NGS Conversations…

Nicolas Mermod, Professor of Biotechnology, University of Lausanne, Switzerland

Next generation sequencing technologies and applications are becoming more and more advanced. In your opinion, why is this a particularly exciting area of research?

In my opinion, it is a very exciting area of research because of the windows it opens on the evolutions of genomes. Before the advent of next generation sequencing, we were able to analyse the evolution of genomes across species or across centuries. And now, all of a sudden, provided that we have the right tools to analyse next generation sequencing data, we can characterise genome evolution within current populations of live cells or organisms, basically following the variations of genomic sequences at each generation. And that opens up the level of resolution for analyzing this micro-evolution of genome sequences. This was not possible before.

What do you think are likely to be the most exciting developments in the next generation sequencing industry over the next couple of years?

I cannot judge the next generation sequencing industry as a whole, but I may provide an answer on what relates to my field of research. In my research, basically, it will be the characterisation of genomes of cell populations generated and maintained in vitro, and I see two main applications in the industry for that: one is to express recombinant therapeutic proteins, where we have to maintain a high degree of reliability with regards to the sequence and properties of the expressed recombinant protein, for increased safety. The other one is to characterise the genome of cells that are planned to be used in the field of regenerative medicine, or for gene or cell therapies, especially when the cells have to be maintained in vitro for some time and/or genetically modified. The ability to characterise genomes of cells within populations by next generation sequencing is of great importance, in particular for the safety and efficacy approach.

At our 8th Annual Next Generation Sequencing Congress, you will be delivering a talk on 'NGS Technologies And Platforms For The Characterization Of Therapeutic Producing Cells'. Can you share with us a little background into the work that you are doing?

When you generate cell lines that produce therapeutic proteins, you must really maintain a high degree of safety for the patients. Basically, there are three key aspects that you may want to consider that are related to next generation sequencing. First is the possible occurrence of transgene mutations, when you introduce multiple copies of a transgene into a cell to express a therapeutic protein, and you would like to ascertain that none of the copies of this transgene is mutated. We use whole-genome next generation sequencing to characterise that in great depths. Another aspect is the potential modification of the cell metabolism, for instance as you introduce the new gene that is used to express a therapeutic protein, sometimes the genes that you introduce will integrate within cellular genes, and thereby damage them. We found that transgenes often integrate within active cellular genes, and therefore you want to make sure that this will not affect a crucial function of the cell, a function for example that maintains the genome stability. So next generation sequencing allows you not only to characterise the transgene you have introduced but also a number of key cellular genes that are important for the function and maintenance of the cell. A further aspect is clonality: for safety reasons, the national regulatory authorities usually require demonstration that the population of cells producing a therapeutic protein is clonal. Again, looking at mutations and subpopulations of your cell bank will allow you to assess whether the population comes from a single cell, therefore is of clonal origin, or if it comes from a mixture of cells having different mutations.

Career and Experience

Nicolas Mermod is Professor of Biotechnology at the Faculty of Biology and Medicine of the University of Lausanne, and a co-founder of Selexis SA, a biotech company. Nic completed his PhD at the University of Geneva in environmental biotechnology, followed by post-doctoral studies at the University of California at Berkley, USA, in the laboratory of Professor Robert Tjian. Nic then joined the University of Lausanne as an Assistant Professor of the Swiss National Science Foundation, to become full Professor and the director of the Institute of Biotechnology. Nic heads the Laboratory for Molecular Biotechnology at EPFL, which has gained global recognition in the field of gene expression in biotechnology by publishing over 100 papers in peer reviewed renowned journals. Besides his scientific publications, Nic has authored a number of patents on epigenetic regulatory elements and gene transfer.

Nicolas Mermod will be speaking on Day 1 of our 8th Annual Next Generation Sequencing Congress in the NGS Data Management and Bioinformatics stream: NGS Technologies And Platforms For The Characterization Of Therapeutic Producing Cells