



Editorial

With the closure of Winter, we can look back at the activities of the PDEng trainees during this period. Enclosed in this edition we present successful design projects, conference experiences and company visits, as well as all of the social activities that the trainees enjoyed.

International Dinner 2019

The cultural diversity of the PDEng office is no secret, which results in a vast range of recipes and cooking knowledge among the trainees, inspired by our varying origins and experiences. The international dinner, hosted on the 5th of October, exploited this to bring an explosion of smells and flavours for the trainees to enjoy. Each participant selected a home-made dish that would best represent their food culture and gave their best efforts in the kitchen with some truly mouth-watering results. With many excellent dishes to choose from, a vote was held to crown the dishes that stood out from the rest. In third place ranked Marina Carrer with a fabulous Italian Tiramisú; in second place, Jeremy Mantingh found success with his British Apple Crumble and Custard. The winning dish was a superb Greek Moussaka, created from the combined efforts of Andreas Pateromichelakis, Thanos Pappas and Konstantinos Alexias. The combination of food, drinks, games, music and good company made for a thoroughly satisfying evening that was enjoyed by all.



Visit to 3M facilities, Delft

On November 20th, 2019 3M Innovation Center in Delft opened up their doors to receive the new PDEng trainees from TU Delft and a group of students from the ATHENS Programme. 3M leaders and employees presented to the group how the corporation went from a small and unprofitable Minnesota Mining and Manufacturing company (where the three "M"s come from) in the early 1900s, to one of the most successful product companies in the world today. In fact, 3M developed the famous Post-it® Notes some years ago.

Later, we attended to a presentation entitled "Separation and purification of monoclonal antibodies", with a lot of interaction between the interlocutor and the audience. To finish in the best way, we had a coffee break and the chance to do networking, including time to talk with PDEng alumni who are currently working in 3M.

Florence Conference 2019

In September, four PDEng trainees had the opportunity to promote the PDEng program and their work at the conjunct European Congress of Chemical Engineering and Applied Biotechnology. The conference was held in Fortezza da Basso, in the amazing city of Florence, Italy. With over than 500 posters and 200 sessions, the conference gathered researchers from all over the world. The PDEngs from the chemical product design track presented a poster on the replacement of Cr VI in the aerospace industry, while the process and equipment design team on Coal Fired Power Plants replacement to Metal Fuels. Besides the conference, the trainees had the opportunity to explore the city, which has such an astonishing cultural and artistic heritage that a newsletter article cannot do justice. The views, museums and artwork gave a breath taking feeling, throwing the trainees back to life during the Renaissance, which along with the amazing food and drink made it very difficult to comeback.



PDEng Christmas Dinner



To celebrate the end of a semester and the start of the holiday period, on the 6th December the trainees piled into De Beren in Delft's Beestenmarkt for their Christmas dinner. Along with every trainee came two gifts. However, this year Santa decided against his traditional naughty or nice list and instead used the roll of a dice to decide which gifts went to whom. After this gift exchange, the party moved to Rotterdam to finish the night.

On the 6th September, the PDEng office headed to Rotterdam for the Wereld Havendagen event taking place. The first stop was the Port of Rotterdam, where we were welcomed with a tour of the BP Refinery. Here the trainees first learnt about the work that BP do in the Netherlands, before being shown around the plant itself. Finally, the trainees were able to visit the control room to receive some insights from the plant operators. Following this, the trainees were given time to enjoy the events taking place in the city before attending the seminar titled 'The future is renewable' from Neste. The trainees learned about the sustainable vision of Neste, and took the opportunity to network with the company representatives. To round out the day in excellent fashion, dinner at Idol's Wok Restaurant was enjoyed.



Individual Design Project

N-1 Perfusion and High Seed Production



The individual design project (IDP) is the most significant event undertaken in the development of a PDEng trainee, and in this Autumn edition of the newsletter Salim Şimşek, a trainee in Bioprocess Engineering, has kindly shared his experiences with this significant task. Salim's project, titled N-1 Perfusion and High Seed Production is facilitated by the Janssen Pharmaceutical Companies of Johnson & Johnson, a leading pharmaceutical company focusing on immunology, cardiology, metabolics and oncology. The aim of Salim's project is to assess the technical and economic feasibility of N-1 perfusion and high seed production technology, which aims to intensify the production process by increasing the seeding density of the production bioreactor. Higher seeding density in the production bioreactor increases the volumetric productivity which improves the bioreactor utilization and enables to diversify the product pipeline without a capital investment. With new technology, cell density is significantly increased in the N-1 step to achieve higher seeding density in the production bioreactor.

New technology changes the operation mode of the N-1 (seed) bioreactor from fed-batch to continuous and employs an alternating tangential flow (ATF) filter in the N-1 step to retain the cells in the bioreactor as well as increase the feed rate. One major goal that Salim has achieved thus far is the design of the lab-scale proof-of-concept experiments, for which he developed scale-down models based on the assumed large scale operation. Moreover, he introduced a lab scale automated feeding strategy based on a model predicting the cell growth in the N-1 step. This strategy saves significant amount of media which is needed for the cell growth and improves the process robustness. The result of his work in this area was a successful proof of concept. Following this, he developed a lab scale mass transfer model and performed conceptual scale up calculations for new technology. Salim is currently furthering his progress in this project by finalizing the techno-economic assessment of new technology. To achieve these goals, Salim relied on his technical knowledge in scale up/scale down, fermentation technology and techno-economic evaluation; however, he has found that his skills in project management have been his most useful tool. The key challenges that Salim faced in this project include handling changes in the project scope, which is a common occurrence in a dynamic company environment, as well as difficulty in stakeholder management. Salim will continue this project until February, where he hopes to close out his work by concluding on the techno-economic feasibility of new technology.

- Salim Şimşek
Bio-Process Engineering

Meat is a hot topic of the modern era. Climate concerns and ethical conundrums are significant issues that result from meat consumption, which is forcing questions about the place of meat in our diets. However, there are some people that believe that we can keep eating meat without environmental or ethical concerns. These people are the start-up company called Meatable, who enlisted the PDEng trainees Luís Parreira, Konstantinos Alexias, Paula Gonzàlvez Querol and Thanos Pappas to perform the conceptual design of their cultured meat production process. Cultured meat is grown directly from the cells of an unharmed animal, which reduces the environmental burdens of meat production and avoids the ethical issues associated with slaughtering. Process feasibility on the lab-scale is one thing, but the trainees set out to investigate if the industrial scale process would be feasible and profitable. The full production chain from the proliferation of stem cells up until the final stage of meat production was considered, with critical areas for improvement being identified with particular

regard for process economics. On a cost per kilogram basis, the trainees discovered that this cultured meat venture could be a cost competitive alternative for large scale meat production. However, the design uncertainties associated with the technologically advanced “cell differentiation reactor/scaffold” stage of the process, along with the nutrition media of the cells, which is biologically complex, were identified as key challenges for the process. During their project, the team faced difficulty in addressing the novel differentiation reactor due to its deviation from conventional bioreactor principles. This difficulty was further exacerbated due to lacking of relevant literature, which forced the team to use their engineering intuitions to make key decisions with as much accuracy as possible. Nevertheless, these difficulties were overcome to conclude that the scale-up of this cultured meat process is likely to be a feasible opportunity to address the issues that our modern society faces as a result of meat based diets.



*Luís Parreira, Konstantinos Alexias, Paula Gonzàlvez Querol and Thanos Pappas
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Upcoming Events!!

visit to ECN facilities of TNO

Ice breaking event for new trainees

..and many more exciting opportunities!

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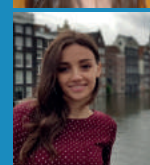
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