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Biological Screening Workshop

Other Body Fluids and Tissues

Vaginal Secretions

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Vaginal Secretions

- **Vaginal secretions are a complex mixture of cells and secretions**
- **There is no confirmatory test to identify vaginal secretions**
- **Several screening tests based on microscopy have been proposed**

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Vaginal Secretions

- **Vaginal epithelial cells are large, and many contain glycogen (a polysaccharide) which can be demonstrated by staining with iodine in the form of a solution or exposing to iodine vapor**
- **The presence of glycogenated cells is variable depending on the stage of the estrous cycle**
- **Glycogenated cells can be found in other body secretions (i.e. oral, anal)**

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Lugol's Staining

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Fecal Material

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Fecal Material

- **Feces are food residues passed after completion of travel through the digestive system**
- **Has a characteristic odor mainly due to skatole, an organic compound that occurs naturally in feces**

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Fecal Material

- **Microscopy**
  - **Microscopy has been used to identify fecal material**
    - **Looking for undigested residues of food material**
- **Chemical Tests**
  - **Detection of urobilinogen, a bile pigment excreted in feces, which may be detected using its fluorescent reaction to Edelman's reagent**

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Urine

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Urine

- **No confirmatory tests for the presence of urine**
- **Urine stains fluorescent under ultraviolet light**
  - **This can be useful for locating stains prior to chemical testing**
- **Has a characteristic odor**

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Urine

- **Contains a large amount of urea, a chemical byproduct of normal metabolic processes in the body**
  - **Identification of high levels of urea can serve as a screening test for urine in fluids or stains**
  - **Perspiration can give reactions similar to urine**

Urea – Litmus Paper Test

- **Litmus paper test for the detection of ammonia**
- **Relies on the indirect identification of urea by reacting a test sample with urease to generate ammonia from the urea**
- **Litmus paper is used to detect the ammonia**

$$\text{Urea} + H_2O \leftrightarrow CO_2 + 2NH_3$$

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Urea – Litmus Paper Test

- **A known urine sample and a blank are tested as a positive and negative control**
- **A substrate control may be tested, as needed**

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Urea – Nitrogen Tube Test

- **Relies on the indirect identification of urea by reacting a test sample with urease to generate ammonia from the urea**
- **Ammonia is subsequently identified by the production of a deep blue-colored solution**

$$\text{Urea} + H_2O \leftrightarrow CO_2 + 2NH_3$$

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Urea – Nitrogen Tube Test – How to Perform

Sample	Expected Results
Negative Control	No color
Standard	Deep blue color
Positive Control	Deep blue color
Substrate Control	No color
Question Sample (without urease)	No color

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Creatinine

- **Jaffe Test**
  - **One of the oldest tests for the detection of creatinine-1886**
  - **Creatinine forms a red compound with picric acid (Jaffe test)**

Hair

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Hair

- **Composed of cylindrical structures or shafts made up of tightly compacted cells that grow from follicles**
- **Diameter ranges from 15 to 120 µm**
  - **Depends on type of hair and body region**
- **Root material can be used for nuclear DNA testing**
- **Shaft material can be used for mtDNA testing**

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Hair

- **Human hairs are distinguishable from hairs of other mammals**
  - **Human hairs are generally consistent in color and pigmentation throughout the length of the hair shaft**
  - **Animal hairs may exhibit radical color changes in a short distance, called banding**

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Hair

- **The medulla, when present in human hairs, is amorphous in appearance, and the width is generally less than one-third the overall diameter of the hair shaft**
- **The medulla in animal hairs is normally continuous and structured and generally occupies an area of greater than one-third the overall diameter of the hair shaft**

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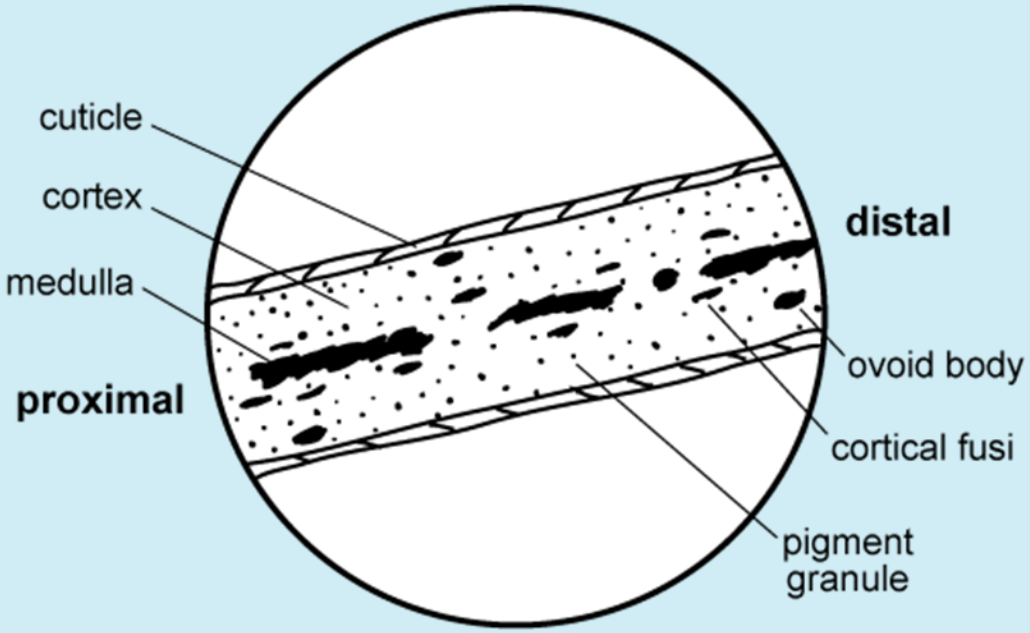
Hair

- **Structure**
- **Three cell types**
  - **Outer cuticle**
  - **Central cortex**
  - **Central medulla**



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Hair

- **In some instances human hairs can be classified by racial origin such as:**
  - **Caucasian (European origin)**
  - **Negroid (African origin)**
  - **Mongoloid (Asian origin)**
- **In some instances the region of the body where a hair originated can be determined by its gross appearance and microscopic characteristics**

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Hair

- **The length and color can be determined**
- **It can also be determined whether the hair was forcibly removed, damaged by burning or crushing, or artificially treated by dyeing or bleaching**

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Hair

- **The growth phase of the hair is important in determining whether the root is suitable for nuclear DNA analysis testing**
- **Growth Cycles**
  - **Anagen phase**
  - **Catagen phase**
  - **Telogen phase**

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Hair – Anagen Phase

- **Active hair growth**
- **Contains nucleated cells in the root and in the surrounding sheath material**
- **Generally suitable for nuclear DNA analysis**

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Hair – Anagen Hair

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Hair – Catagen Phase

- **Transitional phase after active hair growth, cell division stops**
- **Characteristic club appearance of root**
- **May be suitable for nuclear DNA analysis**

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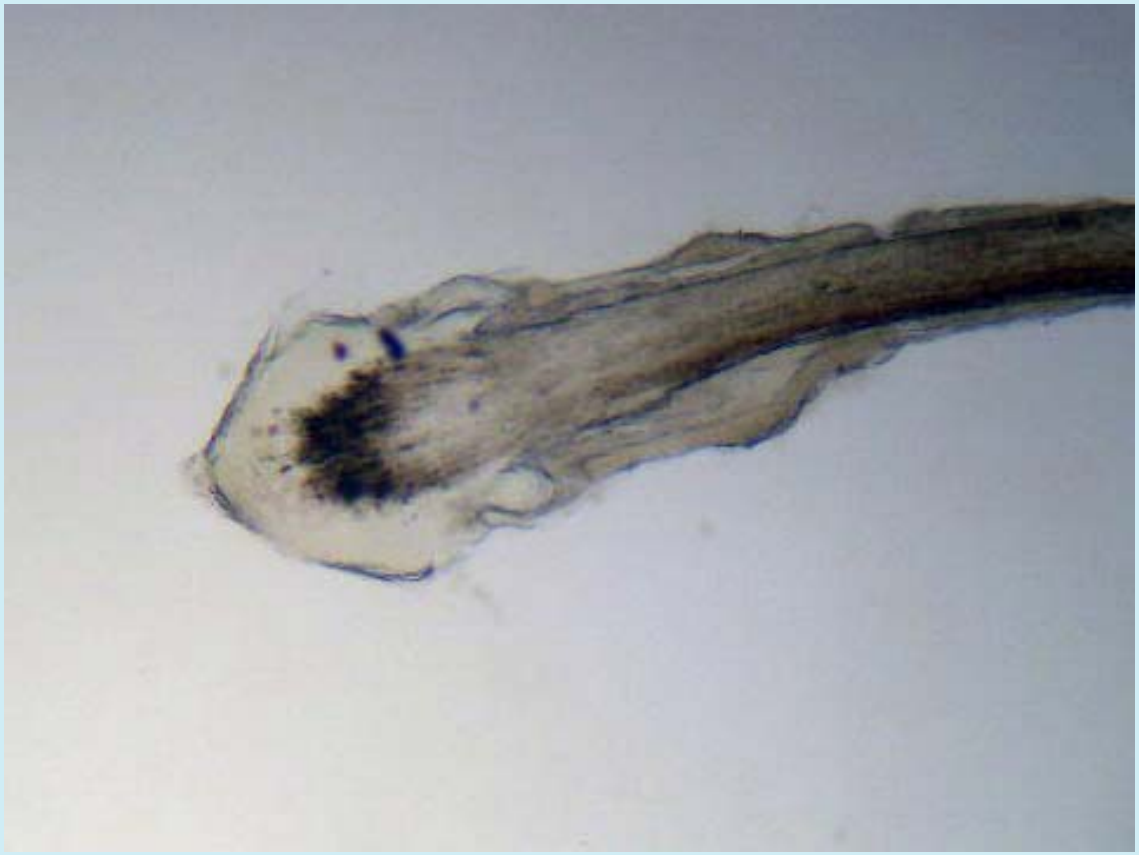
Hair – Catagen Hair



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Hair – Telogen Phase

- **Follows transitional phase-growth ceases**
- **Shedding phase**
- **Telogen hairs without follicular tissue may not be amenable to nuclear DNA analysis because of the lack of nucleated cells**
  - **May contain sufficient mitochondrial DNA in their roots and hair shafts for analysis**

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Hair – Telogen Hair

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Hair – Basic Evaluation Steps

1. **Determine if the sample is a hair.**
2. **Determine if the hair is of human origin.**
3. **Determine if the hair has root material that is suitable for nuclear DNA analysis (characteristic of a particular growth phase).**
   - **If not suitable for nuclear DNA analysis, determine if the hair is sufficient in size for mtDNA analysis (two to three centimeters)**

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Hair

- **DNA analysis of hair is a destructive technique and results in the consumption of portions of the hair**
  - **Hair characteristics, such as color, length, shape, and texture should be noted in the case file for future reference prior to DNA analysis**
    - **Notes and digital images**

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Questions?

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