OPTICAL MICROSCOPY

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OBJECTIVES

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Familiarize

Understand the basic principles of optical microscopy and how to use a stereomicroscope.

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Use a stereomicroscope to observe tiny 3D objects.

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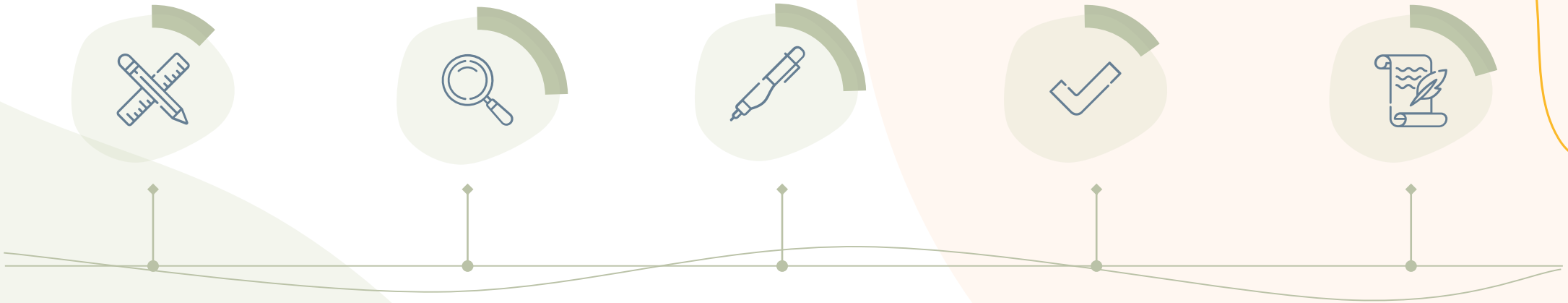
Characterize

Characterize different microscopy modes

METHODOLOGY



STEREOMICROSCOPE SETUP

- The stereomicroscope is placed on a flat surface and the eyepieces are adjusted so that a single circular field of view is seen with both eyes open.

SAMPLE PLACEMENT

- The sample is placed on the stage of the stereomicroscope and secured with the stage clips.

FOCUSING PROCEDURE

- The large knob near the toothed gear is used to move the lenses up or down until a focused image is seen with the left eye.
- The right eye is covered and the focusing ring on the eyepiece barrel is adjusted until the image appears focused through the right eyepiece.

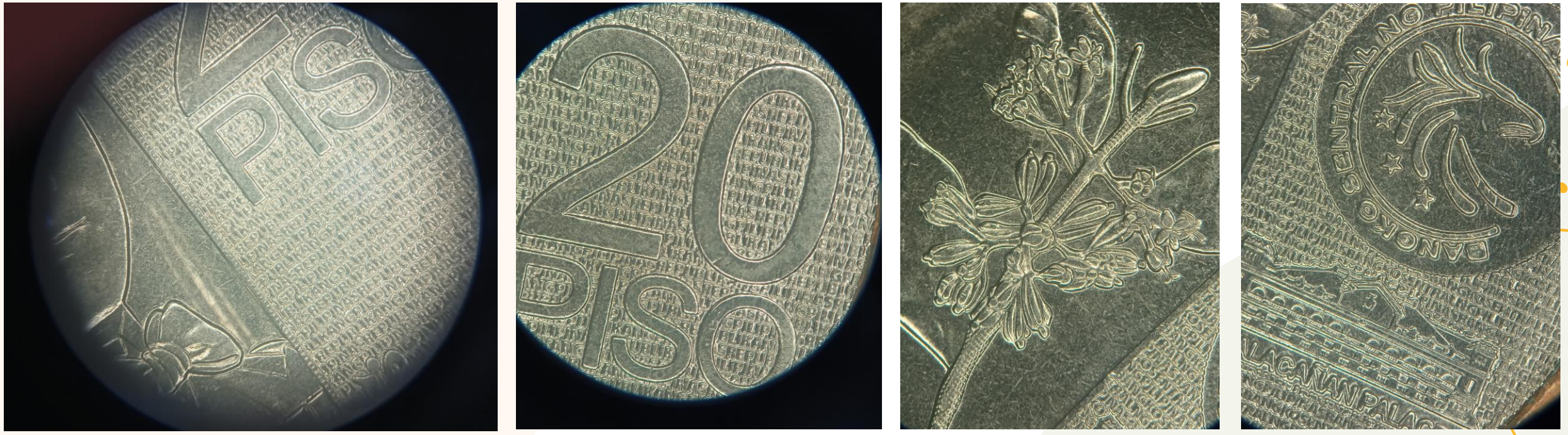
MAGNIFICATION ADJUSTMENT

- The magnification knob is adjusted to increase or decrease the magnification.

IMAGE CAPTURE

- A cellphone camera is used to take a picture of the sample through one of the eyepieces.

RESULTS: PHILIPPINE COINS



20-peso coin viewed under a microscope in 1.0x magnification (first two images) and 3.0x maginification (last two images)

Viewing the 20 peso coin under a microscope **allows us to see the small details of the coin that are not visible to the naked eye**. This can help us to **appreciate the craftsmanship of the coin** and **to learn more about its features that might go unnoticed in casual observation.**

On the obverse side of the coin, as seen in the first two figures, we can clearly see the **figure of Manuel L. Quezon** and the phrase "**Republika ng Pilipinas**" (Republic of the Philippines) **in small print in a pattern of interwoven lines** behind the currency label. On the reverse side of the coin, as seen in the last two figures, we can clearly see the **Nilad flower**, together with the **logo of the Bangko Sentral ng Pilipinas (BSP), the Malacañang Palace**, and a **"Bangko Central ng Pilipinas" pattern behind them.**

RESULTS: PHILIPPINE COINS

The photo on the right is the reverse side of a 5 peso coin, basically the same as the first coin from the previous slide. Here, **we can clearly see the Jade Vine flower** alongside with its printed name Tayabak, the **logo of the Bangko Sentral ng Pilipinas (BSP)** and **a "Bangko Central ng Pilipinas" pattern behind the logo.**

I've included this image due to a personal interest in the Jade Vine. Having learned about its rarity during a visit to Masungi Georeserve last semester, where it thrives as one of the world's rarest and most vulnerable flowers, exclusively found in the Philippines. This simple coin becomes a miniature canvas that brings attention to a unique natural treasure in our homeland.

5-peso coin viewed under a microscope in 1.2x magnification

RESULTS: PHILIPPINE BILLS

Here, I've captured the two details of the 200 peso bill that aren't visible when we first look at it:

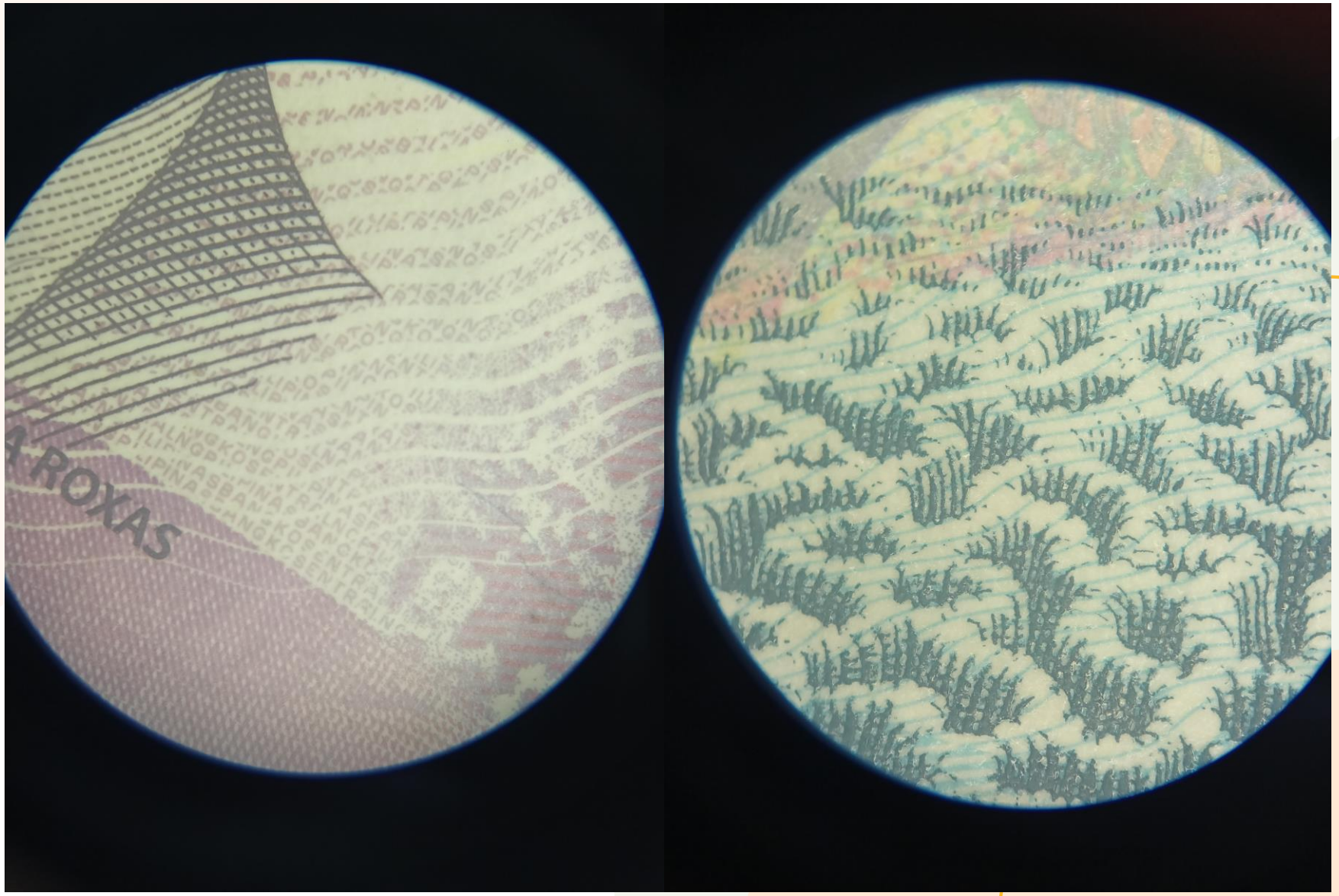
Obverse side: The Declaration of Philippine Independence in Kawit, Cavite with a pattern of interwoven lines behind it.
Reverse side: A close-up version of the Philippine Tarsier.

The individual letters and numbers of the Declaration of Independence are sharp and well-defined, and the faces of the people featured are in great detail. The fur and eyes of the Philippine Tarsier are also clearly visible.

200-peso bill viewed under a microscope in 1.0x magnification

RESULTS: PHILIPPINE BILLS

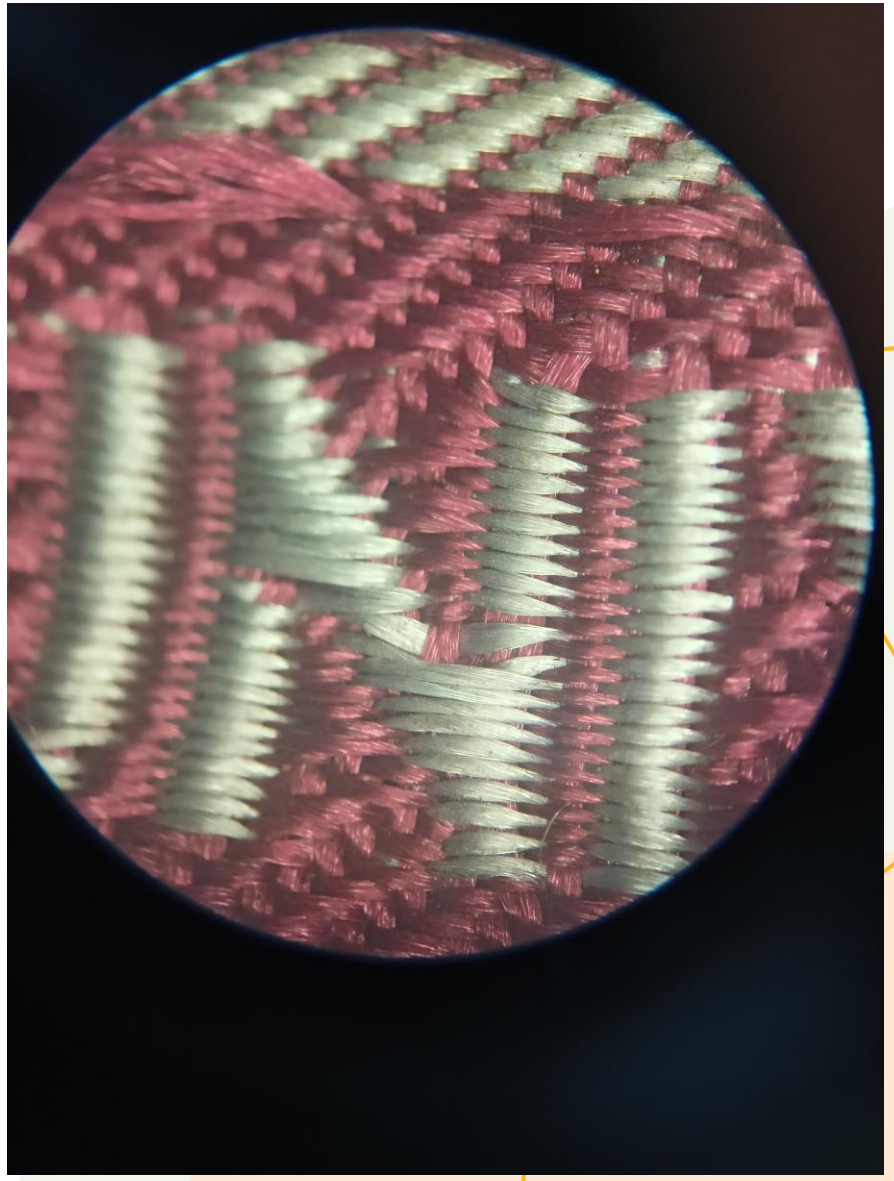
If we just look at these two bills using our naked eyes, we would see a wave-like lines on a 100 peso bill and just a coral reef on the 1000 peso bill. But under a microscope, it is noteworthy that **the lines on the 100 peso bill is actually a BSP pattern** and that **the close up of a coral reef actually contains seagrasses.**



100-peso bill (left) and 1000-peso bill (right) viewed under a microscope in 1.0x magnification

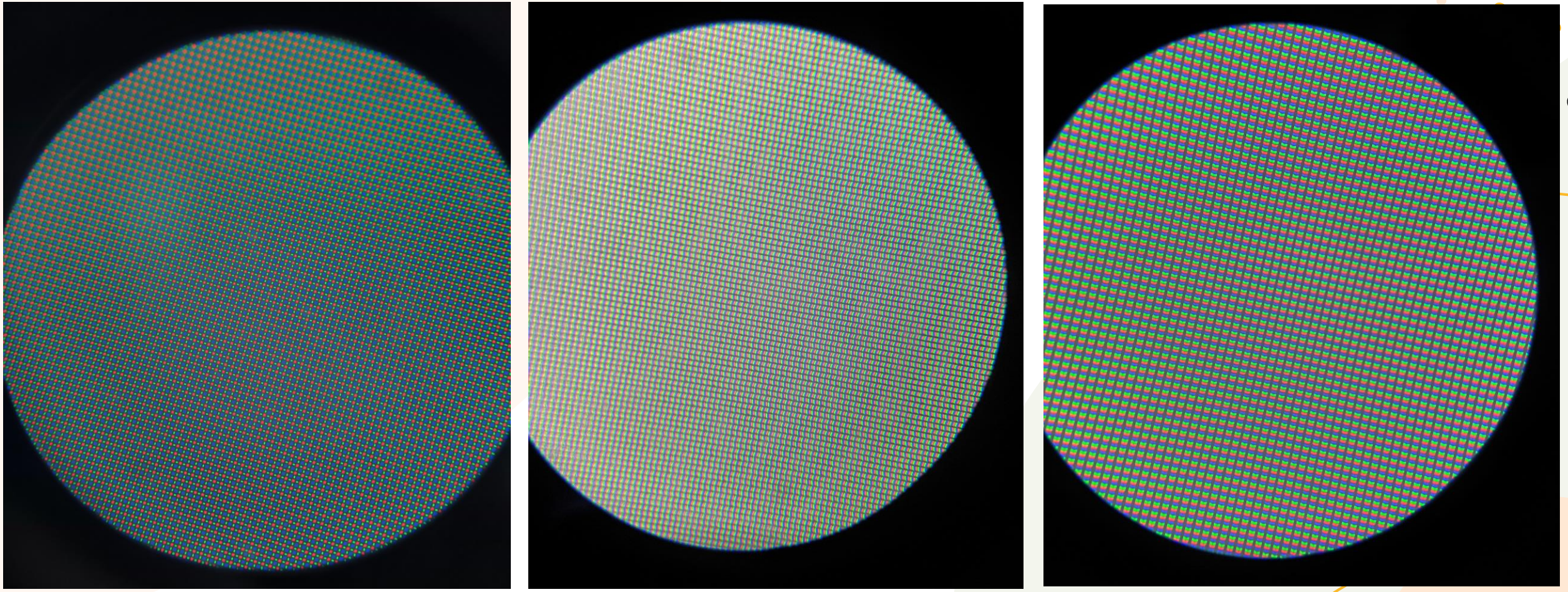
RESULTS: EMBROIDED LANYARD

This is also an interesting sample I have captured during the activity. Using the naked eye, the only things that we could see in this embroidered lanyard are the embroidered letters on the lanyard, the colors of the thread, and the overall pattern of the embroidery. But **the microscope allows us to see the embroidered lanyard in a whole new way.** Here, we can see that the **letters are in a horizontal pattern weave**, **the individual stitches that make up the design**, and **the way the different colors of thread interact with each other.**



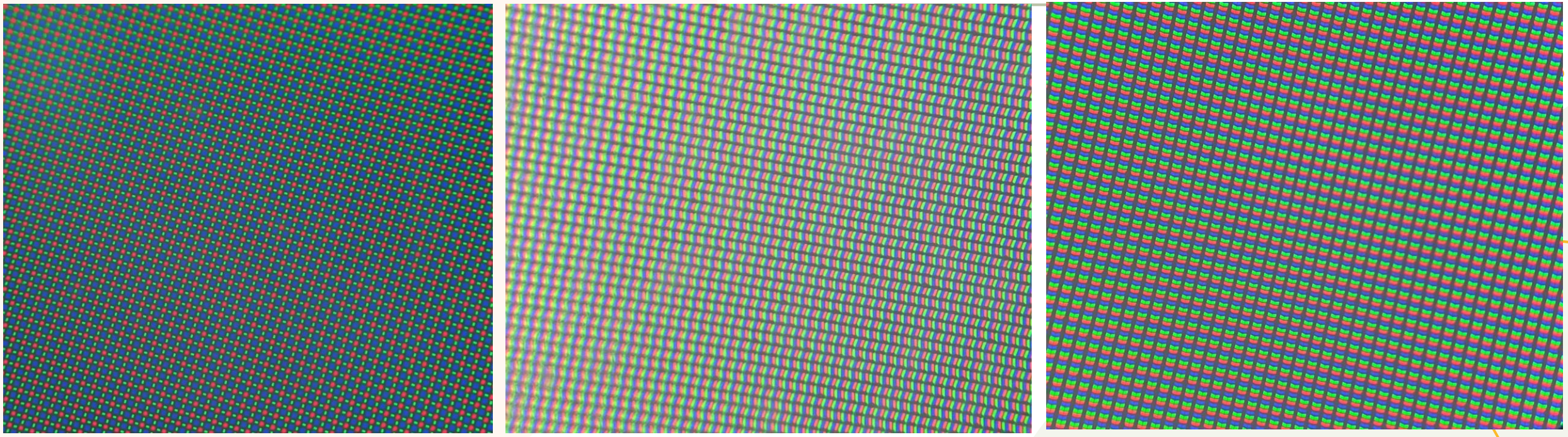
UP embroided lanyard viewed under a microscope in 2.5x magnification

RESULTS: RGB PIXELS



iPhone screen (left), Android screen (middle), and iPad screen (right) under a microscope in 4x magnification

RESULTS: RGB PIXELS



iPhone screen (left), Android screen (middle), and iPad screen (right) under a microscope in 4x magnification

As can be observed here, Android and iPad screens have almost similar RGB pixel. However, **Android screen has smaller pixels, which gives greater pixel intensity**. This means that Android screens can display images with more detail and sharpness than iPad screens. Although **iPad screen has the lowest pixel density of the three screens**, it still has a high enough pixel density to display images with good detail and sharpness. The iPad screen also has a wide color gamut, which makes images appear vibrant and realistic. But among the three, **iPhone screen has the best image quality of the three screens due to its high pixel density and wide color gamut**. Visually speaking, it is unique among all as it is already OLED. OLED screens are unique because they can produce true black. This is because OLED screens can completely turn off individual pixels. This results in a much higher contrast ratio than LCD screens, which means that the screen can display darker blacks and brighter whites. This makes images appear more vibrant and realistic.

DARK FIELD MICROSCOPE

Darkfield microscopy is a form of microscopy that **highlights the edges and contours of objects using oblique lighting.** It operates by. **preventing direct light from passing through the objective lens and allowing only scattered light to flow through** This dispersed light is subsequently concentrated on the picture plane, where it creates a brilliant image of the object against a dark background.

Transparent things, such as **cells and tissues**, are frequently studied using darkfield microscopy. It can also be used to investigate items that are difficult to view using brightfield microscopy, such as very small objects or objects with a lot of background noise. It has a number of advantages, including high contrast, easy use, and beautiful images. However, it also has some challenges, such as insufficient illumination, alignment and focus, and sample preparation.

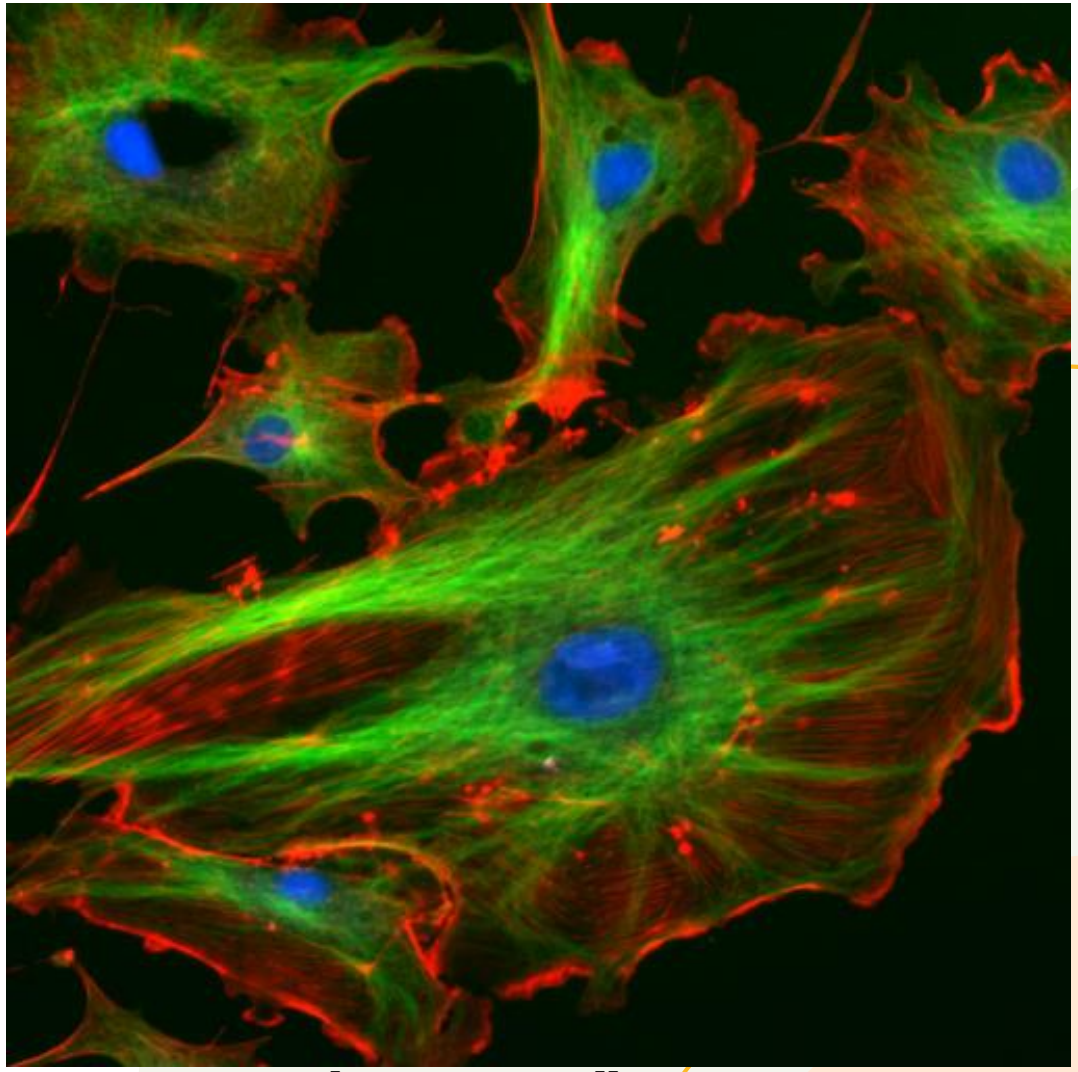
Silkworm larva spiracle and trachea (left) and butterfly (right).

Adapted from "What Is Darkfield Microscopy?" by A. De Grand, 2020, Evident. Retrieved from https://www.olympus-lifescience.com/en/discovery/what-is-darkfield-microscopy/

FLUORESCENCE MICROSCOPE

Fluorescence microscopy is a type of microscopy that **use the fluorescence phenomenon to image objects**. The **emission of light by a material that has absorbed light or other electromagnetic radiation** is known as fluorescence.

Fluorescence microscopy works by The light emitted by the microscope objective is t**illuminating a certain wavelength of light on a material. This light stimulates the fluorescent molecules in the sample, causing them to produce longer-wavelength light.** hen collected and processed through a filter to eliminate the excitation light. As a result, the fluorescent molecules look brilliant against a dark backdrop in the picture of the sample.



Fluorescent cells

Adapted from "Fluorescent cells", LibreTexts Biology. Retrieved from https://bio.libretexts.org/Courses/Northwest_University/MKBN211%3A_Introductory_Microbiology_(Bezuidenhout)/02%3A_Microscopy/2.04%3A_Other_Types_of_Microscopy/2.4.04%3A_Fluorescence_Microscopy

REFLECTION

I thoroughly enjoyed this hands-on microscopy activity. It was amazing to be able to look at things I didn't seem to notice before**.** I was especially amazed by the RGB image of the white background on my phone. I never would have thought that it would look so complex under a microscope. I learned a lot about microscopy during this activity. I learned about the different types of microscopes, how to use them, and how to interpret the images they produce.

I was able to meet all of the objectives of the activity, so I give myself a perfect score of **100/100.**

REFERENCES

[1] Grand, A. D. (2020, December 17). What is darkfield microscopy?. Olympus LS. https://www.olympus-lifescience.com/en/discovery/what-is-darkfield-microscopy/

[2] Libretexts. (2023, September 13). 2.4.4: Fluorescence microscopy. Biology LibreTexts. https://bio.libretexts.org/Courses/Northwest_University/MKBN211%3A_Introductory_Microbiology_(Bezuidenhout)/02%3A_Microscopy/2.04%3A_Other_Types_of_Microscopy/2.4.04%3A_Fluorescence_Microscopy

THANK YOU!