



Emerging Investigators in Flow Chemistry 2023

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Continuous flow technology has emerged as a powerful solution to address scalability and selectivity challenges in organic synthesis, while enabling access to new chemical space. When employed in the synthesis of pharmaceuticals and agrochemicals, continuous flow reactors can improve the robustness and reproducibility of synthetic platforms, thereby facilitating the transfer of synthetic protocols from laboratory to industrial scale. More recently, innovations demonstrating the integration of flow technology with in-line analytical techniques, automation protocols and machine learning algorithms fortified flow chemistry's position as a key enabling technology for both industrial and academic applications.

As the premier specialized journal on the topic, the Journal of Flow Chemistry has documented all major advancements in the field since 2010, becoming a reference point for the entire flow chemistry community. Two years after the first successful special issue edited by Milad Abolhasani and Jean-Christophe M. Monbaliu, the editorial team is excited to announce a second “Emerging Investigators in Flow Chemistry” special issue, edited by Jie Wu, Cecilia Bottecchia and Luca Capaldo.

In collaboration with our dedicated editorial team, we have carefully curated a collection of contributions from early career researchers from academia and industry. The researchers featured in this special issue not only embraced continuous flow technology, but acted as innovators and architects of change for the broader field. Their collective efforts are a prime example of the original research driving the field of flow chemistry forward, and a testament to the growing impact of this technology.

One particular feature of this Special Issue is the diversity in scientific perspectives and approaches to the field, a reflection of the wide range of backgrounds and expertise from the contributors, from organic and inorganic chemistry to mechanical and chemical engineering and materials science. As readers navigate through the articles, we encourage them to appreciate the collective mosaic of ideas, methodologies, and applications that characterize the field of flow chemistry. By highlighting the emerging talents and research groups adopting continuous flow technology, we hope this special issue will foster new productive collaborations and contribute to expand our scientific community and the journal's readership.

Our sincere gratitude goes to all the authors featured in this special issue for choosing to share their innovative and timely findings with the flow chemistry community. A special thank you goes to our reviewers for taking the time to offer their constructive feedback, and for ensuring a timely peer review process. Last but definitely not least, we wish to acknowledge our readers for their continued curiosity and interest in continuous flow technology. Thank you all for being part of our journey towards advancing the frontiers of flow chemistry!

Luca, Cecilia and Jie

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Emerging Investigators



Francesco Mutti is professor of biocatalysis at the University of Amsterdam (Netherlands). He graduated in Industrial Chemistry (2004) at the University of Milan (Italy). After obtaining his PhD in Chemistry (2008), he was research associate in the groups of Prof. W. Kroutil at the University of Graz (2009–2012) and Prof. N. Turner at the University of Manchester (UK; 2013–2014). Since 2015, he is the group leader of the Biocatalysis at the University of Amsterdam. Among the others, he has been a Marie Skłodowska-Curie fellow, received an ERC Starting Grant as well as several Dutch national grants and industry funds. He has published about 60 research papers, several book chapters and 5 world patents. Among the others, he is Fellow of Royal Society of Chemistry (UK) and honorary member of the Argentinian Chemical Society. His main research interest is on biocatalysis and biotransformations in organic chemistry (biocatalytic cascades for sustainable synthesis of chemicals, enzyme discovery and engineering, continuous flow biocatalysis, biocatalysis in vivo and bio-electrochemistry).



Anna Slater received her PhD in supramolecular chemistry from the University of Nottingham in 2011. Following postdoctoral positions in porphyrin self-assembly and porous organic cage materials she took up a Royal Society-EPSCRC Dorothy Hodgkin Fellowship in 2016 and a Royal Society University Research Fellowship in 2021, both at the University of Liverpool. She was promoted to Chair

of Chemistry in 2022. Anna developed an interest in flow chemistry during her postdoc positions, recognizing that the technology has a lot to offer the supramolecular chemist. Exploiting flow processes for enhanced control of chemistry is now a central theme of her work, for which she was awarded the Royal Society of Chemistry Harrison-Meldola Memorial Prize in 2023. Her research interests include molecular materials, enabling technology and organic synthesis and self-assembly.



Jie Wu pursued his PhD study with Prof. James S. Panek at Boston University working on natural product total synthesis. In his postdoc research at MIT with Prof. Timothy Jamison and Prof. Alan Hatton, Jie has been exposed to the hard core of continuous flow chemistry. Since joining the department of chemistry, National University of Singapore, in July 2015, his research group focuses on new synthetic methodology development using photocatalysis assisted by advanced flow technologies. His group is also interested in the development of advanced flow technologies for on-demand and automated synthesis of functionalized organic molecules. In July 2021, Jie was promoted to tenured associate professor. Jie is a recipient of Dean's Chair Professor (2023), Tokyo Chemical Industry-SNIC Industry Award in Synthetic Chemistry (2021), NUS Young Research Award (2021), Yong Scientist Award (2020), Asian Core Program Lectureship Award (2017–2023), Thieme Chemistry Journal Award (2019), and NUS Chemistry Department Young Chemist Award (2018).



Joshua P. Barham was born in Watford, U.K. He received his industry-based Ph.D. in 2017 under the supervision of Prof. John A. Murphy and Dr. Matthew P. John at the University of Strathclyde and GSK, U.K. His postdoctoral studies with Prof. Yasuo Norikane and Prof. Yoshitaka Hamashima at AIST and the University of Shizuoka, Japan, specialized in flow chemistry and photoredox catalysis. Since 2019, his independent group has investigated photo-, electro-, photoelectro- and continuous flow organic synthesis at the University of Regensburg, supported by a Sofja Kovalevskaja Award. In 2022, he was awarded an ERC Starting Grant.



Paul Schaffer completed his undergraduate in Chemistry and Biochemistry at the University of British Columbia, followed by his graduate work in Chemistry at McMaster University. After 3 years as a Research Associate at the McMaster Nuclear Reactor, he joined GE Global Research as a Lead Scientist working on radiopharmaceutical development. He returned to Canada and has been the Director, Life Sciences at TRIUMF since 2009, and holds cross appointments in the Depts. of Chemistry at Simon Fraser University and Radiology at the University of British Columbia; and is an affiliated scientist with the Research Centre for Nuclear Physics in Osaka, Japan. Dr. Schaffer also serves as Chief Technology Officer of ARTMS, Inc., a spinoff company enabling reliable, large-scale, clinical radioisotope production. His research interests include the development of novel radiofluorinated amino acids, as well as novel radiometal-chelates, and radiolabeled large molecular weight targeting agents for diagnostic and therapeutic applications.



Daniele Mazarella studied chemistry at the universities of Rome and Bologna (Italy). After a brief experience in Japan working for Nippon Kayaku Co. Ltd, in 2016, Daniele joined Prof. Paolo Melchiorre's group at the ICIQ (Tarragona, Spain) as a Marie Curie funded PhD student. He was then awarded a postdoctoral Marie Curie Individual Fellowship to continue his research in the laboratory of Prof. Timothy Noël at the University of Amsterdam (The Netherlands). As of November 2022, Daniele holds the position of assistant professor at the University of Padova (Italy), contributing to the development of novel electrochemical and photochemical transformations.



Maksim Ošeka studied biotechnology and applied chemistry in Tallinn University of Technology, Estonia. He joined the Professor Tõnis Kanger research group first as an undergraduate student in 2009 and then successfully completed his PhD in 2017. Maksim's research in the group was mainly focused on the development of new asymmetric organocatalyzed reactions and mechanistic studies. As part of his master's studies, Maksim undertook an Erasmus placement at Oslo University, Norway, working with Prof. Lise-Lotte Gundersen and as a visiting PhD student he joined the Melchiorre group at ICIQ, Spain, where he participated in the development of a novel photocatalytic enantioselective alkylation reaction. After obtaining his doctoral degree, he conducted research with Dr. Dzmitry Kananovich and then moved to the Netherlands to pursue postdoctoral studies. During the two-year postdoc under Prof. Timothy Noël at Eindhoven University of Technology,

Maksim worked on the development of novel electrochemical methods in continuous flow. In 2021, Maksim returned to Tallinn University of Technology to start his independent career and was later promoted to Assistant Professor. The Ošek group's research at TalTech is focused on synergizing organic synthesis areas including photochemistry, electrochemistry, asymmetric organocatalysis, and flow chemistry.



Eugenie Romero earned her Ph.D. in chemistry from the Université de Lorraine in France in 2015, focusing on the synthesis and conformational studies of pseudopeptidic nanotubes. She then joined the laboratory of Prof. R. H. Dodd and K. Cariou at the ICSN in Gif-sur-Yvette, France, for a post-doctoral position in medicinal chemistry, before pursuing two post-doctoral positions in photoredox chemistry, in Belgium and Philadelphia with Prof. G. Evans and Prof. G. A. Molander respectively. In 2019, she became Director of the HTE Center at UPenn, Philadelphia, before coming back to France where she is working as a Research Scientist at the CEA in 2020. Her group aims to develop new photoinduced synthesis methodologies to access scaffolds of interest in medicinal chemistry. The group has set up an HTE laboratory in 2021 to support their research in photoredox methodologies but also to investigate the therapeutic potential of their molecules via a direct-to-biology approach.



Andrea Basso was born in Genova in 1971. He obtained the PhD degree from the University of Southampton (UK) in 2000, under the guidance of Prof. Mark Bradley. He is

currently full professor of organic chemistry at the University of Genova. His main research interests focus on sustainable synthetic methodologies based on multicomponent reactions and photoinduced transformations. He is also interested in educational research in the area of organic chemistry.



Thomas Heugebaert obtained a Ph. D. in Bioscience engineering in 2012 at the Department of Sustainable Organic Chemistry and Technology, research group Syn-Bioc, under the guidance of Prof. Christian Stevens, studying gold catalysis and its application in the synthesis of biologically active organic molecules. These include plant hormones, azaheterocyclic analgesics and five-membered heteroaromatic compounds. The subsequent academic postdoctoral research (2012–2018) at the same department focused on the development and use of microreactor technology. This included a broad range of subjects, such as amidations, halogenations, alkyl-lithium chemistry, photochemistry, gas/liquid interface chemistry, reactor design, etc. During a postdoctoral stay at Graz University, Austria, in 2014, under the guidance of Prof. Oliver Kappe, the efficient application of continuous flow photochemistry in the field of singlet oxygen oxidation of renewable chemicals was also investigated. Following two years of industrial postdoctoral research on starch modification (2019–2020), he started a tenure track position in green chemistry and photochemical process intensification at Ghent University in 2021.



Martina Letizia Contente is an Assistant Professor at the University of Milan. She graduated in Pharmacy at the

same University, where she obtained also her PhD in Medicinal Chemistry. During her years as postdoc she had the opportunity to work in different international environments increasing her expertise in the development of intensified and sustainable flow-biobased processes for the preparation of bioactive compounds and pharma/food ingredients. Among her research interests enzyme discovery, protein immobilization and stabilization for continuous processing are the most important.



Ana I. Benítez-Mateos has been SNSF Ambizione Group Leader at ETH Zürich since October 2023. She obtained her PhD in 2019 with Prof. F. López-Gallego at CICbiomaGUNE (Spain). Her research was focused on the co-immobilization of cell-free enzymes and cofactors and their implementation into flow reactors. She then joined the group of Prof. F. Paradisi, firstly at the University of Nottingham (UK) and later at the University of Bern (Switzerland) under a Seal of Excellence Postdoctoral Fellowship. During this time, she implemented several biocatalytic processes into continuous flow, with special attention to the sustainability and cost-efficiency of the whole system.



Margherita Brindisi received her PhD in Pharmaceutical Sciences from the University of Siena. She was a postdoctoral fellow in Prof. Arun K. Ghosh's research group at Purdue University (USA) in 2010–2011 and a Visiting Scientist in the same group in 2016–2017. In April 2019, she was appointed as Assistant Professor at the Department of Pharmacy at University of Naples Federico II, and in April

2022 she was promoted to Associate Professor in the same Department. Margherita is currently involved in the development of novel therapeutic options against infectious and rare diseases, and she is focusing on the application of flow chemistry and sustainable methodologies to her drug discovery projects. Margherita is co-author in more than 100 publications, with over 3600 citations, and she is inventor of two patents in the field of infectious diseases.



Marco Colella is a researcher in Organic Chemistry at the University of Bari (Italy). He earned his M.Sc. (summa cum laude) in Chemistry and Pharmaceutical Technology from the University of Bari in 2016. In 2019, he was a visiting scholar in the group of Prof. Aiichiro Nagaki at Kyoto University (Japan). During this period, he refined his expertise in the field of flash chemistry, which deals with the generation and synthetic use of highly reactive organometallic intermediates in continuous flow reactors. In 2020, he completed his Ph.D. in Chemical and Molecular Sciences under the supervision of Prof. Renzo Luisi and was honored with the CINMPIS award for the best Ph.D. thesis. Following a research stint at the University of Salento, he returned to the University of Bari. In 2023, he spent a research period at the Noël Research Group (University of Amsterdam), exploring innovative methodologies for fluorination in continuous flow systems. Currently, his research is centered on the application of flow microreactor technology in organometallic chemistry and the development of photochemical processes in continuous flow reactors.



Shusaku Asano studied chemical engineering at Kyoto University (Japan). He is currently an assistant professor at the Institute for Materials Chemistry and Engineering, Kyushu University. His research interests cover chemical reaction engineering, automation, and process intensification with flow systems. He was awarded the outstanding young researcher from SCEJ (the Society of Chemical Engineering, Japan) in 2024.



Balamurugan Ramalingam obtained his PhD degree from Bharathidasan University, India in Bioinorganic chemistry with Prof. M. Palaniandavar. After postdoctoral training in Asymmetric catalysis at the University of Basel, Switzerland under Prof. Andreas Pfaltz, he has been working at Agency for Science, Technology and Research (A*STAR), Singapore since 2007. He is currently working as a senior scientist at the Institute of Sustainability for Chemistry, Energy and Environment (ISCE²) and the Institute of Materials Research and Engineering (IMRE) focusing on flow chemistry, catalysis, green and sustainable chemical processes, high-throughput experimentation, and data-driven reaction optimizations.



Taotao Fu is Professor of chemical engineering at Tianjin University of China. Dr. Fu obtained his Bachelor degree from East China University of Science and Technology in 2005, majoring in chemical engineering and technology. After then, Dr. Fu spent 5 years in studying chemical engineering at Tianjin University for his Ph. D. degree, under the supervision of Professor Youguang Ma. During this period, he spent about 21 months in Institut National Polytechnique de Lorraine in France for a Joint-Ph.D. programme with Tianjin University, under the supervision of Professor

Huai-Zhi Li. From 2010, he joined the faculty of Tianjin University as an assistant professor and was promoted to associate professor in 2013 and to full professor in 2021. During September 2015 to September 2016, he visited Prof. Ronald Gary LARSON' group at University of Michigan as a visiting scholar. His interests include microchemical engineering and flow chemistry, microfluidics, interfacial transport phenomena, fluid mechanics at microscale, multiphase flow, and complex fluids. He has published more than 150 articles in peer-reviewed journals, such as *AICHE Journal*, *Chemical Engineering Science*, *Industrial & Engineering Chemistry Research*, *Chemical Engineering Journal*, *Physical Review E.*, *Microfluidics and Nanofluidics*, *Langmuir*, etc. He has been selected as the 2019 Class of Influential Researchers by *Industrial & Engineering Chemistry Research*, and the *Emerging Investigators in Flow Chemistry* by *Journal of Flow Chemistry* in 2023.



Takahide Fukuyama received his PhD degree in 1999 from Osaka University under the direction of Profs. Shinji Murai and Naoto Chatani. He spent 1999–2000 as a JSPS Postdoctoral Fellow at Okayama University of Science (Prof. Junzo Otera). In 2000, he was appointed as an Assistant Professor at Osaka Prefecture University. He was promoted to Lecturer in 2007 and an Associate Professor in 2010. He also worked with Prof. Max Malacria at the University of Pierre and Marie Curie as a Visiting Scientist in 2006. He is the recipient of the DIC Award of the Society of Synthetic Organic Chemistry, Japan (2002) and the Kansai Award of the Society of Synthetic Organic Chemistry, Japan (2014). His research interests include new methodologies based on transition metal catalysis and organic synthesis using flow reaction technology.



Jing Hou obtained a Ph.D. in organic synthesis under the supervision of Prof. Qi-Lin Zhou in 2016 at Nankai University. He joined Prof. Jie Wu's group as a postdoctoral researcher in November 2016 working on photocatalysis and flow chemistry. In 2018, he started his independent career at Nanjing University of Science and Technology focusing on the development of photocatalyzed C1 chemistry and continuous flow synthesis.



Kejun Wu obtained his Bachelor's degree in 2007 and the PhD degree in 2012 from Zhejiang University, China, both in Chemical Engineering. He is currently ZJU100 Young Professor at Zhejiang University. His main research interests focus on the development of process intensification methods to perform physical and chemical processes of high significance.



Natan Padoin is currently an Adjunct Professor (tenured) at the Department of Chemical and Food Engineering

of the Federal University of Santa Catarina (UFSC), Florianópolis/SC, Brazil. He develops his research mainly at the Laboratory of Materials and Scientific Computing (LabMAC)– UFSC. B.E. (2011), M.Sc. (2013), and Ph.D. (2016), Chemical Engineering– Federal University of Santa Catarina (UFSC), Brazil. His research is focused on mathematical modeling and numerical simulation, Computational Fluid Dynamics (CFD), process intensification, artificial intelligence in chemical processes, and the development of advanced materials.



Tatiana Matiazzo is currently a postdoctoral researcher at the Materials and Scientific Computing Lab (LabMAC), Department of Chemical and Food Engineering, Federal University of Santa Catarina (UFSC), Florianópolis/SC, Brazil. B.E. (2015) and M.Sc. (2017), Chemical Engineering– University of Blumenau (FURB), Brazil. Ph.D. (2022), Chemical Engineering - Federal University of Santa Catarina (UFSC), Brazil. Her research is focused on the convergence of optics and Computational Fluid Dynamics (CFD). Her focus areas include process intensification, microfluidics, optimization, multiphase flow, and turbulence.



Humberto Gracher Riella is currently a Full Professor at the Department of Chemical and Food Engineering of the Federal University of Santa Catarina (UFSC), Florianópolis/SC, Brazil. He develops his research mainly at the Laboratory of Materials and Scientific Computing (LabMAC)– UFSC. B.E. (1975), Chemical Engineering– Federal University of Paraná (UFPR), Brazil. M.Sc. (1978),

Nuclear Technology– University of São Paulo (USP), Brazil. Ph.D. (1983), Maschinenbauingenier– Karlsruher Institut für Technologie (KIT), Germany. His research is focused on nuclear fuels and reactors, process intensification, the development of advanced materials, and the valorization of industrial waste.



Cíntia Soares is currently an Associate Professor at the Department of Chemical and Food Engineering of the Federal University of Santa Catarina (UFSC), Florianópolis/SC, Brazil. She develops her research mainly at the Laboratory of Materials and Scientific Computing (LabMAC)– UFSC (group leader). B.E. (1998), Chemical Engineering– University of Blumenau (FURB), Brazil. M.Sc. (2000) and Ph.D. (2005), Chemical Engineering– Campinas State University (UNICAMP), Brazil. Her research is focused on mathematical modeling and numerical simulation, Computational Fluid Dynamics (CFD), process intensification, artificial intelligence in chemical processes, and the development of advanced materials.



Vanessa Kairouz obtained both her B.Sc. (2011) and M.Sc. (2015; supervisor: Prof. Andreea R. Schmitzer) in chemistry from Université de Montréal (UdeM). She is the director of the Center for Continuous Flow Synthesis at the Department of Chemistry at UdeM. She has a diverse educational background in supramolecular chemistry, catalysis, green chemistry, biochemistry, and continuous flow sciences. Her versatile expertise, coupled with her extensive experience in mentoring students, has led her to collaborate

on projects with academia and industry alike. With a track record of 16 publications and over 30 scientific presentations, Vanessa is a proven asset in bridging the gap between theoretical knowledge and practical application in the field of flow chemistry. Since 2020, in collaboration with Prof. André B. Charette, they have secured significant funding from various agencies and companies to provide solutions to mitigate supply chain challenges through on-demand synthesis of active pharmaceutical ingredients (APIs) and other valuable compounds using continuous flow chemistry.



Koen Kuijpers completed his entire studies at Eindhoven University of Technology in the Netherlands. After obtaining his BSc in Chemical Engineering & Chemistry, he pursued his MSc studies specializing in Process Technology. His MSc graduation project focused on scaling up gas-liquid photocatalytic oxidations in flow under the supervision of Prof. Timothy Noël. Following his studies, he remained in Prof. Timothy Noël's group to earn his doctorate in the areas of automation, flow reactor design, and scale-up of photocatalytic processes in flow. After completing his PhD, he joined the Process Engineering group at Janssen R&D, where he currently focuses on the development and scale-up of processes for small molecules.



Upendra K. Sharma received his PhD (2011) from CSIR-Institute of Himalayan Bioresource Technology, Palampur, India. Thereafter, he worked as an assistant professor for a short period at the National Institute of Technology, Jalandhar, India. In 2013, he joined the research group

of Prof. Erik Van der Eycken at the University of Leuven, Belgium, followed by postdoctoral stints with Prof. Steven Ley (University of Cambridge), Prof. Timothy Noël (University of Eindhoven), Prof. Shu-Li You (SIOC, China), and Prof. Klavs Jensen (MIT). In 2020, he joined KU Leuven as a research-expert (Jr. group leader). His research interests include new reaction methodologies employing photoredox catalysis, electrochemistry, C-H functionalizations in continuous flow.



Lana Borukhova is leading the industrial implementation of continuous manufacturing for drug substance at Sanofi France. Her team is responsible for industrialization of new products at manufacturing organization. She defended her Ph.D. thesis in 2016 on Flow reactor networks for the integrated synthesis of active pharmaceutical ingredients under the supervision of Prof. Dr. Volker Hessel in collaboration with Ajinomoto OmniChem N.V. She started her carrier at Janssen Pharmaceutica as a Process Engineer in API Small Molecule Development. Subsequently, she moved to Innosyn B.V. to specialize in delivering sustainable solutions within process engineering using continuous processing. She relied on data-rich experimentation to rapidly optimize and develop continuous processes for pharmaceutical, fragrance and polymer-based products. Her current interest lies in advanced process control and hybrid manufacturing.



Robert Rönnback is leading a team of scientists and engineers for new product drug substance development and industrialization at Sanofi France. The team is focusing on small molecule new product industrialization, life cycle management as well as new manufacturing technologies, covering topics like continuous manufacturing, biocatalysis, particle engineering and PAT. He holds a master's degree in chemical engineering from Abo Akademi University in Finland and has a more than 25 year experience in the industry, both in drug substance and drug product manufacturing development.



Jing Zhang received his PhD degree in Chemical Engineering from Iowa State University (2014). After being a post-doctoral fellow for four years at the University of Colorado Boulder, he joined the faculty of the Department of Chemical Engineering at East China University of Science and Technology (ECUST) in 2019. He is a full professor and deputy director of the United Laboratory of Chemical Reaction Engineering at ECUST. His current research focuses on microfluidic technology and heterogeneous catalysis. He has received the American Institute of Chemists Postdoctoral Award, Outstanding Contribution Award from “Green Chemical Engineering”, Youth Research Group Award of Shanghai, etc.

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