

LILIA ALBERGHINA

English CV



Lilia Alberghina is the Director of SYSBIO, Centre of Systems Biology, Milan, Italy. Full professor of biochemistry from 1977 to 2010, first at the University of Milan, then at the University of Milano-Bicocca, she has been component of the Steering Committee that governed the foundation of the latter University, as well as, later on, member of the Board of Regents and Dean of the teaching program in Industrial Biotechnology and presently Emeritus Professor. In 2012 she has been awarded a Laurea honoris causa in Molecular and Industrial Biotechnology from the University of Naples "Federico II".

She is a member of the Italian National Academy of Sciences (dei Quaranta) and Gold Medal of the City of Milan, Scholar of the Johns Hopkins University, USA, Fellow of the American Institute of Medical and Biological Engineering (AIMBE).

She started her academic career after graduating in Biology, magna cum laude, at the University of Milan, and has been Fulbright Research Fellow first, and, later, Visiting Professor at the Johns Hopkins University, Baltimore, MD, USA.

She is author or co-author of 320 publications on international peer-review journals, author with Enrico Cernia of the book "Biotechnologie e Bioindustria", UTET 1996, editor of the volume "Protein engineering for Industrial Biotechnology", Harvard Academic Publisher, 2000, and editor with Hans V. Westerhoff of the book "Systems Biology - Definitions and Perspectives", Springer Verlag 2005. Lilia Alberghina is also author of a series of bestseller biology books for high school.

Lilia Alberghina has been one of the promoters of biotechnology research and education in Italy and in more recent years she is a driving force for the development of Systems Biology. She has been component or chair of a large number of Scientific Committees at National and European level, the more relevant of which are: component, for more than 10 years, of the Council of the European Molecular Biology Laboratory in Heidelberg, Germany; chair of the External Advisory Group on Cell Factory for the Fifth Framework Program of EU; component of the "Working Group on establishing an independent advisory board on science and technology policy in Europe"; component of the "Steering and Managing Committee for a Biotechnology project of the Italian National Research Council"; member of the Council of the Consortium for Biotechnology in Italy (CIB); coordinator of the subproject "Biopharmaceuticals" of the second Targeted Project "Biotechnology" of CNR; Scientific Director of the "Center of Excellence for Industrial Biotechnology" (CEBIB) at the University of Milano-Bicocca; component of the Scientific and Organizing Committees of the 11th "International Biotechnology Symposium" (IBS 2010), and of the FEBS Congress 2011; President of the Scientific Committees for three editions of the "SysBioHealth Symposium" held at the University of Milano-Bicocca (2005, 2007, 2009); component of the General Evaluation Panel of the Institutes of the Italian National Research Council (CNR) (2007/2010); component of the Evaluation Panel for a call to set up

Centres of Systems Biology in Netherlands (NOW) (2009/2010). She has also been President of the Scientific Committee for the VI European Congress of Biotechnology (1993) and of the XI European Conference on Cell Cycle (1997).

At present she is: Editor of the scientific journals “Current Opinion in Biotechnology”, “Frontiers in Systems Physiology”, “International Journal of Systems Biology” and “Biomedical Technologies” (IJSBBT); Principal Investigator of a Research Unit on EU/FP7 UNICELLSYS project, funded by the EC; Referee for the European Research Council, for the European Science Foundation, for the Italian Ministry of University and Research; President of the Scientific society “Systems Biology for Health” (SysBioHealth, based in Italy); Co-founder of the International Society for Systems Biology.

Scientific Profile

The scientific work of Lilia Alberghina can be recapitulated around two different lines:

- From the biochemistry of growth and cycle to Systems Biology
- Industrial Biotechnology

that are going to be summarized in the following.

From the biochemistry of growth and cycle to Systems Biology

Lilia Alberghina identified very early in her scientific career which was to be the focus of her research activity: the molecular controls of growth and cell cycle, pursued in different experimental systems from lower eukaryotes to normal and transformed mammalian cells, always keeping her work at the frontiers of technology.

In this field, she has realized several relevant breakthroughs:

- discovery of molecular mechanisms that control the G1 to S transition in budding yeast, a well known model for cell cycle studies. Seminal achievements are: the identification of a new component of the basic cycle machinery; the finding, by systems biology approaches, that a central function of cycle control (the requirement of a critical cell size to enter S phase) is a system-level property of the entire G1 to S network;
- construction and simulation analysis of a mathematical model of the onset of DNA replication in yeast, that uncovers the role of multisite protein phosphorylation in yielding synchronous onset of cell cycle events;
- comparison of network analysis with dynamic mathematical models in their ability to give insight into molecular basis of biological functions ;
- besides, Alberghina’s laboratory has developed a large, original body of work on the control of yeast cell cycle by nutrients and by signaling pathways: cAMP/PKA; Ras/GEF; CK2, TOR, Snf1 (AMPK), that taken together yield a better understanding of cell cycle controls;
- a previous line of work on quantitative analysis of RNA, protein and DNA synthesis, and of protein degradation in lower eukaryotes, had set the ground for the following systems biology approaches;
- development of a systems analysis of ageing determinants in yeast and mammalian cells;

- isolation and characterization of the mammalian gene homologous to yeast CDC25/GEF and identification of its specific role in nervous cells;
- analysis of the signaling events by which PDGF (and EGF) control mammalian cell proliferation and impact on cell cycle recruiting;
- discovery that downregulation of the K-ras pathway is able to yield phenotypic reversion of transformed fibroblasts;
- development of an innovative line of work on the molecular basis of cancer cell growth, that starts from the consideration (firstly developed by Lilia Alberghina in her yeast cell cycle studies) that complex cellular functions are system-level properties of their underlying molecular networks. The cancer phenotype that is analyzed is unrestricted proliferation in high glucose and cell death in low glucose of Kras transformed mouse fibroblasts, as compared to normal ones.

By postgenomic and hypothesis-driven molecular analysis, the delimitation of the network responsible for this phenotype has been obtained and the interplay between glycolysis and mitochondria (presently analyzed in a collaboration of Lilia Alberghina's team with the laboratory of Greg Stephanopoulos at MIT, Boston, USA) is found crucial for the generation of the system-level properties under investigation.

Industrial Biotechnology

Lilia Alberghina has utilized her background on yeast genetics and physiology to develop it as a cell factory for the production of recombinant DNA protein, improving the processes by manipulation of promoter sequences, yeast culture conditions, or by inducing secretion of the product. Then she transferred these techniques to mammalian cells for the production of highly active human, recombinant NGF and development of "in vitro" and "in vivo" approaches to bring rhNGF and a new, very active peptide-mimetic of NGF to industrial application as a drug. She has contributed also to the development of a metabolic engineering process for the production of lactic acid from yeast and to the development of "tailored" lipases for industrial application.

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