

WORKSHOP

# Complex Systems: from Physics to Biomedicine

in honor of **Giorgio Parisi**  
Nobel Laureate for Physics 2021

**May 10<sup>th</sup> 2022**

TEATRO E SCUDERIE VECCHIE  
VILLA TORLONIA  
Via L. Spallanzani 5, Rome

Organizing Committee:  
**Lilia Alberghina** and **Riccardo Zecchina**



ACCADEMIA NAZIONALE  
DELLE SCIENZE DETTA DEI XL

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## PROGRAMME / **TEATRO DI VILLA TORLONIA**

**9:15** OPENING

**Corrado De Concini**, President Accademia Nazionale delle Scienze detta dei XL  
**Maria Cristina Messa**, Italian Minister of University and Research  
**Roberto Gualtieri**, Mayor of Rome (TBC)

**09:40** COMPLEX SYSTEMS: FROM A PHYSICIST VIEWPOINT

**Giorgio Parisi**, Sapienza University of Rome

**10:20** SYSTEMS METABOLOMICS TO INVESTIGATE THE COMPLEXITY OF METABOLISM  
AS DRIVER OF CANCER

**Lilia Alberghina**, University of Milano Bicocca

**11:00** INTELLIGENT ARTIFICIAL INTELLIGENCE FOR HEALTH: FROM NEW THERMODYNAMICS  
TO A FUNDAMENTALLY DIFFERENT APPROACH TO NETWORK DISEASES

**Hans V. Westerhoff**, University of Amsterdam

**11:40** FROM SINGLE-CELL TO MULTI-CELLS INFORMATION SYSTEMS ANALYSIS

**Barbara Di Camillo**, University of Padova

**12:20** GENERATIVE AND INTERPRETABLE MODELS FOR APTAMER DESIGN AND ANALYSIS OF IN VITRO  
SEQUENCE SELECTION

**Rémi Monasson**, École Normale Supérieure, Paris

**13:00 - 14:30** Lunch break at the Limonaia Restaurant

**14:30 - 18:00** SHORT COMMUNICATIONS PARALLEL SESSIONS

**18:00** Final discussion on future perspectives chaired by **Riccardo Zecchina**

**19.00** Closing of the meeting





## SHORT COMMUNICATIONS PARALLEL SESSION / **TEATRO DI VILLA TORLONIA**

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- 14.30**     **STRUCTURE FROM DISORDER AND VICEVERSA**  
**Giovanni La Penna**, National Research Council and National Institute for Nuclear Physics, Italy
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- 14.45**     **NEW INSIGHTS INTO OUT-OF-EQUILIBRIUM LAWS FOR MICROBIAL GROWTH**  
**Marco Cosentino-Lagomarsino**, IFOM Foundation and University of Milan, Italy
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- 15.00**     **METABOLISM-DEPENDENT COMPLEX MECHANISM CONTROLLING  
CELL SIZE AND CELL GROWTH IN BUDDING YEAST**  
**Marco Vanoni**, University of Milan-Bicocca, Italy
- 
- 15.15**     **UNRAVELING THE INNER WORKINGS OF CELLS VIA STATISTICAL INFERENCE**  
**Andrea De Martino**, Polytechnic University of Turin and Italian Institute for Genomic Medicine, Turin, Italy
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- 15.30**     **NETWORK MEDICINE FRAMEWORK FOR ANALYZING DIFFERENT BREAST CANCER SUBTYPES**  
**Federica Conte**, Institute for Systems Analysis and Computer Science, National Research Council, Rome, Italy
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- 15.45**     **KNOWLEDGE-BASED MULTI-OMICS DATA INTEGRATION TO UNVEIL THE MANY FACETS  
OF METABOLIC VARIATION AND REGULATION**  
**Chiara Damiani**, University of Milan-Bicocca, Italy
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- 16.00**     **TARGETING LONG NON-CODING RNA H19/CELL ADHESION MOLECULES CIRCUITRY BY  
EPIDRUGS: NOVEL TOOLS TO INHIBIT TUMOR GROWTH AND METASTASIS IN PROSTATE CANCER**  
**Valeria Pecci**, Catholic University of the Sacred Heart, Rome, Italy
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- 16.15**     **THE RULES OF CELL LIFE: MULTISCALE INTEGRATION MODELING OF METABOLISM, GROWTH  
AND CYCLE IN BUDDING YEAST**  
**Pasquale Palumbo**, University of Milan- Bicocca, Italy
- 
- 16.30**     **METABOLIC REWIRING BY LONG NONCODING RNA MALAT1-TARGETING IN PROSTATE CANCER:  
A MULTI-PRONGED APPROACH**  
**Sara De Martino**, Catholic University of the Sacred Heart, Rome, Italy
- 
- 16.45**     **A NOVEL AND ROBUST MOLECULAR SWITCH ACTUATING THE QUANTITATIVE MODEL  
OF EUKARYOTIC CDK CONTROL**  
**Matteo Barberis**, University of Surrey, Guildford, UK
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- 17.00**     **THREE SIMPLE MOTIFS THROUGH WHICH TO UNDERSTAND COMPLEXITY IN NEURAL DIFFERENTIATION**  
**Anna Maria Colangelo**, University of Milan-Bicocca, Milan, Italy
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- 17.15**     **A STOCHASTIC APPROACH TO STUDY THE ASIMPTOTIC BEHAVIOUR OF OSCILLATING  
BIOCHEMICAL SYSTEMS**  
**Alberto Bersani**, Institute for System Analysis and Computer Science, National Research Council, Rome, Italy
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- 17.30**     **RECENT TRENDS AND CHALLENGES IN MODELING AND CONTROL OF THE GLUCOSE-INSULIN SYSTEM**  
**Alessandro Borri**, Institute for System Analysis and Computer Science, National Research Council, Rome  
and University of L'Aquila, Italy
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SHORT COMMUNICATIONS PARALLEL SESSION / **LIBRARY OF ACCADEMY, SCUDERIE VECCHIE DI VILLA TORLONIA**

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- 14.30** CRITICAL BEHAVIOR AND MEMORY FUNCTION IN A MODEL OF SPIKING NEURONS WITH A RESERVOIR OF SPATIO-TEMPORAL PATTERNS  
**Silvia Scarpetta**, University of Salerno, Italy
- 
- 14.45** NUCLEOPORIN 153 DEFICIENCY IN ADULT NEURAL STEM CELLS DEFINES A PATHOLOGICAL PROTEIN-NETWORK SIGNATURE AND DEFECTIVE NEUROGENESIS IN A MOUSE MODEL OF AD  
**Alessia Bertozzi**, Institute for System Analysis and Computer Science, National Research Council, Rome, Italy
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- 15.00** A NEW MATHEMATICAL MODEL OF THE HUMAN THYROID  
**Marcello Pompa**, Catholic University of the Sacred Heart, Rome, Italy
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- 15.15** A NETWORK-BASED ALGORITHM FOR IDENTIFYING DRUG-REPURPOSING OPPORTUNITIES ALONG WITH ITS APPLICATION TO SARS-COV-2 INFECTION  
**Giulia Fiscon**, Sapienza University of Rome and Institute for System Analysis and Computer Science, National Research Council, Rome, Italy
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- 15.30** SARS-COV-2 MULTI VARIANT RAPID DETECTOR BASED ON GRAPHENE TRANSISTOR FUNCTIONALIZED WITH AN ENGINEERING DIMERIC ACE2 RECEPTOR  
**Daniele Di Marino**, Polytechnic University of the Marches, Ancona, Italy
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- 15.45** STATISTICAL MECHANICS FOR THE ANALYSIS OF IMMUNOGENIC MOTIFS IN SARS-COV-2  
**Andrea Di Gioacchino**, École Normale Supérieure, Paris, France
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- 16.00** PHASE TRANSITION IN THE NUCLEUS OF CELLS  
**Mario Nicodemi**, University of Naples 'Federico II' and National Institute for Nuclear Physics, Naples, Italy
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- 16.15** EXPLORING CHROMOSOME THREE-DIMENSIONAL ORGANIZATION IN HEALTHY AND PATHOGENIC GENOMES WITH POLYMER PHYSICS  
**Andrea M. Chiariello**, University of Naples 'Federico II' and National Institute for Nuclear Physics, Naples, Italy
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- 16.30** FROM THE BIRTH OF MEDICAL PHYSICS TO ITS CONTRIBUTION TO MOLECULAR IMAGING  
**Alberto Del Guerra**, University of Pisa and National Institute for Nuclear Physics, Pisa, Italy
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- 16.45** GAMES OF LIFE, COMPUTER SIMULATION AND BIOLOGICAL HOMOCHIRALITY  
**Savino Longo**, University of Bari "Aldo Moro" and Institute for Plasma Science and Technology, National Research Council, Bari, Italy
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- 17.00** THE BOOLEAN SATISFIABILITY PROBLEM IN CLIFFORD ALGEBRA: A BRIDGE BETWEEN CONTINUOUS AND DISCRETE?  
**Marco Budinich**, University of Trieste and, National Institute for Nuclear Physics, Trieste, Italy
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- 17.15** KINETICS OF ENVIRONMENTAL BIOCOMPLEXITY: EXPERIMENTS, QUANTUM CHEMISTRY, TRANSITIVITY THEORY AND MACHINE LEARNING  
**Valter H. Carvahlo-Silva**, University of Brasilia, Brazil
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