Smart DIY Microscopy for Marine Biology

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Over the past decade, imaging technologies have become increasingly sophisticated but also more expensive, limiting access to advanced microscopy tools for many laboratories. This issue is particularly relevant for researchers working in marine and environmental sciences, where imaging is essential for studying organisms such as plankton, larvae, or microplastics, yet resources may vary significantly between institutions and field stations. At the same time, an active international community has emerged around open and accessible microscopy, developing low-cost and open-source instrumentation that can be built, modified, and shared by researchers and educators. These initiatives aim to democratize access to scientific instrumentation while encouraging reproducibility, collaboration, and innovation.

In this workshop, we introduce participants to the **EnderScope. This low-cost, open source and portable microscopy system** based on a 3D printer costs ~ 300 €, weighs 1.8 kgs, fits into a 30 cm x 30 cm box, and can perform **mosaic scans** of a large area in **brightfield and fluorescence**. Furthermore, the instrument can be programmed for **smart microscopy** – or adaptive feedback microscopy – where a microscope is programmed to change its acquisition parameters during an experiment without human intervention.

It was originally developed to analyse microplastics in the oceans[1]. Recent versions feature an improved optical configuration and developed a simple Python-based interface[2] that allows users to easily control the microscope and automate image acquisition, making the EnderScope an excellent platform for broader laboratory use as well as introducing students and researchers to instrument control, reproducible workflows, and image analysis using Python[3]. The reproducibility and adaptability of these instruments are particularly well suited to marine biology research and teaching, where there is a need for flexible imaging tools that can be deployed in coastal laboratories, research stations, or teaching environments.

References

1. Burke et al. "EnderScope: a low-cost 3D printer-based scanning microscope for microplastic detection." *Phil. Trans. Roy. Soc A.* (2024). https://royalsocietypublishing.org/doi/10.1098/rsta.2023.0214
2. Gharbi et al. "Enderscope. py: A library for computational imaging using the EnderScope automated microscope." *SoftwareX* (2025). https://doi.org/10.1016/j.softx.2025.102210
3. https://diy.microscopie.org/explore.html

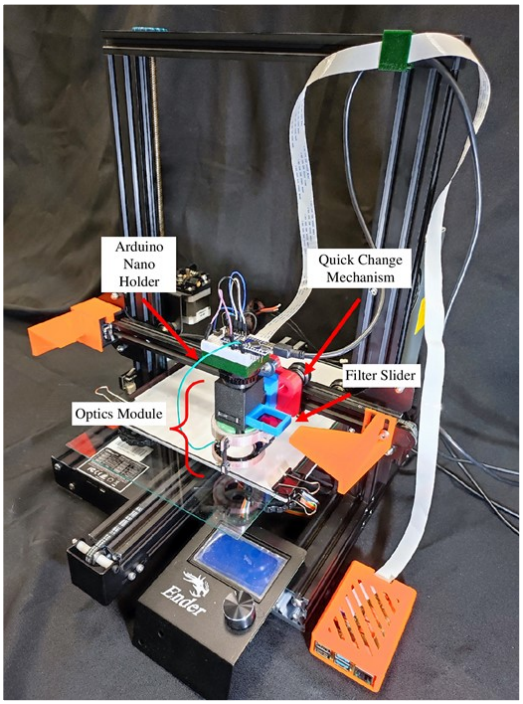
Required knowledge

- Basic practical experience with optical microscopy
- Are interested in scientific instrumentation, teaching, or open hardware approaches
- Basic programming knowledge is sufficient

Researchers, engineers, and advanced students working in marine biology, marine ecology, oceanography, or environmental sciences are particularly encouraged to participate.

Expected outcome

This workshop will cover all stages of the EnderScope system design: component selection, assembly, 3D printing of adapters, and microscope control, enabling them to replicate a “standard” EnderScope and adapt it to their own needs. A unique feature of this training program is that it gives trainees who wish to do so the opportunity to take the system they have assembled back to their laboratory.



Participants will be able to :

- Upcycle a 3D printer into a motorised imaging system
- Clone a Git repository to reuse existing code and 3D parts (Open Science)
- Make use of Jupyter Notebooks to manage their Python scripts
- Programmatically control all elements of a microscope with Python
- Perform simple image analysis tasks like segmentation with Scikit-Image
- Implement Smart Microscopy workflows by combining microscope control and image analysis
- Better apprehend frugal science concepts

All code, pre-written or produced during the workshop, will be made available for participants to be able to reproduce it in their own lab environment.

Registration: https://forms.gle/cWE2praCgC6c44XP7

Deadline: **02 April 2026**

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