

# **SELF ASSEMBLE ABLE PORTABLE SMARTPHONE AIDED MICROSCOPE**

Submitted in partial fulfilment of the requirements for the award of  
Bachelor of Technology in Biotechnology.

By

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**DEPARTMENT OF BIOTECHNOLOGY  
SCHOOL OF BIO AND CHEMICAL  
ENGINEERING**

## **SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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**MAY - 2022**



# **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

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**Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE**

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## **DEPARTMENT OF BIOTECHNOLOGY**

### **BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of

**ASWINI SAI BALAJI (39230004)** who carried out the project entitled "SELF ASSEMBLE  
ABLE PORTABLE SMARTPHONE AIDED MICROSCOPE" under our supervision from

**February 2022 to April 2022.**

DR. VALLI NACHIYAR

Internal Guide

DR. SANGEETHA

External Guide

**DR. V. RAMESH KUMAR**  
**HEAD OF THE DEPARTMENT**

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**Submitted for Viva voce Examination held on**

Internal Examiner

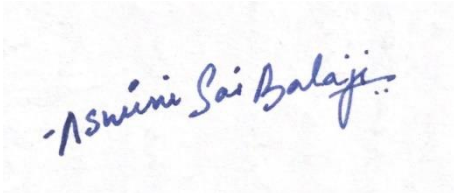
External Examiner

## DECLARATION

I ASWINI SAI BALAJI hereby declare that the Project Report entitled "SELF ASSEMBLE ABLE PORTABLE SMARTPHONE AIDED MICROSCOPE" done by me under the guidance of Dr. VALLI NACHIYAR (Internal) and Dr. SANGEETHA (External), is submitted in partial fulfilment of the requirements for the award of Bachelor of Technology degree in Biotechnology.

DATE: 29-04-2022

PLACE: CHENNAI



SIGNATURE OF THE CANDIDATE

## **ACKNOWLEDGEMENT**

I am pleased to acknowledge my sincere thanks to the Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to Dr. V. Ramesh Kumar, Dean, School of Bio and Chemical Engineering and Dr. V. Ramesh Kumar, Head of the Department, Dept. of Biotechnology, for providing me with necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my project guide Dr. Valli Nachiyar and Dr. Sangeetha for their valuable guidance, suggestions and constant encouragement which paved way for the successful completion of my project work.

## **ABSTRACT**

A microscope is a vital component of research for science enthusiasts who belong to a plethora of age groups. The portability and the cost of the conventional microscope are questionable. The development of a microscope that is user-friendly and portable can help intrigue the new generation and help researchers achieve results and observations with less hassle.

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## CHAPTER 1 - INTRODUCTION

A microscope is an instrument that helps visualize things that can not be visualized by the naked eye .One of the most vital apparatus for research and education in science. The most commonly used microscope in schools and research is the light microscope. Even though the light microscope effectively helps visualize small specimen and objects, it is economically not feasible to a lot of schools and labs. Due to this the personnel to apparatus ratio is not balanced. Apart from that the light microscope is also space consuming and cannot be fit into a small space therefore putting forward storage issues.

A compound microscope or a light microscope is so important for research and scientific studies .Underprivileged people or people who do not have access to a facility that hosts apparatus like a microscope end up not pursuing the field of their interest. Development of an alternative that is engineered with materials that are easily available and economically feasible is very important.

This developed alternative can tackle problems faced by schools and colleges with respect to the volume and availability of the microscope. This will not only help equip people and bright students with their very own microscope but also will help the educators teach the subject more effectively and the students will be able to understand and grasp the subject better.

## CHAPTER 2 - LITERATURE SURVEY

1. <https://akjournals.com/view/journals/2051/3/1/article-p13.xml>

A teacher's point of view on microscope usage in laboratory. The advantages and disadvantages of using a microscope in a school setting.

2. <https://www.semanticscholar.org/paper/APPLICATION-OF-MOBILE-PHONE-BASED-PORTABLE-IN-A-WaliullahAS/16e7bf6634d212b93259c18caebaf701328d1c2b>

Broadened the applications and usage of a smartphone based portable microscopy. Drew parallels between a conventional light microscope and a smartphone based portable microscope and drew a conclusion that they are both similar in imaging and can be used for histopathological sample investigations.

### **CHAPTER 3 - AIM AND OBJECTIVE**

The world that is invisible to the naked eye is filled with wonders. A microscope is a device that helps view very minute structures, even cells, based on the magnification. Microscopes are a vital part of the bio sciences field, not only in research but also in the educational sectors. In the research field it is used to observe and infer results for research projects whereas in the educational sector, it intrigues the smart young minds about the vast topic.

It is of utmost importance that the new generation that will lead tomorrow have access to and can operate a microscope. The conventional compound microscope was found to be hard to work with in few districts in India, and in other parts of the world it is hard to get your hands on to such equipment considering it has high economic value. During this course, individuals generally tend to lose interest in the subject.

A self-assemble able, portable, smartphone aided microscope is an instrument that helps solve a lot of these issues. It not only is extremely easy to assemble but it is also economically viable and can be operated by different age groups. It increases the interest of the individuals trying to learn about life science and is economically also a good decision for schools that can not afford conventional microscope. The self-assemble able, portable, smartphone aided microscope also has a lot of scope to be utilized in the research industry.

## CHAPTER 4 - MATERIALS AND METHODS

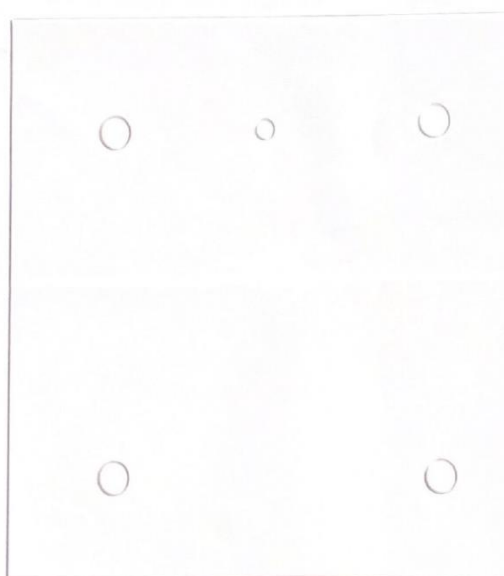
The materials were sourced keeping in mind that they need to be easily available to procure. The materials used were:

- a. Plank with four equally spaced holes.
- b. A transparent sheet with holes cut out ( acrylic sheet)
- c. A long bolt
- d. Lens with 40x magnification. (extracted from a laser light)
- e. Nuts
- f. A strip of magnet or metal
- g. A round magnet
- h. A transparent rectangular piece or microscope slide

(a)



(b)



(c)



(f)



(g)



(e)



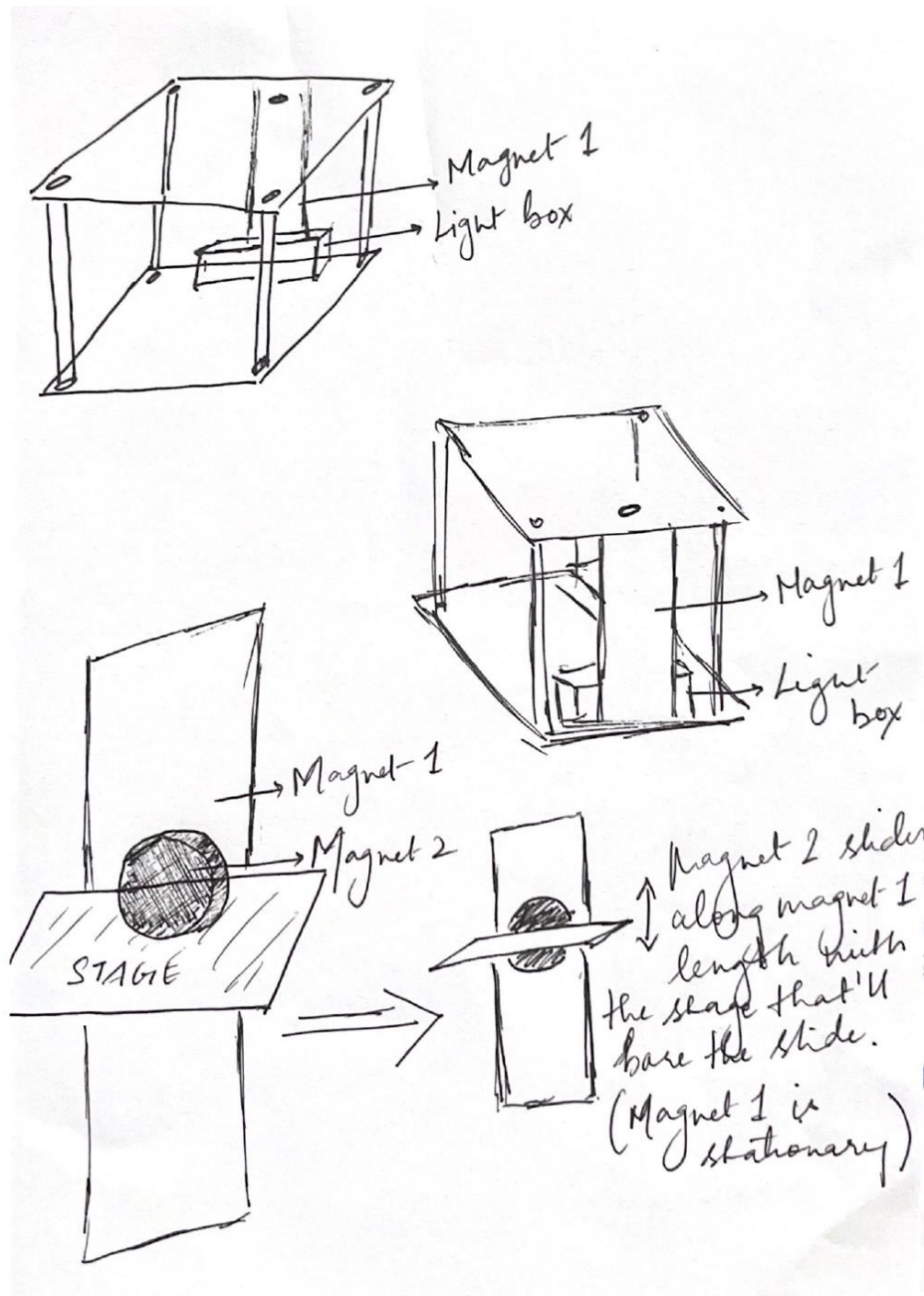
(d)



(h)

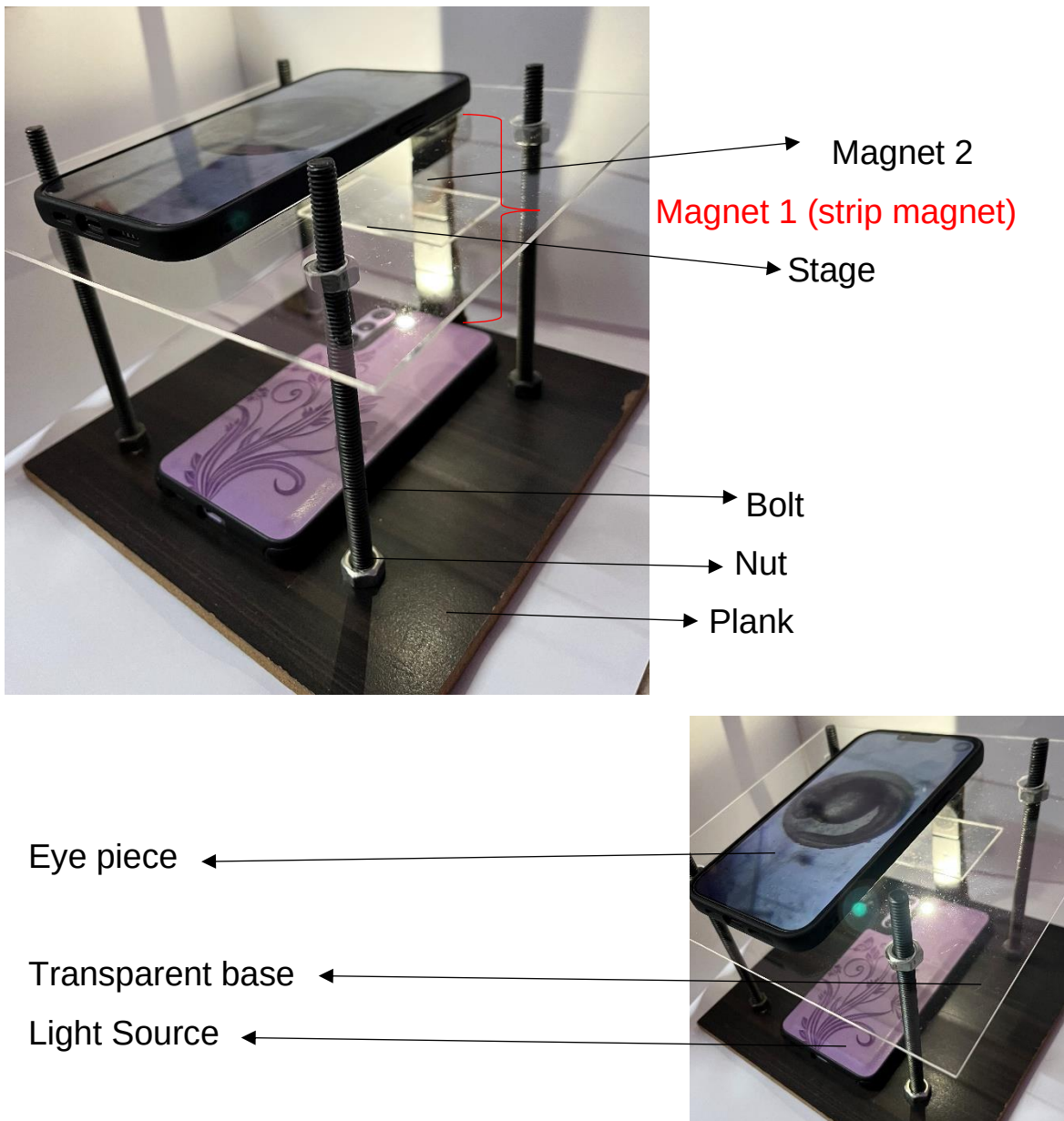


When broken down to most basic components, A microscope has 5 basic structures that make it all come together. They are, the eye piece, the stage, the lens, the focus mechanism and the light source. The microscope was then constructed using the materials keeping in mind that the microscope has to be functional and constructing the microscope should be an activity rather than a task.



( Initial sketch of prototype)

While focusing a microscope, even small distances are very important to focus the specimen we are observing. The focus mechanism is designed with magnets and a ferromagnetic metal that will help us focus more accurately. The magnification of the microscope depends on the smartphone used after it aligns with the lens. As different smartphone cameras have different magnification capacities. The magnification will be the magnification of the lens and the magnification of the phone combined. The materials are assembled as shown in the picture attached below and the specimen is viewed.



## **CHAPTER 5 - RESULTS AND DISCUSSION**

The Microscope constructed proved to function. It was a device that could not only help visualize plant tissue but animal tissue and zebra fish embryos also. Visualisation of such specimen helps intrigue the new generation and also helps researchers get equipped with an easy, affordable and effective alternative to view samples.

In the educational sector, such microscopes are of great need as the reason most of the schools not showing interest in the biological field is the lack of equipment, or lack of skill to use a microscope. Other reasons included not being enough time and such equipment being economically draining. Every single one of these problems can be tackled with a more economically viable solution that uses easily available materials to build a equipment that can easily fit into tiny spaces once dismantled therefore not taking up space.

Further analysing the topic we can note how the teachers feel the biological subject to be demanding enough and not seeing the need to expose the students to a laboratory environment where they can genuinely learn and explore more. The education system is something that has needed a lot of changes to be incorporated that can help the educators and the students and with equipment like this we are one step closer.

## Visualization:

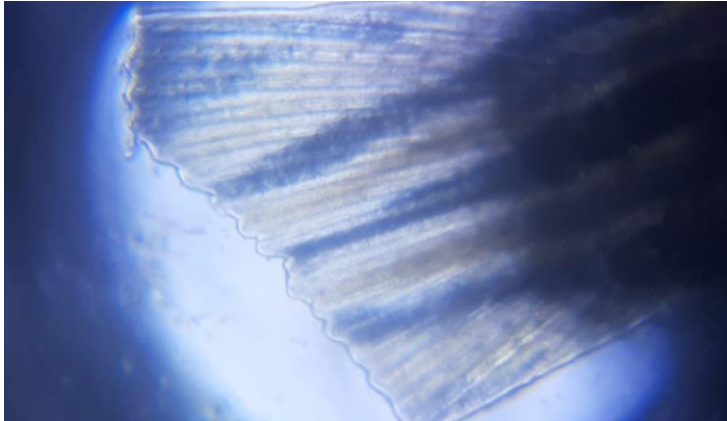


Fig 5.1 *Danio rerio* Fin

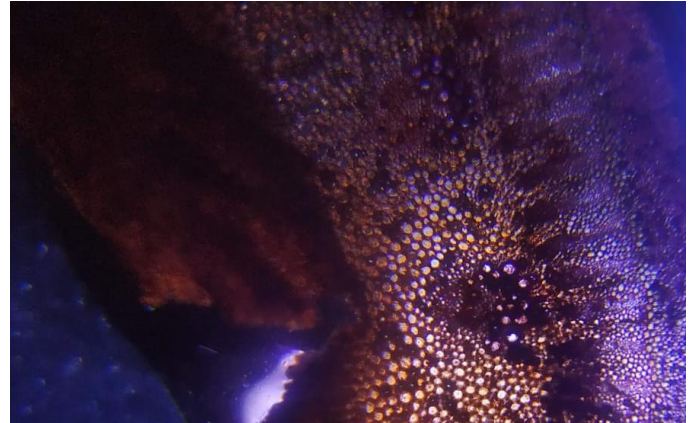


Fig 5.2 Papaya stem

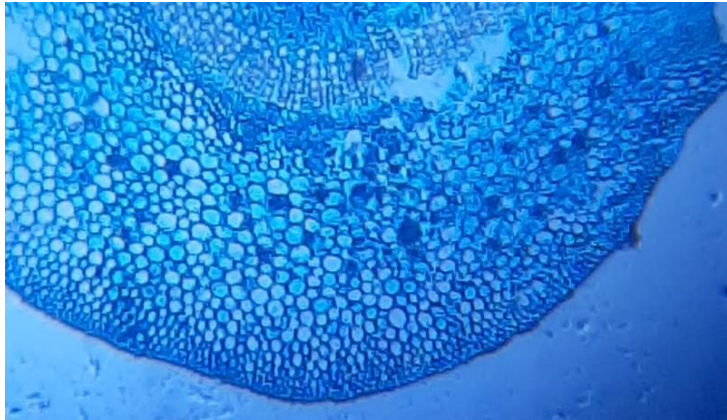


Fig 5.3 Dicot stem



Fig 5.4 *Danio Rerio* embryo

## **CHAPTER 6 – SUMMARY AND CONCLUSION**

The “ Self-assemble able portable, smartphone aided microscope” is an apparatus with which students and researchers can view specimen with an alternative to the conventional microscope that is more compact, economical, and available. Such a microscope helps tackle the problems faced by schools and colleges like the expenditure that goes into buying the conventional compound microscope, the availability of the apparatus, the student to microscope ratio, the issue of microscopes occupying a lot of space and so on. This alternative offers portability and customization that further helps widen our options.

The microscope engineered and assembled could visualize plant and animal tissue. Such a microscope can be also used for human histopathological sample investigations. Images acquired using a virtual based microscope and the light microscope rendered similar results therefore backing up the fact that the new age microscopes can be used for more than just education.

Bio sciences often assumed as the demanding or the boring subject can be reversed as more students get to see the beauty and the diversity of the subject and observe life itself under a microscope. Building a microscope is more than just engineering an apparatus, it is giving a person a passion for the rest of their life and equipping them with the power to make the decision.

## REFERENCES

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# SELF ASSEMBLE ABLE PORTABLE SMARTPHONE AIDED MICROSCOPE



Interdisciplinary project review- 1

Internal Guide: Dr. Valli Nachiyar

Extrenal guide: Dr. Sangeetha

Biotechnology x Mechatronics

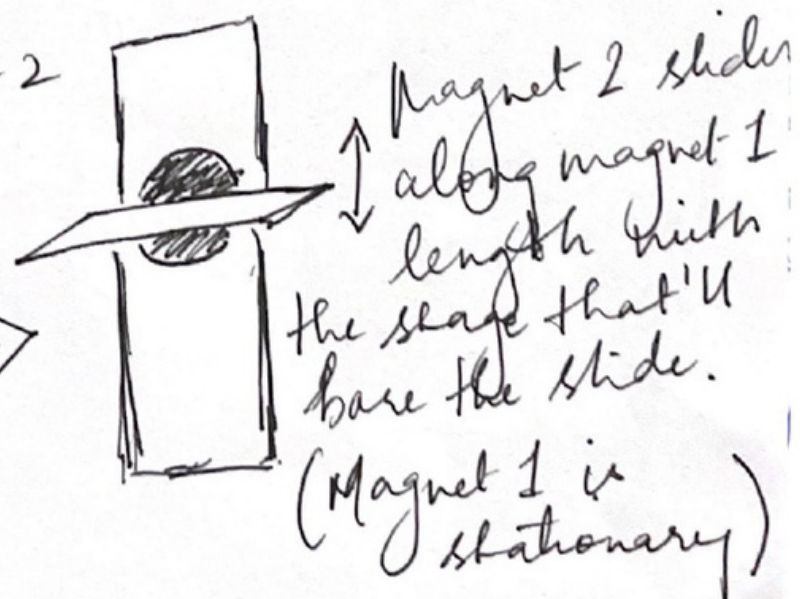
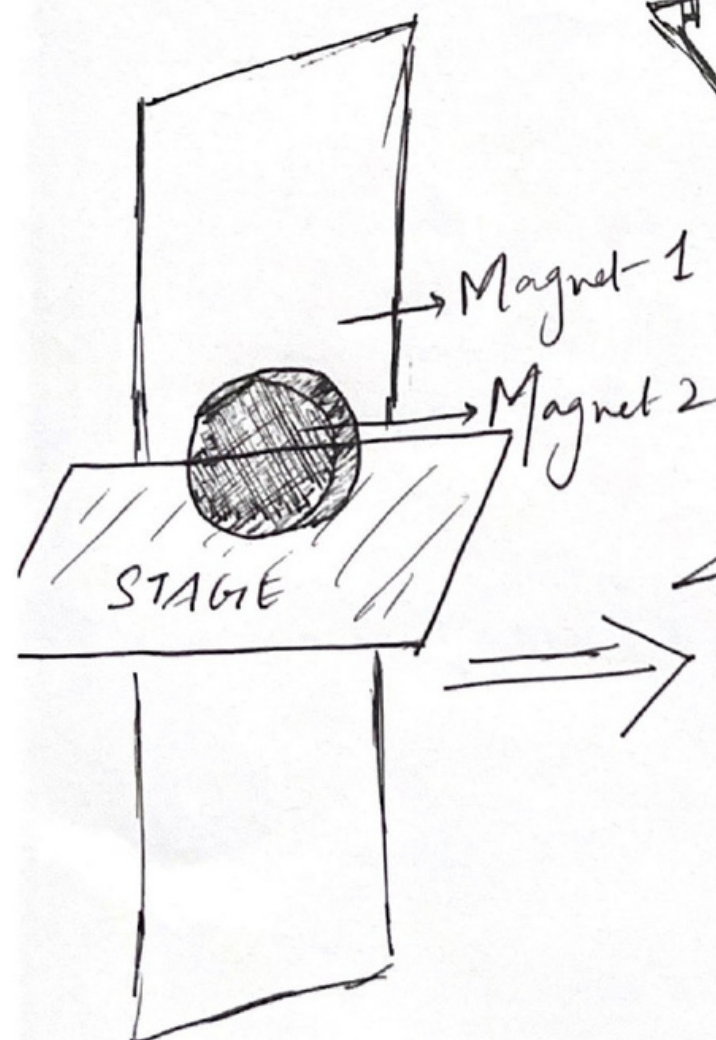
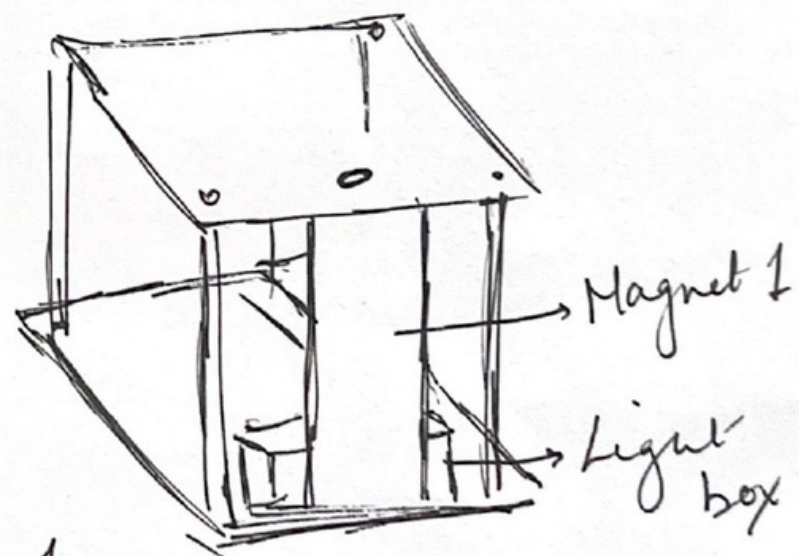
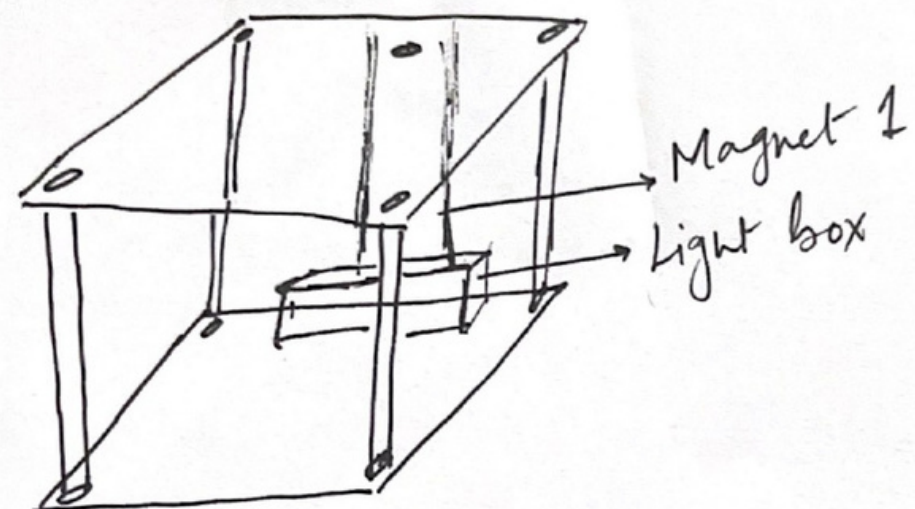
Aswini Sai Balaji (39230004)

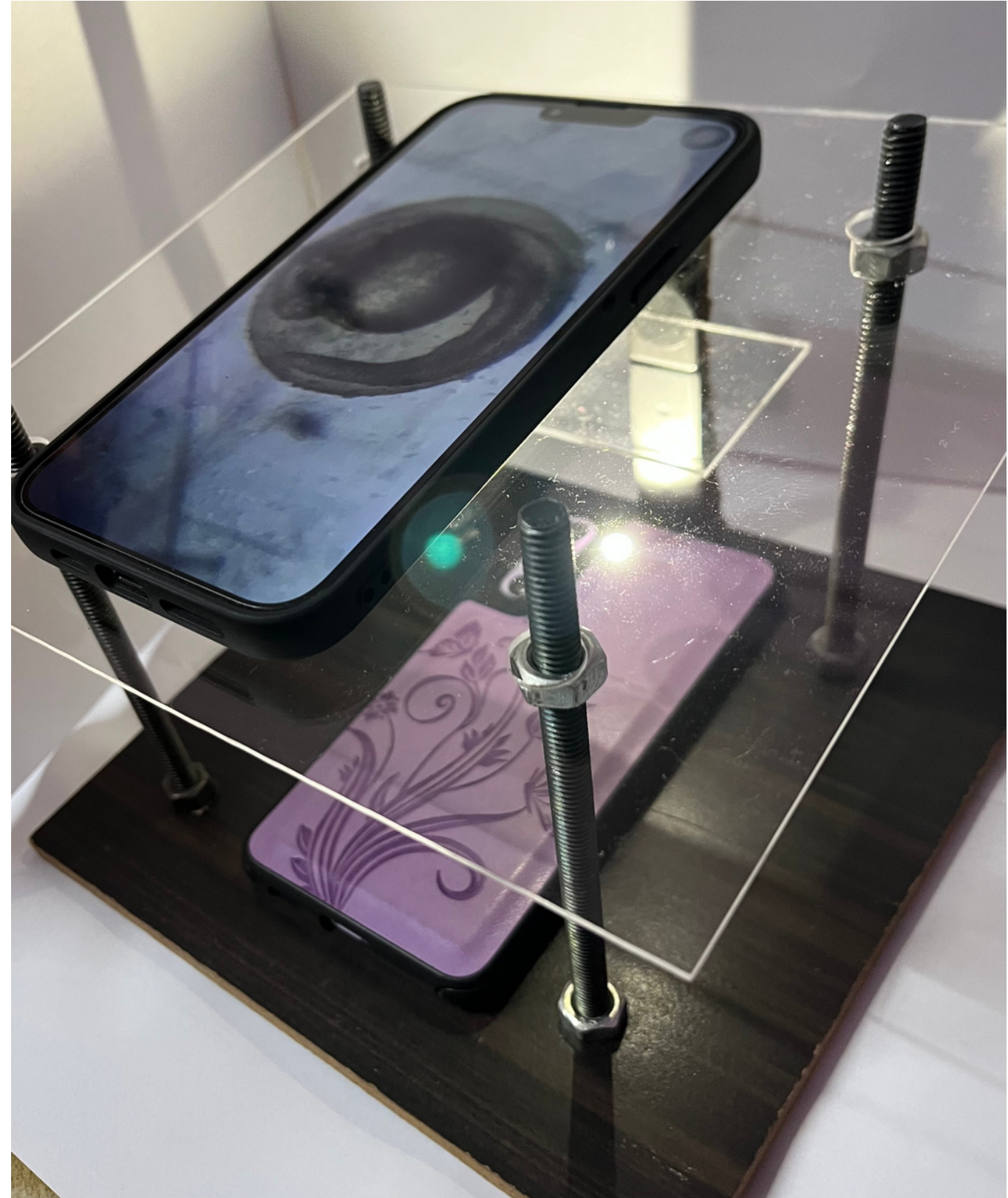
Department of Biotechnology

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# **ABSTRACT**

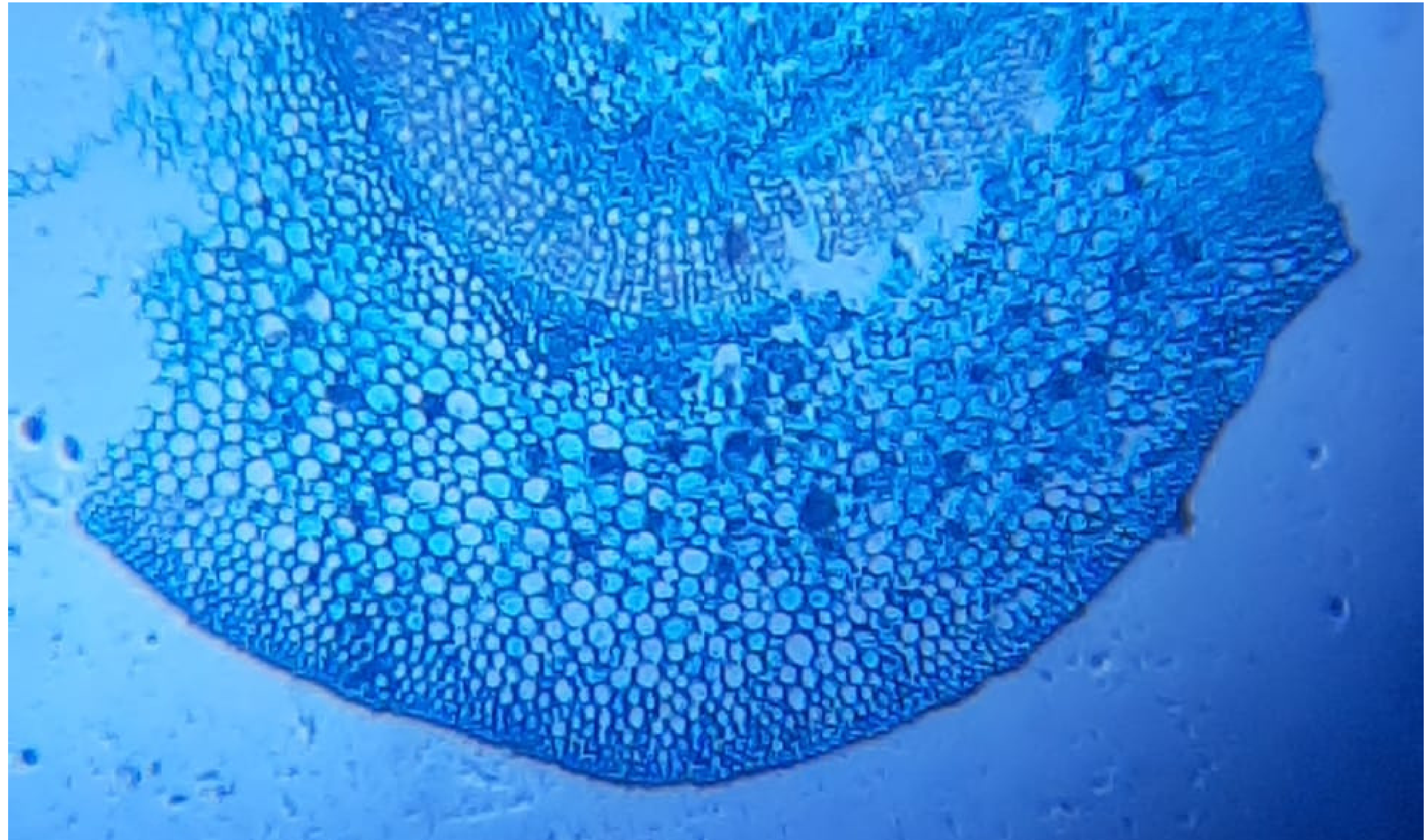
A microscope is a vital component of research for science enthusiasts who belong to a plethora of age groups. The conventional microscopes that are widely used nowadays have little to no portability and are economically not feasible . The development of a user-friendly microscope that is more portable, aimed at intriguing the new generation and supporting budding researchers is a product that is long overdue. Such a product can also be equipped in countries where the availability of resources is minimal.

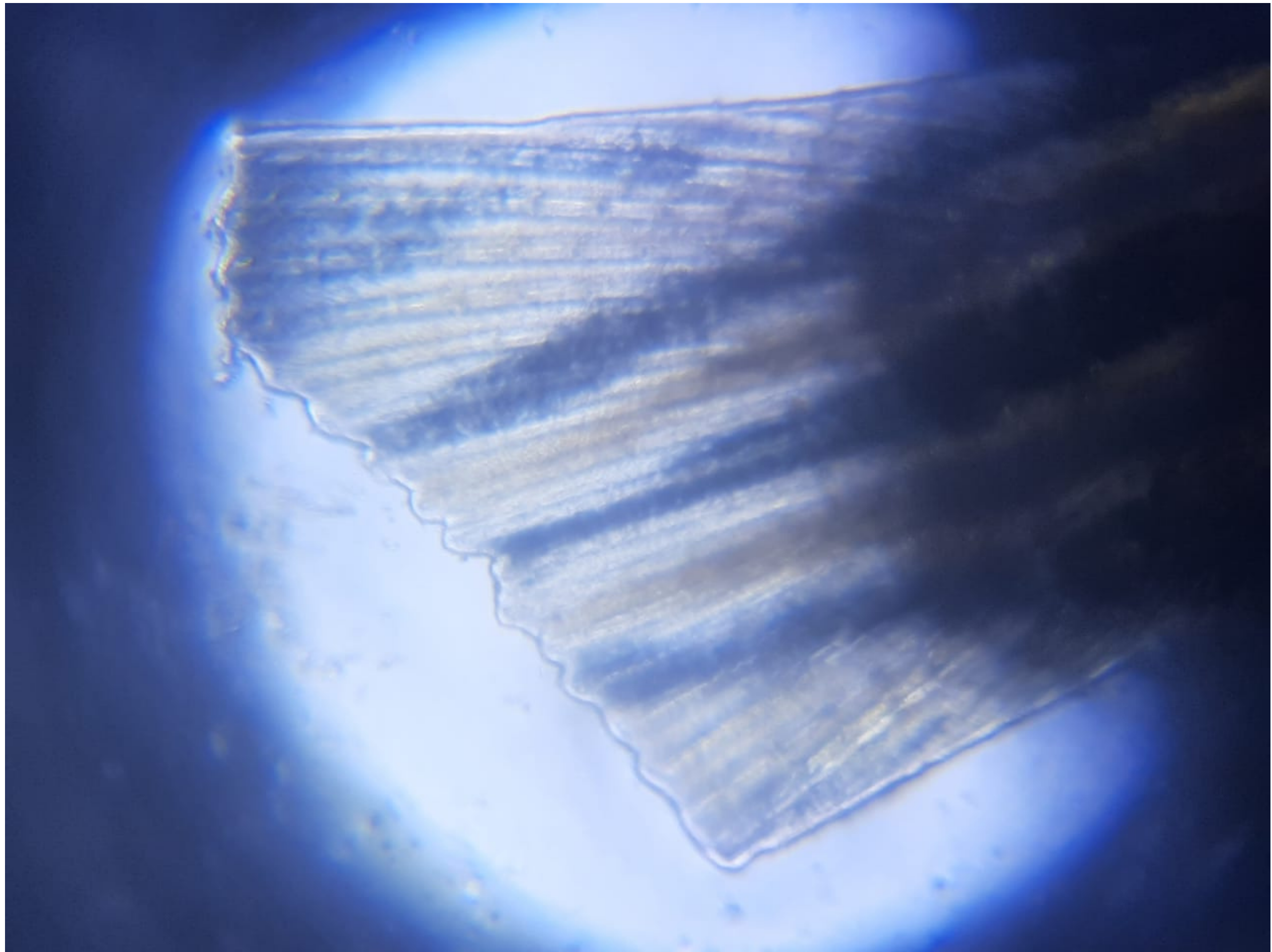












**THANK YOU**

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