Electrospinning with Fluorescein

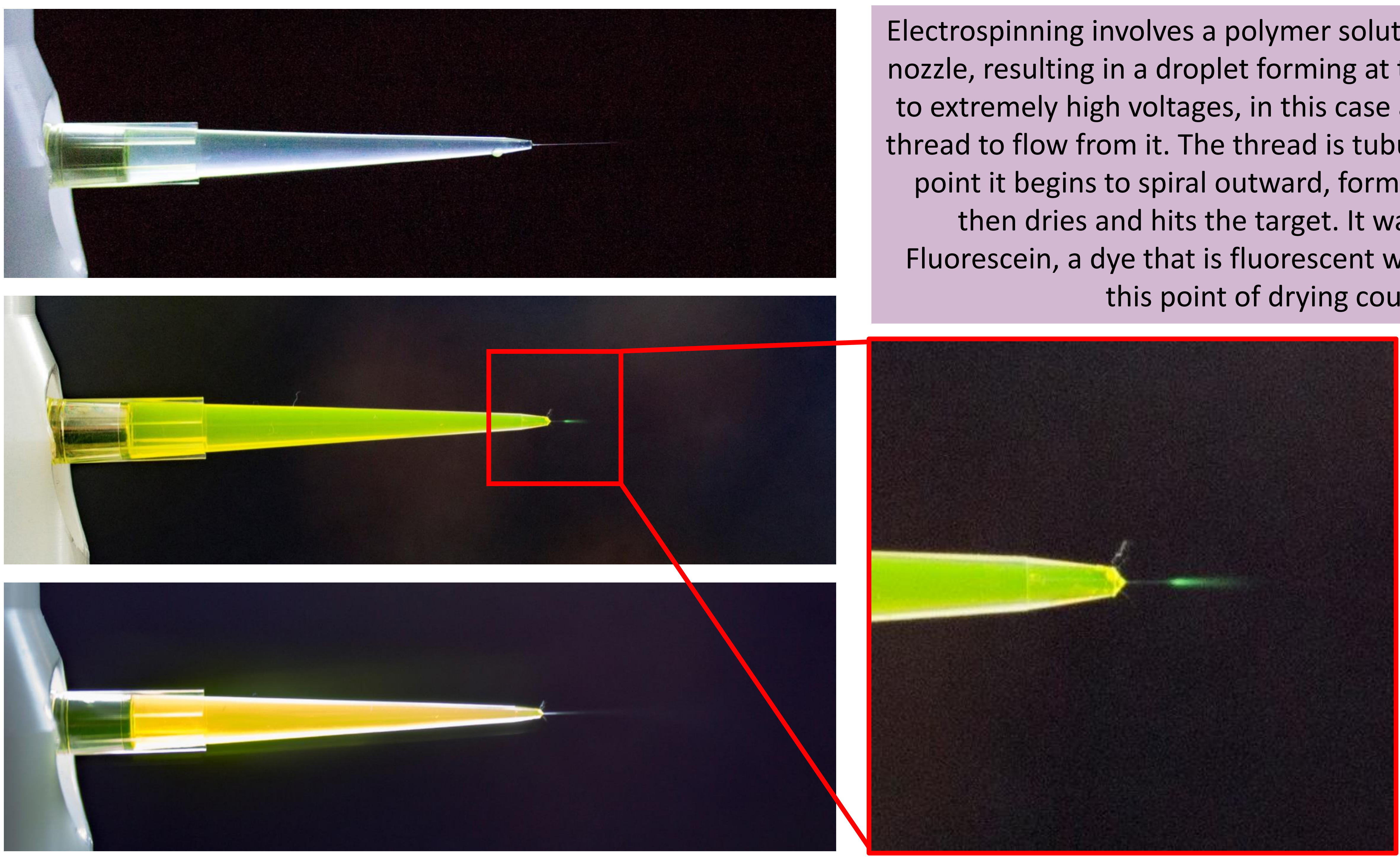

Figure 1:Comparative images of the spinning tip which has a diameter of 6mm containing the PVOH with (top) No fluorescein under UV, (middle) Fluorescein under low UV, and (bottom) Fluorescein under high UV.

Electrospinning involves a polymer solution being fed through a small nozzle, resulting in a droplet forming at the tip. This is then subjected to extremely high voltages, in this case around 33kV, which causes a thread to flow from it. The thread is tubular in shape, and at a certain point it begins to spiral outward, forming an expanding helix; this then dries and hits the target. It was hoped that by adding Fluorescein, a dye that is fluorescent when wet but isn't when dry, this point of drying could be found.

Fluorescein is a dye that is used as a tracer in several fields– plumbing, medicine, and others. It is fluorescent under UV light when in solution. This is due to the ways that the dye is quenched, which include dimerization, collisions and F.R.E.T.

The method for this project is to mix fluorescein in with a common polymer, in this case PVOH, and spin it, using high-quality photography to find the drying point.

Differences between the High and Low level UV images are in unexpected places. In the zoomed red square on the low UV image the straight wet fibre has little to no fluorescence, while the spiralling fibre becomes brighter. However, the spiralling part of the fibre is much fainter on the High UV. One thought is that due to the fine-ness of the fibre, some element of quenching occurs which is then undone as the fibre begins to spiral and spread out. Unfortunately, this doesn't explain why it is only visible at Low UV.

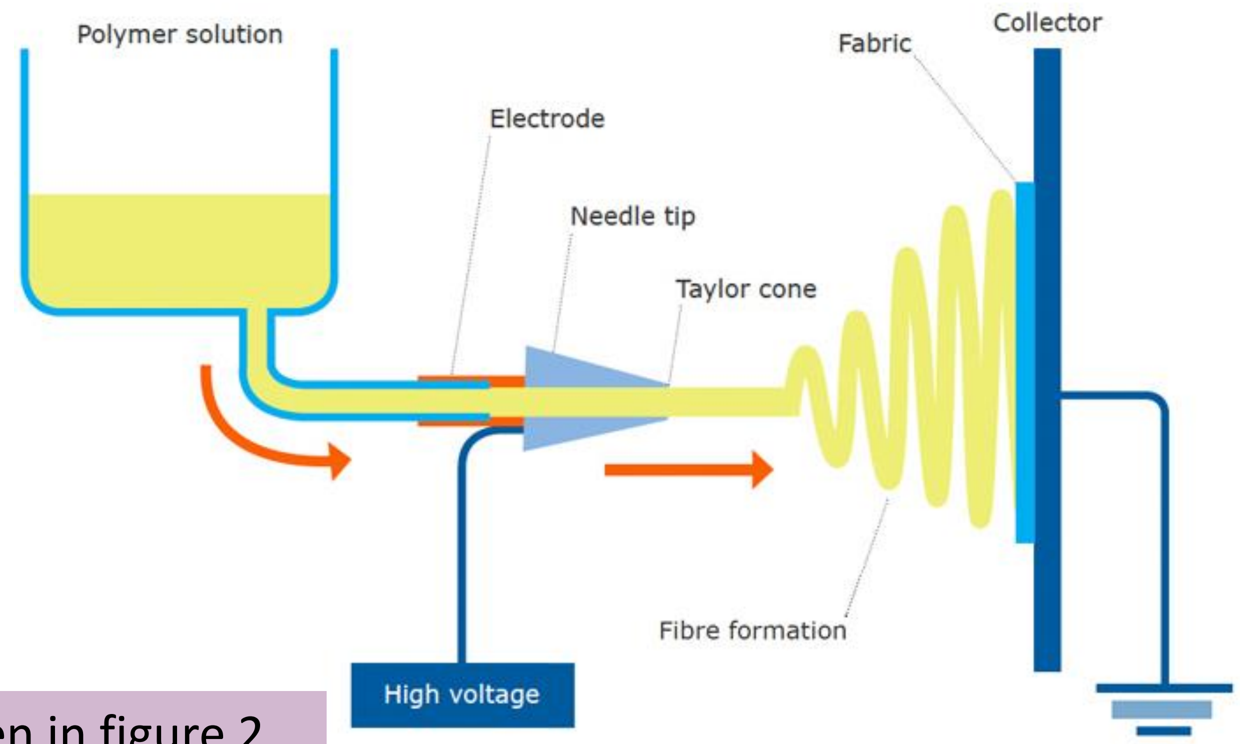

Figure 3: Schematic of Electrospinning set-up.

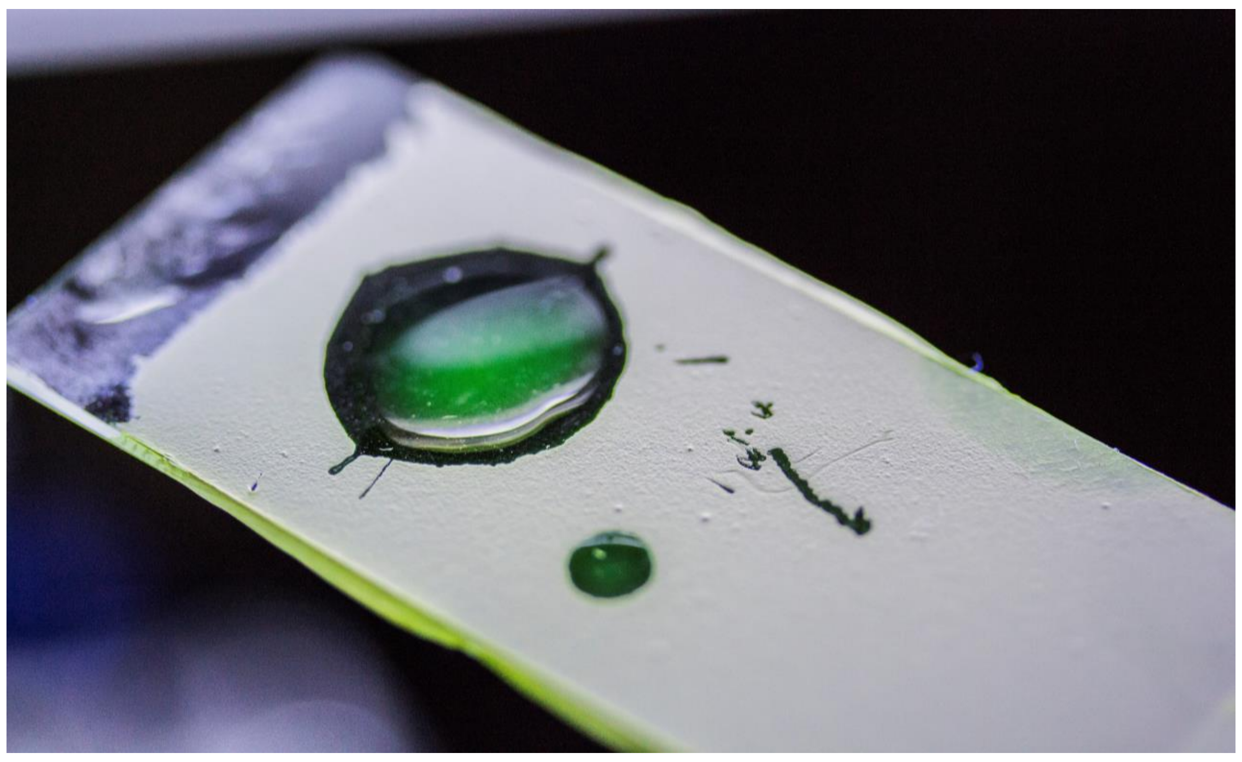

Figure 2: Water was pipetted onto the slide that had collected the fibres and is shown under UV, showing how the fluorescence is restored upon reforming the solution.

As can be seen in figure 2, when the nanofiber is dry, it is still slightly fluorescent, although when it is put back into solution (inside the water droplet) it becomes much more fluorescent again as expected. It is possible that the PVOH is keeping the molecules apart, thus preventing total quenching.

Electrospinning is a relatively unexplored technique, and there is much still to be done. First of all, Fluorescence Spectroscopy of both the PVOH solution and the fibre is required to determine the exact change in fluorescence. Also, a manipulation of the tip width and the voltage can be done to observe the effect on the length of fibre before the spiralling begins. It hold much scope for further work, and is something I wish to pursue

Student // Sorcha Hulme

Supervisor // Dr Matthew Booth

UNIVERSITY OF LINCOLN
Lincoln Academy of Learning and Teaching

UROS Funded

DISCOVER_
LNCN.EU/UROS
@U0L_LALT
#UROS2018