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PhD student / ESR 6

PhD on

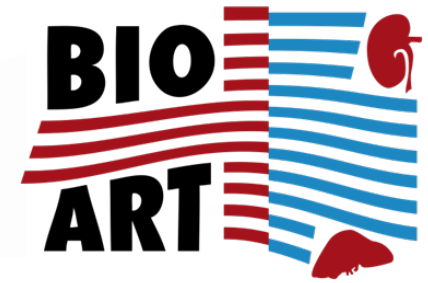
**Bioartificial liver using hepatocytes
and endothelial cells**

Aim & Things done
October 2014

PhD start date: November 2013

Institute on Membrane Technology National Research Council of Italy (CNR-ITM)
Department of Environmental & Chemical Engineering (DIATIC), University of Calabria

Network



BIOART

(WP1)

Artificial Kidney

(WP2)

Bioartificial Kidney

(WP3)

Bioartificial Liver

France

(ESR8, ER3)

Germany

(ESR9, ESR10)

Italy

(ESR6, ESR7, ESR11)

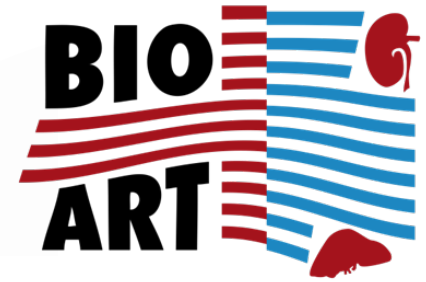
(ESR6) Mass transfer modeling & optimization (P5)

(ESR7) In-vitro models using primary human liver cells & stem cells (P5)

(ESR11) Dynamic model & Process Control (P7)

Host institution: (P5) Institute on Membrane Technology,
National Research Council of Italy (CNR– ITM)

Objectives



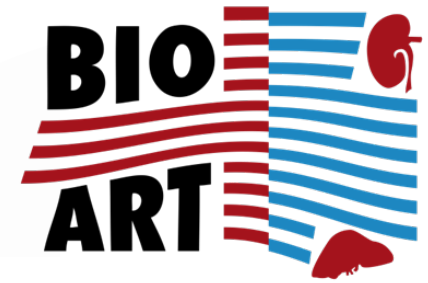
Objectives:

- i. Realization of the hollow fiber membrane bioreactor (HFMBR)
 - HFMBR configuration
 - Other process units
 - Establishment of the operative culture conditions

- ii. Analysis of the transport phenomena
 - Experimental work:
 - Permeability studies
 - Characterization & optimization of the bioreactor fluid dynamics
 - Mathematical analysis: Mass transfer + fluid dynamics modeling

- iii. Evaluation of the liver-specific functions of the bioreactor

Progress (outline)



i. HFMBR Realization

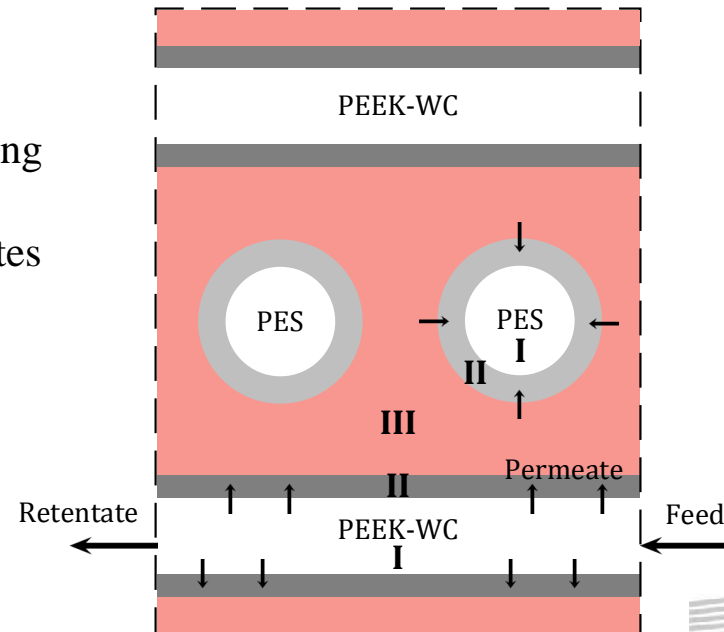
(Based on the model developed by *L. De Bartolo et. al (2009), Biomaterials, 30, 2531–2543*)

- ✓ Modified bioreactor housing
- ✓ Improved HF configuration
- ✓ Revised PFD

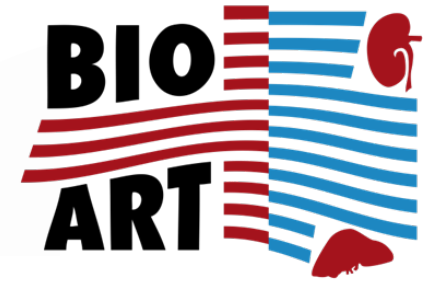


- Polyetheretherketone (PEEK-WC): supplying nutrients and metabolites
- Polyethersulfone (PES): removing catabolites

- (I) Lumen
- (II) Membrane
- (III) Extra-capillary space (ECS)

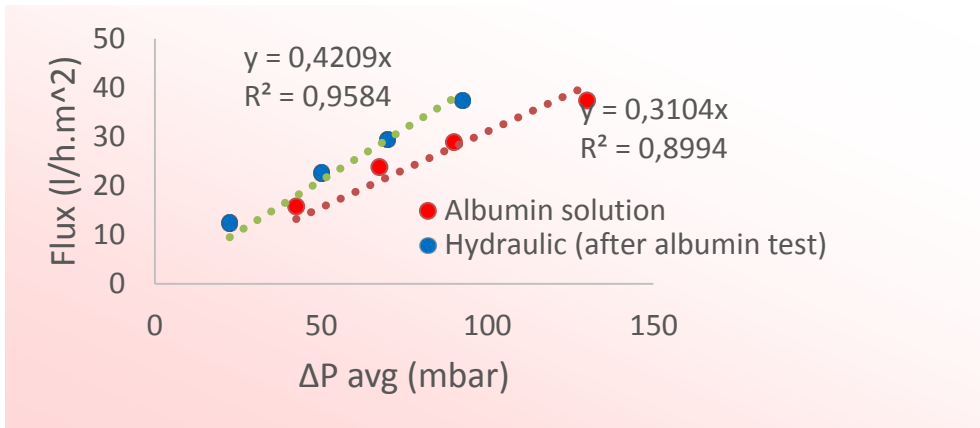


Progress (outline)

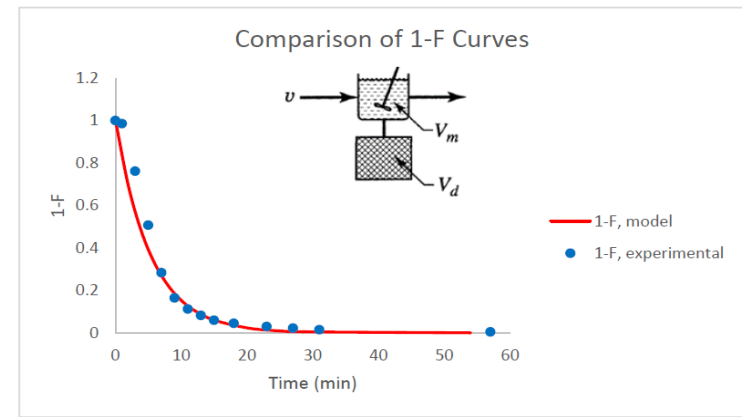


ii. Analysis of the transport phenomena

Permeability of proteins through hollow fibers
(sample: Albumin through PEEK-WC)



HFMBR fluid dynamics
(RTD analysis)



Development and numerical analysis of the mathematical model
under investigation for the simplified case (Krogh cylinder)

