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Rokos Internship Report

Laboratoire Adhésion Inflammation
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What is it to be a scientist? As a student of Physics, studying at a world-class university, it is a question I constantly ponder and yet one which I am actually faced with very little. The perpetual drive for academic excellence has been instilled within all of us here at Oxford, even before we picked up our chosen degree, whether it be a science or a humanity. But this same drive often over-shadows the more significant facets that make up a scientist.

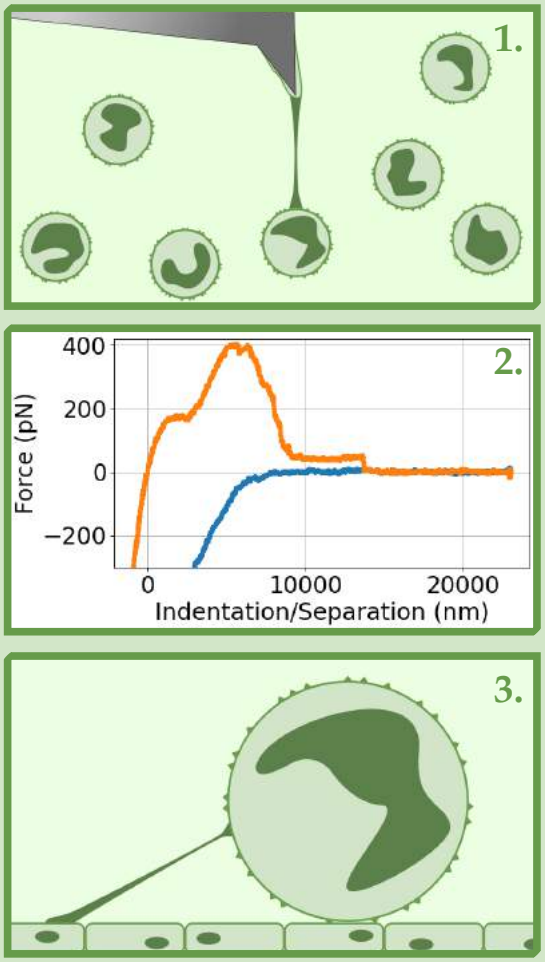
As I travelled to Marseille on my way to my internship, organised through the Oxford Careers Service, I considered this question. This was to be my first serious foray into professional academic science and as such I was naturally apprehensive.

I started my first day of work, walking from my accommodation, through the southern french heat, to the laboratory I would be working at for the next 9 weeks. My first few days were spent reading up on the theories I would soon be researching and after that, I started my work in earnest.

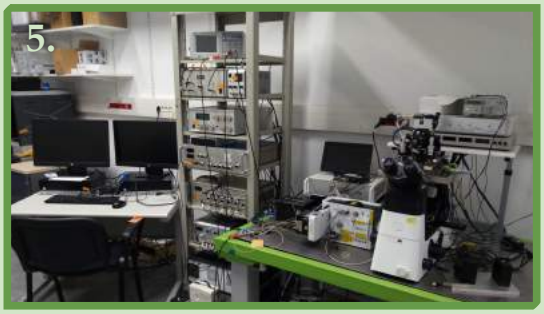
Atomic force microscopy (AFM) has many different uses, one of which being force spectroscopy. The cantilever of the AFM, coated in a chemical such as poly-l-lysine, approaches the surface of a sample of THP-1 cells (a cell line of leukocytes, white blood cells) (Fig. 1). The coating allows the cantilever tip, only 2 μm in size, to stick to a cell within our sample, and, as the cantilever retracts, we observe how the force on the cantilever changes with retraction distance.

This tells us a great many things about the surface of our THP-1 cells. The focus of my project was specifically the tethers that could be drawn off of these cells. When receptors, connected both to the outside of the cell and the cantilever, are pulled from the cell membrane, membrane nanotubes form. These exert a constant force on our cantilever, which can be seen as a plateau in our force-distance curves (Fig. 2).

These tethers are an important characteristic of leukocytes that have been little researched within the scientific community. We know that, within the body, white blood cells roll along the inside of blood vessel walls as they approach the site of the damage. This acts to slow the cells down and allows a receptor



1. A diagram of a cantilever (grey), coated in a chemical such as Poly-l-lysine, interacting with a receptor on the surface of a THP-1 cell to form a tether.
2. A force curve showing a potential tether that has formed between the cantilever and our THP-1 cells during an experiment.
3. A diagram of the same THP-1 cell that has, while rolling along the vascular wall, formed a tether with the surface of the wall.



5. The PS-NEX HS-AFM equipment used to collect the tether data.
6. The head of the PS-NEX, containing the cantilever, laser, photodiode and lenses to find the force exerted on the cantilever.
7. The cell culture lab with the laminar flow hood.
8. A sunset over Marseille bay.
9. Street art in Cours Julien, Marseille.

to attach to the surface of the wall, forming a tether (Fig. 3). The leukocytes can then move out of the circulatory system to the damaged site. But the details of these tethers, the forces they hold at, their extensions, these are all unknown.

My work focused mainly on programming analytical tools to get data from these tethers, within Python. I worked on code previously developed by another member of the lab, improving on her code to create user-friendly software to analyse the AFM data, apply corrections to it and analyse the tethers.

My other jobs during the internship all revolved around the analysis of tethers. I worked on the PS-NEX, a type of probe-scanning high-speed AFM (HS-AFM) developed in Japan (Fig. 5 & 6). This was the instrument with which we collected the data to be analysed. I was also in charge of keeping the THP-1 cells healthy, working in the cell culture room in the lab (Fig. 7). I found the biological skills I gained during my time there to be particularly rewarding.

Beyond the research itself, the people that made up the lab were some of the kindest and most welcoming I have ever had the fortune to meet. It is by no means true of every research group, so I consider myself very lucky to have been a part of such a talented group of researchers.

During my time in Marseille, I lived in the student accommodation kindly provided by the university. The view out of the window displayed the full splendor of the national park that encompassed the campus and many of the weekends were spent exploring this, watching the sun reflect off of the Marseille bay as it fell below the horizon (Fig. 8).

Marseille is a truly gorgeous city, though it is certainly an acquired taste. There is, on the surface, a rustic, sometimes rundown feel to the city. However, its true nature is often betrayed by the clear care taken in the stunning street art (Fig. 9), in the hanging plants and flowers at every window and in the love that the Marseille people show for their city. Marseille is a love letter to the aesthetic subtlety of French decor and walking through its streets, this was what I could sense from every fibre of the bustling city.

As I left Marseille, taking the metros and buses that I had grown so accustomed to, for the last time, I considered again the question that had faced me 10 weeks prior. So what is it to be a scientist? I think it was that which was so perfectly exemplified by this internship. It is the fact that, no matter what part of the world you work in, you will be working with people with shared experiences, shared ambitions and shared aspirations. That is what it is to be a scientist. To be connected to all the parts that make the whole.