

Pursuing Sustainability via Rigorous Process Systems Modelling in Advanced Pharmaceutical Manufacturing

Prof. Dimitrios I. Gerogiorgis (D.Gerogiorgis@ed.ac.uk)

Institute for Materials & Processes (IMP), School of Engineering, University of Edinburgh, UK

Abstract

Globalized epidemics pose formidable challenges to advanced pharmaceutical manufacturing, as most processes are routinely designed and scaled up suboptimally, with ever-increasing pressure on material and energy resources. Social responsibility is at the heart of addressing emerging (Covid19) as much as persistent (cancer, HIV) crises. Quality by Design (QbD) must be attained by a relentless pursuit of efficiency in energy and solvent use; above all a strong business case for a product must secure R&D time and cost savings vs. competition and strict patent limits. Model-based economic analyses can quickly elucidate these advantages *in silico*, thus inducing strong interest by pharma corporations, but also sustained support and guidelines by authoritative regulatory (FDA, EMA) bodies.

This seminar will present key successful applications of several process systems engineering (PSE) methodologies (kinetic & thermodyn. parameter estimation, model-based simulation and optimisation, design space visualization) to evaluate technical efficiency and economic viability of new processes based on lab demonstrations for certain small molecules (Active Pharmaceutical Ingredients, APIs) and biotherapeutics (monoclonal antibodies, mAbs). Specifically, we will discuss a series of recent journal publications on optimal process design, solvent selection and economics for Adavosertib, an experimental anti-cancer drug (in collaboration with AstraZeneca, Macclesfield, UK).



Biosketch

Prof. Dimitrios Gerogiorgis is a Fellow of IChemE, Senior AIChE member, fmr. Director of the IChemE-accredited MSc in Adv. Chem. Eng., and recent Royal Society and Royal Academy of Eng. Industrial Fellow (School of Eng., Univ. of Edinburgh), focusing on process systems modeling, design and optimization. He holds a Diploma in Chem. Eng. (Aristotle University of Thessaloniki, Greece), an MSc in Elec. & Computer Eng. and a PhD in Chem. Eng. (Carnegie Mellon University, Pittsburgh). He also holds a Diploma in Higher Education (CMU) and is a chartered linguist (Diploma in Translation, IoLET, London, UK). His research portfolio spans the model-based design of the Alcoa ARP carbothermic aluminium reactor, the NTUA vertical perlite expansion furnace (Athens), the optimization of investment planning for efficient polygeneration (Imperial College), the first-ever technoeconomic comparison of batch vs. continuous pharma plants (Novartis-MIT), the multi-objective dynamic optimization of beer fermentation (WestBeer, MolsonCoors), and new pharma manufacturing advances (GSK, AstraZeneca). He has co-authored over 130 peer-reviewed publications in journals and book series, and is recognized with two Academy of Athens (L. Mousoulou/2015, H.L. Zervas/2023) Awards, a Fulbright Fellowship, a High Commendation for the IChemE Global Food and Drink Award (2017), and the Best Presentation Award of the 3rd CSIRO International CFD Conference (Australia). He has delivered invited lectures at Cambridge, Imperial, Sheffield and Strathclyde (UK), Princeton (US), McGill (Canada), Univ. Rovira i Virgili (Spain), the Max Planck Institute (Potsdam, Germany), Maribor (Slovenia) and Budapest/BUTE (Hungary). His course on Oil & Gas Systems Engineering (with Atkins/now Kent) was an IChemE Global Education Award finalist (2015), and won him the University of Edinburgh Teacher of the Year Award (College of Science & Engineering/CSE) in April 2024.