

# Manchester Microscopical & Natural History Society

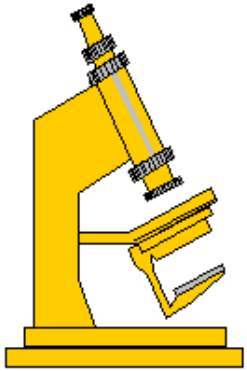
*Established 1880*

*[www.manchestermicroscopical.org.uk](http://www.manchestermicroscopical.org.uk)*



???

*Mike Mahon, October 26<sup>th</sup> 2023*



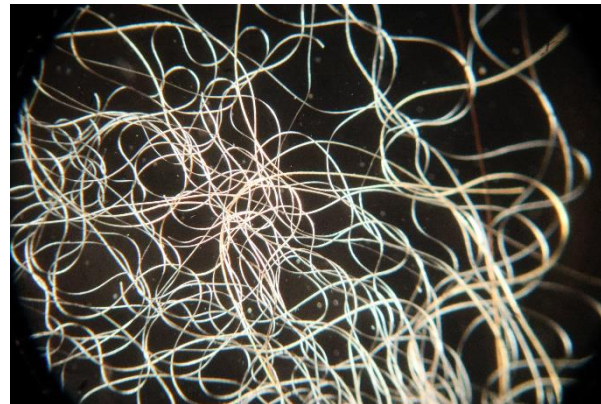
# Manchester Microscopical & Natural History Society

*Established 1880*

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## Hair of the Dog !



*Mike Mahon, October 26<sup>th</sup> 2023*



**Arthur – the Keeshond 2012-2023 R.I.P.**



10<sup>th</sup> Oct 2023



*Microscopy results not as expected, so ....*

For comparison ....



**Merlin** – (Keeshond puppy) 5 months



**Mike** - ?!

# Pelage

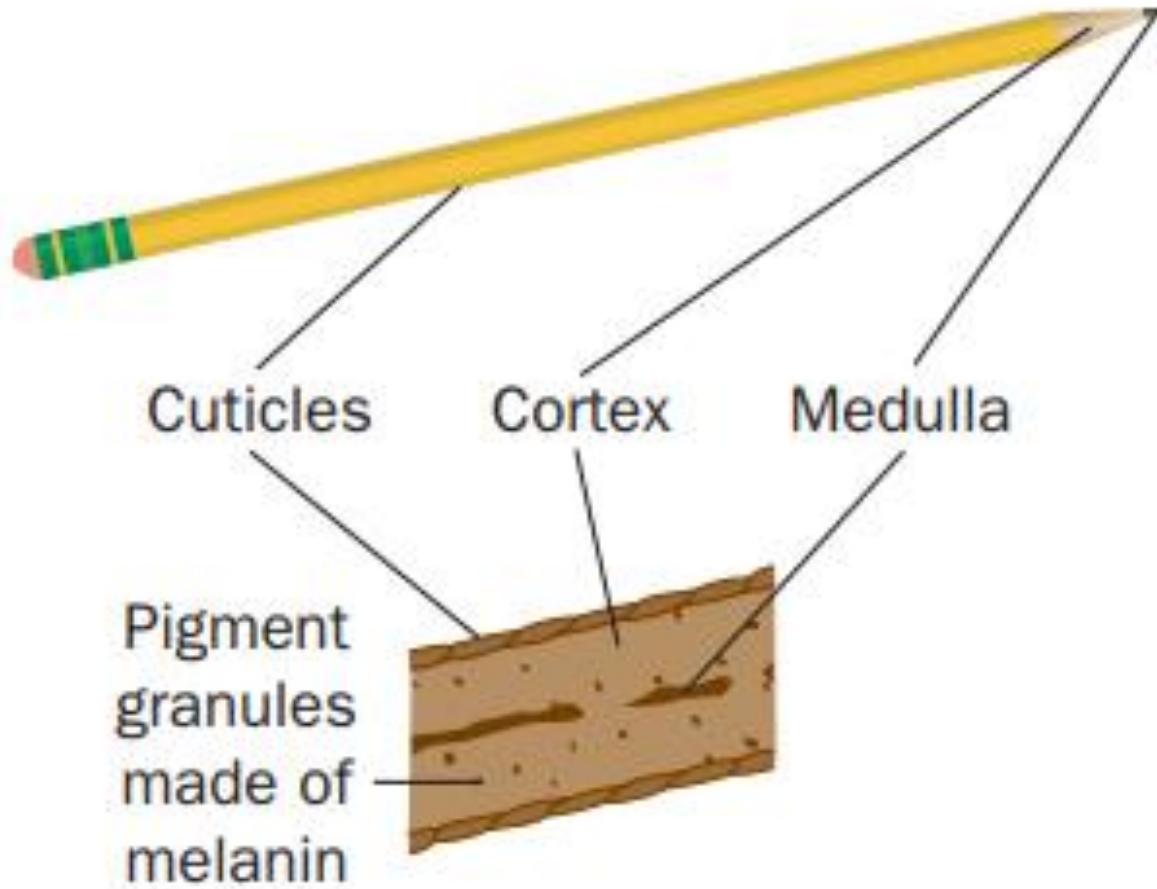
hairy, woolly, or furry coat of a mammal

- Fur
- Hair
- Fluff

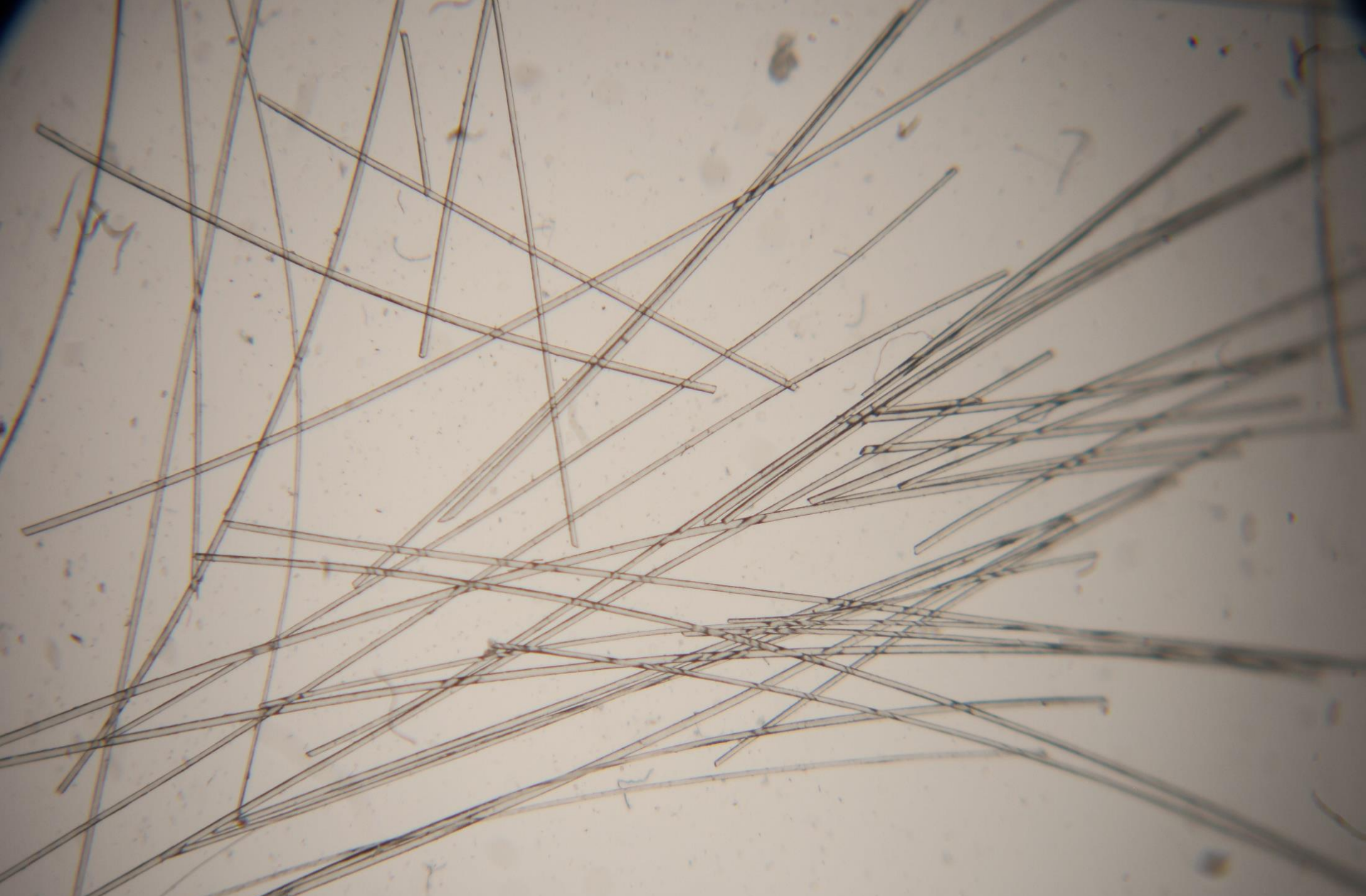
Hair is usually described as longer, finer, often wavy or curly, and has a longer growth cycle, while fur is described as shorter, denser, and has a shorter growth cycle, resulting in more frequent shedding.

	Hair	Fur
Texture	<b>Varies, but often less dense than fur; can be soft, straight, smooth, frizzy, wavy, etc</b>	<b>Often densely packed and smooth, but can also be coarse and hard; some fur is extremely soft</b>
Uses/Purpose	<b>Fashion, very little insulation purposes</b>	<b>Used for insulation, especially when an animal has a double coat</b>
Growth	<b>Continues to grow throughout lifetime; needs trimming</b>	<b>Grows to a certain length; sheds seasonally rather than continues growing in length</b>
Human or Animal	<b>Humans or animals</b>	<b>Animals only</b>
Layers or Density	<b>Single layer, can range in follicle size and amount of follicles</b>	<b>Can have multiple layers of fur for extreme climates; ranges in density and thickness</b>

# Hair Structure

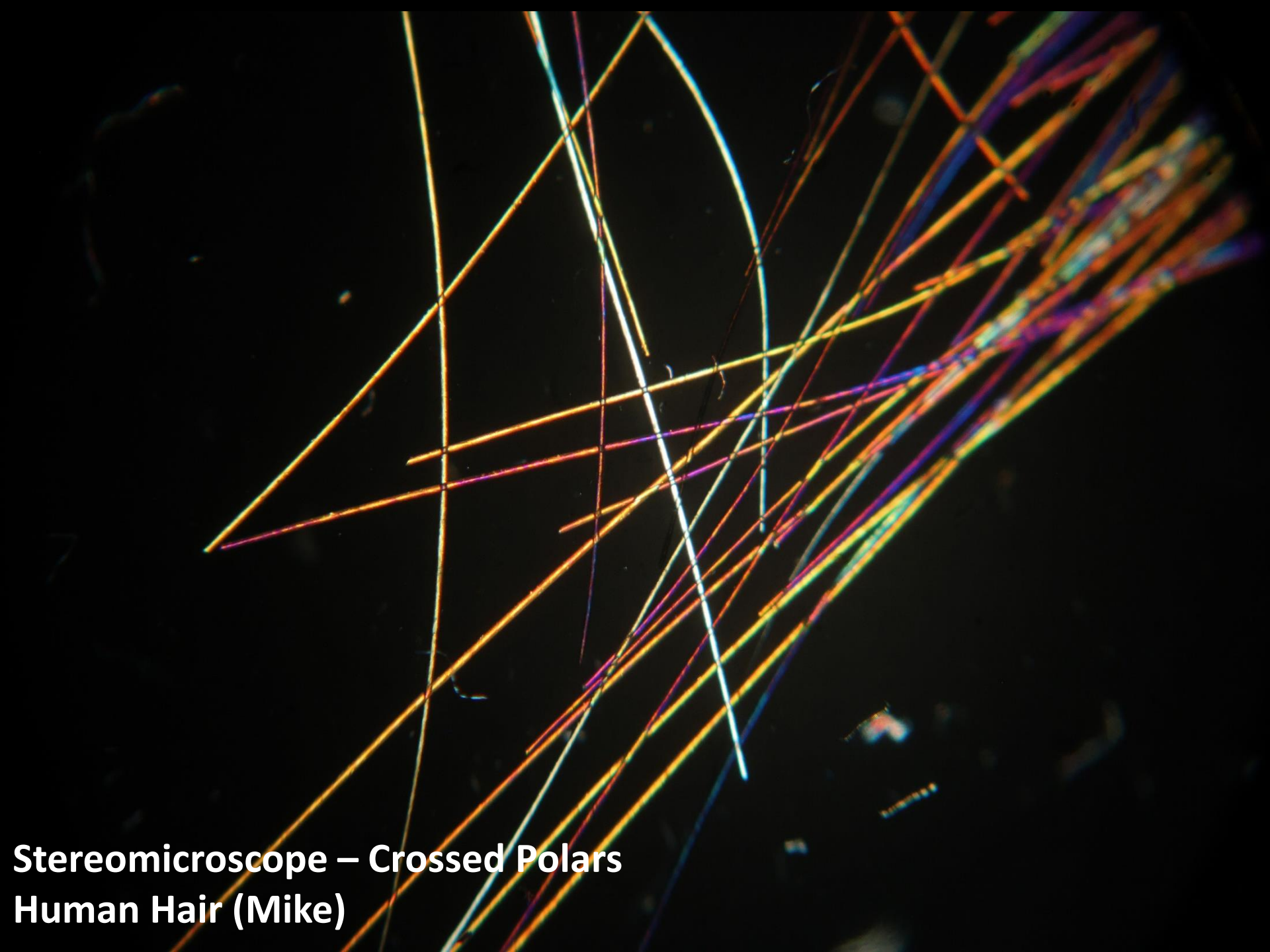






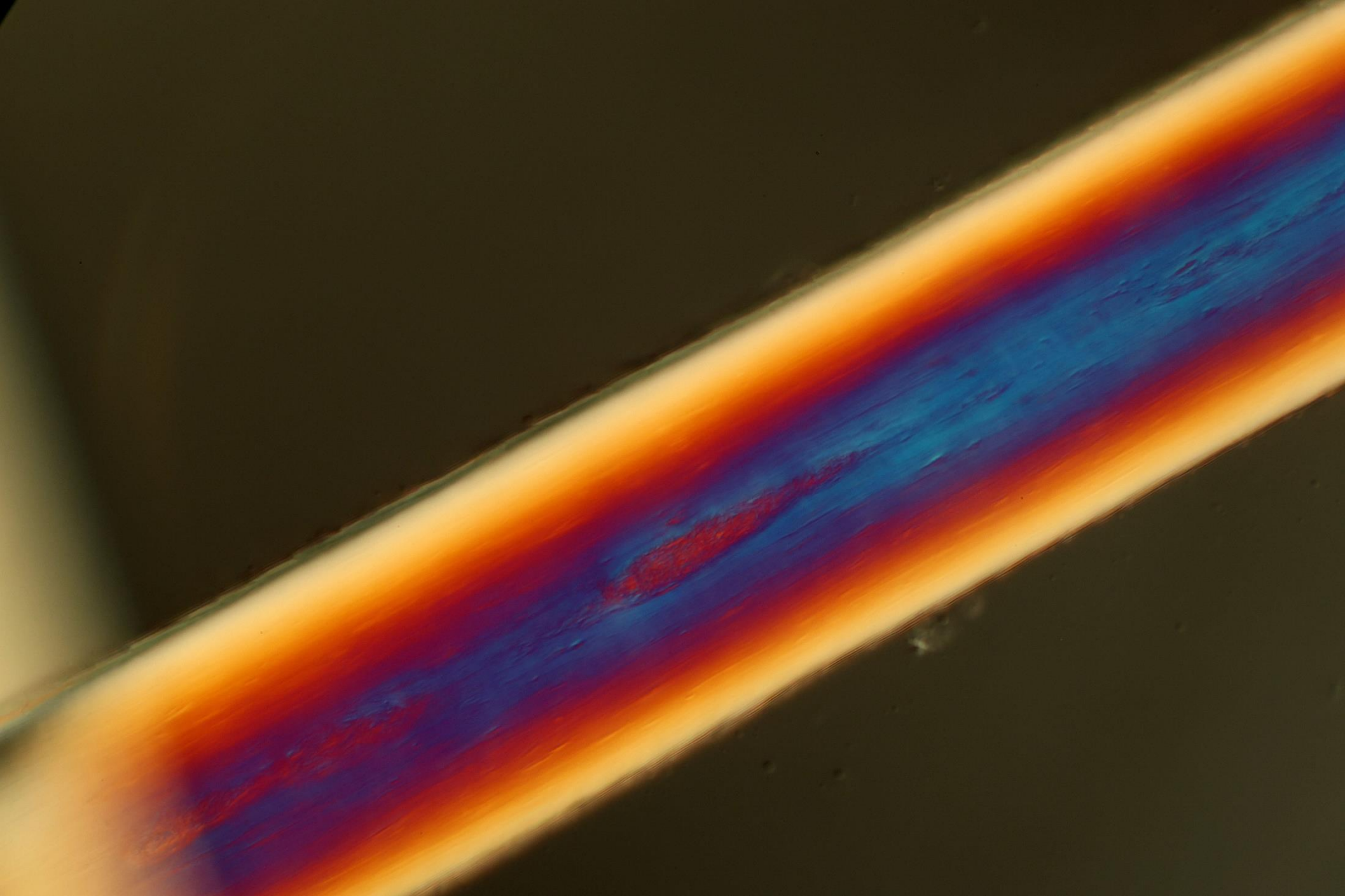
**Stereomicroscope**  
**Human Hair (Mike)**

FOV = ~ 2cm

A stereomicroscopic image of human hair fibers under crossed polars. The fibers appear as thin, overlapping lines with various colors (yellow, orange, red, purple, blue, green) due to birefringence. The background is black. The fibers are oriented in various directions, creating a complex, crisscrossing pattern. The colors change as the fibers cross, indicating different orientations relative to the polarizers.

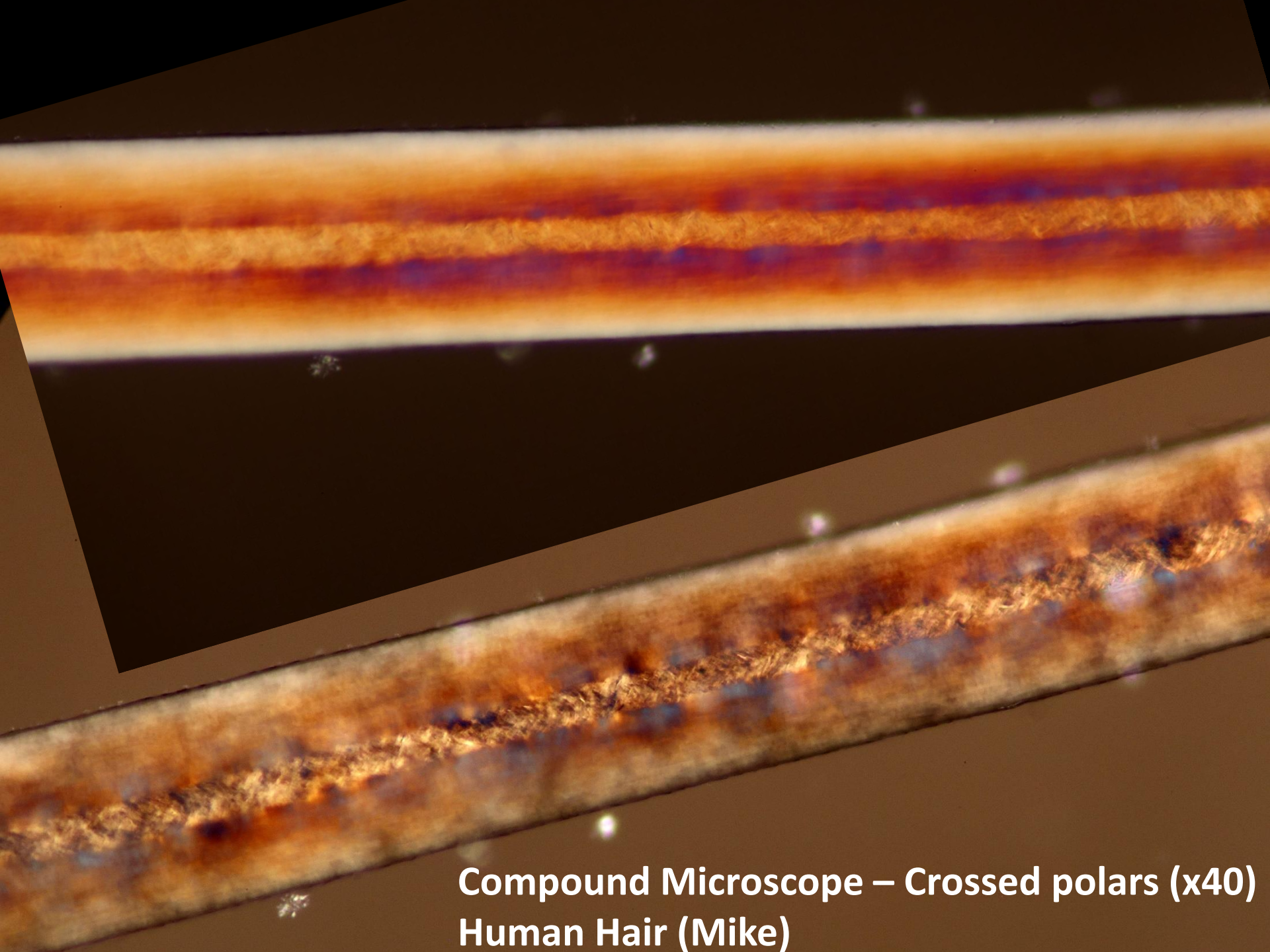
**Stereomicroscope – Crossed Polars  
Human Hair (Mike)**





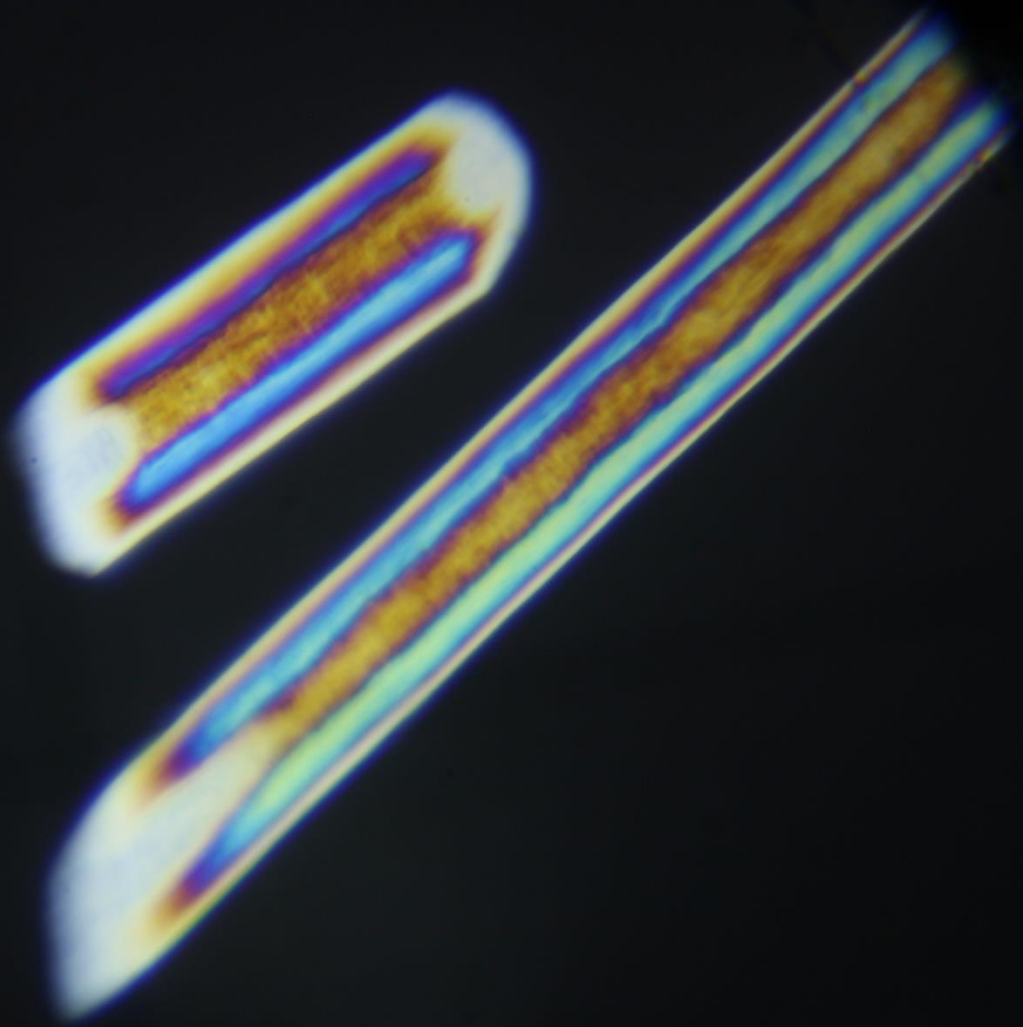
**Compound Microscope – Crossed polars + DIC (x40)**  
**Human Hair (Mike)**

Diameter  $\sim 80\mu\text{m}$



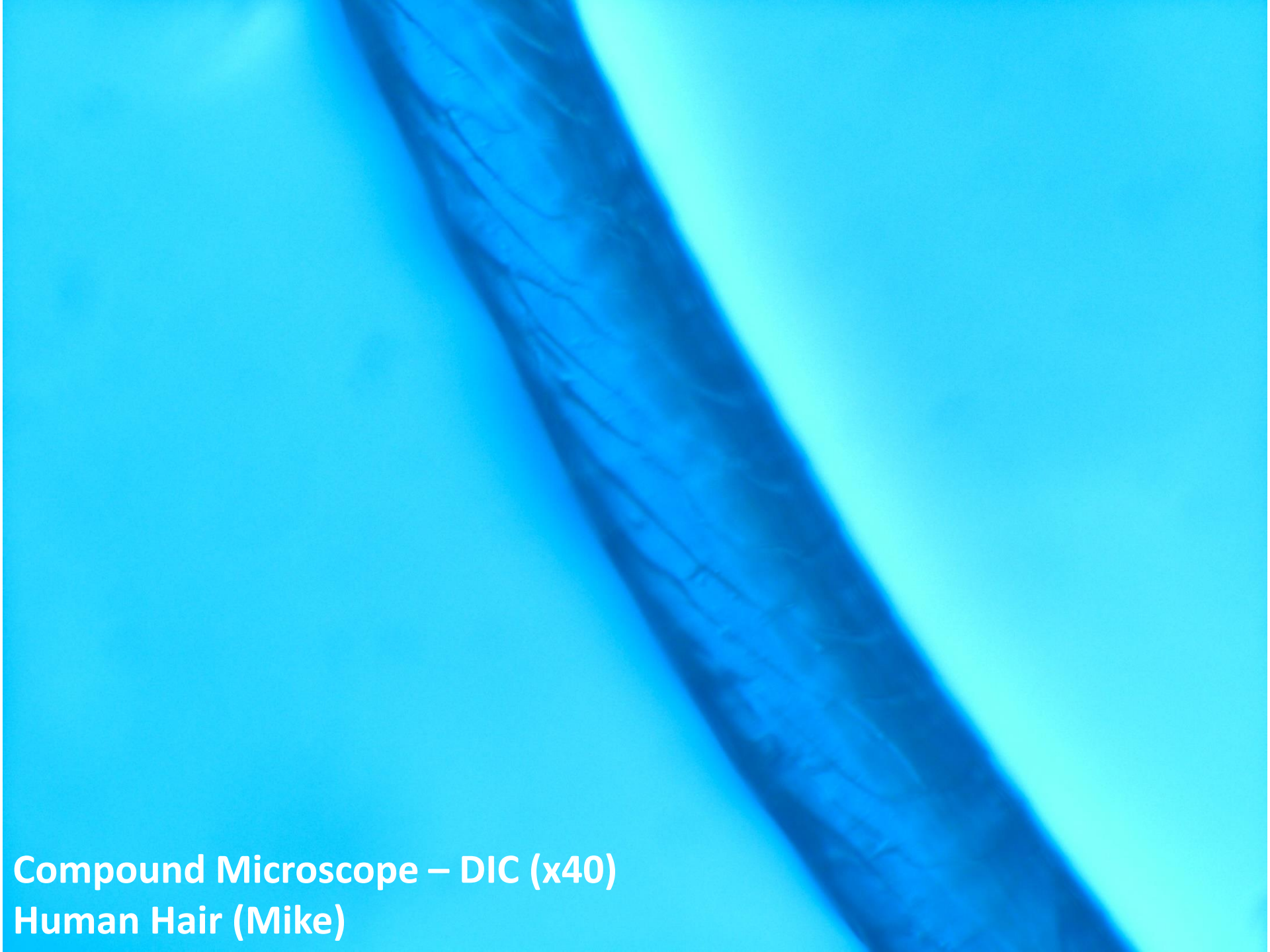
**Compound Microscope – Crossed polars (x40)  
Human Hair (Mike)**



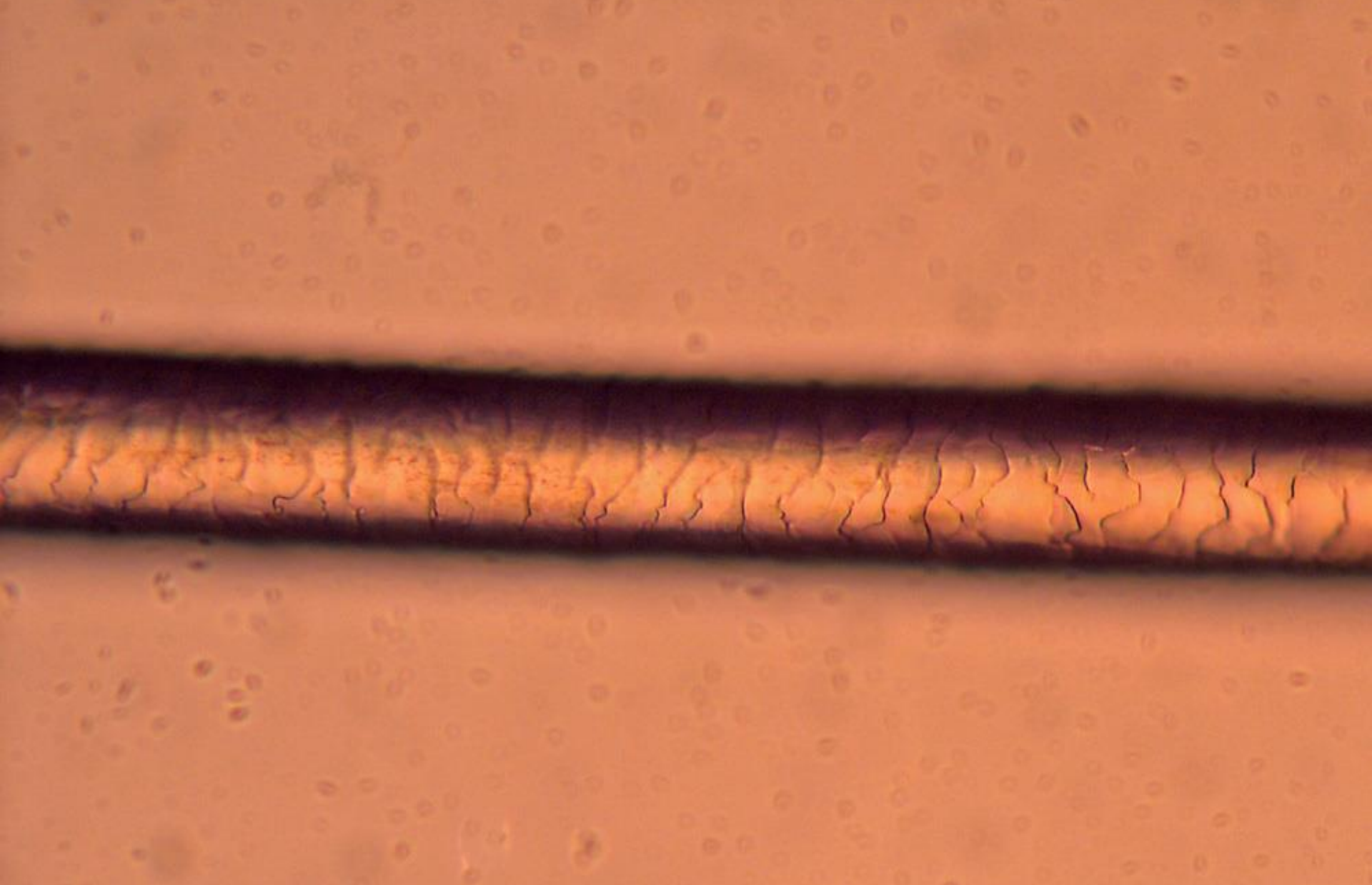


**Compound Microscope – Crossed polars (x40)  
Human Hair shavings (Derek Haworth)**





Compound Microscope – DIC (x40)  
Human Hair (Mike)



**Reflectance Microscopy**  
Hair of 5 year old human

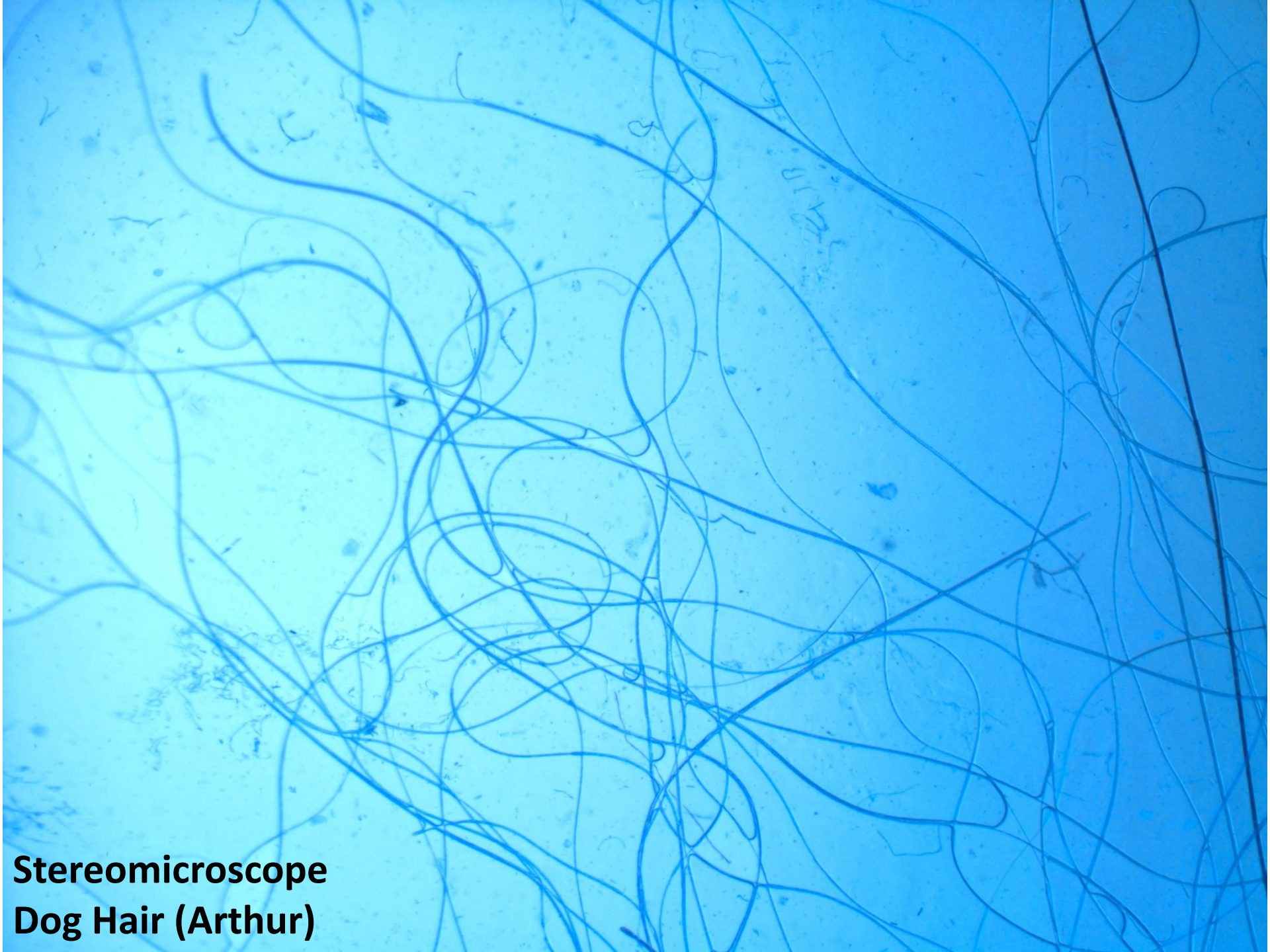
*Hair & photo courtesy of Harrison Almond (2021)*



# Keeshond Dog Hair - Arthur

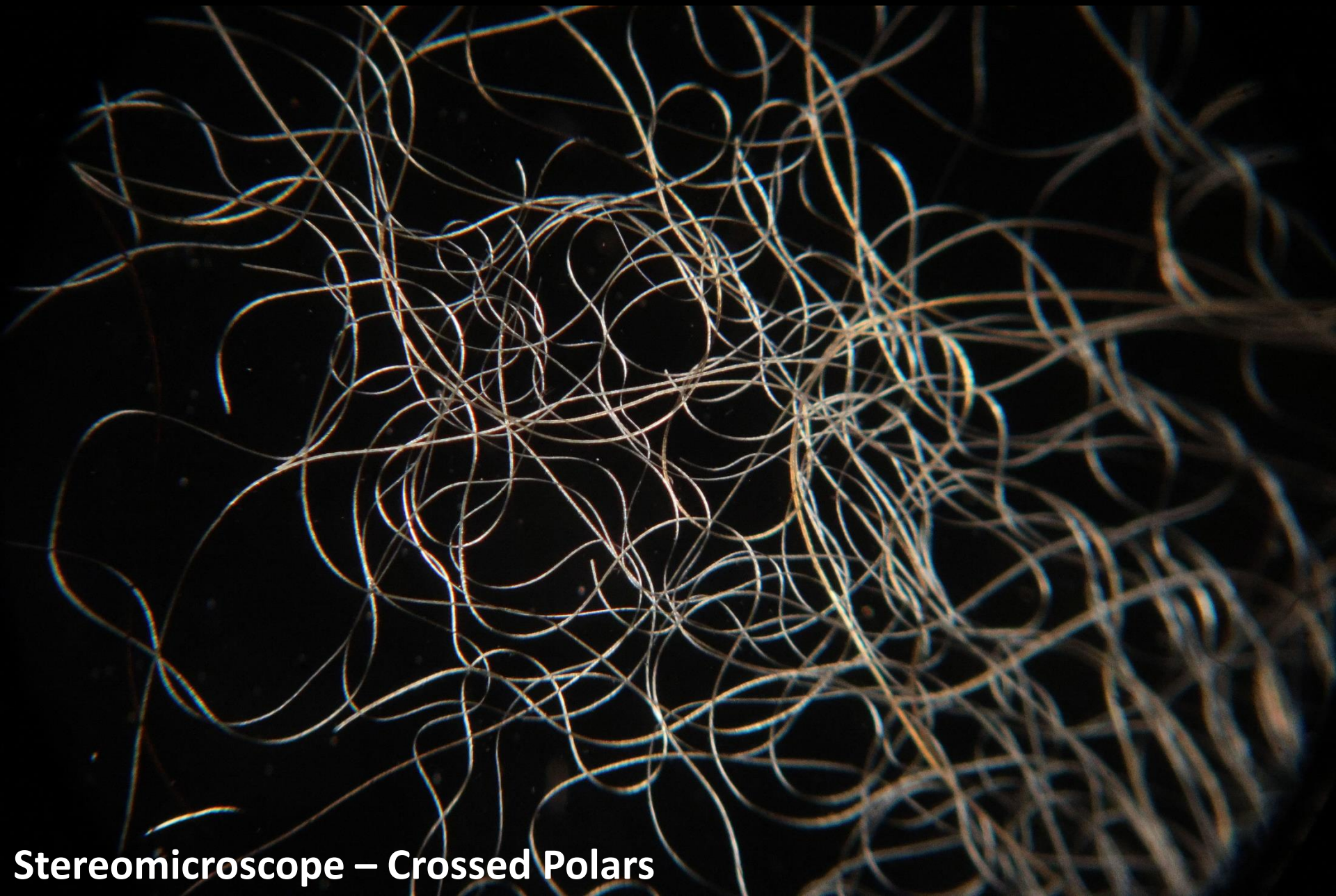






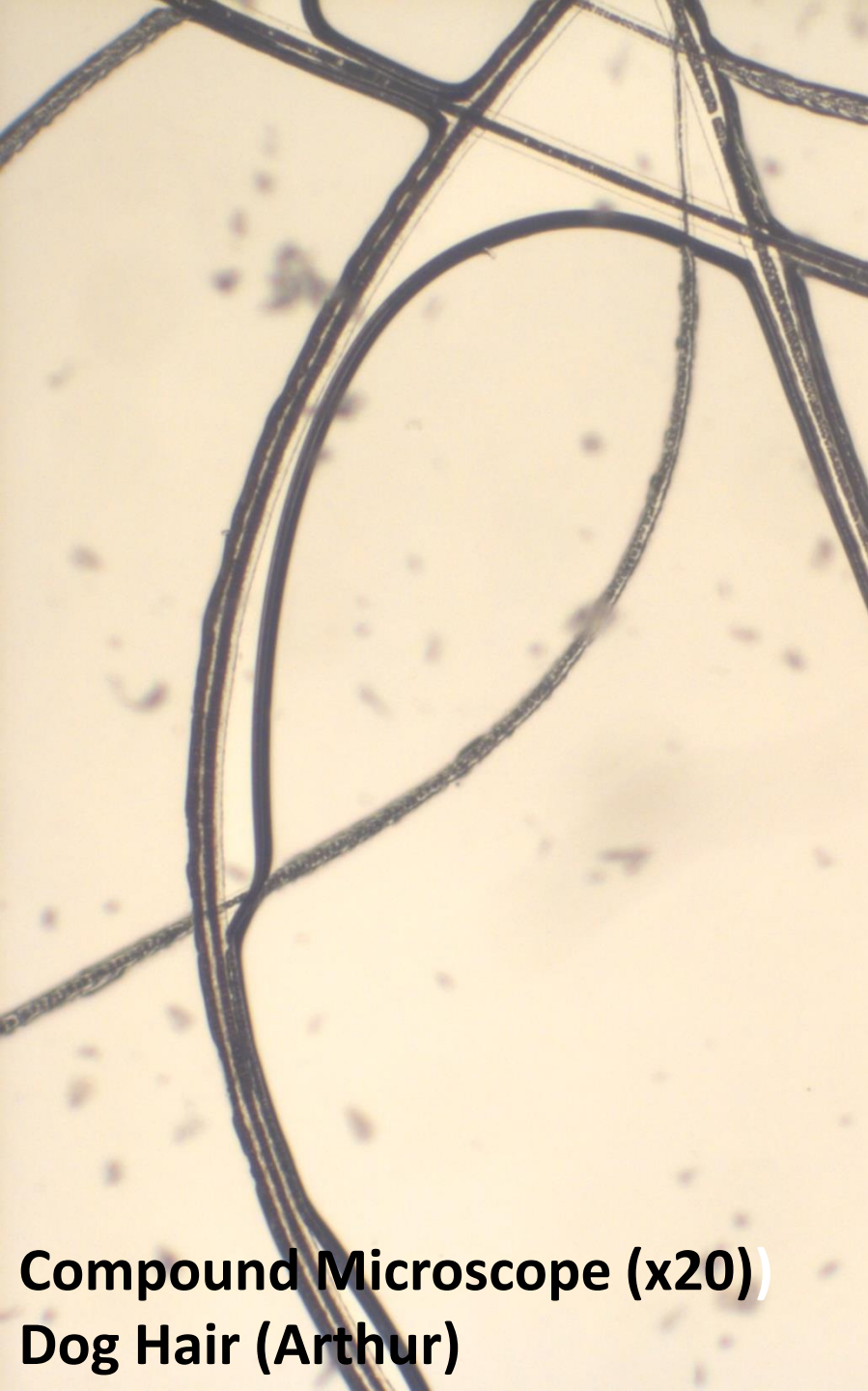
**Stereomicroscope  
Dog Hair (Arthur)**





**Stereomicroscope – Crossed Polars**  
**Dog Hair (Arthur)**





**Compound Microscope (x20)  
Dog Hair (Arthur)**

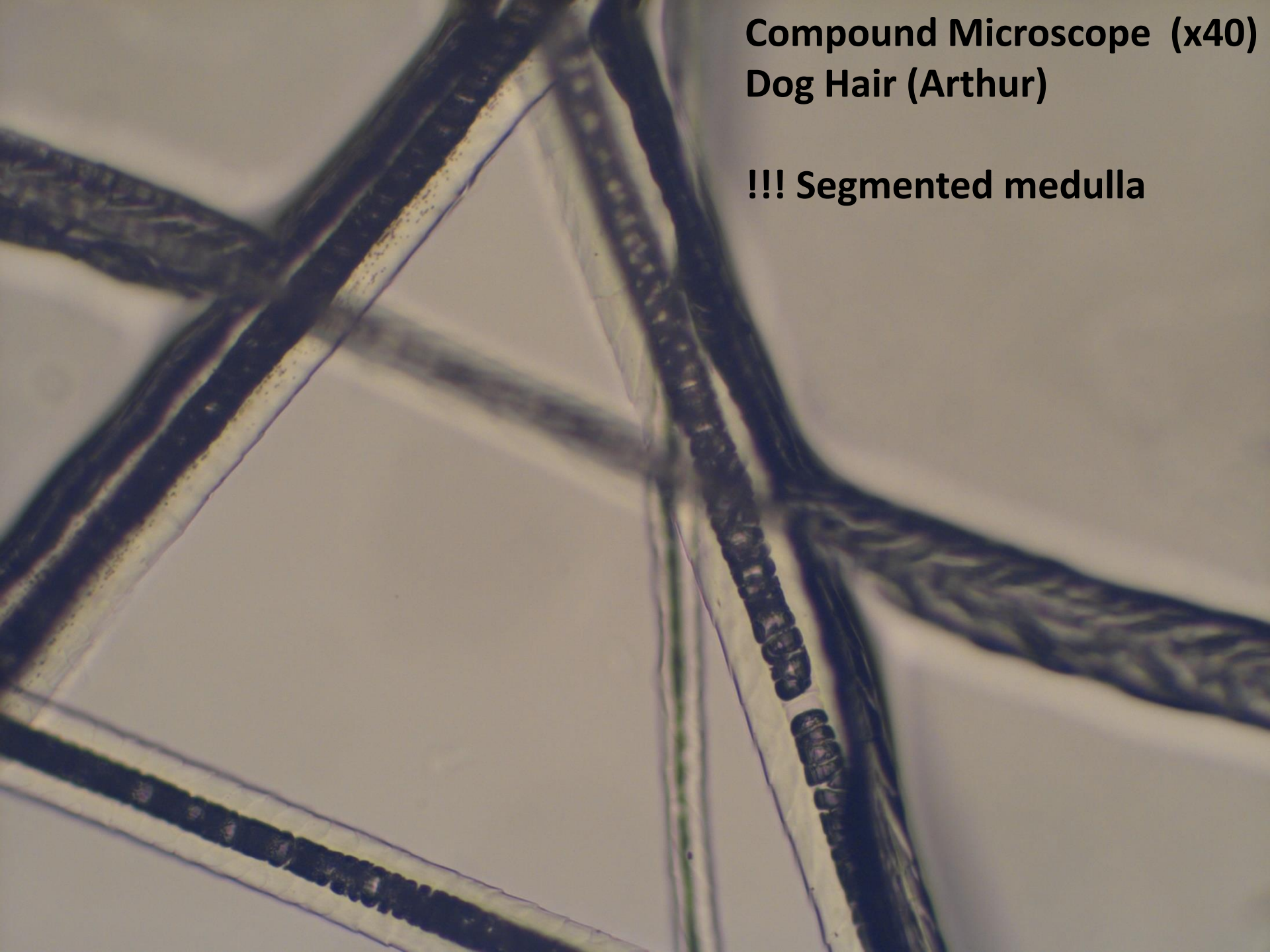


**+ Crossed Polars**



**Compound Microscope (x40)**  
**Dog Hair (Arthur)**

**!!! Segmented medulla**

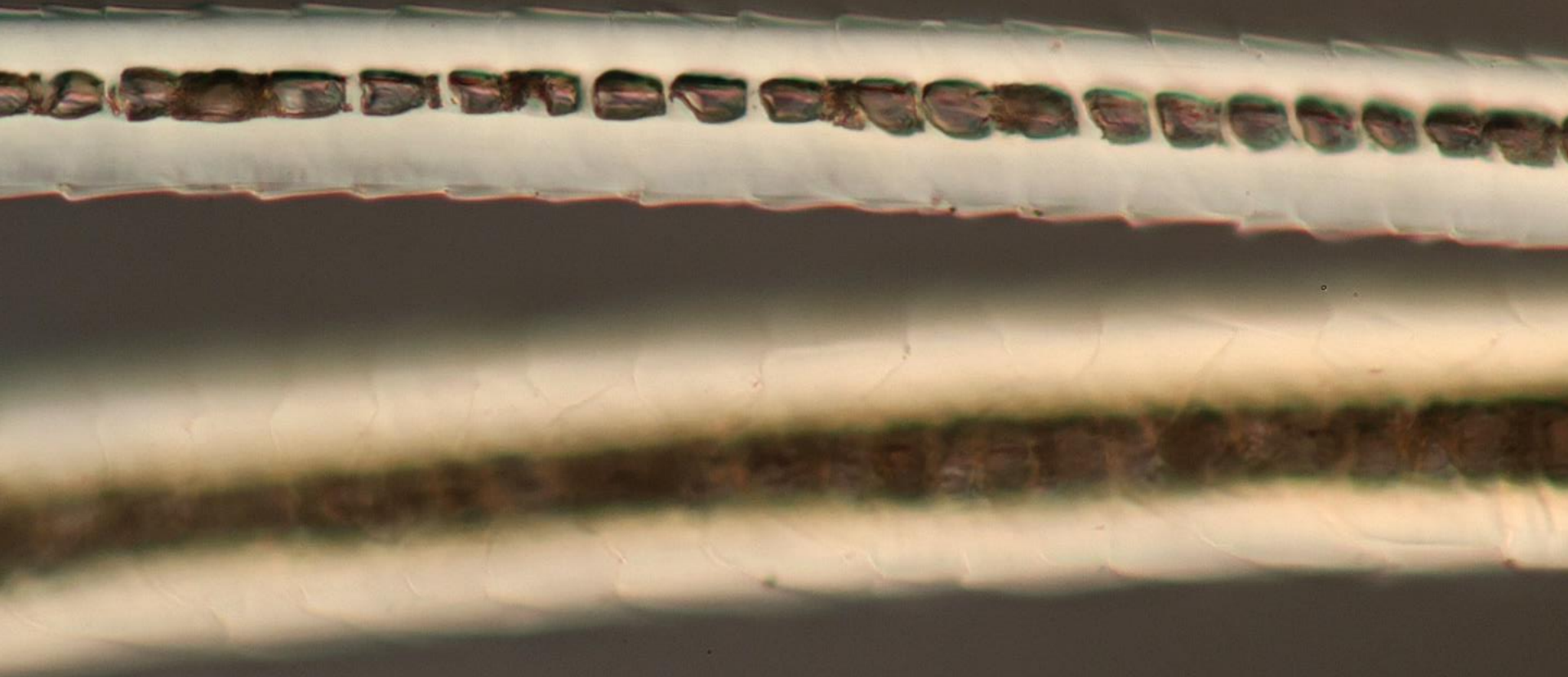


Compound Microscope - adjusted condensor  
Dog Hair (Arthur)








Diameters  $\sim 30\mu\text{m}$  &  $50\mu\text{m}$

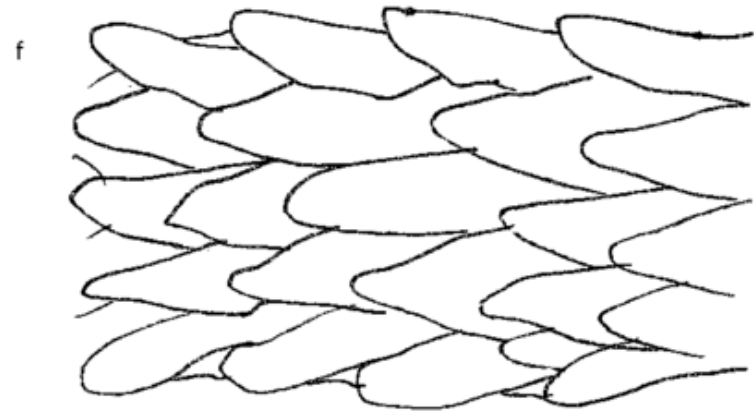
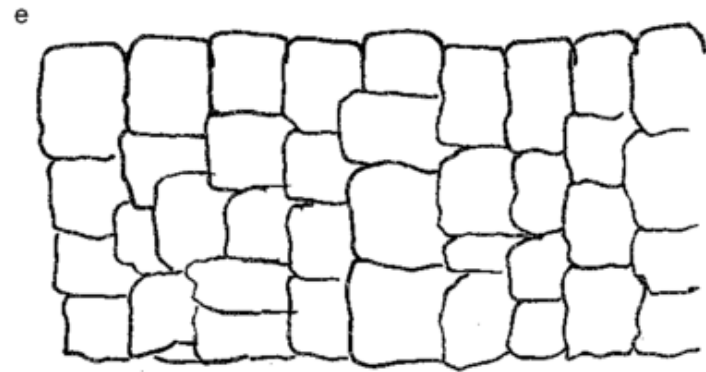
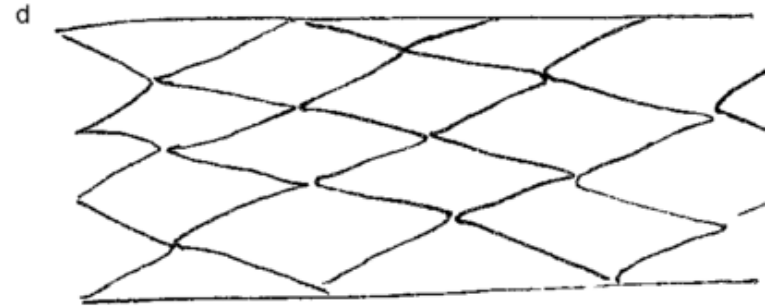
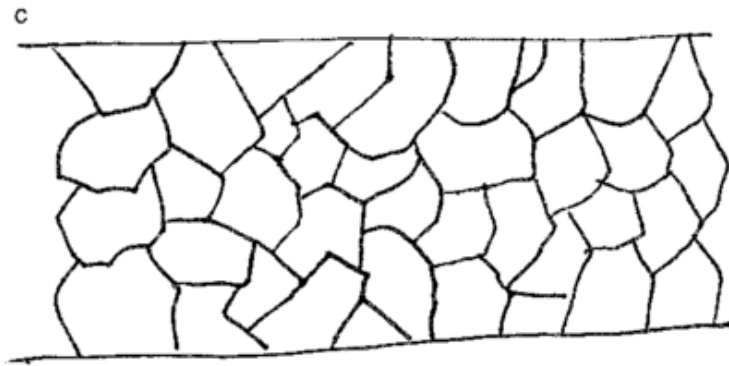
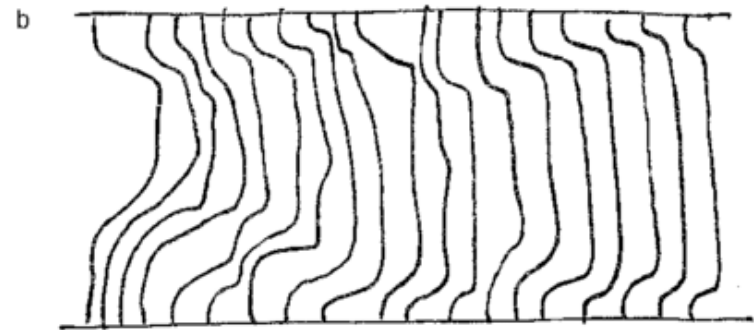
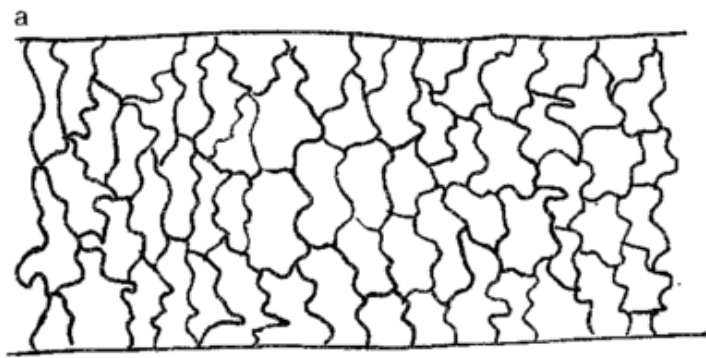




Compound Microscope DIC (x40)  
Dog Hair (Arthur)

Medulla Pattern	Description	Diagram
<b>Continuous</b>	One unbroken line of color	
<b>Interrupted (Intermittent)</b>	Pigmented line broken at regular intervals	
<b>Fragmented or Segmented</b>	Pigmented line unevenly spaced	
<b>Solid</b>	Pigmented area filling both the medulla and the cortex	
<b>None</b>	No separate pigmentation in the medulla	





Scale patterns of hair shafts in dogs: (a) irregular wave, (b) streaked, (c) mosaic, (d) narrow diamond petal, (e) broad petal and (f) elongate petal.

*Tumilowicz et al 2018 Vet Derm 29 Preliminary study of guard hair morphology in four dog breeds*

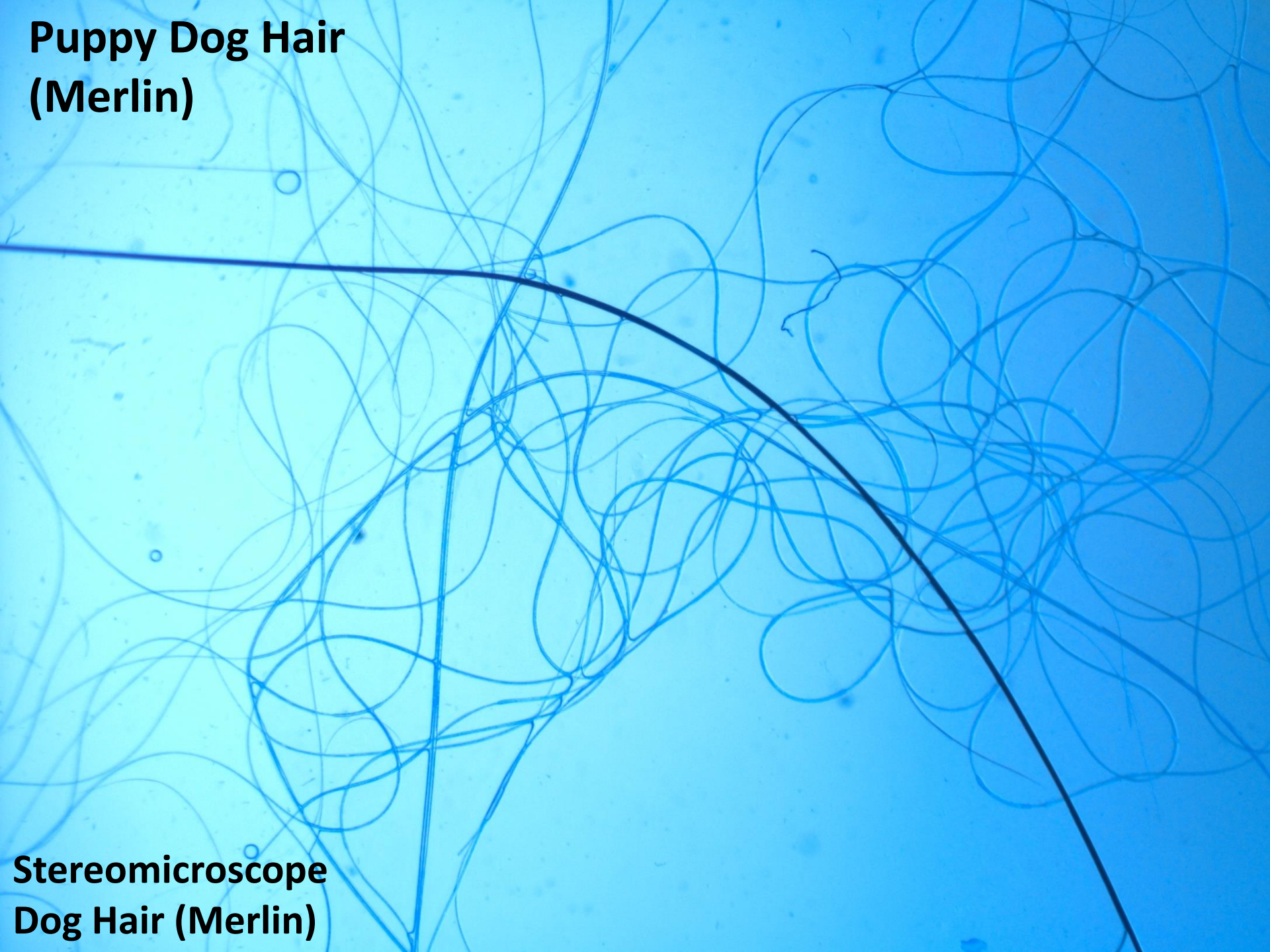
## Keeshond Puppy Hair – Merlin (5 months)



Merlin (3 months)

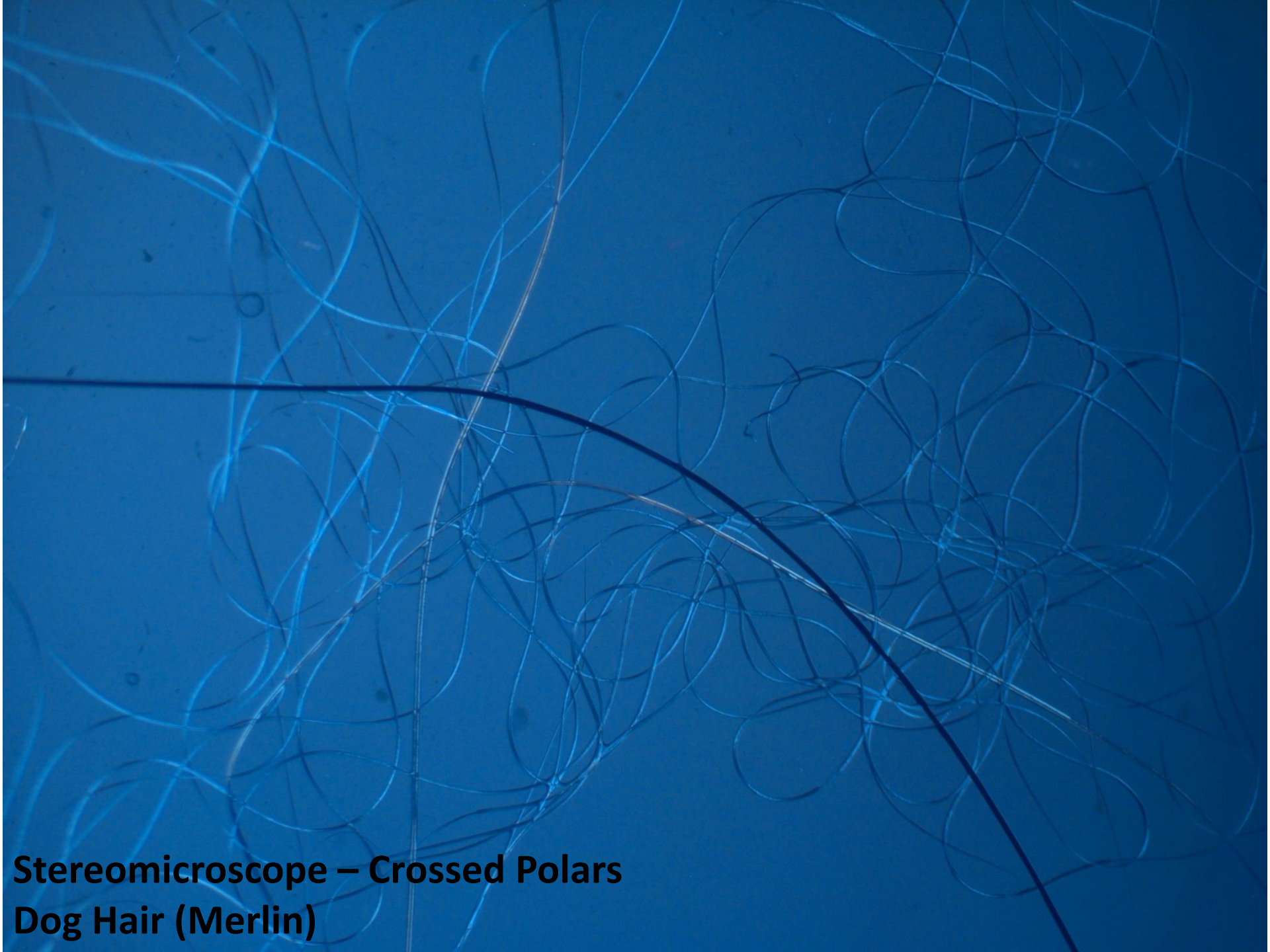


**Puppy Dog Hair  
(Merlin)**



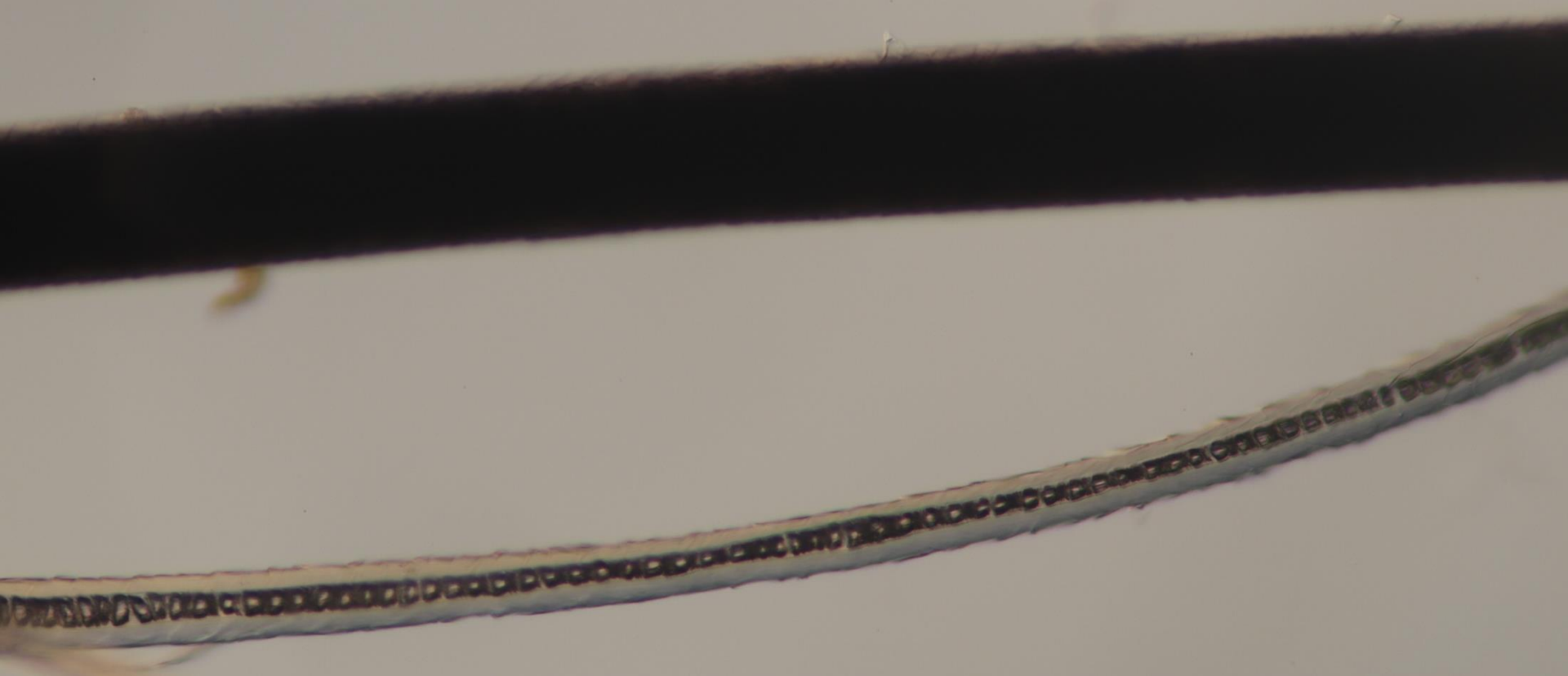
**Stereomicroscope  
Dog Hair (Merlin)**



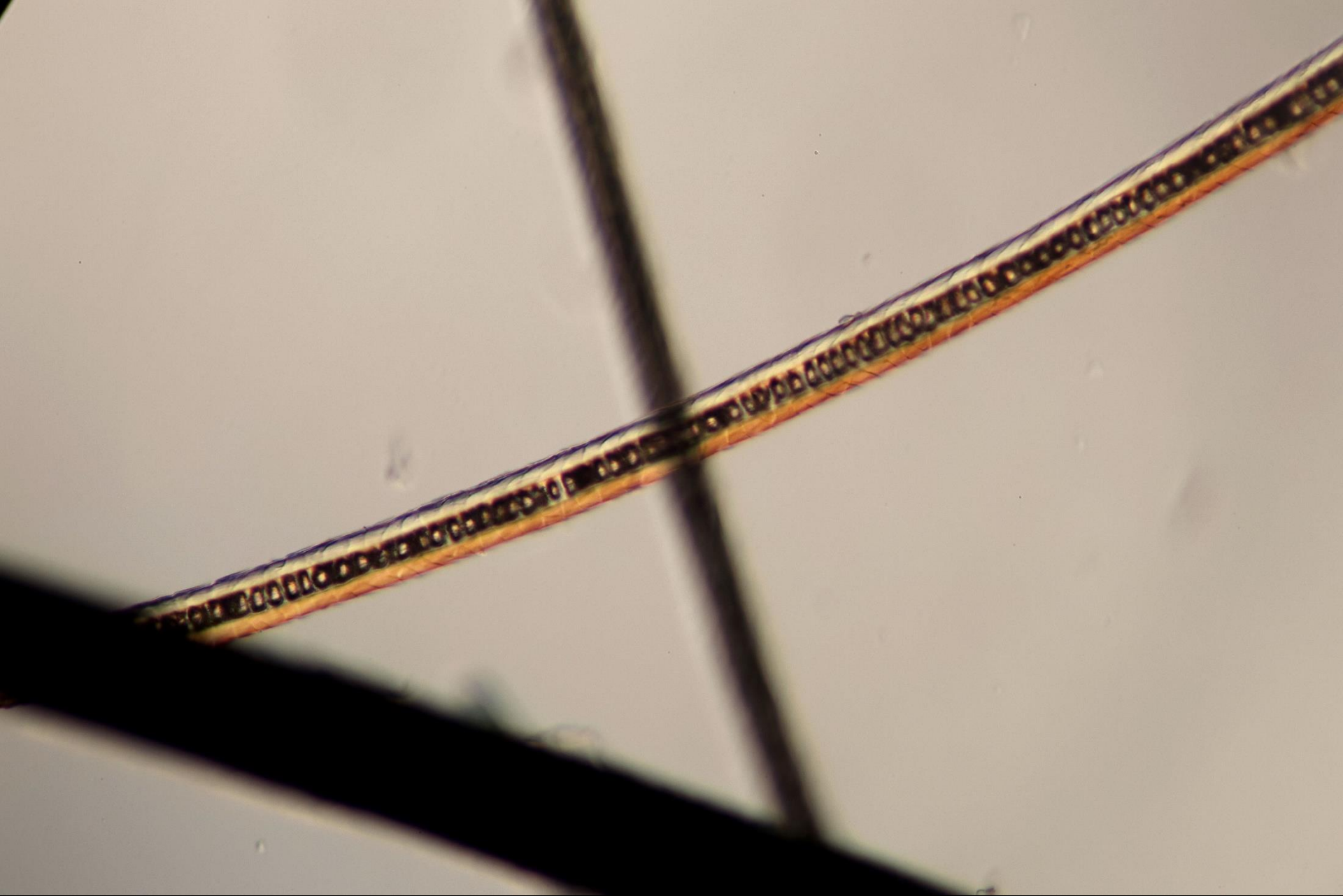


**Stereomicroscope – Crossed Polars**  
**Dog Hair (Merlin)**





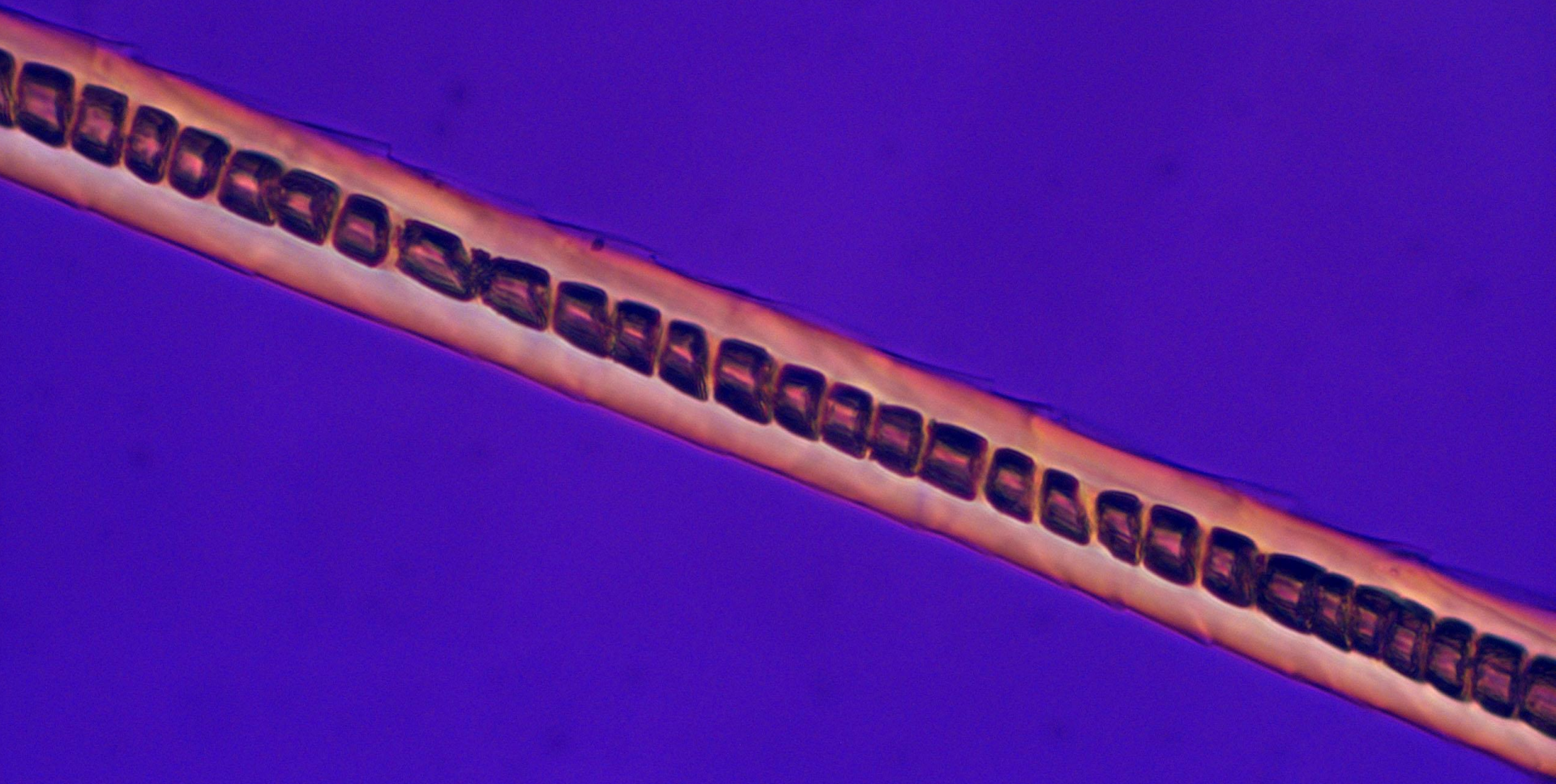
**Compound Microscope DIC (x20, x40)  
Puppy Dog Hair (Merlin)**



**Compound Microscope – DIC (x40)**  
**Puppy Dog Hair (Merlin)**

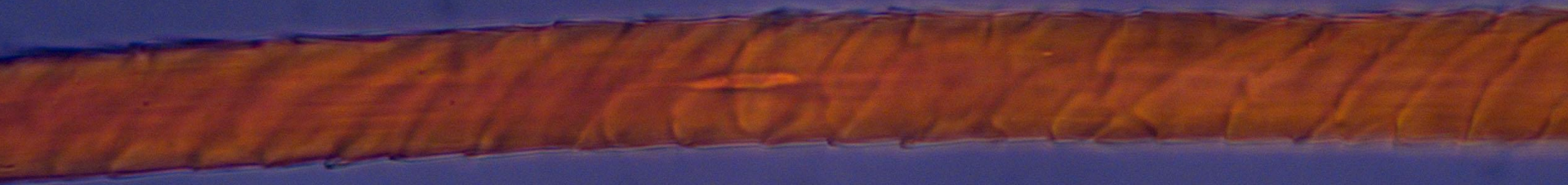
Diameters  $\sim 30\mu\text{m}$  &  $60\mu\text{m}$





**Compound Microscope – Polarising + Full Wave Plate (x40)**  
**Puppy Dog Hair (Merlin)**





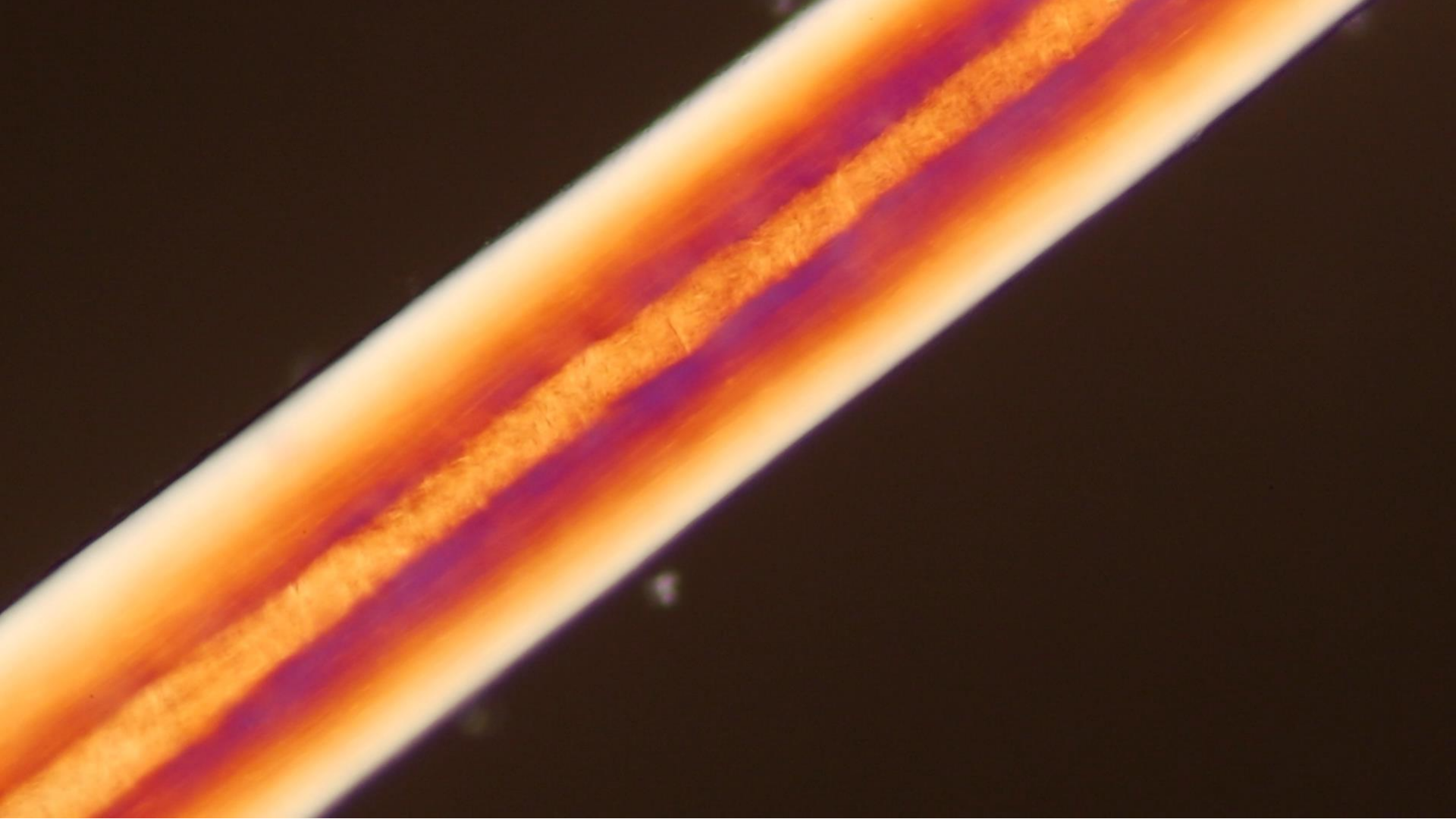
**Compound Microscope – DIC (x20) of ‘thick black hair shaft’  
Puppy Dog Hair (Merlin)**





**Videos** – polarising microscopy in action with rotation of microscope stage

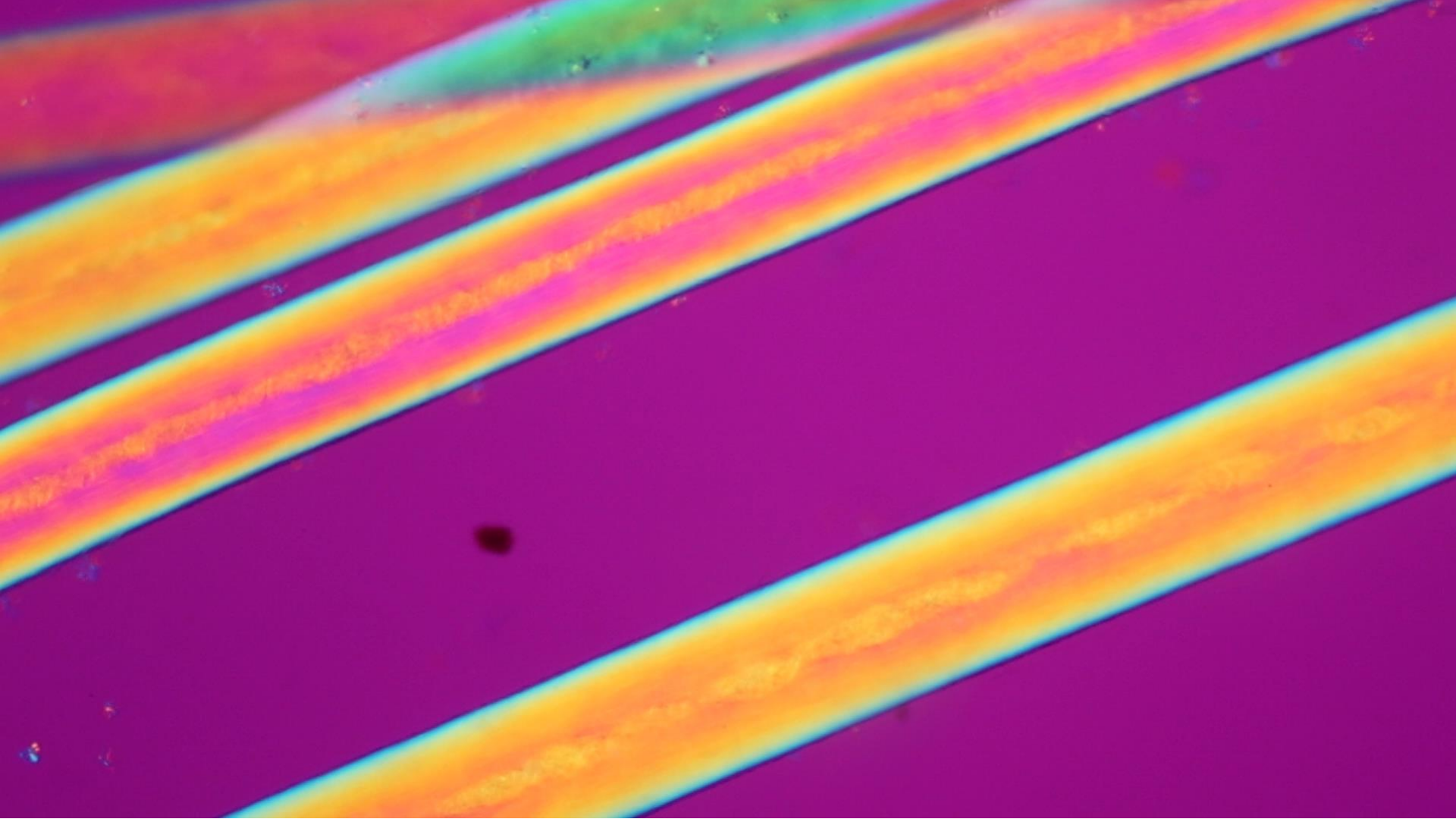
**Human Hair (Mike)**



**Videos** – polarising microscopy in action with rotation of microscope stage

**Human Hair (Mike)**





**Videos** – polarising microscopy in action with rotation of microscope stage

**Human Hair (Mike)**

+ 530nm Full Wave plate



**Videos** – polarising microscopy in action with rotation of microscope stage

**Dog Hair (Arthur)**

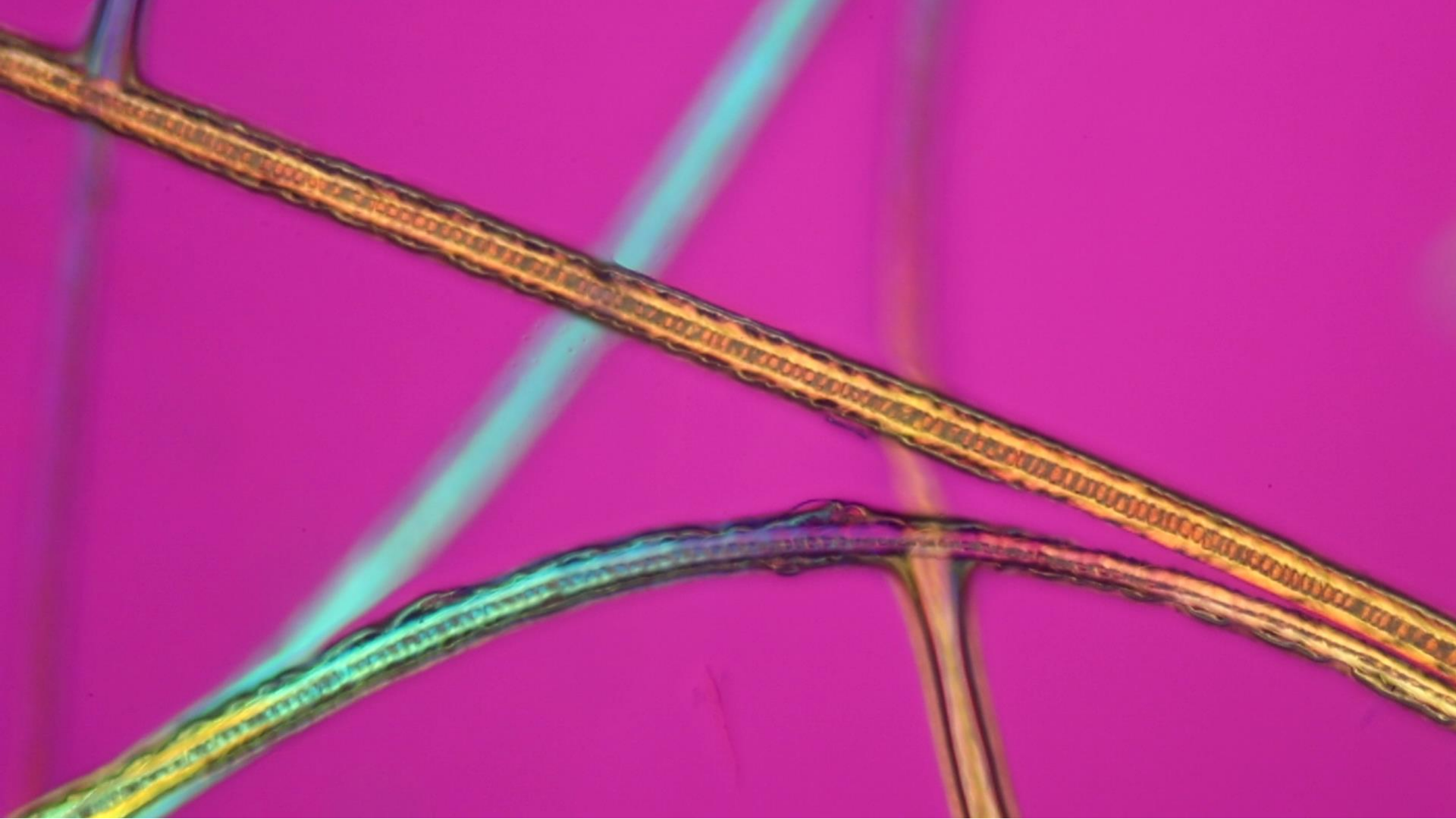




**Videos** – polarising microscopy in action with rotation of microscope stage

**Dog Hair (Arthur)**

+ 530nm Full Wave plate



**Videos** – polarising microscopy in action with rotation of microscope stage

**Puppy Dog Hair (Merlin)**

+ 530nm Full Wave plate



# Conclusions

- Hair is a very interesting subject for microscopical study
  - Easy material to collect
  - Easy to prepare
  - Suitable for various microscopical techniques
- More data needed on human and other species
  - Hair thickness range
  - Cortex / Medulla ratios
  - Scale size & distribution
  - Medullary patterns
  - .....

# Equipment Used ...

- Scissors
- Slides
- Brunel Stereomicroscope + polarisers
- Olympus BH2 Compound Microscope + Pol, DIC, Phase
- Micrometer slide
- Cameras – Jenoptik 5mp & Canon R6 24 mp



# Further Information ...

- Robinson & Bradbury (1992) Qualitative Polarised light Microscopy. RMS Handbook
- Delly (2017) Essentials of polarized light microscopy and ancillary techniques.
- [Mesmerizing Microphotography of the Hairs of Different Animals Under Polarized Light – The Marginalian](#) Museum of Microscopy – Florida State University
- The Study of Hair (2010), Ch 3 National Geographic Learning [31559\\_03\\_ch03\\_p048-075.indd \(cengage.com\)](#)
- *Tumilowicz et al (2018) Vet Derm 29 Preliminary study of guard hair morphology in four dog breeds*

# Hair of the dog !



- an alcoholic drink taken to cure a hangover

## *Origin*

- Originally, the expression referred to a method of treating a rabid dog bite; hair from the dog was placed in the wound. So in that sense, having another drink (any drink) is like taking hair from the dog that bit you.





*In Memoriam - Arthur*