

I am a French student from Paris who has always wanted to become a researcher, I have quickly become conscious that my passion for astrophysics was missing something fundamental. As I got older I made mine Socrates' idea that we should understand ourselves first if we want to improve the life of every human being. It nourished my passion for understanding the intricate mechanisms of our beings, from the networks of our brains to the networks of pathways in our cells. I was lucky enough to discover my interest early thanks to trips to foreign countries and to the infinite amount of knowledge I found on the web. This interest was always interdisciplinary, ranging from mathematics and computer science to genetics, physics and neuroscience. I was also amazed at the spur given to knowledge by some visionary minds.

Indeed, few people made me more aware of the need for entrepreneurship in science than Elon Musk and Nikola Tesla. I think that today, only teamwork can bring success and disruption. Such an idea quickly gave me the inclination to bring people together and produce materials and tools that required the cohesion of a team : something echoed through my work in the making of the biggest music festival on my campus -the NoLarsen Festival- as well as an innovative startup in professional messaging called PiPle.

So I went to an integrated* preparatory school in Paris. During my two years of PTSI** studies , I was given intensive courses on a broad range of subjects in mathematics, electronics, physics & computer science, which gave me the foundation I needed for the next stages of my studies.

I was happy to master in biomedical engineering and felt closer to where I wanted to be while studying physiology, imaging, signal processing and robotics. I enjoyed gathering courses from friends in M.D. as well. I think it is thanks to this enlarged knowledge, together with a semester abroad in Mexico -at TEC de Monterey- plus a particularly interesting internship in Highlife -a R&D startup in semi-biological heart valve implantology- that I have been able to make my way as an intern at the Flatiron Institute. In this NYC research facility, I grasped what research life is made of and I got the opportunity of meeting many interdisciplinary researchers.

By working under the supervision of Andrea Giovannucci and Eftychios Pnevmatikakis, I have created a comparison function of CalmAn's output, a -Calcium Imaging Analysis- software able to infer neurons and their activity from recorded in vivo brain activity, allowing for performance testing and continuous integration of the program. I also worked on explaining the software with a documentation & description of the algorithms for open source contributors and neuroscientists. This experiment confirmed my wish to work in understanding, modeling and visualizing neural networks. An idea that drove me to participate to Human Brain Project workshops in Lausanne and Geneva to get to know more about the tools used by computational neuroscientists such as neuron modeling -PyNN, Emergent- and the novel supercomputer architectures like SpiNNaker and BrainScaleS.

Since data science seemed to capture most of the complexity and potential of this project, I have felt I needed to focus on it. I feel that teaching to students in my engineering school gave me such a particular way of looking at topics. That is why I have managed to get a double degree arrangement with the University of Kent in England to get a M.Sc. in Computational Intelligence, studying computation in natural systems, neural networks and data science. All those choices and experiments, which, according to me, are necessary requirements for my future Ph.D., have led me to write this letter.

My future research decisions will be driven, on the one hand by my interest in computational neuroscience and on the other hand by my hope to work in the most promising technologies to improve the life of the next generation. It seems essential for me to understand the importance of reproducible science in natural sciences and of bringing researchers together into interdisciplinary projects. The forthcoming endeavors of research require models that allow us to examine and understand the particular dynamics of complex systems, that permit data-driven experiments with shareable and usable concepts. I think that this letter shows a background that addresses these future challenges, it is dictated by my curiosity and life-long motivation in science.

Jérémie KALFON

* *Even if they are quite arduous, integrated preparatory schools prepare students to integrate an Engineering school to which they are associated, allowing them to succeed. Instead of preparing for two years and then choosing a college according to an exam, they take the exam first for a subset of colleges and then prepare for it for two years, thus alleviating the uncertainty of the famous French Concours.*

** *PTSI - Physics Technology & Engineering Sciences*