

ALL. B – CODICE CONCORSO 2024PAE011**Decreto Rettore Università di Roma “La Sapienza” n 2125/2024 del 04/09/2024****Lorenzo Carnevale, PhD
CURRICULUM VITAE****A. EDUCATION AND TRAINING**

- 14/04/2023 Professional Training by Massachusetts Institute of Technology (MIT, Boston, Massachusetts, USA) Professional Education – Applied Data Science.
- 23/10/2020 Ph.D. XXXII class in “Methods, models and technologies for engineering”, University of Cassino and Southern Latium – Supervisor Prof. Francesco Tortorella. Thesis title: “Application of machine learning techniques to brain magnetic resonance imaging in hypertensive patients”
- 21/09/2016 M.Sc. in Computer Engineering, University of Cassino and Southern Latium (FR). 110/110 cum laude – Supervisor Prof. Francesco Tortorella. Thesis title “Data extraction and mining for tractographical analysis of the brain”
- 25/09/2014 B.Sc. in Computer and Telecommunication Engineering, University of Cassino (FR). 97/110 – Supervisor Dott. Ciro D’Elia.

B. PROFESSIONAL EMPLOYMENT AND POST-LAUREAM RESEARCH EXPERIENCE

- 01/01/24 – current Visiting Researcher at the Centre for Cardiovascular Medicine – University of Edinburgh, for the research project “Characterize the disruption of the connectivity blueprint in hypertension.” Granted by the Italian Society of Hypertension – Supervisor Prof. Tomasz Guzik
- 01/01/22 – current Research Associate at the Department of Angiocardioneurology and Translational Medicine – IRCCS Neuromed, responsible for the basic and clinical imaging research program on cardiovascular disease and advanced neuroimaging - Supervisor Prof. Giuseppe Lembo – SSD MED/50 – 06/N1
- 01/01/19 – 31/12/21 3-years research contract at the Department of Angiocardioneurology and Translational Medicine – IRCCS Neuromed, in the program of hypertension and neuroimaging of the research project RF-2018-12366235 “Novel approaches of advanced neuroimaging based on MRI fiber tracking to detect early signs of vascular cognitive impairment in hypertensive patients.” and the Ministry of Health project “Neuroimaging Network” – Supervisor Prof. Giuseppe Lembo – SSD MED/50 – 06/N1
- 01/01/15 – 31/12/18 Research fellowship at the Department of Angiocardioneurology and Translational Medicine – IRCCS Neuromed, in the program of the Ministry of Health project “Neuroimaging Network”, in the PON03PE_00060_7 project and in the PON01_01227 SIRT-in project – Supervisor Prof. Giuseppe Lembo – SSD MED/50 – 06/N1
- 01/05/13 - 31/12/14 Software and Web developer of healthcare services and project management tools for the SANARE (“Characterization of novel molecular targets in the human

vascular wall”) project, a screening program for the monitoring of abdominal aortic aneurysm at IRCCS Neuromed.

C. TEACHING ACTIVITY

A.A. 24/25	Information Technology teaching, Inf/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 24/25	Statistics for Medicine teaching, Med/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 24/25	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Biomedical Laboratory (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 24/25	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 24/25	Physics of the Radiological Instruments, Med/50, 1 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 23/24	Information Technology teaching, Inf/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 23/24	Statistics for Medicine teaching, Med/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 23/24	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Biomedical Laboratory (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 23/24	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 23/24	Physics of the Radiological Instruments, Med/50, 1 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 22/23	Information Technology teaching, Inf/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 22/23	Statistics for Medicine teaching, Med/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 22/23	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Biomedical Laboratory (L/SNT3) – at Università Sapienza di Roma, Polo Molise

A.A. 22/23	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 22/23	Physics of the Radiological Instruments, Med/50, 1 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 21/22	Information Technology teaching, Inf/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 21/22	Statistics for Medicine teaching, Med/01, 1 CFU in the Faculty of Medicine – Nursing (L/SNT1) – at Università Sapienza di Roma, Polo Molise
A.A. 21/22	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Biomedical Laboratory (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 21/22	Statistics for Medicine teaching, Med/01, 2 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 21/22	Physics of the Radiological Instruments, Med/50, 1 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise
A.A. 20/21	Physics of the Radiological Instruments, Med/50, 1 CFU in the Faculty of Medicine – Techniques for Medical Radiology (L/SNT3) – at Università Sapienza di Roma, Polo Molise

D. FUNDING INFORMATION

2023 - ongoing	PI of Ricerca Corrente research project at IRCCS Neuromed “Modelli computazionali avanzati e intelligenze artificiali per l’elaborazione di immagini multimodali per la caratterizzazione del danno cerebrale nelle patologie croniche cardiovascolari” – IRCCS Neuromed.
2019 - 2024	Co-PI of Ministry of Health funded project “Novel approaches of advanced neuroimaging based on MRI fiber tracking to detect early signs of vascular cognitive impairment in hypertensive patients.” – IRCCS Neuromed. (PI Prof. Giuseppe Lembo). Total funding: € 408.000
2017 - ongoing	Coordinator of IRCCS Neuromed preclinical WP in the framework of the Italian Neuroimaging Network of Ministry of Health for development of preclinical 7T MRI in small animals – IRCCS Neuromed
2017 - 2021	PI of the research project “Declino cognitivo vascolare e ipertensione: nuovi approcci traslazionali per identificare marcatori predittivi di demenza in pazienti ipertesi” funded by 5x1000 2016 IRCCS Neuromed. Total funding: € 525.573,75

- 2023 - ongoing Under 40 Research Collaborator of the PNRR-funded project “Investigating the neuro-immune-metabolic interfaces in human and experimental atherosclerosis” – IRCCS Neuromed. PI and Consortium Coordinator Prof. Giuseppe Lembo.
Total funding: € 975.000
- 2020 - ongoing Participant to ERA-CVD “ImmuneHyperCog” EU and Italian Ministry of Health funded project – IRCCS Neuromed. PI and Consortium Coordinator Prof. Giuseppe Lembo.
Total funding: € 937.565
- 2017 - 2021 Participant to ERA-CVD “Plauefight” EU and Italian Ministry of Health funded project – IRCCS Neuromed. PI Prof. Giuseppe Lembo.
Total funding: € 998.165
- 2016 - 2018 PON03PE_00060_7 “Sviluppo preclinico di nuove terapie e di strategie innovative per la produzione di molecole ad azione farmacologica”, granted by MIUR in the framework of Programma Operativo Nazionale PON Ricerca e Competitività 2007-2013.
- 2015 PON01_01227 “SIRT-in: sviluppo di modulatori delle Sirtuine come nuovo approccio terapeutico nelle patologie neurodegenerative, oncologiche e cardiovascolari” granted by MIUR in the framework of Programma Operativo Nazionale PON Ricerca e Competitività 2007-2013.

E. PROFESSIONAL SKILLS

Clinical

Neuroimaging:

Development and implementation of pipelines for structural, microstructural and functional high field clinical Magnetic Resonance Imaging (MRI). All pipelines were implemented leveraging de-facto gold-standard softwares and imaging analysis techniques, as FSL, Freesurfer, SPM and Conn. Further approaches leveraging Artificial Intelligence models developed ad hoc resulted in new systems for Deep-Learning based segmentation of the hypertension induced white matter hyperintensities in the brain of hypertensive patients. Overall, the resulting technological framework was developed to investigate the cerebral injury induced by hypertension and led to the following publications:

- Carnevale L et al, Cardiovascular Research 2018b (first author)
- Carnevale L et al, Hypertension 2020 (first author)
- Siedlinski M, Carnevale L, et al European Heart Journal 2023 (collaboration paper in which I am the first author of my research group)
- Carnevale L et al, Cardiovascular Research 2024 (first author – invited review).

Translational

Neuroimaging:

Development and implementation of imaging protocols of structural, microstructural, functional and perfusion high field preclinical Magnetic Resonance Imaging (MRI). All pipelines were implemented leveraging de-facto gold-standard softwares and customized packages to work on small-animal neuroimaging, as FSL, SPM, RABIES, ITKSnap. Further approaches of automated brain segmentation by deep learning artificial intelligence models were developed ad hoc in order to refine the process of identification and measurement of several cerebral areas of mice. All the resulting technological framework was developed to investigate with translational tools the effect of hypertension on the cerebral injury and understand the underlying correlated

molecular mechanisms of cerebral and vascular injury. This research activity led to the following publications:

- Carnevale L et al, Cardiovascular Research 2023 (first author)
- Carnevale L et al, Hypertension 2024 (first and corresponding author).

Biological Data

and Signal Processing:

Development and implementation of several signal processing techniques applied to both image signal (confocal microscopy, ultrasound imaging) or microneurographic electrophysiological neural signal. These analysis's techniques were implemented using cutting-edge image processing methods, as the ones used for automated quantitative analysis of the spleens to identify markers of neuroimmune interfaces in cardiovascular diseases (see Nature Communications 2016, Cardiovascular Research 2018a, Cell Reports 2020), to brain images to quantify and evaluate the health of microvascular bed in hypertensive mouse models (see Cardiovascular Research 2023, Hypertension 2024) or the amyloid beta load in the same mouse models (see Neurobiology of Aging 2012). Microneurographic signal processing was developed to understand the interplay between the brain and lymphoid organs in the context of cardiovascular diseases as hypertension and atherosclerosis, and was implemented either using spike analyses systems for the splenic nerve (see Nature Communications 2016, Cardiovascular Research 2018a, Cell Reports 2020, Nature 2022) or ad-hoc developed Matlab tools to interpret complex nervous activity as the vagus nerve activity (see Cell Reports 2020, Nature 2022).

F. HONORS AND AWARDS

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| 2024 | Eligibility as Associate Professor in Technical and Medical Sciences – (National Program of Qualification for Associate Professorships) |
| 2023 | “Paul Dudley White International Scholar Award”: best Italian Abstract at “Scientific Sessions of the American Heart Association 2023”, Philadelphia (PA). – Carnevale L , Perrotta M, Mastroiacovo F, Carnevale R, Pacella J, Carnevale D, Lembo G “Hypertension induces metabolite content alterations in hypoperfused mouse brain cortex” |
| 2023 | Best abstract award at: XV Congresso Nazionale, Società Italiana dell’Ipertensione Arteriosa SIIA - 2023, Bologna - Carnevale L , Dell’Oro R, Maffei A, Pavone L, Quarti-Trevano F, Landolfi A, Carnevale D, Grassi G, Lembo G. “La componente continua e la componente ciclica della pressione arteriosa mostrano differenti pattern di danno cerebrale” |
| 2023 | Award for Patient-Oriented or Clinical Research at: Council on Hypertension of the American Heart Association - Scientific Sessions 2023, Boston - Carnevale L , Carnevale D, Grassi G, Lembo G. “Continuous And Cyclic Components Of Blood Pressure Profile Have Impact on Different Brain Areas In Controlled Hypertensive Patients” |
| 2022 | Best abstract award at: XXXIX Congresso Nazionale, Società Italiana dell’Ipertensione Arteriosa SIIA - 2022, Roma - Carnevale L , Mohanta S, Perrotta M, Carnevale R, Pallante F, Habenict A, Lembo G. “Il processo aterosclerotico stabilisce circuiti artero-cerebrali che a loro volta modulano l’attività simpatica splenica” |

- 2021 Best poster award: international award at “24th Meeting of the European Council for Cardiovascular Research (ECCR)”, Virtual Edition – **Carnevale L**, Carnevale R, Mastroiacovo F, Perrotta M, Carnevale D, Lembo G. “Advanced brain injury characterization by neuroimaging in a mouse model of hypertension-induced cognitive decline”
- 2021 Research award “Bruno Magnani” for the project “A machine learning approach to predict cognitive impairment in hypertensive patients” – SIIA Società Italiana dell’Ipertensione Arteriosa 2021
- 2021 Selection of the paper **Carnevale L**, Maffei A, Landolfi A, Grillea G, Carnevale D, Lembo G. “Brain functional MRI highlights altered connections and functional networks in hypertensive patients.” (*Hypertension*, 2021;78:00–00. DOI: 10.1161/HYPERTENSIONAHA.121.17447) as winner of the “Alberto Zanchetti” Prize for best scientific publication – SIIA Società Italiana dell’Ipertensione Arteriosa 2021
- 2021 Selection of the paper **Carnevale L**, Maffei A, Landolfi A, Grillea G, Carnevale D, Lembo G. “Brain functional MRI highlights altered connections and functional networks in hypertensive patients.” (*Hypertension*, 2021;78:00–00. DOI: 10.1161/HYPERTENSIONAHA.121.17447) Among High Impact Papers in “Hypertension” Journal of the American Heart Association – Winter 2020
- 2020 Best poster award: International Award at “Gordon Research Conference Angiotensin – The RAAS: Integrating novel technologies, clinical studies and personalized therapeutics to preserve health”, Barga (Italia). - **Carnevale L**, Pallante F, Perrotta M, Iodice D, Carnevale D, Lembo G. “Novel approaches of Bioelectronic Medicine to investigate the Angiotensin II induced immune response in Experimental Models of Hypertension”
- 2017 “MakeYourIdea” Granting for a development project and production of an animal bed prototype for 2 photon microscopy (September 2017), BicLazio Grant.

G. SCIENTIFIC SOCIETIES AND PROFESSIONAL ORDERS MEMBERSHIP

- 2024 Member of the Council of Hypertension Leadership Committee of the American Heart Association
- 2024 Ordinary member of the Italian Association for MRI in Medicine (AIRMM)
- 2023 Ordinary member of the European Society of Hypertension – Brain Working Group (ESH – Working Group)
- 2021 Ordinary member of Italian Hypertension Society (SIIA)
- 2020 Ordinary member of European Society for Molecular Imaging (ESMI)
- 2018 Ordinary member of American Heart Association (AHA)– Council on Hypertension

H. INVITED LECTURES

- 2024 - Italian Society for Hypertension 2024 Annual Meeting - Invited lecture entitled "Artificial intelligence models identify presymptomatic dementia in hypertension" – 28th September 2024, Brescia (Italy)
- 2024 - European Society for Hypertension 2024 Annual Meeting - Invited lecture entitled "The advanced Neuroimaging in Hypertension: translational tools to map the pattern of Cerebral Injury" – 1st June 2024, Berlin (Germany)
- 2023 - European Council for Cardiovascular Research 2023 Annual Meeting - Invited lecture entitled "Hypertension, Immune system, Neurovascular Dysfunction, and Cognitive Impairment." – 25th November 2023, (Virtual)
- 2022 - ECM Course – "Corso di aggiornamento in legislazione ed elementi di statistica per utilizzo animali ai fini scientifici" – ECM credited event – 28th September 2022 - IRCCS Neuromed, Pozzilli (Italy)
- 2021 - Webinar "I mercoledì della SIIA" – "Neuroimaging avanzato per identificare marker di declino cognitivo nei pazienti ipertesi" – 24th March 2021 – ECM credited event (Virtual)

I. SELECTED PRESENTATIONS AT NATIONAL AND INTERNATIONAL CONFERENCES

Oral Presentations

- 2024 - **Carnevale L**, Maffei A, Carnevale D, Lembo G "L'integrità microstrutturale della materia bianca e le performances cognitive sono associate a marcatori di rischio infiammatorio e leucociti circolanti in pazienti ipertesi" – XVI Congresso Nazionale, Società Italiana dell'Iperensione Arteriosa SIIA, 2024, Brescia (Italy)
- 2024 - Pacella J, Fardella V, Migliaccio A, Pallante F, Carnevale D, Lembo G, **Carnevale L** "Evaluation of the effects of CD8 knock-out on cognitive decline in the TAC-induced hypertension mouse model" – Council on Hypertension 2024, Chicago (USA)
- 2024 - **Carnevale L**, Maffei A, Carnevale D, Lembo G "RAAS Targeting Antihypertensive Strategies Have Different Impact on the Cerebral Injury Pattern in Hypertensives" – Gordon Research Conference – Angiotensin 2024, Barga (Italy)
- 2023 - **Carnevale L**, Perrotta M, Mastroiacovo F, Carnevale R, Pacella J, Carnevale D, Lembo G "Hypertension induces metabolite content alterations in hypoperfused mouse brain cortex" – American Heart Scientific Sessions 2023, Philadelphia (USA)
- 2023 - **Carnevale L**, Dell'Oro R, Maffei A, Pavone L, Quarti-Trevano F, Landolfi A, Carnevale D, Grassi G, Lembo G. "La componente continua e la componente ciclica della pressione arteriosa mostrano differenti pattern di danno cerebrale" – XV Congresso Nazionale, Società Italiana dell'Iperensione Arteriosa SIIA, 2023, Bologna (Italy)
- 2023 - **Carnevale L**, Carnevale D, Grassi G, Lembo G. "Continuous And Cyclic Components Of Blood Pressure Profile Have Impact on Different Brain Areas In Controlled Hypertensive Patients". Council on Hypertension 2023, Boston (USA)
- 2022 - **Carnevale L**, Maffei A, Landolfi A, Grillea G, Berardi V, Carnevale D, Lembo G "Impact of anti-hypertensive therapy on cerebral functional networks and connectivity". International Society of Hypertension 2022, Kyoto (Japan)

- 2022 - **Carnevale L**, Mohanta S, Perrotta M, Carnevale R, Pallante F, Habenict A, Lembo G. "Il processo aterosclerotico stabilisce circuiti artero-cerebrali che a loro volta modulano l'attività simpatica splenica" XXXIX Congresso Nazionale, Società Italiana dell'Ipertensione Arteriosa SIIA - 2022, Roma (Italy)
- 2022 - **Carnevale L**, Berardi V, Carnevale D, Lembo G "Anti-hypertensive Treatment With Acei Vs Arbs: The Differential Effect On Brain Microstructural Integrity Parameters Of Raas-targeting Treatments". Hypertension 2022 – Scientific Sessions, San Diego (USA)
- 2020 - **Carnevale L**, Lembo G. "Application of Deep Learning approaches to segmentation of white matter hyperintensities". Emim 2020 (Virtual)
- 2020 - **Carnevale L**, Carnevale R, Cifelli G, Mastroiacovo F, Carnevale D, Lembo G. "Ultrasonography-guided catheter implantation improves conscious radiotelemetric blood pressure measurement in mice.". Emim 2020 (Virtual)
- 2019 - **Carnevale L**, Perrotta M, Pallante F, Carnevale D, Lembo G. "A New Vagal Stimulation Technique To Activate Neuromodulation Of Splenic Immune Response: Physiopathological Mechanisms In Experimental Models Of Hypertension." American Heart Scientific Sessions 2019, Filadelfia (USA)
- 2019 - **Carnevale L**, Maffei A, Landolfi A, Grillea G, Lembo G, Carnevale D. "Uno studio di Risonanza Magnetica funzionale cerebrale (Resting-state functional MRI rs-fMRI) individua connessioni aberranti e alterazione delle reti funzionali in pazienti ipertesi" XXXVI Congresso Nazionale, Società Italiana dell'Ipertensione Arteriosa SIIA 2019, Roma (Italy)
- 2019 - **Carnevale L**, Perrotta M, Pallante F, Fardella S, Carnevale D, Lembo G. "Un nuovo approccio di stimolazione vagale per attivare la neuromodulazione della risposta immunitaria splenica: meccanismi fisiopatologici nell'ipertensione arteriosa sperimentale." XXXVI Congresso Nazionale, Società Italiana dell'Ipertensione Arteriosa SIIA 2019, Roma (Italy)
- 2018 - **Carnevale L**, D'Angelosante V, Landolfi A, Grillea G, Storto M, Selvetella G, Lembo G, Carnevale D. "I pazienti ipertesi mostrano un profilo di alterazioni cerebrali della sostanza bianca evidenziate mediante trattografia con risonanza magnetica nucleare, predittivo di demenza." XXXV Congresso Nazionale, Società Italiana dell'Ipertensione Arteriosa SIIA 2018, Roma (Italy)
- 2018 - **Carnevale L**, Perrotta M, Pallante F, Carnevale D, Lembo G. "Il Pathway infiammatorio colinergico è attivato da stimoli ipertensivi per promuovere la risposta immunitaria splenica" XXXV Congresso Nazionale, Società Italiana dell'Ipertensione Arteriosa SIIA 2018, Roma (Italy)
- Poster**
- 2024 - **Carnevale L**, Maffei A, Carnevale D, Lembo G "Cerebral injury and cognitive performances are correlated with immunoinflammatory markers in hypertensive patients". Council on Hypertension 2024 Chicago (USA)
- 2024 - **Carnevale L**, Maffei A, Landolfi A, Carnevale D, Lembo G "The White Matter Integrity And Cognitive Performances Of Hypertensive Patients Are Associated To Circulatory Inflammatory Risk Biomarkers And Circulating White Blood Cells". European Society of Hypertension – Annual Meeting 2024 Berlin (Germany)

- 2023 - **Carnevale L**, Maffei A, Landolfi A, Carnevale D, Lembo G “Blood pressure lowering therapeutical strategies have different impact on brain functional connectivity.”. American Heart Association Scientific Sessions 2023 Philadelphia (USA)
- 2023 - **Carnevale L**, Perrotta M, Mastroiacovo F, Carnevale D, Lembo G “Cerebral blood flow measurement by arterial spin labelling in a experimental model of hypertension-induced brain injury is correlated to cognitive impairment of the spatial memory domain”. European Molecular Imaging Meeting 2023 Salzburg (Austria)
- 2022 - **Carnevale L**, Berardi V, Carnevale D, Lembo G “Anti-hypertensive Treatment With Acei Vs Arbs: The Differential Effect On Brain Microstructural Integrity Parameters Of Raas-targeting Treatments”. Best of Speciality Congress from Hypertension 2022 - American Heart Scientific Sessions 2022, Chicago (USA)
- 2022 - **Carnevale L**, Carnevale R, Mastroiacovo F, Perrotta M, Carnevale D, Lembo G. “Cerebral Blood Flow Measured By Mri Is A Key Translational Hallmark Of Brain Injury In Experimental Models Of Hypertension-induced Cognitive Impairment” American Heart Scientific Sessions 2022, Chicago (USA)
- 2022 - **Carnevale L**, Carnevale R, Mastroiacovo F, Perrotta M, Carnevale D, Lembo G. “MRI cerebrovascular characterization in a mouse model of hypertension-induced brain injury” International Society of Hypertension 2022, Kyoto (Japan)
- 2022 - **Carnevale L**, Maffei A, Landolfi A, Grillea G, Carnevale D, Lembo G “L’effetto della terapia antiipertensiva sulle reti funzionali cerebrali”. XXXIX Congresso Nazionale, Società Italiana dell’Ipertensione Arteriosa SIIA - 2022, Roma (Italy)
- 2021 - **Carnevale L**, Carnevale R, Mastroiacovo F, Perrotta M, Carnevale D, Lembo G. “Advanced brain injury characterization by neuroimaging in a mouse model of hypertension-induced cognitive decline” 24th Meeting of the European Council for Cardiovascular Research (ECCR)”, (Virtual)
- 2021 - **Carnevale L**, Carnevale R, Mastroiacovo F, Perrotta M, Carnevale D, Lembo G. “Danno cerebrovascolare in un modello murino di declino cognitivo: uno studio di neuroimaging avanzato con imaging in risonanza magnetica nucleare ad alto campo” XXXVIII Congresso Nazionale, Società Italiana dell’Ipertensione Arteriosa SIIA, Bologna (Italy)
- 2020 - **Carnevale L**, Pallante F, Perrotta M, Iodice D, Carnevale D, Lembo G. “Novel approaches of Bioelectronic Medicine to investigate the Angiotensin II induced immune response in Experimental Models of Hypertension” Gordon Research Conference Angiotensin – The RAAS: Integrating novel technologies, clinical studies and personalized therapeutics to preserve health”, Barga (Italia)
- 2019 - **Carnevale L**, Maffei A, Landolfi A, Grillea G, Lembo G, Carnevale D. “A Functional Mri (resting State Functional Mri Rs-fMRI) Highlights Altered Connections And Altered Functional Networks In Hypertensive Patients” American Heart Scientific Sessions 2019, Philadelphia (USA)
- 2018 - **Carnevale L**, Perrotta M, Pallante F, Carnevale D, Lembo G. “The Cholinergic Inflammatory Pathway is Activated by Hypertensive Challenges to Prime Splenic Immune Response” Bioelectronic Medicine Symposium 2018, Saltsjöbaden, Stockholm, (Sweden)

2017 - **Carnevale L**, D'Angelosante V, Grillea G, Lembo G, Carnevale D, Tortorella F, "Application of brain MRI fiber-tracking to reveal white matter alterations in hypertensive patients with no sign of damage at conventional neuroimaging" Winter school CobCom 2017 Juan-Les-Pins (France)

J. PARTICIPATION IN TRUST COMMITTEES AND NATIONAL AND INTERNATIONAL NETWORKS

- Member of the Council of Hypertension Leadership Committee of the American Heart Association
- Member of the European Society of Hypertension – Hypertension and Brain Working Group
- Coordinator of IRCCS Neuromed preclinical WP of the Neuroimaging Network of Ministry of Health

K. EDITORIAL AND REVIEWING ACTIVITY

2024 - Member of the Editorial Board for *Frontiers in Molecular Biosciences* (Frontiers – JCR 2023 IF: 3.9)

2021 - Member of the Editorial Board for *Frontiers in Physiology* (Frontiers – JCR 2023 IF: 3.2)

Reviewer for:

- Alzheimers & Dementia (JCR 2023 IF: 13.0)
- Pharmacology & Therapeutics (JCR 2023 IF: 12.0)
- Cardiovascular Research (JCR 2023 IF: 10.2)
- Hypertension (JCR 2023 IF: 6.9)
- International Journal of Molecular Sciences (JCR 2023 IF: 4.9)
- Biomedicines (JCR 2023 IF: 3.9)
- Scientific Reports (JCR 2023 IF: 3.8)
- Frontiers in Physiology (JCR 2023 IF: 3.2)
- Journal of Clinical Medicine (JCR 2023 IF: 3.0)
- Sensors (JCR 2023 IF: 3.4)
- Genes (JCR 2023 IF: 2.8)
- Brain Imaging and Behavior (JCR 2023 IF: 2.4)

L. RESEARCH AND SCIENTIFIC INTEREST

I have 10 years work experience in the research field and 2 years work experience in the IT sector applied to healthcare, with most of my career spent in the Department of Angiocardioneurology and Translational Medicine under the supervision of Prof. Giuseppe Lembo. During my work there I got my Ph.D. in Methods and Models for Engineering at the University of Cassino and Southern Latium under the supervision of Prof. Francesco Tortorella with a project aimed at the application of Machine Learning models and techniques to healthcare systems. My research has been equally split between clinical and translational/basic research, applying engineering principles to develop and optimize medical technologies, as well as to methods that integrate medical sciences, biomedical sciences and engineering sciences. The topics where I focused my main research interests are two main transversal themes: the brain injury in hypertension and the neuro-immune-cardiovascular interfaces in cardiovascular diseases.

BRAIN INJURY IN HYPERTENSION

Clinical Research Activity: My research has been focused on the advanced neuroimaging analysis, specifically developed for clinical observational studies aimed at investigating brain damage and dementia in patients affected by cardiovascular diseases and, in particular, to identify the pattern of injury that hypertension

imposes to the brain. I have set up and developed all the procedures related to the definition of MRI protocols and neuroimaging analysis pipelines for structural, diffusion and functional imaging performed on a high field 3 Tesla MRI. I have set up the data analysis procedures to extract features characterizing the cerebral injury in hypertensive patients and performed all the statistical and machine learning analyses on the obtained dataset. One key initial finding was the identification of a characteristic injury of white matter damage highlighted through diffusion tensor imaging techniques and leading to my first-author publication in *Cardiovascular Research* 2018b. Subsequently I demonstrated how hypertensive patients manifest alterations in the functional organization of the brain, publishing these results as first-author in *Hypertension* 2020. In a joint effort with the University of Cassino, I have developed a neural network for my final doctorate thesis aimed at the segmentation of the white matter hyperintensities from T2-FLAIR analyses, a typical trait of hypertensive injury in the brain, which has been added to the previously developed pipelines. Finally, the aforementioned technological framework was applied to a translational international collaborative study that leveraged genetic information obtained from the UK Biobank patients to identify the causal relationship between blood pressure, cerebral injury and cognitive impairment, then verified in a prospectively recruited population of hypertensives that I have scanned at the MRI at IRCCS Neuromed. This work led to the publication of the paper published by *European Heart Journal* (2023) in which I have a second-author position.

Preclinical Research Activity: The investigation of the mechanisms underlying hypertensive brain injury started with the development of image analysis techniques to quantify the load of amyloid beta plaques in hypertensive mouse model, a work that I conducted as undergraduate student (see *Neurobiology of Aging* 2012). Then, I deepened the characterization of the cerebral injury in models of cardiovascular diseases, implementing image processing systems to quantify the density of the microvascular bed in cerebral areas of interest and to characterize its integrity (see *Cardiovascular Research* 2023, *Hypertension* 2024). I have developed all the imaging procedures to identify translational patterns of injury associated with the aforementioned markers of microvascular and cerebral damage implementing several small animal MRI protocols and the associated imaging analysis techniques. In particular, I focused on the structural, microstructural and perfusion imaging that let me identify a translational pattern of injury in hypertensive mouse models that I have published as first and corresponding author in *Hypertension* 2024.

NEURO-IMMUNE-CARDIOVASCULAR INTERFACES IN CARDIOVASCULAR DISEASES

My research efforts have also been devoted to investigating how the nervous system dialogues with the periphery in translational models of cardiovascular diseases. In particular, I developed tools to analyze and quantify the bidirectional interplay established among the brain, the immune and the cardiovascular systems, in health and disease. I have developed and supervised the techniques to record and stimulate the peripheral nervous system in mice, in order to understand the mechanisms leading to immune system activation in the context of hypertension (see *Nature Communications* 2016) and atherosclerosis (see *Nature* 2022). I have developed the bioelectronic medicine know-how to design a stimulation electrode focused on the modulation of immune system activity in contexts relevant for cardiovascular diseases. The results of this technological advancement were published by *Cell Reports* (Carnevale L, et al 2020). I have performed and optimized immune cell sorting and analysis, designed panels for multiparametric conventional and spectral flow cytometry analysis to characterize the immune cells interacting with the cardiovascular system (see *Hypertension* 2021). Finally, I have developed several different image analysis techniques applied to confocal microscopy, with the aim of characterizing the vascular integrity (*Immunity*, 2017; *ATVB* 2018) and the neuroimmune interactions in the spleen in the context of cardiovascular diseases (*Cardiovascular Research* 2018a, *Cell Reports* 2020).

M. SUMMARY OF SCIENTIFIC ACHIEVEMENTS**[Impact Factor=IF 2023 JCR Science Edition]****23 Publications, 9 of them as first author or corresponding author and 3 as second author (main author of my research group)**

Total Impact Factor: 259.2

Average IF per paper: 11.26

H index: 12

Cit. 580

Average Citations per paper: 25.21

1. Carnevale L, Lembo G. "Imaging the cerebral vasculature at different scales: translational tools to investigate the neurovascular interfaces". **Cardiovascular Research** (2024) *Doi: 10.1093/cvr/cvae165*

2023 IF: 10.2

2. Lembo M, Joshi S, Geers J, Bing R, Carnevale L, Pawade TA, Doris MK, Tzolos E, Grodecki K, Cadet S, Craig N, Singh T, Slomka PJ, White A, Guala A, Rodriguez-Palomares JF, Ruiz-Munoz A, Dux-Santoy L, Teixido-Tura G, Galian-Gay L, Williams MC, Newby DE, Kwak S, Lee SP, Clavel MA, Dey D, Dweck MR. "Quantitative computed tomography angiography for the evaluation of valvular fibrocalcific volume in aortic stenosis" **JACC: Cardiovascular Imaging** (2024) *Doi: 10.1016/j.jcmg.2024.06.007*

2023 IF: 12.8 (Cit. 1)

3. RIN – Neuroimaging Network "Differential diagnosis of neurodegenerative dementias with the explainable MRI based machine learning algorithm MUQUBIA" **Scientific Reports** (2023) *Doi: 10.1038/s41598-023-43706-6*

2023 IF: 3.8 (Cit. 2)

4. Carnevale L, Perrotta M, Mastroiacovo F, Perrotta S, Migliaccio A, Fardella V, Pacella J, Fardella S, Pallante F, Carnevale R, Carnevale D, Lembo G. "Advanced magnetic resonance imaging to define the microvascular injury driven by neuroinflammation in the brain of a mouse model of hypertension" **Hypertension** (2024) *Doi: 10.1161/HYPERTENSIONAHA.123.21940*

2023 IF: 6.9 (Cit. 1)

5. Perrotta M, Carnevale D, Carnevale L. "Mouse models of cerebral injury and cognitive impairment in hypertension" **Frontiers in Aging Neuroscience** (2023) *Doi: 10.3389/fnagi.2023.1199612*

2023 IF: 4.1 (Cit. 2)

6. Siedlinski M, Carnevale L, Xu X, Carnevale D, Evangelou E, Caulfield M, Maffia P, Wardlaw J, Samani NJ, Tomaszewski M, Lembo G, Holmes MV, Guzik TJ. "Genetic analyses identify brain structures related to cognitive impairment associated with elevated blood pressure" **European Heart Journal** (2023) *Doi: 10.1093/eurheartj/ehad101*

2023 IF: 37.6 (Cit. 26)

7. Apaydin D, Zakarauskas-Seth B*, Carnevale L*, Apaydin O, Perrotta M, Carnevale R, Kotini M, Kotlar-Goldaper I, Belting H, Carnevale D, Filosa A, Sawamiphak S "Interferon- γ drives macrophage reprogramming, cerebrovascular remodelling and cognitive dysfunction in a zebrafish and a mouse model of ion imbalance and pressure overload". **Cardiovascular Research** (2023) *Doi: 10.1093/cvr/cvac188*.

2023 IF: 10.2 (Cit. 8)

8. Mohanta SK, Peng L, Li Y, Lu S, Sun T, Carnevale L, ... & Habenicht AJ. "Neuroimmune cardiovascular interfaces control atherosclerosis" **Nature** (2022) *Doi: 10.1038/s41586-022-04673-6*

2023 IF: 50.5 (Cit. 105)

9. RIN – Neuroimaging Network “MRI data quality assessment for the RIN - Neuroimaging Network using the ACR phantoms” **Physica Medica** (2022) *Doi: 10.1016/j.ejmp.2022.10.008*
2023 IF: 3.3 (Cit. 5)
10. RIN – Neuroimaging Network “Multi-centre and multi-vendor reproducibility of a standardized protocol for quantitative susceptibility Mapping of the human brain at 3T”. **Physica Medica** (2022) *Doi: 10.1016/j.ejmp.2022.09.012*.
2023 IF: 3.3 (Cit. 9)
11. RIN – Neuroimaging Network “Quantitative MRI Harmonization to Maximize Clinical Impact: The RIN–Neuroimaging Network” **Frontiers in Neurology** (2022) *Doi: 10.3389/fneur.2022.855125*.
2023 IF: 2.7 (Cit. 13)
12. Carnevale L, Perrotta M, Lembo G. “A focused review of neural recording and stimulation techniques with immune-modulatory targets” **Frontiers in Immunology** (2022) *Doi: 10.3389/fimmu.2021.689344*
2023 IF: 5.7 (Cit. 3)
13. Carnevale D, Carnevale L, Perrotta S, Pallante F, Migliaccio A, Iodice D, Perrotta M, Lembo G. “Chronic 3D Vascular-Immune Interface Established by Coculturing Pressurized Resistance Arteries and Immune Cells” **Hypertension** (2021) *Doi: 10.1161/HYPERTENSIONAHA.121.17447*
2023 IF: 6.9 (Cit. 10)
14. Carnevale L, Carnevale R, Mastroiacovo F, Cifelli G, Carnevale D, Lembo G. “Ultrasound-guided catheter implantation improves conscious radiotelemetric blood pressure measurement in mice” **Cardiovascular Research** (2021) *Doi: 10.1093/cvr/cvab011*
2023 IF: 10.2 (Cit. 2)
15. Carnevale L, Pallante F, Perrotta M, Iodice D, Perrotta S, Fardella S, Mastroiacovo F, Carnevale D, Lembo G. “Celiac Vagus Nerve Stimulation Recapitulates Angiotensin II-Induced Splenic Noradrenergic Activation, Driving Egress of CD8 Effector Cells” **Cell Reports** (2020) *Doi: 10.1016/j.celrep.2020.108494*
2023 IF: 7.5 (Cit. 22)
16. Carnevale L, Maffei A, Landolfi A, Grillea G, Carnevale D, Lembo G. “Brain functional MRI highlights altered connections and functional networks in hypertensive patients” **Hypertension** (2020) *Doi: 10.1161/HYPERTENSIONAHA.120.15296*
2023 IF: 6.9 (Cit. 39)
17. Carnevale L, Lembo G. “Innovative MRI Techniques in Neuroimaging Approaches for Cerebrovascular Diseases and Vascular Cognitive Impairment” **International journal of molecular sciences** (2019) *Doi: 10.3390/ijms20112656*
2023 IF: 4.9 (Cit. 20)
18. Carnevale D, Facchinello N, Iodice D, Bizzotto D, Perrotta M, De Stefani D, Pallante F, Carnevale L, Ricciardi F, Cifelli G, Da Ros F, Casaburo M, Fardella S, Bonaldo P, Innocenzi G, Rizzuto R, Braghetta P, Lembo G, and Bressan GM. "Loss of Emilin-1 enhances arteriolar myogenic tone through TGF- β dependent transactivation of EGFR and is relevant for hypertension in mice and humans" **Arteriosclerosis Thrombosis and Vascular Biology** (2018) *Doi: 10.1161/ATVBAHA.118.311115*
2023 IF: 7.4 (Cit. 24)
19. Carnevale L, D’Angelosante V, Selvetella G, Grillea G, Costagliola C, Lembo G, Carnevale D. “Brain MRI fiber-tracking reveals white matter alterations in hypertensive patients without damage at conventional neuroimaging” **Cardiovascular Research** (2018) *Doi: 10.1093/cvr/cvy104*
2023 IF: 10.2 (Cit. 31)

20. Perrotta M, Lori A, Carnevale L, Fardella S, Cifelli G, Iacobucci R, Mastroiacovo F, Iodice D, Pallante F, Storto M, Lembo G, Carnevale D. "DOCA-salt hypertension activates PlGF in the spleen to couple sympathetic drive and immune system activation" **Cardiovascular Research** (2018) *Doi: 10.1093/cvr/cvy001*
2023 IF: 10.2 (Cit. 33)
21. Da Ros F, Carnevale R, Cifelli G, Bizzotto D, Casaburo M, Perrotta M, Carnevale L, Vinciguerra I, Fardella S, Iacobucci R, Bressan GM, Braghetta P, Lembo G, Carnevale D. "Targeting Interleukin-1 β protects from aortic aneurysms induced by disrupted Transforming Growth Factor- β signaling" **Immunity** (2017) *Doi: 10.1016/j.immuni.2017.10.016*
2023 IF: 25.5 (Cit. 41)
22. Carnevale D, Perrotta M, Pallante F, Fardella V, Iacobucci R, Fardella S, Carnevale L, Carnevale R, De Lucia M, Cifeli G, Lembo G. "A cholinergic-sympathetic pathway that primes immunity in hypertension mediates the brain-to-spleen connection". **Nature Communications** (2016) *Doi: 10.1038/ncomms13035*
2023 IF: 14.7 (Cit. 100)
23. Carnevale D, Mascio G, Ajmone-Cat MA, D'Andrea I, Cifelli G, Madonna M, Cocozza G, Frati A, Carullo P, Carnevale L, Alleva E, Branchi I, Lembo G, Minghetti L. "Role of neuroinflammation in hypertension-induced brain amyloid pathology" **Neurobiology of Aging** (2012) *Doi: 10.1016/j.neurobiolaging.2010.08.013*
2023 IF: 3.7 (Cit. 81)

Publications Of Books Chapters

- Carnevale D, Lembo G, Perrotta M & **Carnevale L**. Book Chapter "Neuronal Regulation of Immune System in Cardiovascular Diseases", Published by CRC Press/Taylor & Francis in "Immune Cells, Inflammation and Cardiovascular Diseases". ISBN 9780367459079

N. SELECTED PUBLICATIONS FOR THE EVALUATION**[Impact Factor of the publication year]****12 Publications from last five years selected for the Evaluation**Total Impact Factor: of the 12 selected publications: **190.831**Average IF per paper: **15.90****5/12 First Name Authorship****4/12 Main author of my research group****2/12 Corresponding Author**

* Indicates publication that received editorial or press/media releases

1. Lembo M, Joshi S, Geers J, Bing R, Carnevale L, Pawade TA, Doris MK, Tzolos E, Grodecki K, Cadet S, Craig N, Signh T, Slomka PJ, White A, Guala A, Rodriguez-Palomares JF, Ruiz-Munoz A, Dux-Santoy L, Teixido-Tura G, Galian-Gay L, Williams MC, Newby DE, Kwak S, Lee SP, Clavel MA, Dey D, Dweck MR. "Quantitative computed tomography angiography for the evaluation of valvular fibrocalcific volume in aortic stenosis" **JACC: Cardiovascular Imaging** (2024) Doi: 10.1016/j.jcmg.2024.06.007

***2023 IF: 12.8** (Cit. 1)

2. Carnevale L, Perrotta M, Mastroiacovo F, Perrotta S, Migliaccio A, Fardella V, Pacella J, Fardella S, Pallante F, Carnevale R, Carnevale D, Lembo G. "Advanced magnetic resonance imaging to define the microvascular injury driven by neuroinflammation in the brain of a mouse model of hypertension" **Hypertension** (2024) Doi: 10.1161/HYPERTENSIONAHA.123.21940

2023 IF: 6.9 (Cit. 1)

3. Perrotta M, Carnevale D, Carnevale L. "Mouse models of cerebral injury and cognitive impairment in hypertension" **Frontiers in Aging Neuroscience** (2023) Doi: 10.3389/fnagi.2023.1199612

2023 IF: 4.1 (Cit. 2)

4. Siedlinski M, Carnevale L, Xu X, Carnevale D, Evangelou E, Caulfield M, Maffia P, Wardlaw J, Samani NJ, Tomaszewski M, Lembo G, Holmes MV, Guzik TJ. "Genetic analyses identify brain structures related to cognitive impairment associated with elevated blood pressure" **European Heart Journal** (2023) Doi: 10.1093/eurheartj/ehad101

***2023 IF: 37.6** (Cit. 26)

5. Apaydin D, Zakarauskas-Seth B*, Carnevale L*, Apaydin O, Perrotta M, Carnevale R, Kotini M, Kotlar-Goldaper I, Belting H, Carnevale D, Filosa A, Sawamiphak S "Interferon-γ drives macrophage reprogramming, cerebrovascular remodelling and cognitive dysfunction in a zebrafish and a mouse model of ion imbalance and pressure overload" **Cardiovascular Research** (2023) Doi: 10.1093/cvr/cvac188.

2023 IF: 10.2 (Cit. 8)

6. Mohanta SK, Peng L, Li Y, Lu S, Sun T, Carnevale L, ... & Habenicht AJ. "Neuroimmune cardiovascular interfaces control atherosclerosis" **Nature** (2022) Doi: 10.1038/s41586-022-04673-6

***2022 IF: 64.8** (Cit. 105)

7. RIN – Neuroimaging Network "Quantitative MRI Harmonization to Maximize Clinical Impact: The RIN–Neuroimaging Network" **Frontiers in Neurology** (2022) Doi: 10.3389/fneur.2022.855125.

2022 IF: 3.4 (Cit. 13)

8. Carnevale L, Perrotta M, Lembo G. "A focused review of neural recording and stimulation techniques with immune-modulatory targets" **Frontiers in Immunology** (2022) Doi: 10.3389/fimmu.2021.689344

2022 IF: 7.3 (Cit. 3)

9. Carnevale D, Carnevale L, Perrotta S, Pallante F, Migliaccio A, Iodice D, Perrotta M, Lembo G. "Chronic 3D Vascular-Immune Interface Established by Coculturing Pressurized Resistance Arteries and Immune Cells" **Hypertension** (2021) Doi: 10.1161/HYPERTENSIONAHA.121.17447

2021 IF: 9.879 (Cit. 10)

10. Carnevale L, Carnevale R, Mastroiacovo F, Cifelli G, Carnevale D, Lembo G. "Ultrasound-guided catheter implantation improves conscious radiotelemetric blood pressure measurement in mice" **Cardiovascular Research** (2021) Doi: 10.1093/cvr/cvab011

2021 IF: 14.239 (Cit. 2)

11. Carnevale L, Pallante F, Perrotta M, Iodice D, Perrotta S, Fardella S, Mastroiacovo F, Carnevale D, Lembo G. "Celiac Vagus Nerve Stimulation Recapitulates Angiotensin II-Induced Splenic Noradrenergic Activation, Driving Egress of CD8 Effector Cells" **Cell Reports** (2020) Doi: 10.1016/j.celrep.2020.108494

2020 IF: 9.423 (Cit. 22)

12. Carnevale L, Maffei A, Landolfi A, Grillea G, Carnevale D, Lembo G. "Brain functional MRI highlights altered connections and functional networks in hypertensive patients" **Hypertension** (2020) Doi: 10.1161/HYPERTENSIONAHA.120.15296

*2020 IF: 10.190 (Cit. 39)

Luogo e data: Cassino, 21/10/2024

Lorenzo Carnevale