Interviews

We spoke to respected researcher Dr Sergio Baranzini and neurologist Dr Kristian Steen Frederiksen to find out about their clinical interests and the translation of their research focusses into bedside care.

Sergio Baranzini

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What inspired you to pursue a career in scientific research?

Both my parents were clinical biochemists, and ran their lab next to our house, so I grew up in between microscopes, electrophoretic apparatuses, and centrifuges. Later, when I took my first courses in genetics and molecular biology, I was fascinated with the complexity of living organisms and wanted to dedicate my career to solving some of the puzzles that human diseases represented to me.

After completing your undergraduate and postgraduate degrees in biochemistry, what influenced your decision to specialise in neurology and neurogenetics?

During my PhD, I focused on understanding the phenotypic effects of different mutations that caused Duchenne muscular dystrophy. I shifted the attention of my work to multiple sclerosis (MS), in part because I was motivated by the challenge posed by complex diseases, where small effects from multiple genes converge in shaping risk. If one thinks about the two most complex systems in the human body, the likely choices are the brain and the immune system. Both of them are composed of billions of cells interacting in non-linear ways, producing emergent behaviours (i.e., emotions, fighting pathogens, etc.). In that regard, since MS involves an autoimmune attack on central nervous system myelin, it could be considered the most complex disease ever described. Contributing to understanding MS pathogenesis and devising new therapeutic options were the main two pillars of my decision.

Q3 The work at the Baranzini Lab at UCSF is half computational and half experimental research; how does this strategy of an equally weighted investment into the two strengthen the lab's position in the field and the research it produces?

I strongly believe that a modern laboratory needs to incorporate data science to do relevant work and be successful. This is because we are relying more and more on high-throughput data from our instruments (e.g., 'omics', large-scale electronic health records, real-time monitoring, imaging, etc.). Thus, at the beginning of my career, I needed to decide whether I wanted to collaborate with a bioinformatics lab or become one. Because of my training as a bench scientist, I considered the best option was to build a hybrid lab that could analyse the data it produced.

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Q4 Computational and bioinformatic tools over the past few decades, and artificial intelligence and machine learning in the past few years, have significantly advanced scientific research; how do you see these tools aiding in the research and development of therapies for MS?

I think they will be critical. In my view, biomedicine is lagging behind other fields (e.g., banking, e-commerce, etc.) when it comes to effective utilisation of sophisticated statistics and artificial intelligence. One of the reasons is that biomedicine is more complex, and the standards to trust a given health-related prediction need to be higher than whether a bank will grant a loan to a customer or not. If an algorithm outputs a given treatment for a patient, the doctor needs to know why a given prediction is suggested; it cannot be a black box. Thus, in the near future, we will see more applications of artificial intelligence and machine learning to biomedicine, with the particularity that they will have to be explainable.

Q5 Could you explain the possibility of personalised medicine based on data-driven insights in the management of MS?

Doctors today need to process more information than ever before. New laboratory tests, imaging modalities, and additional patient-derived data (including real-time monitoring, wearables, etc.) further complicate making an accurate diagnosis and deciding on the best course of action for a particular patient. The reality is that no doctor (or for that matter, no human being) can recall, interpret, integrate, and process this colossal amount of information in order to respond adequately (and in real-time) to complex scenarios to achieve the best care for their patient. This is why artificial intelligence will likely be a companion to make sure all possibilities are considered, given the patient's history, to make the best possible decision.

Q6 There has recently been a substantial focus on the link between gut microbiome dysbiosis and numerous diseases, including MS. In your opinion, what is the therapeutic potential of gut microbiome-targeted therapy in the case of MS? What challenges does this field of research still face?

We are still beginning to understand the extent of the role the gut microbiota plays in human diseases; however, I anticipate it will not be minor. Therapeutic options that involve modification of the gut microbiota are not only pharmacological but also involve next-generation probiotics and dietary interventions. In the case of MS, the many therapeutic options already available may limit the applicability of microbial therapies. On the other hand, these may represent a more natural approach, with a more favourable adverse events profile, and thus be attractive to some patients.

Q7 Looking back across your impressive career, do you have a standout or proudest moment?

We all live very busy lives and sometimes do not take time to reflect on ourselves. I will be proud if anything I help discover can make the life of a patient suffering from a chronic disease even a little better.