

CURRICULUM VITAE



PERSONAL INFORMATION

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| Name | Carlo Ventura |
| | Italian Fiscal Code: VNTCRL58E29L328U |
| Addresses | National Laboratory of Molecular Biology and Stem Cell Engineering, Istituto Nazionale Biostrutture e Biosistemi (INBB), Bologna, Italy. |
| Current Position | Full Professor of Molecular Biology, School of Medicine, University of Bologna, Italy. Scientific Director of the National Laboratory of Molecular Biology and Stem Cell Engineering, Istituto Nazionale Biostrutture e Biosistemi (INBB – www.inbb.it), Bologna, Italy. Editor-in-Chief: World Journal of Stem Cells (2020 IF: 5.326, 2021 Journal Citation Reports) Editorial Board: International Journal of Molecular Sciences |
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| Nationality | Italy |
| Date and place of birth | May 29, 1958. Trani (BT), Italy |

PROFESSIONAL EXPERIENCE / POSITIONS

- July 24, 1982 M.D. University of Bologna, Italy
- July 18, 1986 Specialization in Cardiology, School of Medicine, University of Bologna, Italy.
- 1987-1988 Medical Officer.
- 1990 Ph.D. in Biochemistry.
- 1988-1994 Guest Researcher, Laboratory of Cardiovascular Sciences (LCS), National Institute on Aging (NIA) – National Institutes of Health (NIH), Baltimore, MD, USA.
- 1990-2000 Researcher at the Department of Biomedical Sciences, Division of Biochemistry, School of Medicine, University of Sassari, Italy.

- March 1, 2000-September 30, 2000, **Associate Professor in Biochemistry** at the Department of Biomedical Sciences, Division of Biochemistry, School of Medicine University of Sassari, Italy.
- October 1, 2000 - October 31, 2000 **Full Professor in Biochemistry, Chief of the Laboratory of Cardiovascular Research** at the Department of Biomedical Sciences, Division of Biochemistry, School of Medicine, **University of Sassari, Italy.**
- 2000-2003 **Chief of the following institutions: Laboratory of Cardiovascular Research**, Department of Biomedical Sciences, University of Sassari, Italy; **“Division of Cell Biology” of the National Laboratory of the Istituto Nazionale Biostrutture e Biosistemi (INBB), Osilo (Sassari), Italy.**
- November 1, 2003 - **Full Professor of Molecular Biology, School of Medicine, University of Bologna, Italy.**
 - **Chief of the Unit of Experimental Cardiology, Institute of Cardiology, School of Medicine, University of Bologna, Italy.**
 - **Chief of the INBB Division of Bologna, including the INBB Research Units of Firenze, Pisa, and Siena, Italy.**
- 2003 - **Founder and Director of VID Art|Science, (Laboratory of Arts and Sciences).** www.vidartscience.org
- 2011 - **Scientific Director of the Laboratory of Molecular and Cellular Biology of the Istituto Nazionale Biostrutture e Biosistemi (INBB), at the Institute of Cardiology (pavilion 21) of S. Orsola – Malpighi Hospital, University of Bologna, Italy**
- 2012-2019 **Scientific Director of the National Laboratory of Molecular Biology and Stem Cell Engineering, Istituto Nazionale Biostrutture e Biosistemi (INBB – www.inbb.it), Bologna, Italy.**
- 2017 - **Editor-in-Chief: World Journal of Stem Cells**
- 2018 - **Editorial Board: International Journal of Molecular Sciences**

MEMBERSHIP

- 2003 - American Society of Biochemistry and Molecular Biology (ASBMB)

LANGUAGES

ENGLISH

- Ability of reading Full knowledge
- Ability of writing Full knowledge
- Ability of oral expression Full knowledge

RESEARCH ACTIVITY.

PROF. CARLO VENTURA devoted his studies to the molecular dissection of mechanisms underlying the cell growth and differentiation of the cardiac myocytes, discovering nuclear endorphin receptors and small peptide signaling responsible for cardiogenesis in mouse embryonic stem cells. In these cells, he also investigated the potential for differentiating patterning by physical stimuli, discovering that cardiogenesis could be turned on by cell exposure to “extremely low frequency magnetic fields”. He synthesized and developed new molecules harboring differentiating and paracrine logics for human mesenchymal stem cells, affording new strategies in cardiovascular regenerative medicine. He investigated the ability of radio electric fields to modulate the expression of pluripotentiality and counteract senescence in human adult mesenchymal stem cells, and shown the possibility to use this physical energy to achieve efficient reprogramming in human fibroblasts without the need of viral vector-mediated gene transfer. These activities paved the way to the use of physical energy in stem cell science. He published more than 200 full papers in the top level Journals of cellular and molecular biology (<https://www.researchgate.net/profile/Carlo-Ventura>).

MAIN ACHIEVEMENTS

- Discovery of opioid receptors in myocardial cells.
- Identification of cellular mechanisms regulating cytosolic Ca²⁺/pH homeostasis, and contractility in isolated myocardial cells following opioid receptor activation.
- Identification of an opioid gene in cardiac myocytes.
- Characterization of the molecular mechanisms underlying opioid peptide gene expression in myocytes from an experimental model of primary hereditary cardiomyopathy.

- Discovery of opioid receptors in the nucleus of myocardial cells and identification of nuclear receptor-regulated pathways controlling transcriptional homeostasis.
- Identification of an opioid gene orchestrating cardiogenic transcription and the establishment of a myocardial phenotype in embryonal carcinoma cells.
- Discovery of nuclear endorphin receptors and signaling driving cardiogenesis in mouse embryonic stem (ES) cells. Since this finding, the term “intracrine” has been introduced to identify growth regulatory peptides acting within their cell of synthesis on the nuclear envelope, or subnuclear components to drive targeted lineage commitment.
- Synthesis and development of novel molecules harboring differentiating “logics” for cardiovascular repair with human adult stem cells. One of these molecules, a hyaluronan mixed ester of butyric and retinoic acids (HBR) remarkably enhanced the process of cardiogenesis in mouse embryonic stem cells, demonstrating the potential for chemically modifying the gene program of stem cell differentiation without the aid of gene transfer technologies. Transplantation of HBR-preconditioned human mesenchymal stem cells led to successful repair of rat and pig hearts, subjected to experimental myocardial infarction. Recently, HBR afforded significant cardiovascular repair in infarcted rat heart, without the needs of stem cell transplantation. Such a response was mediated by direct angiogenic, antiapoptotic and antifibrotic responses, and also encompassed the local recruitment of endogenous stro-1 positive cells that acquired a number of morphological and immunocytochemical features characteristic of pericyte identity. Thus, HBR provided a rapid and persistent rescue of the infarcted heart, maximizing the change for further cell therapy by cardiac transplantation of stem cells pretreated with the same molecule.
- Discovery of physical forces controlling stem cell growth and differentiation. These studies led to the finding that extremely low frequency magnetic fields (ELF-MF) were able to turn on cardiogenesis in mouse ES cells. More recently, a remarkable increase in the gene expression of cardiogenic, neurogenic and skeletal-myogenic genes was achieved following ES cell exposure to radiofrequency energy (RF). These responses were elicited by a Radio Electric Asymmetric Conveyor (REAC), an innovative device generating RF loops within the Wi-Fi 2.4 GHz band through an array of emitting antennas and a receiving conveyor probe immersed in the bathing medium. REAC exposure ultimately ensued into a high-yield of terminally differentiated myocardial, neuronal and skeletal muscle cells. For decades stem cell commitment has been triggered *in vitro* by chemistry: the current findings provided evidence for the first time that a “physical milieu” can be generated to orchestrate and optimize stem cell expression of pluripotentiality.
- Optimization of multipotency expression in human adipose derived stem cells (hASCs) by the REAC asymmetrically conveyed radioelectric fields.
- Discovery of human skin fibroblast reprogramming by the aid of REAC asymmetrically conveyed radioelectric fields. This procedure afforded a biphasic, initially up- and then down-regulation, of stemness related genes, driving a direct commitment to cardiac, neuronal and skeletal muscle lineages. Due to the late downregulation of pluripotency genes, cells were not frozen into an embryonic-like intermediate, achieving a high-throughput of terminal specification without the potential tumorigenic risk associated to large proportions of undifferentiated embryonal cells.
- The use of radioelectric fields to antagonize stem cell senescence at the molecular level. So far stem cell expansion *in vitro*, a procedure needed to achieve large number of cells amenable for transplantation in damaged tissues, has been severely hampered by the occurrence of cell senescence after prolonged periods in culture. REAC-asymmetrically conveyed radio electric fields acted on a gene and protein expression program of both telomerase-independent and telomerase-dependent patterning to optimize stem cell ability to cope with senescence progression. This finding will consistently enhance the availability of healthy, competent stem cells after prolonged expansion *ex vivo* prior to transplantation.
- The discovery that cells can sense and even produce acoustic vibrations, putatively associated with cell commitment along targeted lineages. To this end, “Sonocytology” is the term that has been introduced to identify a novel area of inquiry based on the fact that, after an accurate process of amplification, given the frequency range of nanomechanical motions recorded at cellular level, the vibrations could be transformed into audible sounds, providing a thorough assessment of mechanistic cellular dynamics (Gimzewski JK, Pelling A, and Ventura C., **International Publication Number WO 2008/105919 A2, International Publication Date 4 September 2008. Title: Nanomechanical Characterization of Cellular Activity**).

- The discovery that nanomechanical vibration in signaling molecules can emerge into a biophotonic activity, and that the use pulsed light of defined frequencies can promote stem cell reprogramming, and targeted lineage commitment.
- The development of a precision regenerative medicine based upon the diffusive features of physical energies (mechanical waves, electromagnetic, and light radiations), and the chance of targeting tissue-resident stem cells *in situ*, boosting our endogenous self-healing potential, without the needs for cell or tissue transplantation.

INTERNATIONAL COLLABORATIONS

- The National Institutes of Health (NIH) – National Institutes on Aging (NIA) and their Laboratory of Cardiovascular Sciences (LCS) in Baltimore, MD, USA. Director Prof Edward G. Lakatta.
- Ludwig Boltzmann Institute for Experimental and Clinical Traumatology Austrian Cluster for Tissue Regeneration, Vienna (Austria). Director Prof. Heinz Redl.
- The University of California, Los Angeles (UCLA), Department of Chemistry & Biochemistry. The California Nanoscience Institute (CNSI) and the Nanoart and Nanoscience Institute. These are all directed by Prof. James K. Gimzewski.

("ai sensi e per gli effetti del D. Lgs 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali", autorizzo al trattamento delle informazioni e dei dati contenuti nel presente curriculum vitae, incluso la loro trasmissione e pubblicazione per le finalità ECM)

Bologna, July 16th, 2024

Signature (First, Last Name)

Carlo Ventura

