Advancing the State-of-the-Art

The ASMENA consortium promised big things at the start of the project. Have the partners achieved their objectives? Professor **Janos Vörös** *is the group leader of the Laboratory of Biosensors and Bioelectronics at ETH Zürich in Switzerland. He is also the current coordinator of the ASMENA project. With the end of the ASMENA project only a month away, he sums up the achievements made and shares his thoughts on what impact ASMENA will have for the project partners involved as well as for the European public.*

– Our goals for this project were very ambitious, and we have achieved a number of our objectives. While we do not have a prototype product that is ready to be introduced to the market, which was never an official goal but something we aimed for, we have developed technologies and methods that have already been used to further develop and improve existing products made by our industrial partners. The state-of-the-art has been significantly moved forward in a number of areas, and there is no doubt that the scientific and technological know-how developed can be used to solve the problems we set out to solve. The ASMENA project is highly interdisciplinary, and I think that has been key to our achievements. We are now very close to achieving membrane protein screening analysis, indeed much closer than we would have been if we had continued working on our own, in our respective fields of expertise, Janos says.

Saving Time and Reducing Cost in Drug Lead Development

Among the main objectives for the ASMENA project was generating the scientific and technological know-how to achieve an electrochemical sensor platform for ion channel/transporter drug screening and analytical profiling. While there is not yet an actual sensor platform for this, ASMENA researchers has demonstrated new methods for assembling membranes on nanoporous sensor chips and measure ion channel function. These nanopore-spanning membranes (artificial patch-clamp) have been shown to lead to much higher stability and simplified experimental setups compatible with the requirements for analytical profiling compared to previous methods. The higher stability of the membranes and simplified experimental setups are key to increasing througput as well as saving time and reducing cost in drug lead development.

Professor ***Janos Vörös*** at the Laboratory of Biosensors and Bioelectronics at ETH Zürich in Switzerland is the coordinator of the ASMENA project.

A New Platform for Aquaporin Screening

Another main objective of the ASMENA project was to create a surface plasmon resonance sensor platform for aquaporin drug screening/analytical profiling, and this objective has been accomplished. The development of this sensor platform includes the development of microfluidic systems able to measure very small sample volumes at revolutionary fast switching times.

Waveguide Spectroscopy For Toxicology Studies

A third main objective was to create a membrane protein functionalized waveguide sensor platform for drug screening/analytical

Achievements In Advancing the State-of-the-Arts

At the start of the project, the ASMENA partners postulated that the state-of-the-art would be substantially moved forward in a number of areas, and this has most certainly been the case:

❏ Nano- and microfabrication of porous substrates compatible with electrochemical and nanoplasmonic sensing ✔

❏ Microfluidics for membrane protein drug screening ✔

❏ Surface functionalization on the micro- and nanometer scale for controlled lipid (vesicle)-substrate interaction ✔

❏ Fundamental understanding of the interaction of (proteo)liposomes with nanoscale chemical and topographical features ✔

❏ Nanoarray sorting of membrane proteins in lipid membrane structures. We have developed methods to do this ✔

❏ Protein integration into supported and free standing membranes ✔ *(Partially achieved, will likely be fully achieved by end of project.)*

❏ Label-free affinity assays and effector compound-membrane interaction measurements ✔

❏ Functional assays for membrane proteins as drug targets ➡ *(In progress, not fully achieved yet.)*

profiling based on self-assembled proteolipid membranes and label-free sensing. Using waveguide spectroscopy, ASMENA researchers have been able to show peptide-lipid membrane interaction, which will have significant impact in the area of toxicology studies as well as for studying antimicrobial substances.

Benefits For the Industrial Partners

Janos is proud to report that the industrial partners involved in the ASMENA project have already seen numerous benefits from their participation.

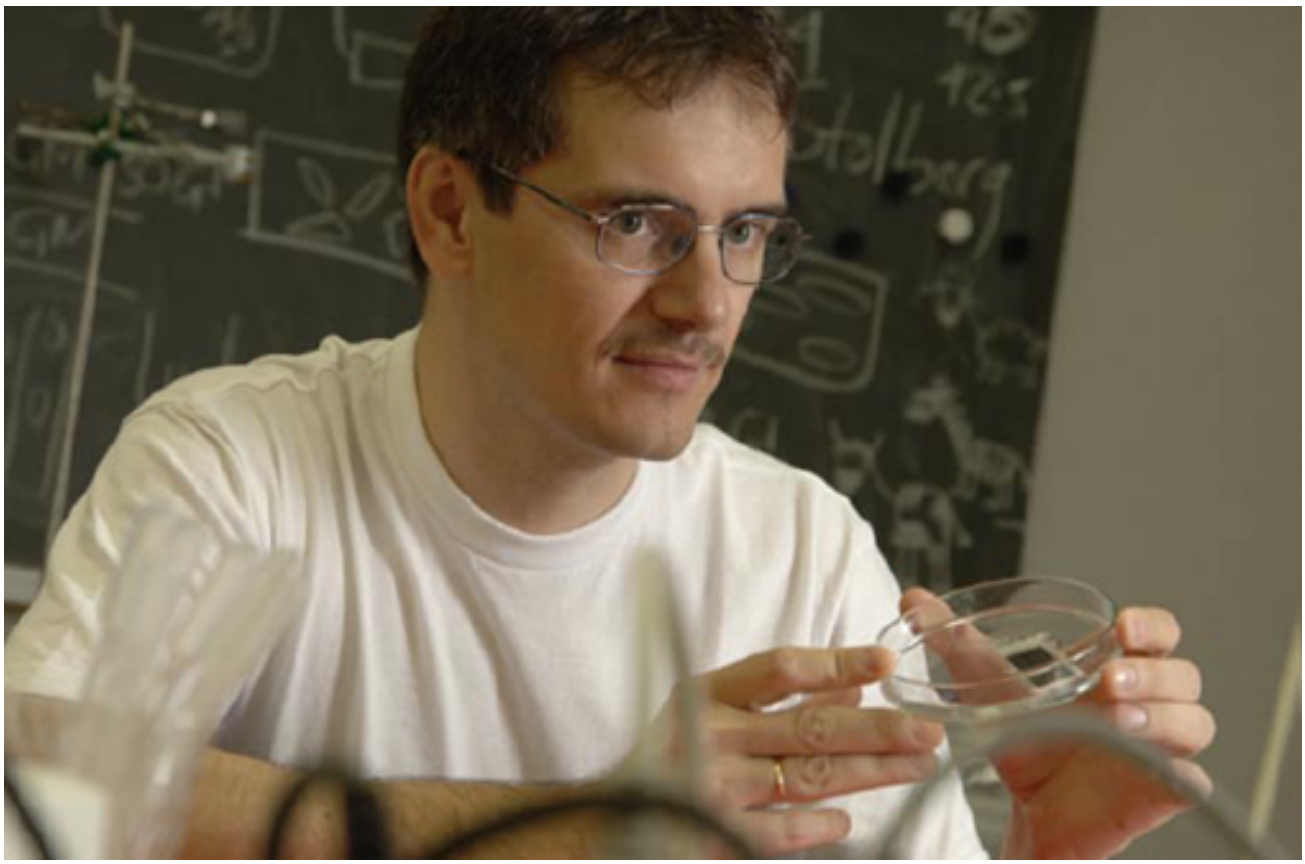
– We have met with the ASMENA industrial advisory board several times during the project, and last time I asked them whether their participation in the ASMENA project has been useful for them. They all said that it has indeed been very beneficial for them. They now understand the development possibilities of their products better. They have discovered new areas of application for their products, and are thus able to increase their sales. Some of the companies are combining their products in ways that enable them to reach more customers. Also, a number of products have already resulted from the ASMENA project. For example, functionalized chips and nanostructured chips for membrane assembly and measurements have already been implemented in an industrial process. Specialized surface modification compounds and protocols for membrane assembly on waveguides and the nanostructured chips are also new products available from the partners. Additionally, two of the partners are investigating the possibilities to start a new spin-off company based partly on inventions made in ASMENA.

Scientific Gains In Many Areas

Moving the state-of-the-art significantly forward was an important goal of the ASMENA project – and one that Janos has reason to be very proud of as well.

– We have learned a lot throughout this project. Numerous publications in leading journals as well as a number of patents clearly show just how much has been achieved. Since we have worked closely with our industrial partners, many of these results have already been implemented in the product development processes. The new methodologies developed will definitely impact device fabrication and drug screening in the years to come.

projects unrelated to, but happening as a result of the ASMENA project. In academia, the tendency is often to work with researchers within your own specialized field. Due the highly interdisciplinary nature of the ASMENA project, however, we have been able to collaborate with researchers whose expertise is decidedly different but at the same time highly complementary to our own, and I would say that is one of the main benefits of these EU-funded projects. We are forced to think in



– As scientists, we need to show that we are useful to society, Janos says. He is convinced that the high level of integration of industrial partners into the ASMENA project has been key to its success.

Building On the Results of ASMENA

With the ASMENA project coming to an end, Janos already sees other long-term benefits for the many partners involved. For example, there is already increased cooperation between his own research group at ETH Zürich and several of the other groups involved in ASMENA.

– Some of the partners are already discussing possible future EU projects, dealing with similar issues and based on the successes of the ASMENA project. There is also already increased cooperation between the groups, in new ways and are thus also made to look at our own expertise and our technologies with new eyes.

– In this case, the industrial partners are extremely integrated into the project, with a very high level of cooperation between the researchers and the companies involved. That is quite different from our everyday work in academia. I would say, the industrial partners keep us on the ground.

He explains,

– Of course, Europe needs fundamental research as well. But as scientists, we need to show that we are useful to society not just in the long-term perspective, but here and now as well. The way to do that is through applied research, and that is where the industrial partners play such an important role. They tell us what they need, which problems they need to have solved, right now. From the very beginning, the ASMENA project was built on asking the right questions, ”Which problems are important to solve right now, and whose expertise do we need to solve those problems?” – and then including academic partners from different disciplines as well as the industrial partners whose products and methodologies that the new platforms could be based on. I believe that is just the right way to achieve the most benefit for both European industry and for the European public.

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 based on in vitro measurements of functional and conformational changes in membrane proteins. Such tools will allow standard profiling and screening of 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 as contribute to fundamental understanding of structure-function relationships of membrane proteins.*

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