ERC GRANTS AT THE UNIVERSITY OF ROME TOR VERGATA

Erc Starting Grant

- **NATURE NANODEVICES** - Nature-inspired theranostic nanodevices for tumor imaging, early diagnosis and targeted drug-release - PI Francesco Ricci
- **HEVO** - Holomorphic Evolution Equations - PI Filippo Bracci
- **PASCAL** - Probabilistic And Statistical methods for Cosmological AppLications - PI Domenico Marinucci
- **DROEMU** - Elliptic Pdes and Symmetry of Interfaces and Layers for Odd Nonlinearities - Pi Mauro Sbragaglia
- **VISION -** Video-oriented UWB-based Intelligent Ubiquitous Sensing - Role: beneficiary
- **EPSILON** - Elliptic Pdes and Symmetry of Interfaces and Layers for Odd Nonlinearities - Role: beneficiary
- **NEWNET** - New Approaches to Network Design - Role: beneficiary

Erc Consolidator Grant

- **NPTEV-TQP2020** - Uncovering New Phenomena at the TeV Scale With Top Quarks - PI Lucio Cerrito

Erc Avanced Grant

- **COCEAL** - The Common Core of European Administrative Law - PI Giacinto della Cananea
- **QUEST** - Quantum Algebraic Structures and Models - PI Roberto Longo
- **NewTURB** - New eddy-simulation concepts and methodologies for frontier problems in Turbulence - PI Luca Biferale
- **DEPTH** - DEsigning new Paths in The differentiation Hyperspace - PI Giovanni Cesareni
- **SIXXI** - Twentieth Century Structural Engineering: the Italian contribution - PI Sergio Poretti
- **OACFT** - Operator Algebras and Conformal Field Theory - PI Roberto Longo
- **MALADY** - MACROSCOPIC LAWS AND DYNAMICAL SYSTEMS - PI Carlangelo Liverani
- **FAST** - Investigating new therapeutic approaches to Friedreich's Ataxia - PI Roberto Testi
- **SICTRANSIT** - The Archaeology of Regime Change: Sicily in Transition - Role: beneficiary
- **PETRYFING** - Petrifying Wealth. The Southern European Shift to Masonry as Collective Investment in Identity, c.1050-1300 - Role: beneficiary

Erc Proof of Concept Grant

- **FAST-DEVELOPS** - Developing new therapeutics for Friedreich ataxia - PI Roberto Testi

- **AB-SWITCH** - Evaluation of commercial potential of a low-cost kit based on DNA-nanoswitches for the single-step measurement of diagnostic antibodies - PI Francesco Ricci

ERC STARTING GRANT

FP7-IDEAS-ERC

NATURE NANODEVICES - Nature-inspired theranostic nanodevices for tumor imaging, early diagnosis and targeted drug-release

From 2014-04-01 **to** 2019-03-31

PI: Francesco Ricci

Objective

"Late diagnosis and difficult treatment represent major obstacles in the fight against cancer. I propose here the development of self-regulated theranostic nanodevices supporting both early cancer diagnosis and targeted, tumor-cell-specific drug-release. Specifically, I will exploit the “designability” of nucleic acids to design and optimize molecular nanodevices that undergo binding-induced conformational changes upon target binding and, in doing so, signal the presence of a specific tumor marker or release a toxic therapeutic cargo. The inspiration behind my approach is derived from nature, which employs similar nanometer-scale protein and nucleic-acid-based “switches” as devices to detect –and respond to- specific molecules even against the complex background “noise” of the physiological environment. Furthering on this “nature-inspired” synthetic biology view I will also exploit naturally occurring regulatory mechanisms (e.g., allostery, cooperativity, etc.) to tune and edit the dose-response curve of these nanodevices, improve their analytical sensitivity, and optimize drug-release efficiency. In summary, I will use biomimetic “tricks’ taken directly from nature to move beyond the state-of-the-art of sensor design, with the goal being improved diagnostics and “smarter,” more effective drug delivery. Achieving these goals will require multidisciplinary expertise in the field of analytical chemistry, biophysics, electrochemistry, bioengineering, computational chemistry and synthetic biology. In my career I have demonstrated skills and expertise in similarly complex projects and in each of these challenging fields. Finally, the development of the proposed nanodevices will significantly impact the safety, compliance and efficacy of therapies and medical procedures bringing to scientific, technological and socio-economic benefits."

Web site http://www.francescoriccilab.com/erc_starting_grant_nature_nanodevice/

Subjects: Biotechnology - Life Sciences

FP7-IDEAS-ERC

HEVO - Holomorphic Evolution Equations

From 2011-11-01 **to** 2016-10-31

PI: Filippo Bracci

Objective

"The scope of this project is to study holomorphic evolution equations and the associated dynamical systems, both from the local and the global point of view. In particular we aim to study general Loewner equations (both autonomous and non-autonomous) and applications to dynamical systems, in one and several complex variables. In one variable we plan to develop a general version of SLE's for non-slit evolutions and apply to physical and others problems. In several variables we plan to develop the general theory, together with applications."

Web site http://www.mat.uniroma2.it/~fbracci/hevo.html

Subjects Mathematics and Statistics - Physical sciences and engineering

FP7-IDEAS-ERC

PASCAL - Probabilistic And Statistical methods for Cosmological AppLications

From 2011-11-01 **to** 2016-10-31

PI: Domenico Marinucci

Objective

"This is an interdisciplinary project at the interface between Mathematical Statistics, Probability and Cosmological Applications. The principal focus is on the harmonic analysis for isotropic, mean square continuous spherical random fields, with a view to applications to Cosmic Microwave Background radiation data analysis. We will focus in particular on the following issues:
1) the characterizations of isotropy in harmonic space, the analysis of higher order polyspectra and their applications to non-Gaussianity analysis;
2) the constructions of spherical needlets/wavelets and their stochastic properties;
3) the analysis of random sections of spin fiber bundles on the sphere, as motivated by the analysis of CMB polarization and weak gravitational lensing
4) adaptive density estimation for directional data, as motivated by Cosmic Rays data analysis."

Web site http://www.mat.uniroma2.it/~marinucc/Pascal/Home.html

FP7-IDEAS-ERC

DROEMU - Elliptic Pdes and Symmetry of Interfaces and Layers for Odd Nonlinearities

From 2011-12-01 **to** 2016-11-30

PI: Mauro Sbragaglia

Objective

The applications of micro- and nanofluidics are now numerous, including lab-on-chip systems based upon micro-manipulation of discrete droplets, emulsions of interest in food and medical industries (drug delivery), analytical separation techniques of biomolecules, such as proteins and DNA, and facile handling of mass-limited samples. The problems involved contain diverse nano- and microstructures with a variety of lifetimes, touching atomistic scales (contact lines, thin films), mesoscopic collective behaviour (emulsions, glassy, soft-jammed systems) and hydrodynamical spatio-temporal evolutions (droplets and interface dynamics) with complex rheology and strong non-equilibrium properties. The interplay of the dynamics at the different scales involved still remains to be fully understood.
The fundamental research I address in this project aims to set up the unified framework for the characterization and modelling of interfaces in confined geometries by means of an innovative micro- and nanofluidic numerical platform.
The main challenging and ambitious questions I intend to address in my project are: How the stability of micro- and nanodroplets is affected by thermal gradients? Or by boundary corrugation and modulated wettability? Or by complex rheological properties of the dispersed and/or continuous phases? How these effects can be tuned to design new optimal devices for emulsions production? What are the rheological properties of these new soft materials? How confinement in small structures changes the bulk emulsion properties? What is the molecular-hydrodynamical mechanism at the origin of contact line slippage? How to realistically model the fluid-particle interactions on the molecular scale?
The strength of the project lies in an innovative and state-of-the-art numerical approach, based on mesoscopic Lattice Boltzmann Models, coupled to microscopic molecular physics, supported by theoretical modelling, lubrication theory and experimental validation.

Subjects Electronics and Microelectronics - Nanotechnology and Nanosciences - Physical sciences and engineering

FP7-IDEAS-ERC

VISION - Video-oriented UWB-based Intelligent Ubiquitous Sensing

From 2010-04-01 **to** 2015-03-31, closed project

Role: beneficiary

PI & Host Institution: Dajana Cassioli - Universita degli Studi dell'Aquila

Beneficiaries

Consorzio Università Industria - Laboratori Di Radiocomunicazioni - Italy
Università Degli Studi Di Roma Tor Vergata - Italy

Ss. Cyril And Methodius University In Skopje - Former Yugoslav Republic Of Macedonia

Objective

Real-time (RT) sensing with enhanced video capabilities is a powerful tool capturing a significant variety of data, thus providing an excellent substrate to build up an accurate context abstraction. Machine capability of creating a good context abstraction will boost several applications. 3D video allows the recognition of objects shapes, human gestures and facial expressions, improving human-to-machine interaction. Surveillance systems, empowered by automatic recognition of gestures, will suddenly detect a threat. Facial expressions may reveal the status of elderly or disabled people. Remote driving and decision making process of robots for scientific or rescue expeditions will improve. VISION aims to developing an innovative infrastructure providing RT sensing services, with particular emphasis on 3D video, with mobile and context-aware operation. Hence, it will address the numerous challenges raised by the limitations of current technology for wireless sensor networks. VISION will exploit the 60 GHz UWB radios enabling broadband transmissions, miniaturized devices and reduced interference. Due to the inherent high resource consumption of broadband wireless necessary for RT 3D video, VISION sensor network will be optimized at all layers. A comprehensive channel model, based on propagation measurements, will be derived and used to design the UWB signal waveform for reliable broadband transmission. Novel techniques to manage the huge number of nodes required by ubiquitous sensing, and innovative tools to support the development process of intelligent services will be designed. Full cross-layer adaptability to external conditions will assure the system be able to manage the available resources to provide the best achievable quality of service guaranteeing graceful degradation for video, audio and sensing applications. Innovative sensor nodes based on the above concepts will be designed and prototyped for the VISION demonstration.

Subjects: Aerospace Technology - Physical sciences and engineering - Space and satellite research

FP7-IDEAS-ERC

EPSILON - Elliptic Pdes and Symmetry of Interfaces and Layers for Odd Nonlinearities

From 2012-01-01 **to** 2016-12-31

Role: beneficiary

PI & Host Institution: Enrico Valdinoci - Forschungsverbund Berlin Ev

Beneficiaries
Università degli Studi di Roma Tor Vergata Italy
Università degli Studi di Milano Italy

Objective

The scope of this project is to perform an analytical study of the geometric properties of the interafaces arising in the scalar Ginzburg-Landau-Allen-Cahn equation, with particular attention to possible 1D symmetries.
Also, we would like to analyze the cases in which the operator is singular, degenrate, subelliptic or fractional and to obtain results for PDEs in manifold and in inverse overdetermined problems, since all

these models share some important features with classical semilinear PDEs and possess a wide range of potential applications.
To achieve our goals, we would like to build a small, mobile and specialized team of young researchers with outstanding professional skills, specialized in the above subjects, which
has a long history together, new upcoming projects and a network to spread out to.

FP7-IDEAS-ERC

NEWNET - New Approaches to Network Design

From 2012-01-01 **to** 2016-12-31

Role: beneficiary

PI & Host Institution: Fabrizio Grandoni - Scuola Universitaria Professionale della Svizzera Italiana (SUPSI)

Beneficiaries

Università degli Studi di Roma Tor Vergata Italy

Objective

"Networks pervade every aspect of nowadays life. This is one of the reasons why their design, management, and analysis is one of the most active areas of theoretical and empirical research in Computer Science and Operations Research. The main goal of this project is to increase our theoretical understanding of networks, with a special focus on faster exact exponential-time algorithms and more accurate polynomial-time approximation algorithms for NP-hard network design problems. We will consider classic, challenging open problems in the literature, as well as new, exciting problems arising from the applications. These problems will be addressed with the most advanced algorithmic and analytical tools, including our recently developed techniques: iterative randomized rounding, core detouring, and randomized dissection.
A second, ambitious goal of this project is to stimulate the interaction and cross-fertilization between exact and approximation algorithms. This might open new research horizons."

Subjects Information Processing and Information Systems - Physical sciences and engineering

ERC CONSOLIDATOR GRANT

H2020

NPTEV-TQP2020 - Uncovering New Phenomena at the TeV Scale With Top Quarks

From 2015-09-01 to 2020-08-31

PI: Lucio Cerrito

Objective

Our understanding of the subatomic world and of the very fabric of the space-time is encompassed in a theory which is the result of all past experimental observations and theoretical developments: the Standard Model of Particle Physics. Yet cosmological observations and theoretical arguments lead us to conclude that new phenomenology, new particles, forces, or a new space-time structure is waiting to be uncovered. Naturalness of the recently discovered Higgs boson suggests that new phenomena should appear at the tera-electronvolt (TeV) scale, and will be accompanied by modifications to the dynamics of the heaviest elementary particle known: the top quark.
The aim of this proposal is to perform five measurements involving top quarks with the data that will be collected by the ATLAS experiment at the upcoming Run II (2015-18) of the Large Hadron Collider (LHC): the top quark mass, the CP violation in B hadron decays from the top, the top-Z boson couplings, the search for the top's Flavour Changing Neutral decays, and the search for heavy resonances decaying to top pairs. While measuring these properties is nothing new, the measurements are performed coherently using novel techniques beyond state-of-the-art to push the boundaries on the sensitivity of the limited Run II data, hence allowing the discovery of new phenomena at the LHC before 2020.

Web site http://nptev-tqp2020.roma2.infn.it/NPTEV-TQP2020/Home.html

ERC ADVANCED GRANT

H2020

COCEAL - The Common Core of European Administrative Law

From 2016-09-01 **to** 2021-08-31

PI: Giacinto della Cananea

Objective

The European dimension of administrative law is the focus of a flurry of initiatives aiming to investigate similarities and differences, and to shape common legal scenarios. A codification of the administrative procedures of the EU has been envisaged by the European Parliament in its resolution of February 2013. A broader proposal of codification, including rulemaking and contractual procedures, has been elaborated by ReNEUAL and has been discussed in a series of workshops in 2015.
The issues that arise are both practical and theoretical:

- it is important to understand whether the method traditionally followed by the European Court of Justice in order to identify the principles that are general and common to national legal systems, only applies when all those systems recognize such principles;
- whether national systems of public law share the same idea of what an administrative procedure is is another question;
whether the specific principles governing administrative procedures, such as the right to be heard and the duty to give reasons, are the same is still another question;
- finally, if any commonality exists, the question that arises is whether it is limited to the level of general principles of law or it includes the which govern procedures.
The research project is innovative on grounds of method, because:
- it aims at ascertaining whether, and the extent to that, the well-established methodology developed under the 'Common Core of European Private Law' project can be applied to EU administrative law;
- it permits to distinguish between 'operative rules', 'descriptive formants', and 'meta-legal formants';
- it also allows to understand whether the specific nature of the interests recognized and protected by the rules of public law require legal methodologies that are distinct and distant from those of private law.

H2020

QUEST - Quantum Algebraic Structures and Models

From 2015-12-01 **to** 2020-11-30

PI: Roberto Longo

Objective

This project aims to an innovative deep interplay between Operator Algebras and Quantum Field Theory. On one hand we want both to develop powerful tools to construct Quantum Field Theory models and provide a mathematical-conceptual description of interesting Physical contexts, on the other hand we want to set up and study the emerging mathematical structures, that have their own interest.
Our first objective aims to an intrinsic description of phase boundaries (defects) in two dimensions, developing mathematical methods needed to this end. The operator-algebraic description of Boundary Conformal Field Theory by the K.-H. Rehren and the PI is the basis to set up the operator-algebraic, Minkowskian description of phase boundary, relating to the tensor categorical, Euclidean description by J. Fröhlich, J. Fuchs, I. Runkel and C. Schweigert. The theory of Subfactors by V. Jones and the PI's notion of Q-system are to be extended to unstudied settings and new basic operations are to be introduced and analyzed. Existing partial classification results will be broadened to more general, physically interesting situations.
A second objective aims to a non-perturbative construction of QFT models that relies on recent ideas, based on algebraic deformation, by E. Witten and the PI (in a massless context) and by G. Lechner (in a massive context), and further developed by other researchers. We aim at a unifying framework and new constructive methods.
A third objective plans to construct, and analyze, new classes of models of local Conformal Nets of von Neumann Algebras by means of Vertex Operator Algebras; among them the "Shorter Moonshine Net".
A further objective points to understand known effects in Information Theory within the Noncommutative Geometrical viewpoint provided by a QFT index theorem proposed by the PI.

FP7-IDEAS-ERC

NewTURB - New eddy-simulation concepts and methodologies for frontier problems in Turbulence

From 2014-03-01 **to** 2019-02-28

PI: Luca Biferale

Objective

Advances in transportation, energy harvesting, chemical processing, climatology, atmospheric and marine pollution are obstructed by the lack of understanding of turbulence. The turbulent energy transfer toward small-scales is characterized by highly non-Gaussian and out-of-equilibrium fluctuations that cannot be described by mean-field theories or traditional closure approximations. State-of-the-art computers and algorithms do not allow to perform brute-force direct numerical simulations of any realistic turbulent configuration: modelling is mandatory. On the other hand, turbulence models are often strongly limited by our lack of understanding of fundamental mechanisms. As a result, we have a deadlock: turbulence is thought of as 'unsolvable' theoretically and computationally 'intensive'. Indeed, progress by using conventional methods has been slow. Last year, however, something new happened. Two unconventional conceptual and numerical methodologies to study Navier-Stokes equations appeared based on: (i) a surgery of nonlinear interactions with different Energy and Helicity contents, (ii) a fractal-Fourier decimation. These unexplored tools are potential breakthroughs to unravel the basic mechanisms governing the turbulent transfer in isotropic, anisotropic and bounded flows, e.g. the mechanism behind the growth of small-scales vorticity and formation/stability of coherent structures, a challenge that has defeated all numerical and theoretical attempts, up to now. The ultimate goal of NewTURB is to integrate the fresh knowledge achieved by using these novel numerical instruments to push forward the frontiers of turbulence modelling, exploiting the possibility to reduce the number-of-degrees-of-freedom in an innovative way to deliver alternative frontier 'multiscale eddy-simulations' methodologies for both unbounded and bounded flows with smooth walls or with heterogeneous landscapes, e.g. flows over a rough surface.

Subjects Construction Technology - Industrial Manufacture - Materials Technology - Physical sciences and engineering

FP7-IDEAS-ERC

DEPTH - DEsigning new Paths in The differentiation Hyperspace

From 2013-04-01 **to** 2018-03-31

PI: Giovanni Cesareni

Objective

"The adult human organism contains heterogeneous reservoirs of pluripotent stem cells characterized by a diversified differentiation potential. Understanding their biology at a system level would advance our ability to selectively activate and control their differentiation potential. Aside from the basic implications this would represent a substantial progress in regenerative medicine by providing a rational framework for using small molecules to control cell trans-determination and reprogramming.
Here we propose a combined experimental and modelling approach to assemble a predictive model of

mesoderm stem cell differentiation. Different cell states are identified by a vector in the differentiation hyperspace, the coordinates of the vector being the activation levels of a large number of nodes of a logic model linking the cell signalling network to the transcription regulatory network.
The premise of this proposal is that differentiation is equivalent to rewiring the cell regulatory network as a consequence of induced perturbation of the gene expression program. This process can be rationally controlled by perturbing specific nodes of the signalling network that in turn control transcription factor activation. We will develop this novel strategy using the mesoangioblast ex vivo differentiation system. Mesoangioblasts are one of the many different types of mesoderm stem/progenitor cells that exhibit myogenic potential. Ex vivo, they readily differentiate into striated muscle. However, under appropriate conditions they can also differentiate, into smooth muscle and adipocytes, albeit less efficiently. We will start by assembling, training and optimizing different predictive models for the undifferentiated mesoangioblast. Next by a combination of experiments and modelling approaches we will learn how, by perturbing the signalling models with different inhibitors and activators we can rewire the cell networks to induce trans-determination or reprogramming."

Subjects Biotechnology - Life Sciences

FP7-IDEAS-ERC

SIXXI - Twentieth Century Structural Engineering: the Italian contribution

From 2012-03-01 **to** 2017-02-28

PI: Sergio Poretti

Objective

"The research project focuses on the works and protagonists of twentieth century structural engineering in Italy. The general goal of the research is to give a major contribution to the international history of the role of engineering in architecture.
Beyond the confines of its national focus, the proposal aims to bring out the fundamental role played by Italian structural engineering in the history of modern architecture, to date largely ignored. The contributions of major figures such as Pier Luigi Nervi, Riccardo Morandi, but also Silvano Zorzi, Sergio Musmeci, Giulio Krall, Gino Covre and others have been overlooked up to now. The relationship between architecture and engineering have focused largely on developments in other countries: France, Switzerland, England and US. The research project aims to fill the missing and significant Italian contribution in the international panorama.
The project has various objectives:
- Substantially improve knowledge on this issue by focusing research on individual engineers and their works;
- Introduce/strengthen the History of Civil Engineering in University Engineering and Architecture Departments (to date in Italy this subject has been completely overlooked) as a fundamental area concerning the history of construction;
- Train young researchers in this sector and organize a knowledge network available to experts and administrations;
- Promote the exploitation and protection of these works by the authorities.
This ambitious project aims to identify the major contribution of Italian Engineering to the European and international twentieth century architecture; and to contextualize the outstanding Italian engineering success, particularly during the economic boom, in the international panorama. It passionately delves into the research area that Eugenio Battisti defined as “a new frontier of historiography”."

Subjects Social sciences and humanities

FP7-IDEAS-ERC

OACFT - Operator Algebras and Conformal Field Theory

From 2008-12-01 **to** 2013-11-30, closed project

PI: Roberto Longo

Objective

The project has two fundamental aims: A) Open new research horizons exploiting the interplay between Operator Algebras and Conformal Quantum Field Theory. B) Use Operator Algebraic methods for a deeper understanding of the internal structure of Conformal Quantum Field Theory, with a possible feedback for Operator Algebras. A) concerns two points in particular: - Find Noncommutative Geometrical structures associated with certain representations of Conformal Nets of von Neumann algebras and provide index theorems for quantum systems with infinitely many degrees of freedom in this framework. - Set up relations between Vertex Algebras and Local Conformal Nets and so provide new methods and results in each of these two subjects by importing and developing methods of the other subject. B) concerns in particular the analysis of following points, some motivated by A): - Structure and classification of conformal nets of von Neumann algebras on the circle and on two-dimensional spacetimes, and of their representations; in particular conformal supersymmetric models. - KMS and super-KMS functional structure in conformal models. - Boundary Conformal Field Theory, in particular regarding new thermalization effects. - Conformal subnet structure, in particular restrictions on the possible index values for conformal subnets. - Nuclearity and trace class properties for representations and modularity properties.

Subjects Mathematics and Statistics - Physical sciences and engineering

FP7-IDEAS-ERC

MALADY - MACROSCOPIC LAWS AND DYNAMICAL SYSTEMS

From 2010-04-01 **to** 2015-07-31, closed project

PI: Carlangelo Liverani

Objective

Physics provides descriptions of the world at many different scales, yet the relations between such descriptions are poorly understood. In particular, since Boltzmann and Einstein, we interpret the world we see as the product of the microscopic dynamics of a large number of atoms. In spite of this, no satisfactory rigorous derivation of a macroscopic equation (e.g. the heat equation) from such a microscopic physical model exists. This sorry state of affairs is extremely unsatisfactory both from the theoretical point of view and for applications. Indeed, as the technology is entering the mesoscopic scale (nanotechnology), the need for a rigorous understanding of how the phenomenological macroscopic laws emerge and of their

limits of validity becomes paramount. We believe that recent advances in the theory of Dynamical Systems and Probability, to which the members of our team have contributed, allow key progresses in the understanding of the above problem. The ultimate goal of this proposal is the derivation of macroscopic evolution laws from a microscopic Hamiltonian evolution. To this end we will consider a series of intermediate models: a) inspired to an anharmonic chain with some noise (of a fixed strength and not itself responsible for the changes in the local energy); b) inspired to hard spheres interacting via elastic collisions and confined by fixed periodic obstacles (gas of geometrically constrained hard spheres). The above project entails the solution of major problems in the fields of Dynamical Systems and Probability. In addition, it would contribute to substantiate Boltzmann's theoretical picture by providing a conclusive rigorous example of non-equilibrium macroscopic behavior arising from an (interacting) microscopic mechanical model.

Web site https://maladyerc.wordpress.com/

Subjects Mathematics and Statistics - Physical sciences and engineering

FP7-IDEAS-ERC

FAST - Investigating new therapeutic approaches to Friedreich's Ataxia

From 2012-03-01 **to** 2015-02-28, closed project

PI : Roberto Testi

Objective

"Friedreich’s Ataxia (FRDA) is a devastating degenerative disease with no specific therapy. It is passed by autosomal recessive inheritance and affects 1:30,000 individuals in Caucasian populations. Symptoms appear in the first decade of life and include progressive and unremitting lack of movement coordination, leading to complete inability, and dilated cardiomyopathy leading to congestive heart failure, the most common cause of premature death. FRDA is due to the insufficient transcription of the gene coding for the mitochondrial protein frataxin. Reduced cellular levels of frataxin cause impaired mitochondrial function and increased sensitivity to oxidative stress, leading to accelerated cell death in critical tissues. Severity of the disease critically depends on residual frataxin levels. Therapeutic efforts are mostly focused on increasing cellular frataxin . We found that frataxin is normally degraded by the ubiquitin-proteasome system. We identified the lysine responsible for the ubiquitination of frataxin and, by computational screening followed by experimental validation, we identified and validated a series of small molecules, called ubiquitin-competing molecules (UCM), that prevent frataxin ubiquitination and induce frataxin accumulation in cells derived from FRDA patients. Moreover, treatment with UCM partially rescues aconitase and ATP production defects in cells derived from FRDA patients.
Our goal is two fold: 1) submit a set of leads we already identified, as well as their new and more complex derivatives, to preclinical testing in FRDA mice 2) identify the E3 ligase that is responsible for frataxin ubiquitination, and investigate the possibility to use it as a druggable target for small molecules to prevent frataxin degradation."

Subjects Healthcare delivery/services - Life Sciences - Medicine and Health

H2020

SICTRANSIT - THE ARCHAEOLOGY OF REGIME CHANGE: SICILY IN TRANSITION

From 2016-08-01 **to** 2021-07-31

Role: beneficiary

PI & Host Institution: University of York, UK

Beneficiaries

Universita degli Studi di Roma Tor Vergata Italy
Università del Salento Italy

Objective

This project will throw new light on human experience during changes of political regime, selecting medieval Sicily as the primary area of study. Between the 6th century and the 13th century, this island experienced four radical changes in regime: from Byzantine to Aghlabid to Fatimid to Norman to Swabian. Potentially, each of these transitions saw new groups of migrants, new forms of agriculture and settlement, new networks of exchange, new distributions of wealth and new types of social control, and we will discover and describe them. We will then compare the Sicilian experience with that of its neighbours over the same period, and so enhance the history of the countries of the western Mediterranean in their formative years. We also expect to deliver insights on a more general and recurrent phenomenon: the relationship between the driving ideology of an imposed regime, its economic performance and the composition and health of its peoples.
This ambitious programme is made possible by new methods of archaeological investigation and the choice of medieval Sicily as the primary area of study. Here we have been given access to data sets from previously unpublished excavations spread throughout Sicily, and permission to investigate a cluster of different types of site at Castronovo in the centre of the island: a Byzantine stronghold, an Islamic and Norman castle and a long-lived 'agrotown.' To these we propose to add two large scale area surveys to study the dynamics of settlement and the way land was used. The integrated archaeological package to be applied is based on research protocols devised by the PI and deploys bioarchaeological methods newly developed at York, in stable isotopes, ancient DNA and the chemical characterisation of residues encountered in pottery. It is new to southern Europe and features techniques that were unavailable anywhere five years ago.

H2020

PETRYFING - Petrifying Wealth. The Southern European Shift to Masonry as Collective Investment in Identity, c.1050-1300

From 2017-01-01 **to** 2021-12-31

Role: beneficiary

PI & Host Institution: Agencia Estatal Consejo Superior de Investigaciones Cientificas, Spain

Beneficiaries

Università degli Studi di Roma Tor Vergata Italy

Objective

Between the years 1050 and 1300 the European landscape turned to stone. It was a structural transformation that led to the birth of a new, long-lasting panorama and helped in the creation of individual, collective and regional identities: a landscape epitomising the way we see the space and territory of Europe. Petrifying Wealth seeks to rewrite the social history of the central Middle Ages, emphasizing the need to reassess from an untried perspective an element that has always been present in our vision of the period—the sudden ubiquity of masonry construction—but which has hardly been given the opportunity to provide in-depth explanations for complex social dynamics. This project seeks to offer novel explanations to previously unasked questions about wealth, building, and collective identity.
The speed, extent, and systematization of the construction of churches, towers, castle walls, palaces, and houses within castles and cities provide evidence of an underlying, if unaddressed, issue. That is, it is precisely in the twelfth and thirteenth centuries that the structural link can most clearly be seen between both private and collective wealth, and the investment in stone structures built to last. Our study of the shift involving new institutional dynamics, but also unprecedented social practices, as well as ideological concepts radically different from those that had prevailed until then, aims to break down assumptions that have naturalized this truly astonishing process while using as case studies the undervalued regions of southern Europe to explore the larger questions. By inverting the standard approach that sees the heart of the former Carolingian empire (present-day France and Germany) as the wellspring from which other "peripheral" territories drank, we bring new light to probe the greater meaning behind the process of masonry building as an investment in social identity in the central Middle Ages.

ERC PROOF OF CONCEPT – POC

H2020

FAST-DEVELOPS - Developing new therapeutics for Friedreich ataxia

From 2015-11-01 **to** 2017-04-30

PI: Roberto Testi

Objective

Friedreich ataxia (FRDA) is a devastating neurodegenerative orphan disease that affects children and young adults, and has no approved therapy. The disease progressively brings patients to severe disability and significantly reduces life expectancy. The genetic defect underlying the disease causes FRDA patients to produce only low amounts of the mitochondrial protein frataxin, compared to normal subjects. Low frataxin results in the accelerated death of peripheral sensory neurons, causing the disease. Goal of any tentative specific therapy is therefore to increase frataxin levels in FRDA patients. Building on our original discovery that unveiled the mechanism of physiological frataxin degradation, we are developing new chemical entities that manage to increase frataxin in FRDA patients cells by preventing the degradation of frataxin. This effort is currently funded by an ERC Advanced Grant (Friedreich Ataxia Seeks Therapy – FAST, project number 293699).
We now plan to bring some of the most promising compounds emerging from the above mentioned ERC-funded project, to the proof of concept (POC) of efficacy in living sensory neurons derived from FRDA patients. This will be achieved by demonstrating that our compounds are able to increase frataxin in

sensory neurons generated from patient-derived induced pluripotent stem cells. A defined path for the further de-risking and development of compounds that have reached the POC stage, has been discussed together with Cydan Development, the leading orphan drug accelerator, and the VC firm Kurma Partners.

H2020

AB-SWITCH - Evaluation of commercial potential of a low-cost kit based on DNA-nanoswitches for the single-step measurement of diagnostic antibodies

From to

PI: Francesco Ricci

Objective

Web site