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Supervisor Expression of Interest MSCA-IF Marie Sklodowska Curie Action-Individual Fellowship 2020

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Department Name: Research topic: (https://www.polimi.it/en/scientific-research/research-at-the-politecnico/departments/)	Chemistry, Materials and Chemical Engineering, "Giulio Natta" PE6_12 Scientific computing, simulation and modelling tools PE7_3 Simulation engineering and modelling
MSCA-IF Research Area Panels	<input type="checkbox"/> CHE_Chemistry <input type="checkbox"/> ECO_Economic Sciences <input type="checkbox"/> ENG_Information Science and Engineering <input type="checkbox"/> ENV_Environmental and Geosciences <input checked="" type="checkbox"/> LIF_Life Sciences <input type="checkbox"/> MAT_Mathematics <input type="checkbox"/> PHY_Physics <input type="checkbox"/> SOC_Social Sciences and Humanities
Politecnico di Milano Areas:	<input type="checkbox"/> Cultural Heritage <input type="checkbox"/> Smart Cities <input type="checkbox"/> Territorial Fragilities <input checked="" type="checkbox"/> Health <input type="checkbox"/> Industry 4.0
Brief description of the Department and Research Group (including URL if applicable):	PSE-Lab is a research group that been active for more than 25 years, and has built on knowledge of modeling and simulation to the innovative field of Quantitative Systems Pharmacology for more than 6 years, producing a number of works and collaborations with national and international universities and clinical partners. The main drive is the application of typical chemical engineering tools such as modeling and control strategies to investigate and analyze the human body response to drugs administration, with the goal of optimizing and individualizing drug dosing and clinical treatments. In particular, research is being carried out on anesthetic and anti-



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	<p>cancer drugs pharmacokinetics and pharmacodynamics, and control of anesthesia. As some research has also been ongoing on the training of operators in both the industrial and the maritime sectors, the addition of a research project on the training of anesthesiologists to the ongoing research activities would extend the fields of application and supplement our expertise, with the aim of making improvements in the complex area of clinical practice.</p> <p>URL: https://pselab.chem.polimi.it/</p>
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<p>Brief project description: (max 1 page)</p>	<p>OPERATOR TRAINING SIMULATOR FOR PRACTITIONERS OF TOTAL INTRAVENOUS ANESTHESIA</p> <p>Although anesthesia is today considered a rather safe procedure, anesthesiologists lack standard, universal methodologies in their training approaches. Indeed, the education and training of medical trainees are still strongly practice-oriented and dependent on the medical trainer's habits, experience, and mindset. Human factors play a paramount role in anesthesia, in terms of experience, level of attention, fatigue, interaction with the rest of the operating room team, and capability of interpreting and reacting to the changes of the multiple monitored physiological parameters of patients. Indeed, according to Kothari et al. (2010) up to 87% of anesthesia-associated incidents are related to human errors, often associated to mistakes in the administration stage and misuse of the devices in the operating room. Anesthesiology is considered a stressful specialty and anesthesiologists are recognized to be at risk of developing stress-related diseases, such as the <i>burnout syndrome</i>. With the increasing attention to the working condition of healthcare operators, it is essential to provide anesthesiologists and especially anesthesia trainees with innovative tools that can help them improving their working conditions and enhancing patients' care. An integration of model-based tools for the simulation of virtual patients with clinicians' expertise and knowledge is desirable to bring actual improvements in clinical practice and quality of patients' care. While in other fields, e.g., transports, the use of simulators for trainees and more experienced operators is quite established, the use of such tools is not common in anesthesia, despite the existence of few commercial solutions.</p> <p>The project we want implement under the MSCA-IF framework aims at developing a simulator using both virtual reality and augmented virtual reality to improve the trainees' knowledge of the monitors and the infusion pumps employed in the operating room. The simulator will be capable of simulating the behavior of <i>in silico</i> patients via physiologically-based pharmacokinetic-pharmacodynamic models, to replicate the dynamics of the main monitored physiological parameters, e.g., hemodynamic variables, quantitative electroencephalogram indexes (e.g., bispectral index, spectral entropy), and respiratory parameters. The models will be used to simulate the response of different <i>in silico</i> patients to the induction of anesthesia, during which the trainee will choose the quantity and timing of drugs administration to induce depth of</p>
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consciousness and analgesia. The simulator will also implement disturbances of the anesthetic state, so that the trainee can learn how to interpret changes of the physiological parameters and react to preserve the level of anesthetic depth of the virtual patients. Finally, to overcome the typical trainer-trainee paradigm, the MSCA-IF assignee will develop an automated performance assessment algorithm to be implemented in the simulator, with the advantages of objectivity and replicability of the performance evaluation. In collaboration with clinical partners, the developed simulator will be finally tested on anesthesia practitioners with various levels of experience.

References:

Kothari, D., Gupta, S., Sharma, C., Kothari, S. (2010). Medication error in anaesthesia and critical care: A cause for concern. Indian journal of anaesthesia, 54, 187.

List of publications of the supervisor for MSCA-IF:

<https://www.scopus.com/authid/detail.uri?origin=resultslist&authorId=7004223789>

<https://publons.com/researcher/2633220/davide-manca/metrics/>

<https://scholar.google.it/citations?user=zhCxzGUAAAJ>

https://www.researchgate.net/profile/Davide_Manca