Microscopy Lab Report

Viewing diatoms under magnification

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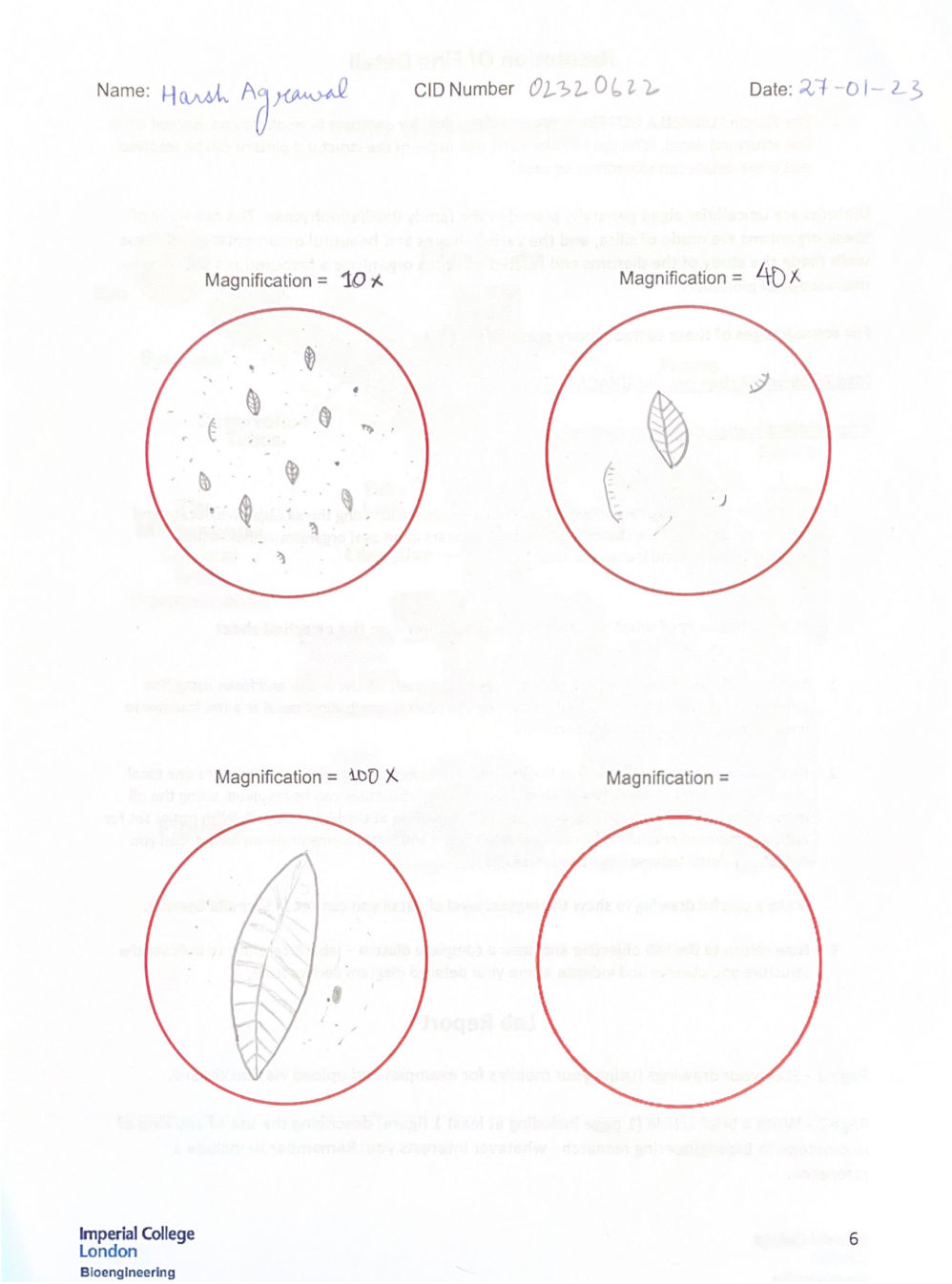
Part A: Viewing Diatoms under Microscope

Aim

To view Surirella Gemma under 10x, 40x, and 100x magnification.

Observation



Drawings of observations under the microscope.

Part B:Lattice Light Sheet Microscopy

One of the most common modalities to study animate cells and sub-cellular structures is fluorescence microscopy. It works by exciting fluorescent dyes with specific wavelengths of dyes. While being a transformational step forward in the field of microscopy, one of the major limitations is an increase risk of cell damage due to photo-toxicity. Developed in the early 2010s Lattice Light Sheet Microscopy proves to be a challenging alternative.

Lattice Light Sheet Microscopy (LLSM) is a combination of elements of both confocal and wide-field fluorescence microscopy techniques. It uses a sheet of laser light to excite only a thin slice of the sample, which reduces photo-damage and photo-blinking compared to traditional wide-field techniques. The excitation lens used is kept perpendicular to the wide-field detection lens to confine the illumination to the neighbourhood of the focal plane.

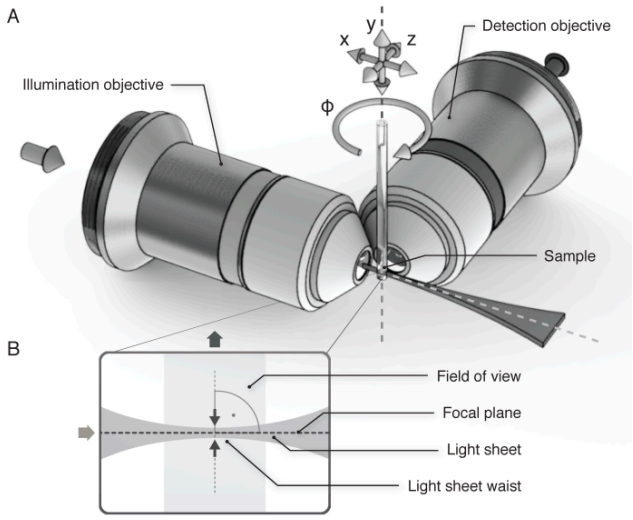


Image Taken From: https://huiskenlab.com/principles/

The image depicts how the sample is placed at the intersection of the illumination and the detection axes. The light sheet excites the sample in a thin volume around the focal plane and the emitted fluorescence is collected by the detection optics. Compared to other illumination schemes, photo-bleaching is dramatically reduced in light sheet microscopy. Live specimen can be imaged over longer periods of time and/or with higher frequency, while being kept at a healthy state. It however also has the limitation of only being applicable to transparent and thin samples.

LLSM has been used in various different applications such as precise tracking of individual cells at a high molecular density, modelling dynamic cellular interactions in super-resolution, etc. With the combination of various chemical and genetic manipulation techniques, it was used to capture the live image of a virus, engineered to spike COVID-19 proteins, infecting a cell for the first time at Harvard Medical School. In 2019, a team from the Advanced Imaging Center at UC Berkeley have created one of the most powerfully cellular imaging microscope - MOSAIC - by combing LLSM, adaptive optics and other techniques. This microscope was used for cellular imaging at a resolution never previously attainted.

This is one of the many uses of LLSMs in the field of super-resolution cellular microscopy. Eric Betzig, the creator of LLSMs believes that this development will have a greater impact than his former creation of super-resolution fluorescence microscopy that earned him the Nobel Prize in Chemistry in 2014.

References

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