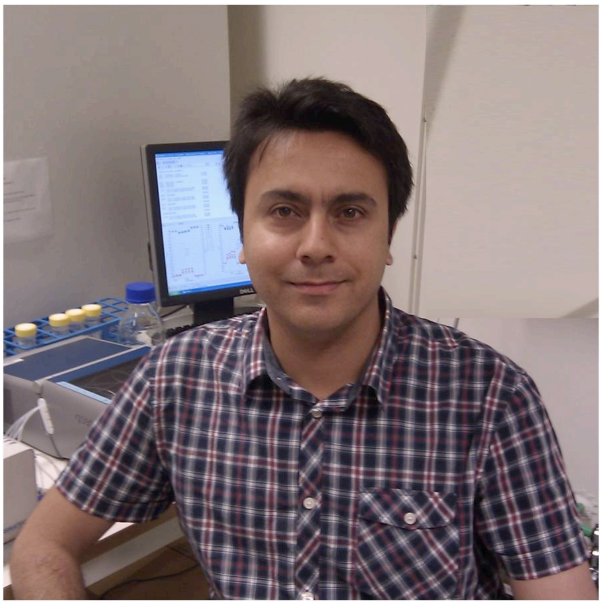
Research With Reality Connection

Meet two young researchers whose work in the ASMENA project has already yielded significant results, from moving the state of the art in the study of water transport proteins significantly forward to engineering new microfluidics systems to make that possible – and possibly finding a cure for malaria along the way.

Seyed Tabaei and **Gabriel Ohlsson** are both PhD students in the Biological Physics group at Chalmers University of Technology in Gothenburg, Sweden. They have collaborated to create an assay to study aquaporins (water transport proteins). Seyed explains,

– Aquaporins are membrane proteins – that means they can be found in the membranes of biological cells. The main function of aquaporins is the selective transport of water across the biological membrane. Thus, their function is really crucial for the cell. Dysfunction of aquaporins is associated with a lot of human diseases, for example various diseases of the kidneys and the eyes, as well as brain oedema.



Seyed Tabaei at Chalmers University of Technology in Gothenburg, Sweden, has created an assay to study aquaporins, an important type of membrane proteins.

– There are different ways of studying these systems, and the classic way involves performing measurements in the bulk.

However, in our group, we have developed a method to perform those measurements on the surface instead. The advantage of this method is that you can perform a screening – that means that you can follow the function of these proteins when adding an inhibitor (a substance that prevents, or decreases the rate of, a chemical reaction) or a potential drug. Of course, this is crucial when testing potential drugs. Also, you can perform lots of experiments on the same setup, which saves time and money.

Gabriel's role in the project has been to create microfluidic systems to make it possible to perform the required measurements on the surface. He explains,

– Microfluidics is about miniturizing our measurement volumes. If you measure the kinds of processes that we are dealing with here in big volumes, then you always have a delay when you move material from one side of your measurement system to the other. With aquaporins, the time scale is a few milliseconds of transportation time. Thus, if you use big volumes and big measurement chambers, you are going to miss the action. Therefore, you want to work with as small volumes as possible. To achieve this, we designed very small and narrow channels, so that there can be a rapid switch from one solute to another. But there are still challenges to be solved, and we are still working on optimization and trying out other approaches.

A Step Towards Curing Malaria

In order to test the efficiency of their assay, Seyed and Gabriel used a type of aquaporin called aquaglyceroporin. This aquaporin is responsible for transport of a small sugar alcohol called glycerol, and malaria parasites make use of these transport channels to take up glycerol while growing inside inside red blood cells of humans. Seyed explains,

– If one is able to find a compound that blocks this aquaporin and thus don't allow glycerol to be transported into the cell, then you might be able to kill the parasite or at least reduce the growth of it. Thus, it could be one pathway for curing malaria.

– We collaborated with another research group, which had some chemicals that they thought might inhibit malaria. We tested these compounds using our assay, found a couple of hits – that is, we found that some of the chemicals seemed to work, and we were able to reduce the transport of glycerol across the cell membrane. Of course, this is just the beginning, but it tells us the importance of the techniques that we have been developing, and it might eventually lead to the cure of malaria and many other diseases.

– I like developing measurement methods that can be applied to something real immediately, and I like working closely with industry, developing actual industrial applications. ASMENA gave me the opportunity to do just that, says Gabriel Ohlsson at Chalmers University of Technology in Gothenburg, Sweden.

Research with 'the Reality Connection'

While Seyed's and Gabriel's research interests are quite different, the ASMENA project provided just the right challenges for them. For Gabriel, it was about engineering:

– I'm very much into measurement method development. Before this project, I worked with the miniturization of the QCM-D (Quartz Crystal Microbalance with Dissipation monitoring), with finding new applications and improving the methodology. I like developing methods that can be applied to something real immediately, and I like working closely with industry, developing actual industrial applications. ASMENA gave me the opportunity to do just that. As a researchers, you need that reality connection. They tell us about the needs of their customers, and they are anchored in reality in a really nice way. Fundamental science has its place too, of course, but we are involved in life science, and then that connection to industry is crucial.

Gabriel and Seyed agree that the networking opportunities that comes with the ASMENA project have been very valuable to them.

– The opportunity to work with people from all over Europe was one of the aspects that really attracted me to the ASMENA project, Gabriel says. Seyed is quick to agree,

– The ASMENA meetings that we have every six months are a very positive thing. Those meetings are like mini conferences, where we have the opportunity to present our work and get feedback from other researchers who might look at our work from a different angle. For me, the most interesting part of those meetings is the Student Day, where all the PhD students get to meet in an informal, friendly atmosphere to discuss our work and exchange ideas. I have found those gatherings very interesting and useful.

A Great Learning Experience

With less than a year left of their PhDs, both Seyed and Gabriel are happy about what they have accomplished so far, and agree that they have learned a lot.

– I'm a pure engineering physicist from the beginning, so I have learned a lot about bioengineering and the biotechnical field, about transfer proteins and cell membranes. I have widened my competence and knowledge quite a lot since I started on this project. I want to be able to build on that, putting it to use by creating and optimizing practical applications, Gabriel says, adding that he sees himself going to industry once he finishes his PhD.

Seyed has different plans:
– I'm a huge fan of academia, and I would like to continue doing research in the same field since it's very interesting and also of great importance. It has been and is very beneficial to be part of this project, and it was exactly what I wanted to study during my Ph.D. I've learned a lot and I want to build on that in my future research.

ASMENA *is part of the EU Seventh Research Framework Programme (FP7). Over three years, the consortium consisting of 15 partners in 7 countries aims to develop new platforms for drug screening and analytical profiling base on in vitro measurements of functional and conformational changes in membrane proteins. Such tools will allow standard profiling and screning also against membrane protein targets that can currently not be screened in these ways. They will shorten the time and cost involved in drug lead development by increasing predictability as well as contribute to fundamental understanding of structure-function relationships of membrane proteins.*

The partners of the consortium are world leading experts on surface functionaliztion, membrane self-assembly, biosensing, membrane protein functional measurements and commercialization of the same. Now, their complementary competences can be put together on the European level to create a timely breakthrough in the area.