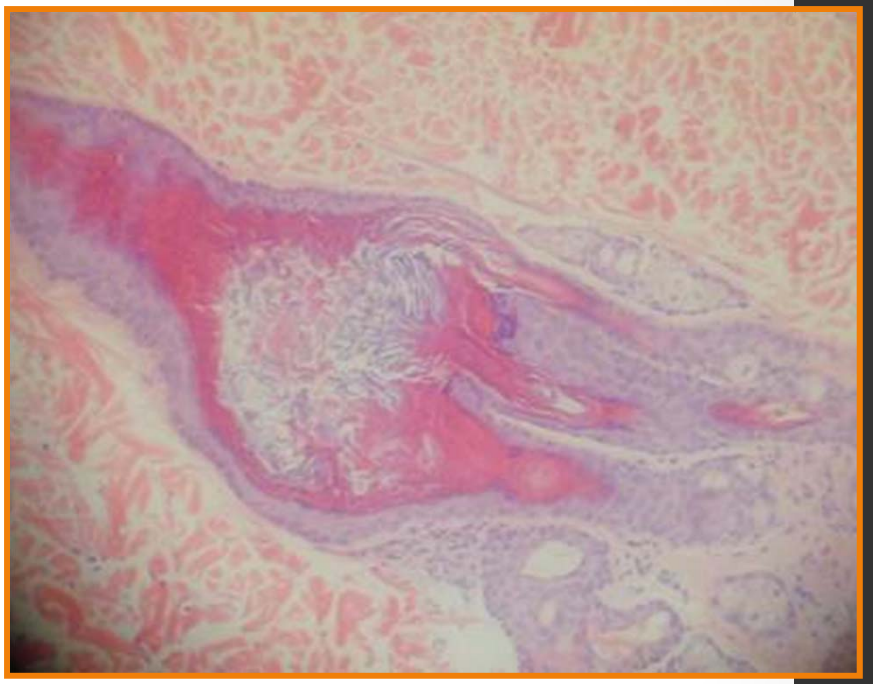
- Clinical signs
  - Age of onset 1.5-6+ yrs
  - Usually symmetrical
  - Often hyperpigmented
  - Occasionally may present with hyperpigmentation on bridge of nose

Atypical presentations

- Predominantly facial alopecia
- Alopecia associated with interface dermatitis
  - Some bulldogs and boxers
- Rhodesian ridgeback dogs have color change without alopecia

Cyclic Flank Alopecia

- Diagnosis
  - Rule out endocrinopathies
  - Biopsy
    - Deformed telogen follicle
- Treatment
  - Melatonin may shorten duration and prevent recurrence



Alopecia X (hair cycle arrest)

- Adrenal hyperplasia-like syndrome
- GH responsive
- Castration responsive
- Biopsy responsive
- Pseudo Cushings

Alopecia X

- Occurs in plush-coated breeds

Alopecia X

- Adults 1-10 yrs of age
- Male=female
- Clinical Signs
  - Symmetrical alopecia
  - Hyperpigmentation
- Not Cushings or hypothyroid

Alopecia X

Alopecia X

Coat funk

Black skin disease

Biopsy-responsive alopecia

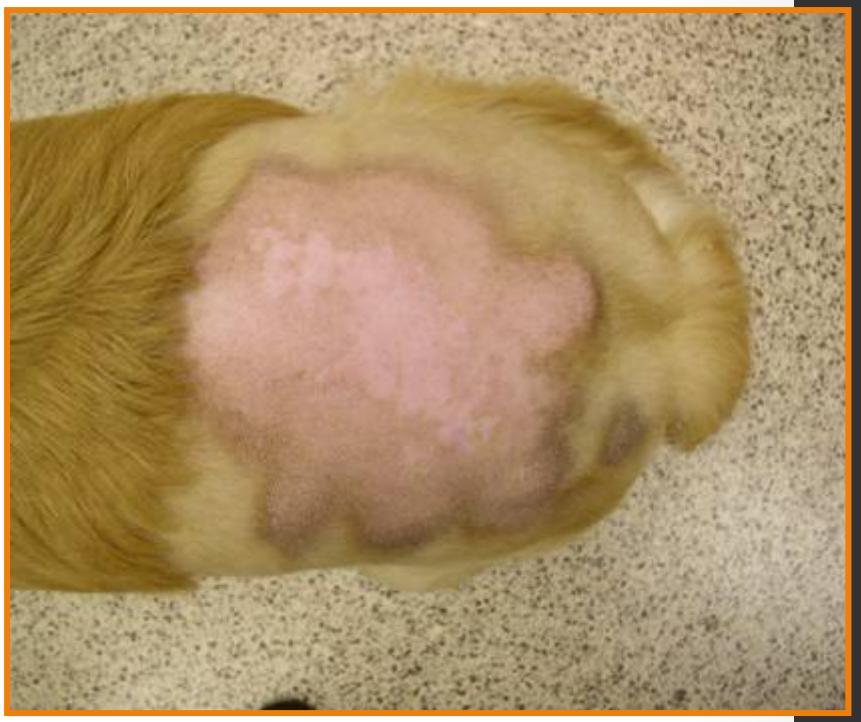
Post-clipping alopecia

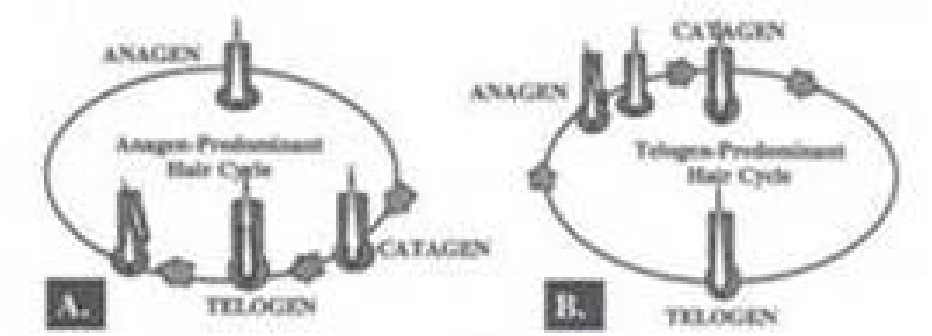
- Failure to regrow hair following CLOSE clipping
- Often seen in Nordic breeds
- Many times areas have been prepared for surgery
- Many times associated with epidurals
- Hair usually grows back within 1 year

Post-clipping alopecia

Theories

- Hair cycle arrest
- Hair at wrong point in cycle

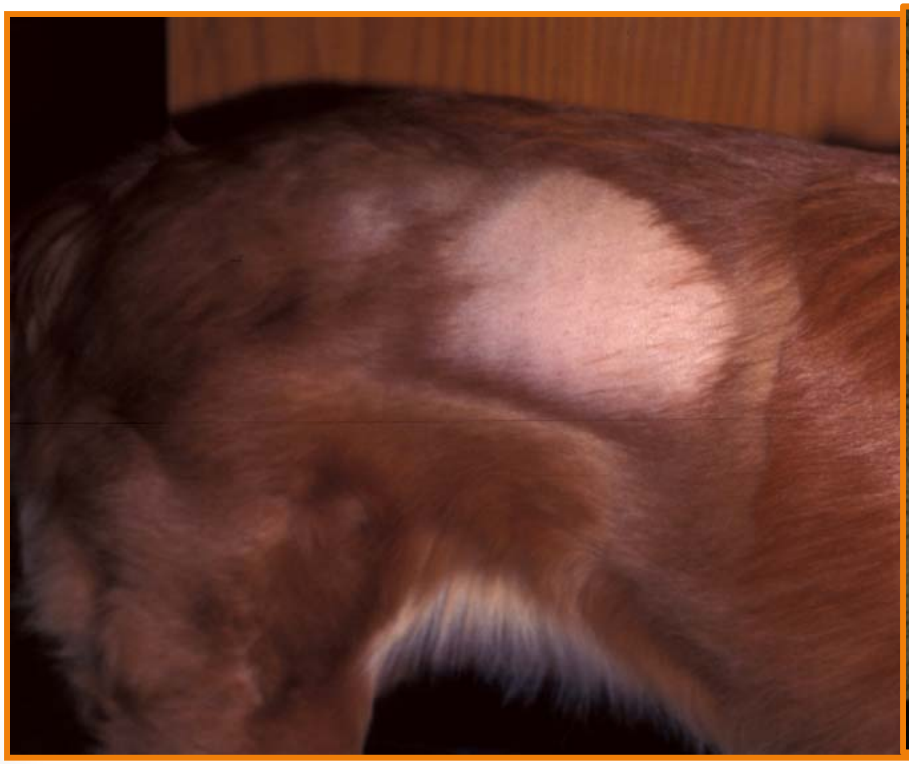




Nordic breeds have longer haired telogen stage than other breeds "follicular hibernation"

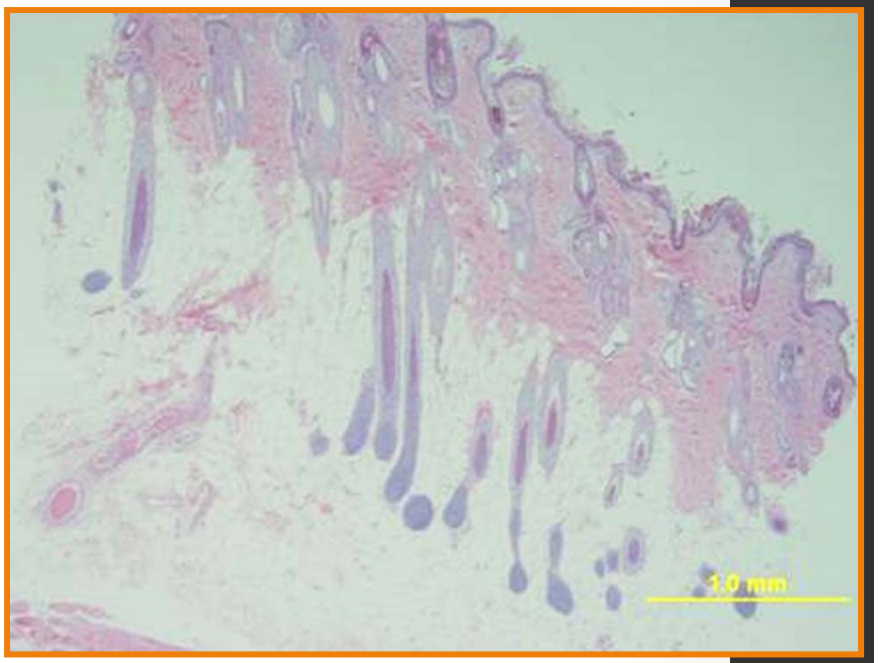
Post-clipping alopecia

- Rule out endocrinopathies



Post-clipping alopecia

- **Biopsy**
  - May show anagen hairs starting to be produced
  - May show hairs in telogen arrest
  - May look similar to haired area from same dog (in Nordic breeds)
- **Treatment**
  - Time – up to 1+ years
  - Melatonin?



Hair's what keeps us growing!