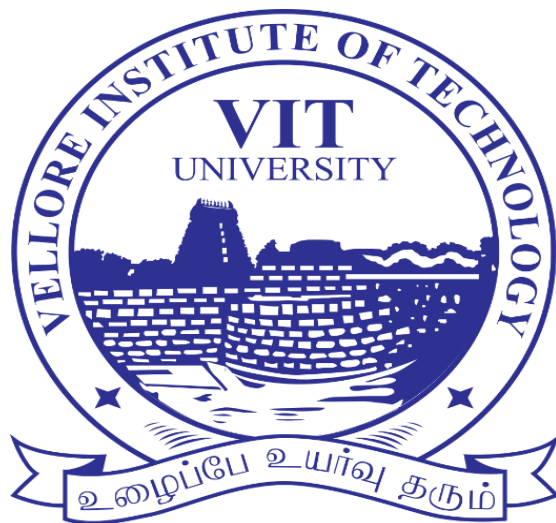# Forensic Science and Technology (BIT3009)

Project Report

TOPIC

Analysis of hair samples using microscopic techniques to ascertain claims of animal species and comparative studies with human hair sample.

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Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3329137/

INTRODUCTION

- Hair is a protein filament that grows from follicles found in the dermis. Hair is one of the defining characteristics of mammals. Most common interest in hair is focused on hair growth, hair types, and hair care, but hair is also an important biomaterial primarily composed of protein, notably alpha-keratin.
- Medulla in a human is smaller (medullary index of less than one-third) and medulla in animals is very thick (medullary index of one-half or greater). Cuticle in humans is imbricated and the cuticle in animals is coronal or spinous.
- Pigmentation in animal hair is denser than human hair. Animal hair can change colors in banded patterns while human hair cannot.
- Medulla, cortex, cuticle are the layers of the hair shaft.
- **Medulla** is the core of the hair which can be found in many patterns like hollow or filled, absent, fragmented, continuous, doubled, pigmented or unpigmented.
- **Cortex** is the middle layer of the hair. Thickest layer containing most of the pigment giving hair its color and shape.
- **Cuticle** is the invisible outside part of the hair made of over lapping scales that protect the inner layers of hair.

Hair anatomy
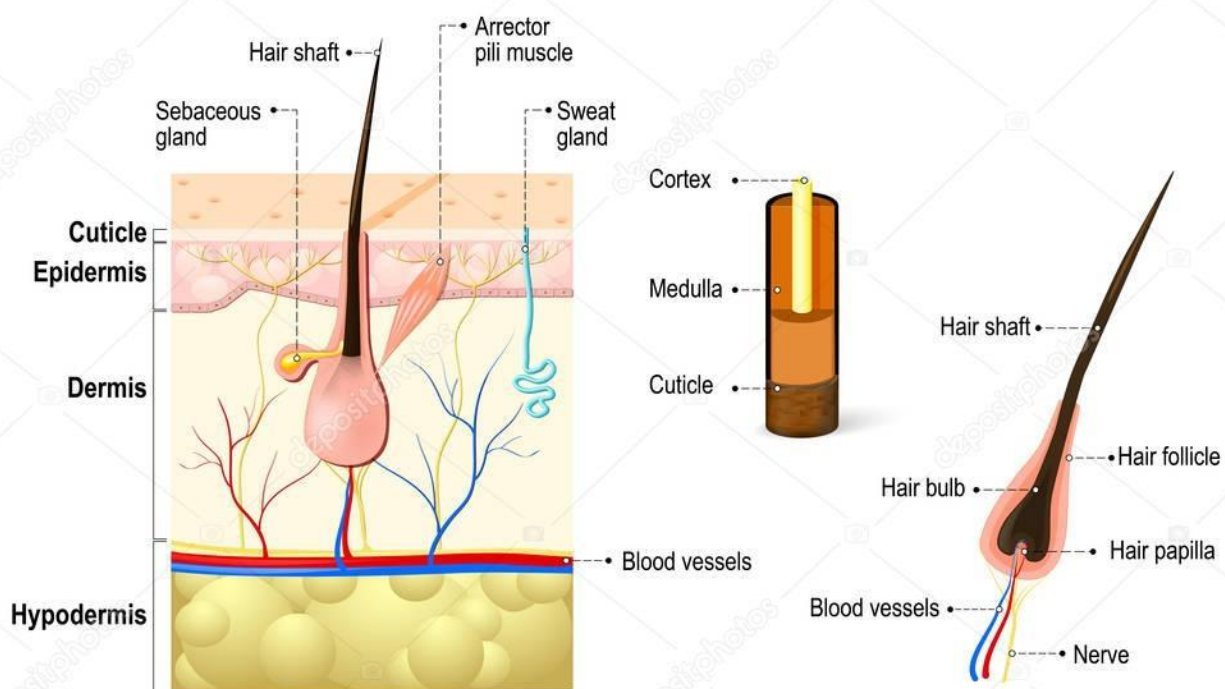
The structure of the hair gives us lots of information and we can find out the type of hair and hair can yield DNA evidence, if hair is pulled out by the root, as in some violent struggles, it will contain root pulp which is a good source of nuclear DNA, the type of DNA most often used in forensics

MATERIALS AND PROCEEDINGS

Materials Used

1) Hair Sample – Animal
2) Hair Sample – Human
3) Scissors
4) Latex Gloves
5) Mask
6) Microscope
7) Microscopic slide
8) Coverslips
9) Forceps
10) Nail Polish – Red

Proceedings

1) We first start this experiment by obtaining the hair samples (human and animal) and the materials.

Phase I (without nail polish)

2) Now set the hair sample we are observing under a microscopic slide and add a drop of water to make it stick to the slide. Now you visualize under microscope at 4x and 40x.
3) On viewing under large magnifications like 100x and 400x, add immersion oil to increase the resolution power of the microscope.
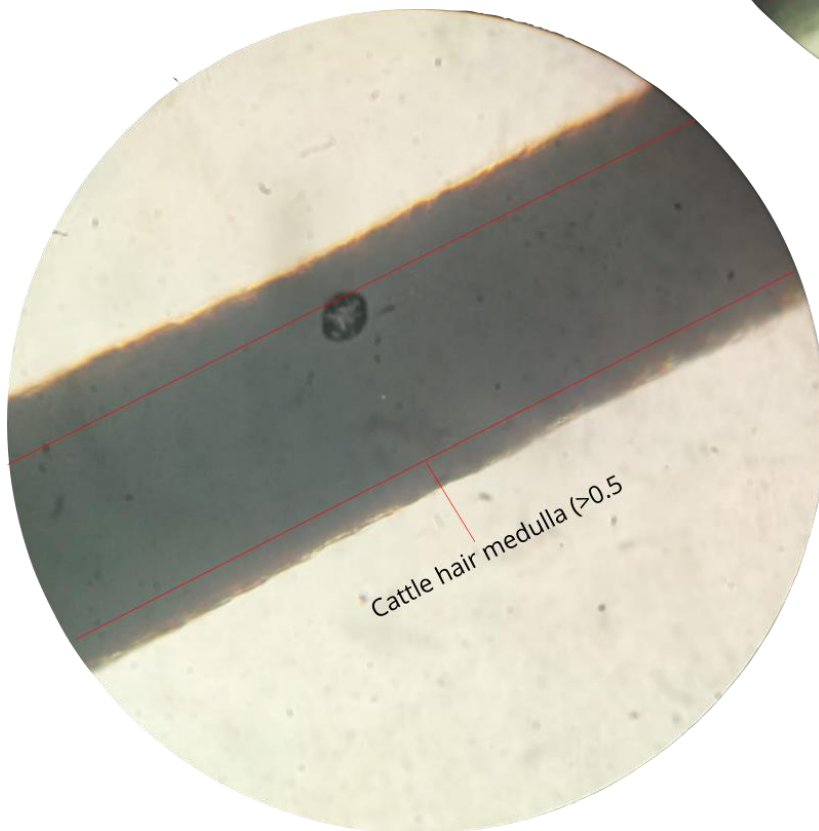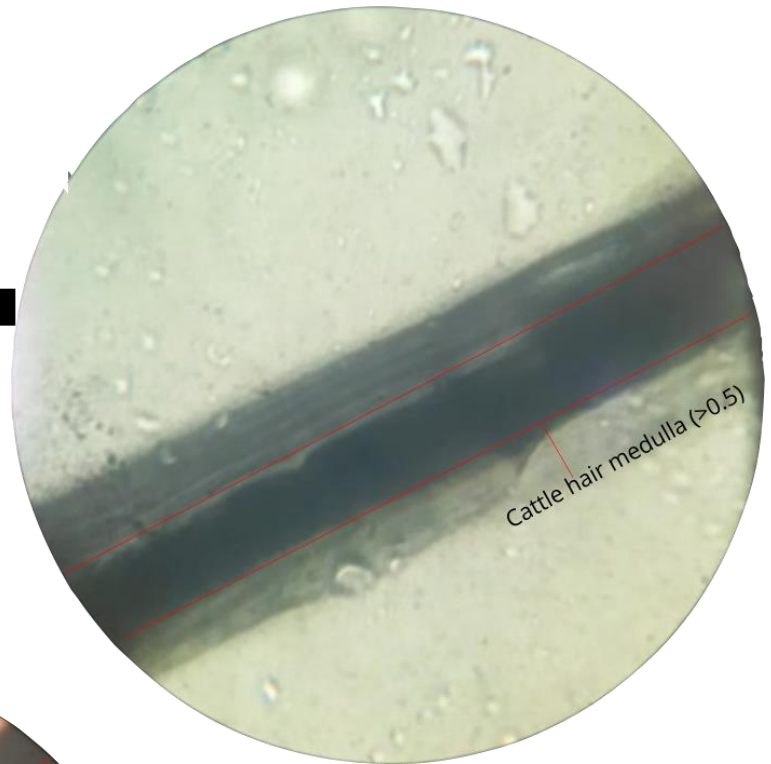
Phase II (with nail polish)

4) We used red nail polish **"AGX® - TULIP"** and we stained the hair samples and dried it for 10 minutes.

5) Then using forceps, we visualize the scale pattern of the nail
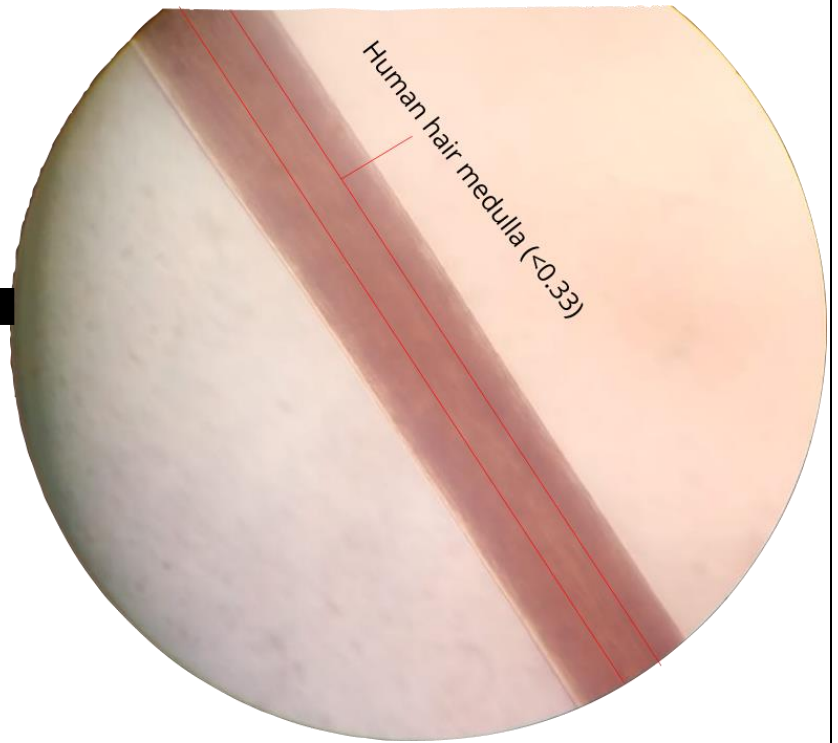polish stained hair samples.

OBSERVATIONS

(i) Not Stained

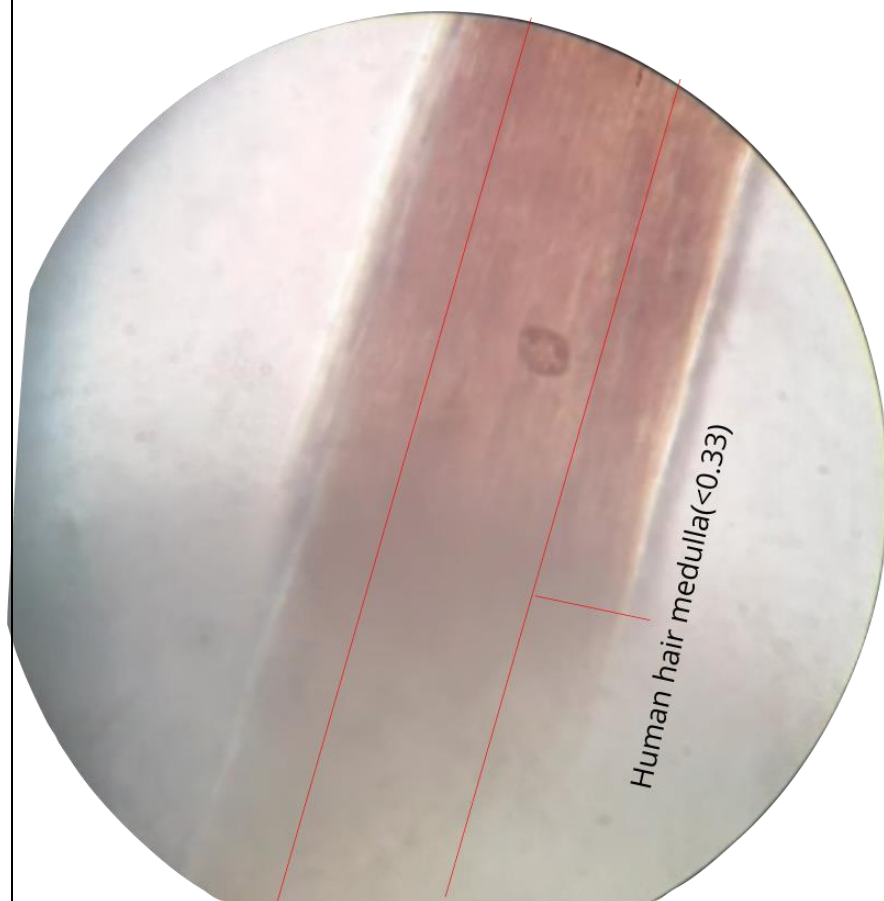Cattle hair
visualized at 40x
in a microscope

Cattle hair medulla (>0.5)

Cattle hair medulla (>0.5

Cattle hair
visualized at 100x
in a microscope

Human hair visualized at 40x in a microscope

Human hair medulla (<0.33)

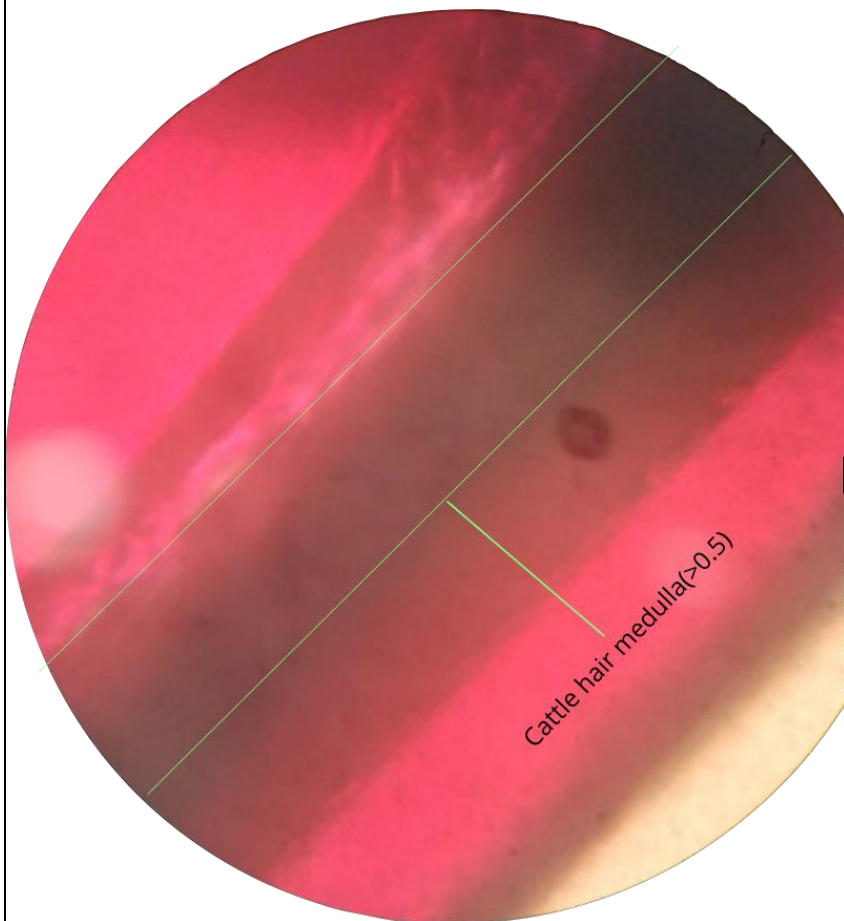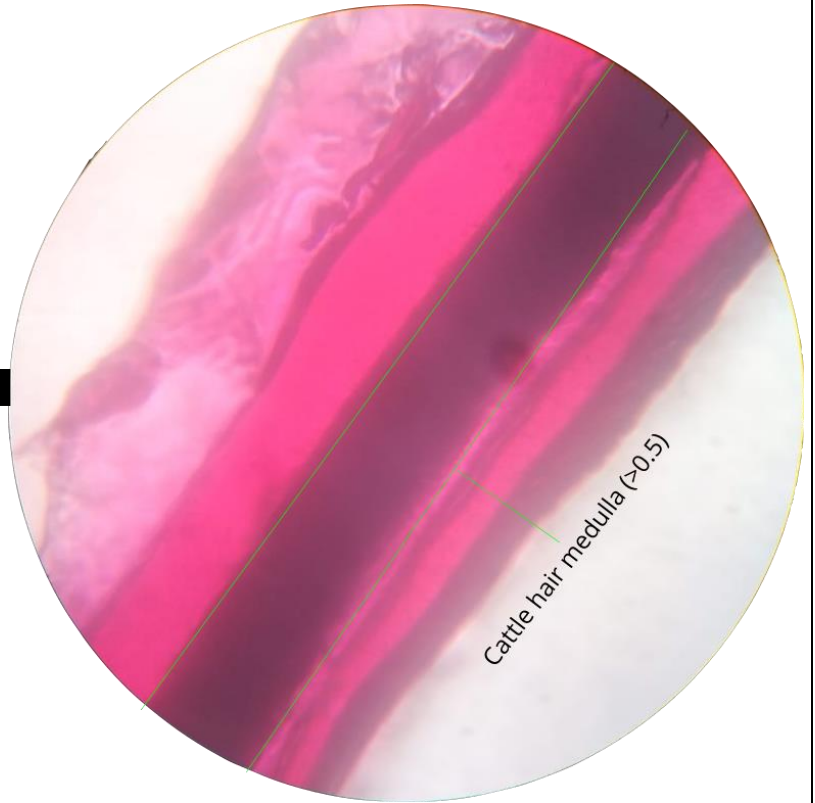Human hair visualized at 100x in a microscope

Human hair medulla(<0.33)
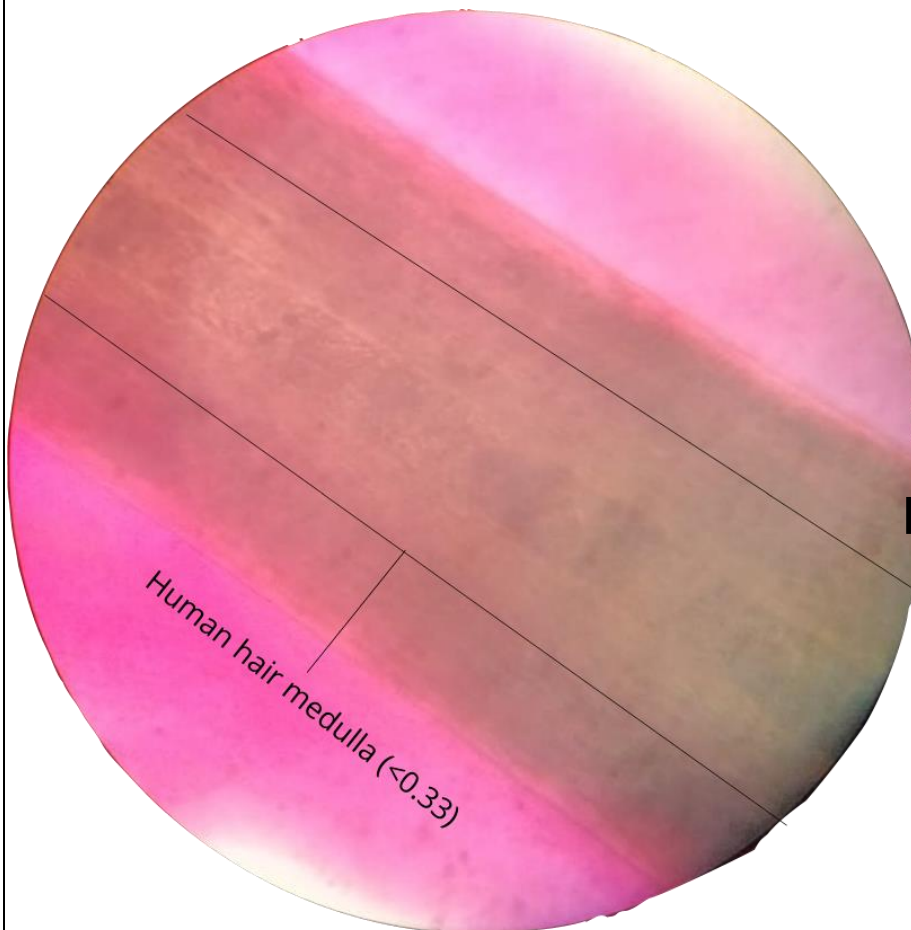
Cattle hair visualized at 40x in a microscope

Cattle hair medulla (>0.5)

Cattle hair visualized at 100x in a microscope

Cattle hair medulla(>0.5)

Human hair visualized at 40x in a microscope

Human hair medulla (<0.33)

Human hair visualized at 100x in a microscope
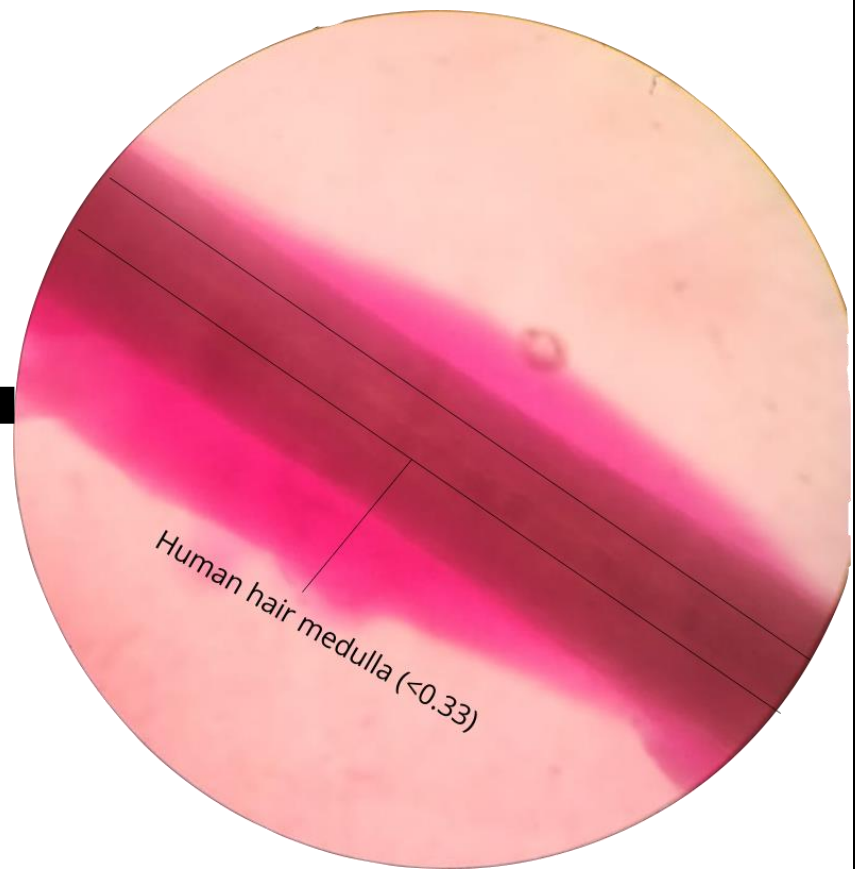
Human hair medulla (<0.33)

INFERENCE AND CONCLUSION

➢ We have observed and differentiated hair samples of human and cattle from the medullary index as humans have medullary index of 0.33 or less and while cattle have medullary index of 0.5 or more.

➢ The scales of the cuticle can be seen with the nail polish cast, it isn't very clear due to lower resolution microscope available in lab.

➢ We will perform bleaching with the help of hydrogen peroxide to remove the natural pigment of hair for better visualization.