Allegato B

Decreto Rettrice Università di Roma "La Sapienza" n. 3141/2020 del 14/12/2020, codice concorso 2020POR039

PIETRO MATRICARDI

Curriculum Vitae

Place: Rome
Date: December 27th, 2020

Part I – GENERAL INFORMATION

Full Name: Pietro Matricardi
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Part II – EDUCATION

Type	**Year**	**Institution**	**Notes (Degree, Experience,…)**
University graduation	1989	University of Rome "La Sapienza"	Degree in Chemistry, 110/110 cum laude
Post-graduate studies	1994	University of Rome "La Sapienza"	PhD in Chemical Sciences (Dottorato di ricerca in Scienze Chimiche, VI Ciclo)
Specialty	2000	University of Camerino	Waste management (Scuola di specializzazione per la gestione e smaltimento dei rifiuti)
Specialty	1995	University of Rome "La Sapienza"	Health and Safety at Workplace (Corso di perfezionamento in chimica e ambienti di lavoro)
Licensure	1992	Provveditorato agli studi di Roma e Provincia	Teaching Qualification for secondary high school (Abilitazione all'insegnamento della chimica, classe A013, nelle scuole medie superiori)
Licensure	1990	University of Rome "La Sapienza"	"Chemist" Qualification. LUAM Registration Number 2413

Part III – APPOINTMENTS

IIIA – Academic Appointments

Start	End	Institution	Position
2019	To present	University of Rome "La Sapienza"	Associate Professor (Professore Associato)
2004	2019	University of Rome "La Sapienza"	Assistant Professor (Ricercatore)
Call 2013 (2014)	01/12/2023	Ministero dell'Istruzione dell'Università e della Ricerca (MIUR)	National Scientific Qualification (ASN) as full professor (Professore di I fascia, Settore Concorsuale 03/D2 Tecnologia, Socioeconomia e Normativa dei Medicinali, SSD CHIM/09 Farmaceutico Tecnologico Applicativo
Call 2012 (2013)	31/01/2020	Ministero dell'Istruzione dell'Università e della Ricerca (MIUR)	National Scientific Qualification (ASN) as associate professor (Professore di II fascia, Settore Concorsuale 03/D2 Tecnologia, Socioeconomia e Normativa dei Medicinali, SSD CHIM/09 Farmaceutico Tecnologico Applicativo

IIIB – Other Academic Appointments

Start	End	Institution	Position
2019		Institut d'études avancées Maison internationale de la recherche, ERMECCe, Université de Cergy-Pontoise	"Invited Researcher" - Paris - Prof. Emanuel Pauthe and Prof. Violeta Rodriguez -15 days
2017		Université Paris 13 Institut Galilée - INSERM U1148, Laboratoire de Recherche Vasculaire Translationnelle	"Invited Visiting Professor" - Paris - Prof. Didier Letourneur and Graciela Pavon David -1 month
2016		Université Paris 13 Institut Galilée - INSERM U1148, Laboratoire de Recherche Vasculaire Translationnelle,	"Invited Visiting Professor" - Paris - Prof. Didier Letourneur and Graciela Pavon David - 1 month
2018	to present	Sapienza University of Rome	Head of the degree "Scienze Farmaceutiche Applicate" – Faculty of Pharmacy and Medicine
2018	to present	Sapienza University of Rome	Director of the "Master" (post-graduation specialty) "Pharmaceutical Industry Methodologies" ("Metodologie Farmaceutiche Industriali")
2018	to present	Sapienza University of Rome	Coordinator of the Erasmus Mobility (CAM per l'area Farmaceutica della Facoltà di Farmacia e Medicina)
2015	to present	Sapienza University of Rome	Responsible for the Erasmus Mobility (RAM per il CdL in Chimica e Tecnologia Farmaceutiche)
2014	to present	Sapienza University of Rome	Board of the PhD school in Pharmaceutical Sciences (Collegio dei docenti del Dottorato di ricerca in Scienze Farmaceutiche)

2020	to present	Sapienza University of Rome	Department Committee for Health and Safety (Commissione sicurezza)
2020		Sapienza University of Rome	Member of the Committee for the admission to the PhD school in "Pharmaceutical Sciences"
2013		Sapienza University of Rome	Member of the Committee for the admission to the PhD school in "Pharmaceutical Sciences"
2015	to present	Sapienza University of Rome	Member of the Board of the “Scuola di specializzazione in farmacia ospedaliera”
2015	to present	Sapienza University of Rome	Member of the Board of the “Master in preparazioni galeniche”
2014	2018	Sapienza University of Rome	Member of the Board of the “Master” in “Metodologie Farmaceutiche Industriali”
2008	to present	Sapienza University of Rome	Member of Committees for the evaluation of several fellowships
2020		Universidad Complutense Madrid	Board for the Conferral of Doctoral Degree
2020		University of Trieste	Board for the Conferral of Doctoral Degree in Nanotechnology
2018		Universitad de Cordoba	Board for the Conferral of Doctoral Degree
2018		Université de Nantes	Board for the Conferral of Doctoral Degree
2018		Università di Cagliari	Board for the Conferral of Doctoral Degree in Pharmaceutical Sciences
2017		Universitat de Valencia	Board for the Conferral of Doctoral Degree
2017		Université Paris 13	Board for the Conferral of Doctoral Degree
2015		Università di Tor Vergata	Board for the Conferral of Doctoral Degree in Chemistry
2013		Universidade de Santiago de Compostela	Board for the Conferral of Doctoral Degree
2013		Università di Cagliari	Board for the Conferral of Doctoral Degree
2011		Universidad Complutense Madrid	Board for the Conferral of Doctoral Degree
2010		Utrecht University	Board for the Conferral of Doctoral Degrees
2009		Universidad de Sivilla	Board for the Conferral of Doctoral Degree
2008		Sapienza Università di Roma	Board for the Conferral of Doctoral Degree
2008		Università di Palermo	Board for the Conferral of Doctoral Degree
2008	to present	Universities of: Santiago de Compostela, Pavia, Padova, Prague, Camerino, Madrid	Evaluator of PhD thesis for the admission to the final defence
2008	to present	Sapienza University of Rome	Tutor of 8 PhD students in Pharmaceutical Sciences
2008		Sapienza University of Rome – Utrecht University	Tutor of 1 PhD student in Pharmaceutical Sciences (in “cotutela”)
2008	to present	Various European Universities	Tutor of 6 Erasmus PhD students and 9 master degree students during their stage in Sapienza University of Rome
2008	to present	Sapienza University of Rome	Tutor of 5 post-doc fellowships from Sapienza University of Rome; tutor of 1 post-doc program "Ciência sem fronteiras", Brasil
2005	to present	Sapienza University of Rome	Tutor of more than 50 master degree theses in “Chimica e Tecnologia Farmaceutiche”, “Farmacia” and “Scienze Farmaceutiche Applicate” Sapienza University of Rome; tutor of 1 thesis of Graduate School in “Farmacia Ospedaliera”; tutor of 3 final dissertations in “Master Universitario di 2° Livello in Sicurezza e Protezione”, Sapienza University of Rome.

IIIC – Other Appointments

Start	End	Institution	Position
2020	at present	ELETTRA- Sincrotrone Trieste S.C.p.A.	Member of the board of directors
1994	2004	INAIL (Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro e Malattie Professionali)	Professional. Health and Safety. Risk analysis and risk management.
1993	1994	Lepetit – Anagni - Frosinone	Professional: Analytical Development

Part IV – TEACHING EXPERIENCE

Years	Institution	Lecture/Course
2019 -	Sapienza University of Rome	"Nanosistemi per la diagnostica e la tecnologia farmaceutica" Corso di Laurea in Chimica e Tecnologia Farmaceutiche, 4 CFU, 32 h
2017 – currently	Sapienza University of Rome	"Tecnologia e Legislazione dei prodotti erboristici", Corso di Laurea in Scienze Farmaceutiche Applicate, 6 CFU, 48 h e "Tecnologia e Normativa dei Medicinali e dei Prodotti Cosmetici e Salutistici", Corso di Laurea in Scienze Farmaceutiche Applicate, 6 CFU, 48 h
2012 - currently	Sapienza University of Rome	"Tecnologia e Legislazione farmaceutiche", Corso di Laurea in Chimica e Tecnologia Farmaceutiche, 10 CFU, 64 h and 40 h lab training
2005-2015	Sapienza University of Rome	"Polymers for Pharmaceutical Technology" (Polimeri di interesse farmaceutico), Corso di Laurea in Chimica e Tecnologia Farmaceutiche, 8 CFU, 64 h
2005-2012	Sapienza University of Rome	Laboratory tutor, "Tecnologia, socio-economia e legislazione farmaceutiche", Corso di Laurea in Chimica e Tecnologia Farmaceutiche, 32 h
2005-2010	Sapienza University of Rome	"Prevenzione e Sicurezza nei laboratori", Corso di Laurea in Chimica e Tecnologia Farmaceutiche, 4 CFU, 32 h
1994-2004	INAIL & Other Institutions	Several courses on "Health and Safety at the Workplace" and on "Chemical Risk Assessment"
2018	Institut d'études avancées - Maison internationale de la recherche, ERMECCe, Université de Cergy-Pontoise	PhD school in Biomaterials, Erasmus program, 8 h
2018	Sapienza University of Rome	PhD School "Corso di Dottorato in Ingegneria Elettrica, dei Materiali e delle Nanotecnologie", 4 h
2018	Sapienza University of Rome	PhD School "Scienze Farmaceutiche", 1 h
2015 - currently	Sapienza University of Rome	"Scuola di specializzazione in farmacia ospedaliera", 1 CFU, 8 h
2012-2014	Sapienza University of Rome	Master in "Chimica e Tecnologie delle Sostanze Organiche e Naturali", 16 h each year
2016	Università degli Studi di Milano	PhD in "Pharmaceutical Sciences" (course on polysaccharide hydrogels)
2012 - 2013	Sapienza University of Rome	Project coordinator and 30 h teaching. *Applicazione di polisaccaridi in ambito biomedico e farmaceutico. Le risorse umane in progetti di sviluppo industriale, por - programma operativo regione Lazio 2007*

		- 2013 pet - 2008/2010 - asse capitale umano - alta formazione e formazione permanente
2006, 2010, 2013, 2019	ADRITELF	PhD advanced school - Cosenza and Soverato (on hydrogels and rheology).

Part V - SOCIETY MEMBERSHIPS, AWARDS AND HONORS

Years	Title
2010 –	CRS (Controlled Release Society) Italy Chapter. *2013-2016*: Member of the Board – Treasurer. *2017 – 2019*: President of the Board. *2020 – at present:* Member of arbitrators
2004 –	ADRITELF (Associazione Docenti e Ricercatori di Tecnologia e Legislazione Farmaceutiche) - member
2015 -	Society for Biohydrogels – Member of the Board
2014 -	SIR (Società Italiana di Reologia) – from 2019 Member of the board
2014 -	SCI (Società Chimica Italiana) - Member
2007	Coviello T., Matricardi P., Marianecci C., Alhaique F., "Polysaccharide hydrogels for modified release formulation", Journal of Controlled Release (2007) 119, 5-24. Doi: 10.1016/j.jconrel.2007.01.004. **Elsevier award, top ten cited paper in 2007**
2013	E. Montanari, S. Capece, C. Di Meo, M. Meringolo, T. Coviello, E. Agostinelli, P. Matricardi*, "Hyaluronic acid nanohydrogels as a useful tool for BSAO immobilization in the treatment of melanoma cancer cells", Macromolecular Bioscience, (2013), 13, 1185–1194. Doi: 10.1002/mabi.201300114. **Cover of the issue**
2014	G. D'Arrigo, G. Navarro, C. Di Meo, P. Matricardi, V. Torchilin, "Gellan gum nanohydrogel containing anti-inflammatory and anti-cancer drugs: a multi-drug delivery system for a combination therapy in cancer treatment", European Journal of Pharmaceutics and Biopharmaceutics, (2014) 87 (1) 208-216. Doi: 0.1016/j.ejpb.2013.11.001. **Best paper award in EJPB 2014**
2014	E. Montanari, G. D'Arrigo, C. Di Meo, A. Virga, T. Coviello, C. Passariello, P. Matricardi "Levofloxacin-loaded hyaluronic acid nanohydrogel for the treatment of intracellular bacterial infections", Antibiotic alternatives for the new millennium, London, November 2014. **Best poster award**
2015	P. Matricardi, C. Di Meo, E. Montanari, C. Cencetti, S. Laserra, G. Manzi, T. Coviello, F. Alhaique, "Polysaccharide-based nanohydrogel systems for drug delivery applications", 55° Simposio AFI, Rimini, Italy, 10-12 giugno 2015. **Best poster award**

Part VI – OTHER ACTIVITIES

Year	Activity
2004 –	Invited lecturer and oral presentations at national and international conferences: 20. Invited plenary speaker: 3 (Prague (Rep. Ceca) 2015: 11th Conference on Polysaccharides-Glycoscience. Natal (Brasil) 2018: 17th Meeting of the Brazilian Materials Research Society. Aveiro (Portugal) 2019: 6th EPNOE International Polysaccharide Conference)

2004 –	Member of the organizing/scientific committee of 5 international and 14 national conferences and workshops
2004 –	Collaboration with international research groups: • prof. Wim Hennink, Department of Pharmaceutics, Utrecht Institute for Pharmaceutical Sciences (UIPS), Utrecht University, Utrecht, NL; • prof. Vladimir Torchilin, Department of Pharmaceutical Sciences, School of Pharmacy, Northeastern University, Boston, USA; • prof. Erik Geissler, Laboratoire Interdisciplinaire de Physique CNRS UMR 5588, Université J. Fourier de Grenoble, Grenoble, France; • prof. Maria Dolores Veiga, Departamento de Farmacia y Tecnologia Farmaceutica, Facultad de Farmacia, Universidad Complutense de Madrid, Spain; • prof. Pierre Weiss, LIOAD, UMR 791, Faculté d'Odontologie, Nantes, France.; • Prof. Cecile Dreiss, Institute of Pharmaceutical Science King's College, London, UK; • Prof. Didier Letourneur et Graciela Pavon David, NSERM U1148, Laboratoire de Recherche Vasculaire Translationnelle, Institut Galilée - Université Paris 13, PRES Sorbonne Paris Cité, France; • prof. Emanule Pauthe, Institut d'études avancées Maison internationale de la recherche, ERMECCe, Université de Cergy-Pontoise, France.
2004 –	Collaborations and Research agreements with Italian companies: FAB - Fidia Advanced Biopolymer, Padova; Tubilux Pharma, Pomezia, Roma; Sigma Tau, Pomezia, Roma; Novagenit, Trento; MicMedical, Roma; OTI Srl, Carsoli, (AQ), QI Srl, Pomezia, Roma; Unifarco, Belluno.
2017 -	Member of the Editorial Board of “Pharmaceutics”, “Biomolecules” and “Gels”
2004 –	Reviewer for several international journals (more than 15) focused on drug delivery and biomaterials and member of the editorial board of two journals (Pharmaceutics, Biomolecules)
2004 –	Project evaluator for some national and European (H2020; Marie Curie) agencies

Part VII - FUNDING INFORMATION [GRANTS AS PRINCIPAL INVESTIGATOR OR INVESTIGATOR]

Year	Title	Program	Grant value
2018	Polyphenols as a preventive strategy in Alzheimer's disease **As investigator**	Sapienza University of Rome (Ateneo) Grant: RM1181642BF3F280	10.000 euro
2017	Sistemi idrogel polisaccaridici per applicazioni biomediche innovative **As Principal Investigator**	Sapienza University of Rome (Ateneo) Grant: RM11715C1743EE89	12.000 euro
2016	Novel Hybrid Graphene-Nanoplatelets/Carbon Nanofiber Polymeric Composites for Electrical and Electromagnetic Applications **As investigator**	Sapienza University of Rome (Ateneo) Grant: RM116154F1B41D9B	12.000 euro
2015	Sviluppo di nuovi “nanomedicine devices” di tipo nanoidrogel per la veicolazione di farmaci” **As Principal Investigator**	Sapienza University of Rome (Ateneo) Grant: C26A15MH7C	8.000 euro
2014	Eradicating bacterial lung infections in Cystic Fibrosis disease using levofloxacin loaded hyaluronan nanohydrogels" **As Principal Investigator**	Sapienza University of Rome (Ateneo) Grant: C26A1432FH	10.000 euro
2013	Nanohydrogels based on polysaccharide-drug conjugates for drug delivery and targeting **As Investigator**	Sapienza University of Rome (Ateneo) Grant: C26A13JTRW	8.000 euro
2012	Antitubercular drug-loaded chitosan-niosome (ChyNo) vectors as innovative inhalable drug-delivery systems for pulmonary tuberculosis **As Investigator**	Sapienza University of Rome (Ateneo) Grant: C26A12PZL3	40.000 euro

2011	Innovative Polysaccharide Hydrogels as Drug Carrier and Scaffold for Cell Cultures **As Principal Investigator**	Sapienza University of Rome (Ateneo) Grant: C26A119N2S	40.000 euro
2008	Idrogel polisaccaridici per il rilascio modificato di farmaci **As Investigator**	PRIN Grant: 2008HTJLN2_001	83.000 euro
2005	Idrogel polisaccaridici per il rilascio modificato di farmaci **As Investigator**	PRIN Grant: 2005035525_001	73.500 euro
2014	"Posture" PhOtocrosslinked hydrogels for guided periodontal TissUe Regeneration (Project Coordinator: Catherine le Visage, INSERM UMR_S 791 LIOAD - Laboratoire d'Ingénierie Ostéo-Articulaire et Dentaire UFR d'Odontologie de Nantes) **As Responsible of the Italian Unit**	Projet EuroNanoMed II	604.380 euro (the project)
2005 –	Funding from collaborations with industries	Projects for the development of new formulations.	Total funding: more than 250.000 euro

Part VIII – RESEARCH ACTIVITIES

Keywords

Polysaccharide Hydrogels, Drug Delivery, Tissue Regeneration, Physico-chemical Characterization, Nanohydrogels, Liposomes, Topical Delivery

Brief Description

My research activity can be described by means of four keywords: polysaccharides, hydrogels, physico-chemical characterization, biomedical applications. The aim of the research is the development and the characterization of new polymeric matrices of soft and/or hydrogel nature, mainly based on polysaccharides, useful for applications in drug delivery and in tissue engineering.

The description of my research, here reported, refers to the 16 selected publications (reported as **Selected Publication A1-A16**) and to the publications listed in the attachment Allegato E_"Elenco Prodotti Attività Scientifica" (reported as **Publications P1-P92, Patents B1-B6 and Book/Book chapters L1-L4**).

My master degree and PhD were focused on the chemical derivatization of pectic polysaccharides and the characterization of these new polymers as a function of the main chain modifications. In particular, the research was devoted to the study of the a) conformational properties of those polymers, b) their interactions with metal ions, c) their solubility in organic solvents (to obtain polymers useful in products processing) and d) their gelling properties. Several polysaccharide hydrogels have been prepared by chemical crosslinking and their rheological properties were extensively studied. The work was developed in partnership with Fidia Spa, Abano Terme (Padova), with prof. S.B. Ross-Murphy, London King's College, with Polybiòs Laboratories, Padriciano (Trieste) and with Prof. Romano Lapasin, University of Trieste. During that period, I had the opportunity to develop part of the research, for short periods, in the labs of the partners *(P1-P4).*

My current research, since 2004, is mainly carried out at the Department of Chemistry and Pharmaceutical Technologies, Faculty of Pharmacy and Medicine, at Sapienza University of Rome, and in close collaboration with several Italian and foreign teams.

Schematically, the subjects of my work and the main achievements can be described as follows.

• Physico-chemical characterization of polysaccharide matrices in solution and in the gel phase, with particular attention to matrices based on: scleroglucan and scleroglucan/borax, alginate and calcium alginate, dextran and dextran methacrylate derivatives. The characterization was focused on the definition of the nature and type of interactions that occurs between the matrix of polymers and the low molecular weight molecules used for the realization of the hydrogel three-dimensional networks. Particular interest was devoted to the characterization of the properties of matrices formed by the interpenetration of polysaccharide macromolecules (semi-Interpenetrated and Interpenetrated Polymer Networks – semi-IPN and IPN). The studied systems, even for possible synergistic effects in their mechanical properties, were mainly: alginate/scleroglucan; alginate/dextran derivatives; haluronan/dextran derivatives.

• Development of innovative systems for drug delivery and of new matrices for tissue engineering applications, based on alginate, hyaluronic acid, dextran and scleroglucan. These matrices prepared in solid form or as hydrogels, have been studied for their ability to carry and to deliver drugs, in different aqueous media. In this respect, we used model molecules with different chemical and physico-chemical characteristics. In particular, we studied the transport and the release properties of monolithic systems (microspheres, hydrogel tablets) in the form of polysaccharide IPNs. For some of the hydrogel matrices we have also evaluated the ability to act as a biocompatible support for applications in tissue engineering applications. Part of the research was devoted to the interaction of polysaccharides with liposomal systems.

• Development of new systems, in the form of "nano" structures based on polysaccharide derivatives to transport and deliver drugs and proteins. In particular, these nanoparticulate systems were prepared by self-assembly (bottom-up and top-down mechanism) of the polysaccharide chains, which were preliminarily modified by hydrophobic moieties.

The various hydrogel systems developed have been characterized in terms of their chemical and physico-chemical properties. The characterizations were carried out using: HPLC, GC, GPC, capillary viscometry, polarimetry, NMR, UV / fluorimetry, SEM, TEM, optical microscopy, confocal microscopy, "in silico", rheology and dynamo-mechanical analysis. Various assemblies have been developed for the preparation of hydrogels for the delivery of drugs and proteins, for the production of medical devices, or suitable as scaffolds for tissue engineering applications: "implantable hydrogels"; "hydrogels as a support for nanovesicular systems"; "*in situ* forming hydrogels"; "beads" and "microspheres"; "antimicrobial patches for wound healing"; "nanohydrogels obtained by self-assembly".

The main results obtained from the research can be summarized as follows (letter “A” refers to the list of selected publications, while letter “P” and “B” refer to the list of publication and the list of patents, respectively, reported in the attached file E ”Elenco prodotti attività scientifica”.

- The research evidenced that the anisotropic swelling behavior of scleroglucan/borax hydrogels, obtained after an appropriate treatment of the polymer matrices, can be related to the formation of ordered structures within the network. These structures, deeply investigated by means of different techniques, influence both the mechanical and physico-chemical properties of the hydrogels and the release behavior of molecules having different steric hindrance (*P5, P6, P7, P9, P11, P12, P22, P23, P27, P34, P41, P66, P92*). The scleroglucan/borax ability to embed molecules in these ordered structures can be exploited for the immobilization of a redox protein, useful in sensor applications (*P24*).

- Scleroglucan was also derivatized obtaining a carboxymethyl derivatives; the gelling abilities and the release properties, as well as the chains arrangement in solution, were modified, leading to a thermosensitive and pH responsive system. The interaction with calcium ions led to a soft matter, useful for topical applications (*P13, P21, P25, P38*).

- The relationships among the gelling properties and the structure of guar gum hydrogels were studied as a function of temperature: a strong influence of the crosslinking density on the mechanical properties

was observed. The "gel points" of the various systems were also investigated and related to the fundamental equations of the "gel point theory" (*P11, P12, P16, P20, P50, P51*).

- The research faced also the synergism in hydrogel formation. In this respect, the synergistic interactions between locust bean gum and xanthan were investigated. The effect of different preparation procedures on the mechanical properties was assessed. The "hot preparation" resulted to be more effective in forming stronger hydrogels: this effect was explained in term of denaturation and refolding of macromolecules in a more complex and networked assembly (*P30*).

- The hydrogel forming polysaccharide gellan was derivatized using lysine and the effects of the derivatization on the hydrogel properties (physical and chemical ones) were investigated. The moieties introduced along the polymer chains are able to interfere with the stacking of the polymer chains during the hydrogel forming process, thus leading to systems capable to modulate the release of embedded drugs (*P26*). Analogously, hyaluronic acid sulphate interferes with the gellan hydrogel forming process, modulating the properties in order to fulfill some application requirements. In this case a beneficial effect was also assessed in the epidural scar prevention (*P32*). The chemical derivatization was also exploited in developing hyaluronic acid hydrogels for *in situ* applications. In this respect, hyaluronic acid was derivatized with benzoyl cysteine and the crosslinking profile, the mechanical properties, the chondrocyte attachment and collagen production demonstrated the potentiality of the hydrogel systems as *in situ* forming scaffolds for cartilage regeneration (*P42*). The mechanical properties of hydrogel scaffolds based on hyaluronic acid that were chemically crosslinked with α,β-poly(N-2-hydroxyethyl)(2-aminoethylcarbamate)-D,L-aspartamide (PHEA-EDA) were investigated in term of mechanical and fibroblast adhesion and proliferation. Results suggest the suitability of the investigated hydrogels as scaffolds for the regeneration of soft tissues such as skin (*P36*).

- Hydrogels based on chitosan, obtained by chemical (tartaric acid) and physical interactions, have been studied for their application in wound healing (*P39, P54*). In this field, new dressings based on gellan fibers, PVA, borax and silver were also developed. The antimicrobial effect against the bacteria more frequently present in wounds was extensively studied, confirming a synergistic antibacterial effect between silver and PVA, whereas gellan confirmed its role as a scaffold in the form of fibers with an excellent strength and fluids absorbing properties (***A3****, P45*).

- The IPN technique was extensively applied in developing various hydrogel systems, demonstrating a high flexibility in modulating the overall properties, thus fulfilling the requirements of the hydrogels in such a different application, i.e., drug delivery and tissue regeneration applications. Scleroglucan and alginate are able to form IPN hydrogels, showing a synergistic effect in the mechanical properties. This property can be exploited in developing tablets able to protect the drug from acidic pH (*P7, P14*).

- The most important results in the IPN technology were obtained by "mixing" dextran methacrylate or dextran hydroxyethylmethacrylate derivatives with calcium alginate hydrogels thus forming a full chemical/physical biocompatible IPN that can be useful for *in situ* applications. The mechanical properties of the resulting hydrogels, as well as the degradation rate, can be tuned in a wide range of values. Most importantly, these IPNs were useful for protein delivery and in tissue engineering, in particular by allowing the formation of collagen of type II by chondrocyte cells (***A2,*** *P18, P29, P31, P35*).

- Different IPNs for other applications were also studied. Hyaluronic acid was used in combination with dextran derivatives as material for bioprinting whereas hyaluronan derivatives were used in combination with calcium alginate to form beads for protein delivery (***A1,*** *P33, P43, P46*). Moreover, a new general method based on calorimetric determinations at low temperature, rheology and low field NMR was developed for the characterization of the hydrogels porosity (*P44*). Moreover, green solvents, like glycerol, were used to form IPN with enhanced properties (P89).

- A very peculiar system, based on hyaluronan and gellan, was also developed for the regeneration of cartilage in osteochondral defects. In this case, the semi-IPN approach was used to form hydrogels that can act, at the same time, as filler and cap of bone/cartilage defects. In particular, triggering of the mechanical and adhesion properties of the hydrogels, obtained by the disturbing effect of hyaluronan on the calcium gellan network formation, was exploited to obtain a homogeneous and stable hydrogel scaffold for cell regeneration (***A9***, *P64*).

- The IPN research line was also extended to proteins or synthetic polymers in order to modify the long-term stability of the hydrogels and their mechanical properties. This was particularly important in the development of hydrogel patches that can be used for antioxidants delivery in cardiovascular system, in order to limit the damages due to the blood reperfusion after injuries (*P76*). PLA and collagen systems, after an appropriate chemical treatment, were developed specifically to form a no-hydrogel biomaterial, to be applied in tendon regeneration (*P69*).

- An innovative hydrogel device useful for *in situ* applications, was based on calcium alginate microparticles, decorated with a PNIPAAM derivative. In this case, the aggregation of the microparticle suspension, triggered by the temperature, was very effective in transport and delivery proteins, while protecting their activity (*P17, P28*).

- In close collaborations with other research groups, new vesicular systems were investigated. In some cases, the interactions between polysaccharide hydrogels and niosomes were studied, in order to develop topical formulation (*P37, P59*). The effect of the decoration of liposomes with polysaccharides was also studied (*P40*). The properties of the hydrogel systems obtained starting from liposomes in special conditions, intended for topical or *in situ* applications, were also studied, and the effect of the various parameter involved, such as concentration, penetration enhancers type, active molecules embedded and temperature were evaluated (***A7, A11, A13***, P52, P55, P61, P68, P70, P73, P75, P77).

- An emerging and very promising research field was related to the development of new nanohydrogel systems based on the self-assembling of polysaccharide chains (hyaluronan and gellan), previously derivatized with hydrophobic moieties (cholesterol, prednisolone, riboflavin – patented platform) by means of the application of a standard autoclave cycle (patented method). If the autoclave treatment is carried out in the presence of the polymers and of a thermo-stable drug, the nanohydrogel formation and loading is achieved simultaneously (patented method). In the case of not thermo-stable drugs, alternate methods have been developed. These nanohydrogels were useful for a number of different applications, being capable to carry and deliver drugs and proteins in anticancer as well as antimicrobial applications (***A5, A6, A8, A12, A14, A15,*** *P47, P49, P53, P56, P58, P60, P65, P67, P71, P72, P74, P78, P79, P81, P82, P84, P85, P86, B3, B4, B5*).

- Nanohydrogels were recently exploited to carry and delivery antioxidants, retaining their activity (*P87*) *in vitro* and *in vivo* conditions (*P88*) and to modify the intracellular fate of antibiotics, thus suggesting the use of these drug delivery systems as a tool to improve the antibiotic activity (***A16,*** *P91*).

- To conclude the description of the research activity, I faced other different topics that can be briefly summarized in: molecular imprinting; hydrogels based on cyclodextrins; hydrogels for: vaginal atrophy, hydrogen storage, cultural heritage protection; polymer prodrugs (***A10,*** *P9, P15, P19, P57, P62, P83, P90, B1, B2, B6*).

- The research activity allowed also the publication of review papers on hydrogels and nanohydrogels (***A4,*** *P8, P10, P48, P63, P80*) and books and book chapters (*L1, L2, L3, L4*).

Part IX – SUMMARY OF SCIENTIFIC ACHIEVEMENTS

Product type	Number	Database	Start	End
Papers on international journals	94	Scopus	1991	2020
Books and book chapters	5	Scopus	2004	2020
Patents	6 (5 active)	Espacenet	2004	2020

Index	Database	Value
Hirsch (H) index	Scopus	31
Total Citations	Scopus	3151 [a] (3126) [b]
Average Citations per Product	Scopus	31.828 [a] (33.255) [b]
Total Impact Factor	ISI Journal Citation Report	293.342 [c]
Average Impact Factor per Product	ISI Journal Citation Report	3.259 [c]

[a] Considering 99 total products from Scopus. [b] Considering 94 "Journal products".

[c] Number of publications considered: 90. From the list of Scopus (total number: 99) were excluded: 4 conference abstracts, 5 book chapters. 1 paper from the list of the ALLEGATO_E, P 73, has been excluded as the journal "Gel" is not yet scored. IF is calculated on the basis of the publication year.

Part X– SELECTED PUBLICATIONS

List of the 16 selected publications
6 out of 16 publications are in the period 2016-2020 (last 5 years)
First name: 1 time
Corresponding author (*): 13 times
Last name: 10 times

A1 - File name: MATRICARDI_01
Pescosolido Laura; Schuurman Wouter; Malda Jos; Matricardi Pietro; Alhaique Franco; Coviello Tommasina; van Weeren, p; Dhert Wouter; Hennink Wim E.; Vermonden Tina
Hyaluronic acid and Dextran based Semi-IPN Hydrogels as Biomaterials for Bioprinting
(2011) Biomacromolecules, 12 (5), pp 1831–1838. Cited 152 times. IF = 5.479
DOI: 10.1021/bm200178w
Document Type: Article
Source: Scopus

A2 - File name: MATRICARDI_02
Pescosolido, L., Vermonden, T., Malda, J., Censi, R., Dhert, W.J.A., Alhaique, F., Hennink, W.E., Matricardi, P.*
In situ forming IPN hydrogels of calcium alginate and dextran-HEMA for biomedical applications
(2011) Acta Biomaterialia, 7 (4), pp. 1627-1633. Cited 62 times. IF = 4.412
DOI: 10.1016/j.actbio.2010.11.040
Document Type: Article
Access Type: Article
Source: Scopus

A3 - File name: MATRICARDI_03
Cencetti, C., Bellini, D., Pavesio, A., Senigaglia, D., Passariello, C., Virga, A., Matricardi, P.*
Preparation and characterization of antimicrobial wound dressings based on silver, gellan, PVA and borax
(2012) Carbohydrate Polymers, 90 (3), pp. 1362-1370. Cited 43 times. IF = 3.479
DOI: 10.1016/j.carbpol.2012.07.005
Document Type: Article
Source: Scopus

A4 - File name: MATRICARDI_04
Matricardi, P.*, Di Meo, C., Coviello, T., Hennink, W.E., Alhaique, F.
Interpenetrating polymer networks polysaccharide hydrogels for drug delivery and tissue engineering
(2013) Advanced Drug Delivery Reviews, 65 (9), pp. 1172-1187. Cited 250 times. IF = 12.707
DOI: 10.1016/j.addr.2013.04.002
Document Type: Article
Source: Scopus

A5 - File name: MATRICARDI_05
Montanari, E., Capece, S., Di Meo, C., Meringolo, M., Coviello, T., Agostinelli, E., Matricardi, P.*
Hyaluronic acid nanohydrogels as a useful tool for BSAO immobilization in the treatment of melanoma cancer cells
(2013) Macromolecular Bioscience, 13 (9), pp. 1185-1194. Cited 35 times. IF = 3.650
DOI: 10.1002/mabi.201300114
Document Type: Article
Source: Scopus

A6 - File name: MATRICARDI_06
D'Arrigo, G., Navarro, G., Di Meo, C., Matricardi, P., Torchilin, V.
Gellan gum nanohydrogel containing anti-inflammatory and anti-cancer drugs: A multi-drug delivery system for a combination therapy in cancer treatment
(2014) European Journal of Pharmaceutics and Biopharmaceutics, 87 (1), pp. 208-216. Cited 46 times. IF = 3.850
DOI: 10.1016/j.ejpb.2013.11.001
Document Type: Article
Source: Scopus

A7 - File name: MATRICARDI_07
Manca, M.L., Castangia, I., Matricardi, P.*, Lampis, S., Fernàndez-Busquets, X., Fadda, A.M., Manconi, M.
Molecular arrangements and interconnected bilayer formation induced by alcohol or polyalcohol in phospholipid vesicles
(2014) Colloids and Surfaces B: Biointerfaces, 117, pp. 360-367. Cited 35 times. IF = 4.152
DOI: 10.1016/j.colsurfb.2014.03.010
Document Type: Article Source: Scopus

A8 - File name: MATRICARDI_08
Montanari, E., D'Arrigo, G., Di Meo, C., Virga, A., Coviello, T., Passariello, C., Matricardi, P.*
Chasing bacteria within the cells using levofloxacin-loaded hyaluronic acid nanohydrogels
(2014) European Journal of Pharmaceutics and Biopharmaceutics, 87 (3), pp. 518-523. Cited 28 times. IF = 3.850
DOI: 10.1016/j.ejpb.2014.03.003
Document Type: Article
Source: Scopus

A9 - File name: MATRICARDI_09
Bellini, D., Cencetti, C., Meraner, J., Stoppoloni, D., D'Abusco, A.S., Matricardi, P.*
An in situ gelling system for bone regeneration of osteochondral defects
(2015) European Polymer Journal, 72, pp. 642-650. Cited 14 times. IF = 3.485

DOI: 10.1016/j.eurpolymj.2015.02.043
Document Type: Article
Source: Scopus

A10 - File name: MATRICARDI_10
Chiara Di Meo, Felisa Cilurzo, Mariano Licciardi, Cinzia Scialabba, Rocchina Sabia, Donatella Paolino, Donatella Capitani, Massimo Fresta, Gaetano Giammona, Claudio Villani, Pietro Matricardi*
Polyaspartamide-doxorubicin conjugate as potential prodrug for anticancer therapy
(2015), Pharmaceutical Research, 32, pp.1557-1569. Cited 14 times. IF = 3.260
DOI: 10.1007/s11095-014-1557-2
Document Type: Article
Source: Scopus

A11 - File name: MATRICARDI_11
Maria Letizia Manca, Claudia Cencetti, Pietro Matricardi*, Ines Castangia, Marco Zaru, Octavio Diez Sales, Amparo Nacher, Donatella Valenti, Anna Maria Maccioni, Anna Maria Fadda, Maria Manconi.
Glycerosomes: use of hydrogenated soy phosphatidylcholine mixture and its effect on vesicle features and diclofenac skin penetration
(2016), International Journal of Pharmaceutics, 511(1), pp. 198-204. Cited 25 times. IF = 3.649
DOI: 10.1016/j.ijpharm.2016.07.009
Document Type: Article
Source: Scopus

A12 - File name: MATRICARDI_12
Elita Montanari, Chiara Di Meo, Simona Sennato, Antonio Francioso, Anna Laura Marinelli, Francesca Ranzo, Serena Schippa, Tommasina Coviello, Federico Bordi, Pietro Matricardi*
Hyaluronan-cholesterol nanohydrogels: Characterisation and effectiveness in carrying alginate lyase
(2017), New Biotechnology, pp. 37, 80–89. Cited 13 times. IF = 3.733
DOI: 10.1016/j.nbt.2016.08.004
Document Type: Article
Source: Scopus

A13 - File name: MATRICARDI_13
Maria Manconi, Maria Letizia Manca, Carla Caddeo, Donatella Valenti, Claudia Cencetti, Octavio Diez-Sales, Amparo Nacher, Silvia Mir-Palomo, Maria Carmen Terencio, Davide Demurtas, Juan Carmelo Gomez-Fernandez, Francisco José Aranda, Anna Maria Fadda, Pietro Matricardi
Nanodesign of new self-assembling core-shell gellan-transfersomes loading baicalin and in vivo evaluation of repair response in skin
(2018), Nanomedicine: Nanotechnology, Biology, and Medicine, 14 (2), pp. 569-579. Cited 20 times.
IF = 5.570
DOI: 10.1016/j.nano.2017.12.001
Document Type: Article
Source: Scopus

A14 - File name: MATRICARDI_14
Elita Montanari, Angela Oates, Chiara Di Meo, Josephine Meade, Rugiada Cerrone, Antonio Francioso, Deirdre Devine, Tommasina Coviello, Patrizia Mancini, Luciana Mosca* and Pietro Matricardi*
Hyaluronan-Based Nanohydrogels for Targeting Intracellular S. aureus in Human Keratinocytes
(2018), Advanced Healthcare Materials, pp. 1701483. Cited 11 times. IF = 6.270
DOI: 10.1002/adhm.201701483
Document Type: Article
Source: Scopus

A15 - File name: MATRICARDI_15
Elita Montanari, Nicole Zoratto, Luciana Mosca, L. Cervoni, Enrique Lallana, Roberta Angelini, Tommasina

Coviello, Chiara Di Meo*, Pietro Matricardi*
Halting hyaluronidase activity with hyaluronan-based particles. Development of smart and versatile injectable materials
(2019), Carbohydrate Polymers, 221, pp.209-220. Cited 4 times. IF (2018) = 6.044
DOI: 10.1016/j.carbpol.2019.06.004
Document Type: Article
Source: Scopus

A16 - File name: MATRICARDI_16
Elita Montanari; Patrizia Mancini; Filippo Galli; Michela Varani; Iolanda Santino; Tommasina Coviello; Luciana Mosca*; Pietro Matricardi*; Fiorenza Rancan; Chiara Di Meo
Biodistribution and intracellular localization of hyaluronan and its nanogels. A strategy to target intracellular S. aureus in persistent skin infections.
(2020), Journal of Controlled Release, 326, pp. 1-12. Cited 1 times. IF = 7.727
DOI: 10.1016/j.jconrel.2020.06.007
Document Type: Article
Source: Scopus

Roma, December, 27th, 2020

Pietro Matricardi