newMAT4CEC

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
CENTRO INTERDIPARTIMENTALE
DI RICERCA INDUSTRIALE SCIENZE DELLA VITA
E TECNOLOGIE PER LA SALUTE

The newMAT4CEC project aims to enhance the hemocompatibility of the polymeric membranes used in the filters of extracorporeal circulation (CEC) devices, with the goal of reducing the risk of postoperative neurological complications that can negatively impact clinical outcomes.
Throughout the project, new functional coatings and surface treatments for the membranes will be developed and tested to improve their interaction with blood, thereby increasing the overall performance of CEC devices.

"Smart membranes for ECC devices: prevention of neurological complications"

Laboratory	CIRI SCIENZE DELLA VITA
Specialization Area	Health and Wellness
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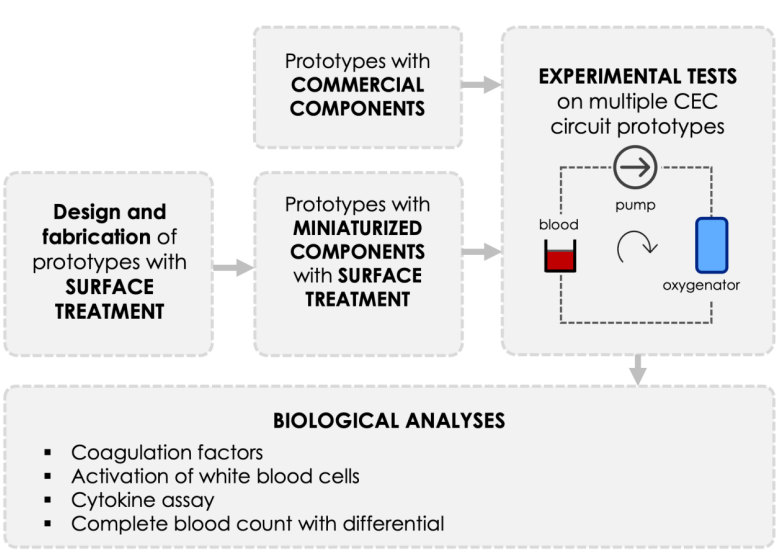
Keyword	Extracorporeal circulation, Filters, Membranes

Fig. 1: Kick – off meeting, 13/03/2024, Mirandola



General overview of the main activities planned for the newMAT4CEC project.

Description

Extracorporeal circulation (CEC) is associated with an increased risk of complications such as postoperative cognitive dysfunction (POCD), stroke, and delirium. Despite the advanced technological development of CEC devices, their hemocompatibility remains insufficient and can therefore be considered one of the contributors to systemic inflammation, which may lead to cognitive disorders and other complications.
The newMAT4CEC project focuses on the development of new functionalized membranes aimed at reducing systemic inflammation.
CEC circuit tests will be divided into preliminary trials using a commercial circuit and final tests using a miniaturized circuit functionalized with the new membrane prototypes. In both cases, biological analyses will be performed to evaluate the improvement in hemocompatibility of the functionalized membranes, comparing the values of parameters identified in the literature as markers of inflammation.

Fig. 2: General overview of the main activities planned for the newMAT4CEC project.

Innovative aspects

Plasma-assisted treatments are used to activate membrane surfaces by promoting the formation of polar groups, which enhance adhesion, stability, and enable the grafting of new molecules such as phosphorylcholine.
Plasma treatments are well-established for plastic materials but have not yet been applied to CEC membranes.

Potential applications

The results of this project will have a strongly positive impact on all technological applications related to extracorporeal blood circulation, including oxygenators, dialyzers, and filters for hemofiltration techniques.

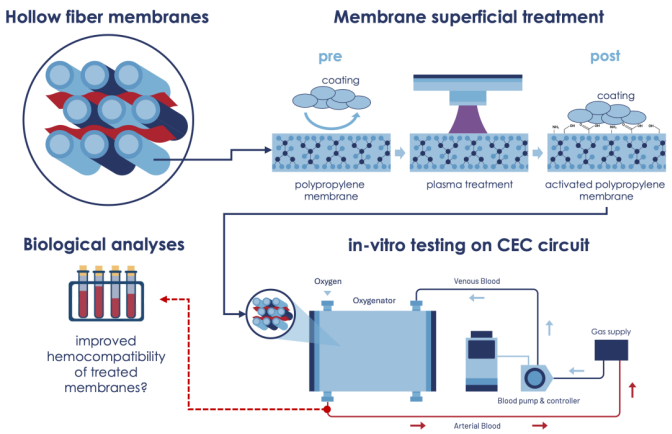


Fig. 3: Production and testing process

Application example

Oxygenators for Extra Corporeal Circulation (ECC).

The project aims to develop oxygenators for CEC equipped with functionalized membranes, specifically designed to optimize hemocompatibility and enhance the performance of these devices. The membranes will undergo functional coatings and surface treatments to improve blood interaction and increase the hemocompatibility of the oxygenators. These modifications will help prevent inflammation and reduce the risk of neurological complications. The final outcome will be a prototype oxygenator featuring advanced membranes, capable of ensuring greater safety and improved performance during CEC procedures. This development will have a direct impact on improving the effectiveness of the treatment and reducing issues related to systemic inflammation in patients undergoing cardiopulmonary surgery.

Involved partners	CIRI MAM TPM (Tecnopolo Mario Veronesi) Fondazione Democenter
Implementation Time	30 months
Technology Readiness Level	TRL4 - Technology validated in lab
Exploitation	The project represents a significant technological advancement in the field of extracorporeal circulation, introducing innovations in the development of cutting-edge medical devices, with the aim of improving patient safety and well-being.

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CIRI SCIENZE DELLA VITA

Centro Interdipartimentale di Ricerca Industriale CIRI Scienze della Vita e Tecnologie per la Salute

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