

# MONDAY 29 July

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PLENARY LECTURE (ISoP Honorary Member LECTURE) (by ISoP)

*Chair*

**John Dolan**, CNRS-Sorbonne University, Villefranche-sur-Mer, France.

Orator -**Tom Fenchel**

University of Copenhagen, Copenhagen, Denmark

*Size, Shape and Function among Protozoa*

1. **SYMPOSIUM on ciliate biology and taxonomy in memory of Denis Lynn** (by FEPS & ISoP)

*Chairs*

**Pierangelo Luporini**, University of Camerino, Camerino, Italy

**Thomas Weisse**, University of Innsbruck, Innsbruck, Austria

In recent decades, free-living ciliates have probably attracted more attention than any other group of non-parasitic protists. Ciliates were among the first protists to be observed and documented and, doubtless because of their rich and varied morphology, have fascinated generations of protistologists ever since. Ciliates are ubiquitous and can be found in almost every habitat where there is sufficient water for their survival. Consequently they exhibit a high level of biodiversity. They are widely used as model organisms for laboratory studies and have formed the basis for a number of Nobel Prize-awarding investigations. Ciliates are also widely recognized as reliable bioindicators of environmental quality.

Prof Denis Lynn was the world's authority on ciliate taxonomy and evolution, and his passing in 2018 left the protistology community overwhelmed with sadness. This symposium, organized in his memory, is intended to be of particular interest to young researchers who Denis recognized as science's greatest investment.

Invited Speakers

**Alan Warren** - Natural History Museum, London, UK. *The biology and systematics of peritrich ciliates: old concepts and new findings*

**Rebecca Zufall** - University of Houston, Houston, USA. *Amitosis and the Evolution of Asexuality in Tetrahymena Ciliates*

**Sabine Agatha** - University of Salzburg, Salzburg, Austria. *The biology and systematics of oligotrichean ciliates: new findings and old concepts*

**Laura Utz** - School of Sciences, PUCRS, Porto Alegre, Brazil. *Ciliate diversity and ecological interactions in Neotropical environments.*

## 2. SYMPOSIUM **From genomics to flagellar and ciliary structures and cytoskeleton dynamics** (by FEPS)

### *Coordinators and Chairs*

**Cristina Miceli**, University of Camerino, Camerino, Italy

**Helena Soares**, University of Lisbon and Gulbenkian Foundation, Lisbon, Portugal

Cilia and flagella are widespread in cells and highly conserved throughout evolution. They play important roles in motility, sensory perception, and life cycles of eukaryotes in organisms ranging from protists to humans. Despite the ubiquity and importance of these organelles, their numerous components and the relation between structure and function are not well known. During the last 15 years, the advanced technologies in genomics and proteomics have revealed the association between many ciliary components and cilia and flagella diseases. From the beginning of these studies, protists have proven to be wonderful models for exploring ciliary structural and functional knowledge. Protists are also models for understanding cytoskeleton dynamics: the hippo-signaling pathway, studied for the size control of organs in all animals, has been demonstrated to control cell polarity in ciliates and to specify the relative dimension of the anterior and posterior daughter cells during division. Symposium speakers will present the most recent advances toward discovering the molecular mechanism of ciliary and flagellum motility, studied in *Trypanosoma* and *Tetrahymena*, and the molecules that have been shown to be connected to human infertility and other diseases. In addition, the molecular signals regulating cell polarity will be shown with examples on how ciliates can complement research on human cells.

### Invited Speakers

**Jack Sunter** - Oxford Brookes University, Oxford, UK- *Genome wide tagging in trypanosomes uncovers flagellum asymmetries*

**Dorota Wloga** - Nencki Institute of Experimental Biology, Warsaw, Poland - *Deciphering the molecular mechanisms that coordinate ciliary outer doublet complexes – search for “missing links”*

**Helena Soares** - University of Lisbon and Polytechnic Institute of Lisbon, Lisbon, Portugal - *Cell polarity and cytoskeleton dynamics: how ciliates can complement research in human cells*

## 3. SYMPOSIUM **Protist diversity and function in the dark ocean - challenging the paradigms of deep-sea ecology** (by FEPS)

### *Coordinators and Chairs*

**John Dolan**, CNRS-Sorbonne University, Villefranche-sur-Mer, France,

**Hartmut Arndt**, University of Cologne, Cologne, Germany

The dark ocean is the largest environment on this planet, covering 54 % of the Earth's surface. Emerging evidence indicates that the dark ocean plays a major role in ocean biogeochemistry and is an “untapped reservoir” of high genetic and metabolic microbial diversity. This largest marine subsystem comprises about 80% of the oceanic volume and the greatest part of the total biosphere on Earth. Although the local diversity of some deep-sea ecosystems has been documented, very little is known about the diversity of taxonomic groups and their functions at greater spatial scales. In fact, a great proportion (> 99%) of the deep-sea has never been studied, and most of the studies have focused on specialized environments, such as vent, ridge or seep habitats. Very little is known about biological rates and biogeochemical processes in abyssal depths. Due to its large volume, the water column of the dark ocean is the largest reservoir of organic carbon in the biosphere. Hence, it likely plays a major role in the global carbon budget. It is also home for a largely enigmatic food web with spectacular and still largely unknown organisms comprising mainly prokaryotes and protists. Large-scale studies demonstrated a close link between biodiversity and ecosystem functioning and estimated that a biodiversity loss of 20—30 % can result in a 50—80 % reduction of key processes in deep-sea ecosystems and their “consequent collapse”. The food webs in the deep ocean are generally considered to be dependent on the sedimenting particulate organic carbon (POC) flux produced by phytoplankton in the sunlit surface waters, being highly sensitive to variations in food supply. Recent discoveries of functional hot spots have contradicted the idea that the deep-sea environment is food-poor. It seems that organic matter on the deep-sea floor is channeled via different and heretofore mostly unknown trophic levels among protistan nano- and microfauna. There are indications of a special protistan deep-sea fauna consisting of specific communities that differ significantly from the fauna of shallow waters. Methodological studies have indicated that hydrostatic pressure significantly influences activities of protists. The symposium seeks to shed light on the globally important role of protists in the dark ocean by bringing together scientists with interests in deep pelagic to deep benthic protistan communities, and by examining issues ranging from the taxonomy

and diversity of protists (including all protistan size classes) to their physiological properties and their role in deep microbial food webs.

#### Invited Speakers

**John Dolan** - CNRS-Sorbonne University, Villefranche-sur-mer, France. - *Temporal dynamics of mesopelagic protist communities*

**Andrew J. Gooday** - National Oceanography Centre, Southampton, UK (alternate speakers **Jan Pawlowski** - University of Geneva, Geneva, Switzerland / **Michal Kucera** - University of Bremen, Bremen, Germany) - *Deep sea as the realm of foraminiferans.*

**Virginia Edgcomb** - Woods Hole Oceanographic Institute, Woods Hole, USA - *New insights to the activity of protists in the dark ocean.*

**Hartmut Arndt, Alexandra Schoenle and Manon Hohlfeld** - University of Cologne, Cologne, Germany - *Superdiverse nanoprotozoans occupying all niches of deep-sea microbial life.*

## TUESDAY 30 JULY

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PLENARY LECTURE (PAST-PRESIDENT LECTURE, by ISoP)

*Chair*

**Avelina Espinosa**, Roger Williams University, Bristol, USA

Orator - **David Bass**

Natural History Museum London, London & Cefas, Weymouth, Dorset, UK

*Micro-eukaryotes in animal and plant microbiomes: ecologies of disease?*

#### 4. ISOP ADVANCES Ten years of metabarcoding: what have we learned and how do we move forward? (by ISOP & Moore Foundation)

*Coordinators and Chairs*

**Luciana Santoferrara** and **George McManus**,  
University of Connecticut, Storrs, USA.

During the last decade, high-throughput metabarcoding has become nearly routine to analyze protist diversity and distribution in nature. Amid a multitude of exciting findings, scientists have also identified and addressed technical and biological limitations, although problems still exist for inference of meaningful phylogenetic and ecological knowledge based on short DNA sequences. Given the extensive use of this approach, it is urgent to settle our understanding of its strengths and drawbacks and, more importantly, to explore how to move forward methodologically and conceptually. This session will examine the 'state of the art' in protist metabarcoding and new cutting-edge ideas that advance the field. We will address questions such as, how can we make metabarcoding more informative and accurate? Are we ready to transition from method validation and field exploration to testing ecologically-relevant hypotheses? And, how can we integrate metabarcoding with other technologies to gain insights on physiology and functions?

#### Invited Speakers

**Luciana Santoferrara** - University of Connecticut, Storrs, USA. *Strengths and limitations of metabarcoding for assessing aquatic protist communities*

**Fabien Burki** - Uppsala University, Uppsala, Sweden. *A novel metabarcoding method using long-read sequences for improved taxonomic and phylogenetic resolution of protist communities in soil*

**Ramiro Logares** - Institute of Marine Sciences, Barcelona, Spain. *Hypothesis testing and inference of ecological patterns from large marine metabarcoding datasets*

**Sabine Filker** - University of Kaiserslautern, Kaiserslautern, Germany. *Metabarcoding as a basis to study halotolerance using ciliate cultures and laboratory experiments*

## 5. SYMPOSIUM All Roads Lead to Rome: Comparing Molecular and Cellular Paths to Eukaryotic Multicellularity (by ISoP)

*Coordinators and Chairs*

**Michelle Leger** and **Sebastián Najie**,  
CSIC -University Pompeu Fabra, Barcelona, Spain

The aim of the proposed symposium is to bring together scientists working on a range of topics relating to the origins of multicellularity in a variety of unicellular eukaryotic lineages, to promote the exchange of ideas between them and develop a comparative view of the molecular and cellular paths that lead to multicellularity in eukaryotes. It will also foster interchange between members of the ISOP community, and researchers working on protists who nevertheless might not generally think of themselves as protistologists, or attend ISOP meetings. As a result, we hope that ISOP members will be able to forge new contacts, and that researchers who work on the origins of multicellularity will be encouraged to include less well-studied eukaryotes in their research.

### Invited Speakers

**Pauline Schaap** - University of Dundee, Dundee, UK. *Evolution of multicellular development in the Dictyostelia from an Amoebozoan stress response*

**Alexander Tice** - Mississippi State University, Starkville, USA. *Comparing paths to multicellularity in amoeboid protists*

**Thibaut Brunet** - University of California, Berkeley, USA *Choanoflagellates and the origin of animal contractile cells*

**László Nagy** - Hungarian Academy of Sciences, Budapest, Hungary. *Not all follow the same road: fungi took a unique evolutionary path to multicellularity*

## 6. ISOP ADVANCES Applications of Genetic Tools for Advancing Research on Marine Protists (by ISoP and Moore Foundation)

*Coordinators and Chairs*

**Virginia Edgcomb**, Woods Hole Oceanographic Institute, Woods Hole, USA,  
**Julius Lukes**, Czech Academy of Sciences, České Budějovice, Czech Republic

Recent investment by the Moore Foundation has greatly advanced the development of genetic tools for marine protists. While development of tools is ongoing for representativeness of diverse protist lineages, significant advances for particular taxa open the possibility for new investigations of genes of unknown function, evolution, and ecological roles of those (and possibly closely related) taxa. This symposium will present the latest advances for selected taxa and will provide examples of new lines of investigation made possible with these new tools.

### Invited Speakers

**Binnypreet Kaur** - Czech Academy of Sciences, České Budějovice, Czech Republic. *Diplonema papillatum, a representative of the highly diverse and abundant marine microeukaryotes, can be genetically manipulated*

**Ross Waller** - Cambridge University, Cambridge, UK. *Transforming Dinoozoa: steps forward and steps back*”.

**Fatma Gomaa** - Harvard University, Cambridge, USA and Woods Hole Oceanographic Institution, Woods Hole, USA. *Tools for stable integrative transfection of Bodo saltans: A micro-eukaryote with polycistronic peptide coding genes*

**Jackie Collier** - Stony Brook University, NY, USA. *Developing molecular genetic tools for thraustochytrids and other labyrinthulomycetes*

**Cristina Miceli**- University of Camerino, Camerino, Italy. *Genome organization in marine ciliates and gene manipulation in Euplotes*

## Wednesday 31 July

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PLENARY LECTURE (by FEPS)

*Chair*

**Maria Cristina Angelici**, National Institute of Health, Rome, Italy

Orator – **Sergey Skarlato**

Russian Academy of Sciences, St. Petersburg, Russia

*Adaptation Strategies of the Invasive Bloom-Forming Dinoflagellates in Brackish Waters*

### 7. SYMPOSIUM Free-living amoeba and neglected pathogen protozoa: health emergency signals? (by FEPS)

*Coordinators and Chairs*

**Maria Cristina Angelici**, National Institute of Health, Rome, Italy

**Joel Dacks**, University of Alberta, Alberta, Canada.

Although their opportunistic ability and severe pathogenicity expressed in the human brain are well known, free-living amoeba are poorly understood. Human infections by *Naegleria fowleri*, *Acanthamoeba* sp. and *Balamuthia mandrillaris* occur rarely, but prove fatal. *Acanthamoeba* sp. is the agent of an ocular surface infection known as amebic keratitis, which especially affects contact lens wearers and frequently causes vision impairment. Free-living amoebae are widespread in freshwater ecosystems and their presence and community composition is significantly associated with warm water temperature. Their association with thermal water and bacterial film, on which they feed, is well known. They colonize human mucosal epithelium in search of bacteria to prey upon. An important cofactor of such an invasion is the host's immunodepression.

Throughput sequencing, metagenomics and qPCR methods are currently used to explore their occurrence in water and to investigate their genome, also in comparison with non-pathogenic species, to better understand the mechanism by which pathogenicity is activated. Characterization of the genetic variability of the strains and correlation with the degree of virulence has proven to be a very helpful approach for identifying pathogenicity in *Acanthamoeba* species.

The pathogenic potential of other protozoa species is not yet well understood. *Blastocystis hominis* is the most prevalent protist of the human intestine and its presence, biological role and relationship with bacterial microbioma in the gut are not yet understood. In recent years its pathogenicity has been assessed, and is probably due to genomic variants now characterized by sequencing. It has been established that *Blastocystis* is associated with gastrointestinal and systemic disease but can also be an asymptomatic colonizer in human populations. Recent findings have shown bacterial microbiota changes associated with this protist, but it is not known whether the presence of *Blastocystis* is the reason for intestinal inflammation. Thus much remains to be learned about this intestinal parasite as an infective agent, but a suitable clinical approach has not yet been developed.

This is also the case for other enteric protozoa whose epidemiology is not yet understood, with the result that these pathogenic agents, such as *Dientamoeba fragilis*, for example, are clinically neglected. Thus there is need for further investigation of the role eukaryotes play within the human microbiome.

Speakers invited to this Symposium will report on the most recent knowledge gained about these misunderstood pathogen protists to generate interest and discussion about biological and clinical aspects.

#### Invited Speakers

**Joel Dacks** - University of Alberta, Alberta, Canada. *A comparative 'omics approach to pathogenicity factor discovery in the brain-eating amoeba, Naegleria fowleri*

**Julia Walochnik** - University of Vienna, Vienna, Austria. *Acanthamoeba as a pathogen?*

**Patrick Scheid** - Bundeswehr Central Hospital in Koblenz, Koblenz, Germany. *"Free living amoebae as pathogens and as vectors of endocytobionts"*.

**Adriana Calderaro** - University of Parma, Parma, Italy. *Intestinal protozoa searching for a disease or for a doctor?*

### 8. SYMPOSIUM **Host-Parasite Interactions in Vector-borne Protozoan Infections** (by FEPS)

#### *Coordinators and Chairs*

**Luigi Gradoni** and **Marina Gramiccia**

National Institute of Health, Rome, Italy

Arthropods transmit numerous protozoa that can cause major diseases in humans and animals, such as leishmaniasis, malaria and babesiosis, among others. In arthropod hosts, parasites have specific locations in which they develop: flagellate protozoa, such as *Leishmania*, develop exclusively in the digestive tract of phlebotomine sand flies. Apicomplexa protozoa, like *Plasmodium* and *Babesia*, undergo some development within the digestive tract of anopheline mosquitoes and ticks, respectively, before invading the hemocoelic compartment, eventually infecting the salivary glands. During their development within the vector, these protozoa undergo major morphological changes, and they must also change their surface molecules that enable interactions with specific arthropod tissues essential for their survival, development and subsequent infectivity to the vertebrate host. Depending on their life cycle, protozoa must face the invertebrate host's immune response first in the gut and then, if they cross an epithelial barrier, in the hemolymph. In the proposed Symposium, we intend to describe recent advances in the understanding of these host-parasite interactions. Presentations will include a short appraisal of the epidemiological aspects of the infection or disease, the description of molecules associated with the adherence to and detachment from the vector's gut epithelium and subsequent maturation to infectious stages, and will share information about proteases expressed in asexual and sexual stages including their localization in invertebrate and vertebrate hosts. The three invited speakers are international leaders in their respective fields, and will report on recent advances in knowledge about their favorite protozoa.

#### Invited Speakers

**Gad Baneth** - Hebrew University, Rehovot, Israel. *Advances in Babesia-tick associations*

**Paul Bates** - Lancaster University, Lancaster, UK. *Revising Leishmania's life cycle in the phlebotomine vector.*

**Anna Olivieri** - National Institute of Health, Rome, Italy. *Proteases expressed in sexual and asexual stages in Plasmodium*

## 9. SYMPOSIUM **Waterborne infections of protozoan origin: how much do we really know?** (by FEPS)

Surface water is a reservoir of different microbiological, mainly enteric, agents that are transmitted to animals and humans by the fecal-oral route. Among them, several protozoan species are the agents of severe gastroenteritis, chronic damage and high morbidity. They exist all over the world and are difficult to control because of their biological characteristics as (oo)cysts/cysts resistant stage, long survival time in water, very thick walls and small size of their cellular body. Moreover, they are chlorine resistant and able to escape the filtration networks. Water-transmitted infectious diseases are termed Waterborne Diseases and their etiological agents are responsible for outbreaks worldwide. Accidental ingestion of contaminated surface water during swimming activities in lakes, rivers, seas, and pools, as well as drinking not drinkable or not well-treated water, or eating unwashed vegetables, fruits and food, expose humans to such possible infections. These infections are often of a zoonotic nature and the environment is a carrier for them, especially in those countries without treated water and with low levels of hygiene. A single environmental contamination can result in the infection of a large numbers of intermediate hosts, and lead to an outbreak. Moreover, there are no specific biological indicators of the presence of these agents in water because European Directives to ensure the good quality of all water bodies only require testing for fecal bacteria, even though it does not have protozoan characteristics. In these situations, without efficient monitoring indicators and notification systems, protozoan infections seem underestimated and neglected and the environmental transmission risk remains a problem. In this era of globalization and climatic changes, we need a clearer understanding of the health risks posed by these environmental infections found throughout the world.

Invited Speakers to this Symposia are researchers and experts on epidemiology, infection biology and measures for controlling environmental exposition risk.

### *Coordinators and Chairs*

**Maria Cristina Angelici**, National Institute of Health, Rome, Italy

**Panagiotis Karanis**, University of Cologne, Cologne, Germany

### Invited speakers

**Panagiotis Karanis** - University of Cologne, Cologne, Germany. *Waterborne Protozoan Infections: Health Problem Dimension Worldwide*

**Melissa Palos Ladeiro** - University of Reims Champagne-Ardenne, Reims, France. *Mollusc Bivalves as Indicators of contamination of water bodies by protozoan parasites*

**Judit Plutzer** - National Public Health Institute, Budapest, Hungary. *New directions in parasite detection: micro-and macrofluidic platforms*

**Maria Cristina Angelici** - National Institute for Health, Rome, Italy. *Waterbone Protozoan Infections in the Climatic Changes Era.*

# Thursday 01 August

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## PLENARY LECTURE (by FEPS)

### *Chair*

**Giulio Petroni**, University of Pisa, Pisa, Italy

Orator – **Sergey Fokin**

University of Pisa, Pisa, Italy

*Prof. H.-D. Goertz and his contribution to our knowledge of protozoan symbiosis.*

## 10. SYMPOSIUM **Symbiosis in ciliates: H.-D. Görtz and his legacy** (by FEPS)

*Coordinators and Chairs*

**Giulio Petroni**, University of Pisa, Pisa, Italy

**Martina Schrällhammer**, University of Freiburg, Freiburg, Germany

Ciliates are useful models for studying various aspects of biology, among them symbiosis: they can harbour a plethora of organisms covering all domains of life and their interactions range from mutualistic to parasitic. Using ciliate hosts, the symbiont's impact can be studied on the levels of the cell, the organism and the population. Furthermore, ciliate symbioses can display fascinating new phenotypes arising from precisely by the mechanism of interaction such as phototropism of hosts of *Chlorella*-like algae or the killer trait of *Paramecium*.

While research on ciliate symbionts was traditionally based mainly on various microscopic techniques, the advent of molecular biology has expanded the available toolbox. In the last decades, our knowledge regarding the diversity of prokaryotic and eukaryotic symbionts of ciliates has grown exponentially and led to new insights into the evolutionary origins and adaptations of intracellular life. The combination of molecular and microscopic approaches opens new avenues for exploring the interactions between hosts and symbionts. Next generation sequencing techniques facilitate their analysis on genomic and transcriptomic level. It saddens us deeply that Hans-Dieter Görtz, prominent member of the symbiosis community and the driver of collaborative and interdisciplinary research, has recently passed away. Many of us have been influenced by his studies and his way of thinking about science and symbiosis. This symposium intends to bring together symbiosis researchers, friends and colleagues. We want to discuss recent achievements and new challenges in the field of ciliate symbiosis and to remember the legacy of Hans-Dieter's work.

### Invited speakers

**Bettina Sonntag** - University of Innsbruck, Innsbruck, Austria. *Life in cooperation: a win-win situation for single cells and scientists*

**Michele Castelli** - University of Milan, Milan, Italy. *Comparative genomics of endosymbionts of ciliates offers new perspectives on Rickettsiales evolution*

**Alexey Potekhin** - Saint Petersburg State University, Saint Petersburg, Russia. *Occasional passengers or functional consortia? Terra incognita of free-living ciliates microbiomes*

Potential additional speakers (already announced willingness to give a presentation)

**Lisa Siegmund** - University of Jena, Jena, Germany.

**Lydia Bright** - State University of New York, NY, USA.

**Elena Sabaneyeva** - Saint Petersburg State University, St. Petersburg, Russia

**Claudia Vannini** - University of Pisa, Pisa, Italy.

**Maria Rautian** - Saint Petersburg State University, St. Petersburg, Russia.

**Thomas Doak** - University of Indiana, Bloomington, USA. *(to be confirmed)*

**Leandro Gammuto** - University of Pisa, Pisa, Italy.

**Martina Schrällhammer** - University of Freiburg, Freiburg, Germany

## 11. SYMPOSIUM **Mixotrophic Planktonic Protists: Living with the "Perfect Beast"** (by ISoP)

*Coordinators and Chairs*

**Aditee Mitra Swansea** and **Per Juel Hansen**

University of Copenhagen, Copenhagen, Denmark

Most protists labelled as phytoplankton, and at least 50% of those labelled as microzooplankton, are actually mixotrophs. We have now mapped the distribution of mixotrophs across global oceans from the poles to the equator and have found these to be ubiquitous common organisms during each and every season. This presents marine science with a range of challenges, some of which have profound consequences for matters of societal concern (fisheries and allied ecology, including harmful

algal blooms, and water quality regulation), as well as for teaching and training of marine-facing protistologists. Understanding the modes through which protist plankton exhibit mixotrophy, and the competitive advantage that this bestows on the individual species presents science with a range of challenges. Those challenges exist at all sectors of our science and society – physiology, molecular biology, ecology, laboratory, field, survey, modelling, management and policy – all these require some level of reinterpretation in light of this new paradigm. This symposium seeks to bring together experts in different, yet synergistic, aspects of this challenge to help develop a roadmap for protist plankton science.

#### Invited Speakers

**Diane Stoecker** - University-Md-Horn Point Lab, Cambridge, USA. *Mixotrophs – HABs and food webs*

**George McManus** - University of Connecticut, Storrs, USA. *Mixotrophs and challenges for experimental studies*

**Fabrice Not** –CNRS-Sorbonne University, Roscoff, France. *Mixotrophs and challenges for molecular biology/ecology*

**Aditee Mitra** - Swansea University, Swansea, UK. *Mixotrophs and challenges for modelling*

## **12. SYMPOSIUM Bioactive molecules from protists: perspectives in Biotechnology**

(by FEPS)

#### *Coordinators and Chairs*

**Adriana Vallesi** and **Sandra Pucciarelli**

University of Camerino, Camerino, Italy

For hundreds of years, mankind has benefited of the natural metabolic processes of microorganisms (in particular yeasts and bacteria) to obtain basic products such as fermented food and alcoholic beverages. More recently, microorganisms have been exploited for the production of antibiotics, vitamins and enzymes to be used in medicine and chemical industries. Additionally, several modern drugs, including those for cancer therapy, are natural products or their derivatives. Protists are a mine of bioactive molecules which are used to face predators and capture prey, communicate within the same species or among different species, respond to environmental challenges and mediate interactions between symbiotic organisms. Therefore, protists are now emerging as new sources of molecules with potential applications in food, cosmetics, and human health, as well as for their use in bioreactors and biosensors. This symposium focuses on bioactive molecules of protists and associated bacteria and their potential applications in biotechnology.

#### Invited Speakers

**Marco Mangiagalli** - University of Milan, Milan, Italy. *Life under stress: ice binding proteins and superoxide dismutases from an Antarctic ciliate.*

**Angelo Fontana** - (ICB) CNR, Naple, Italy. *Function and biotechnological research of metabolites from marine protists*

**Federico Buonanno** - University of Macerata, Macerata, Italy. *Structural modification of the protozoan toxin climacostol for biotechnological applications.*

# Friday 02 August

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## PLENARY LECTURE (by ISoP)

*Chair*

**David Montagnes** - University of Liverpool, Liverpool, UK

Orator - **Micah Dunthorn** (Hunter Award Winner 2019) (by ISoP)

University of Duisburg-Essen, Essen, Germany

*Equating OTUs with Species Diversity*

## 13. SYMPOSIUM Systematics of amoeboid protists (by FEPS)

*Coordinators and Chairs*

**Anush Kosakyan**, Czech Academy of Sciences, Czeske Budejovice, Czech Republic

**Enrique Lara**, Council for Scientific Research, Madrid, Spain

Amoeboid organisms (“amoebae”) are highly abundant and ubiquitous in all ecosystems on Earth. While early classifications grouped them all together into the phylum “Sarcodina” 1, they later have been split up several times, with members distributed in all the main branches of the tree of eukaryotes. The input of molecular biology into protistology saw the establishment of two largely amoeboid clades, *Rhizaria* and *Amoebozoa*, while many other previously known amoebae were assigned to almost all the eukaryotic supergroups on the basis of phylogeny 2. Contradictions between morphology and genetics challenged old classifications, and thus there is a need for a revision of their systematics based on integrative approaches. Recent progress from phylogenetics, in addition to the placement of molecularly undocumented forms, started to contribute to the emergence of a solid taxonomical framework for amoeboid protists. This is urgently needed, especially in order to interpret data from terrestrial systems, as well as marine and freshwater sediments. In this symposium, we propose to discuss the latest advances in knowledge about the diversity of amoeboid protists, and their implications on systematics.

For the symposium, we chose to include one expert for each major amoeboid group and list some of their recent key studies for support (see bibliography). While systematics are key to all other fields in biology, it is particularly difficult to obtain a permanent positions in systematics. Hence, we have willingly chosen speakers from the young generation of protistologists who still work on temporary contracts. All have confirmed their participation.

### Invited Speakers

**Enrique Lara** - Council for Scientific Research, Madrid, Spain. *Species-level taxonomy in amoeboid protists, a solid ground for ecological research.*

**Anush Kosakyan** - Czech Academy of Sciences, Czeske Budejovice, Czech Republic. *From deep evolution of eukaryotes to testate amoebae: challenges and promises.*

**Kenneth Dumack** - University Cologne, Cologne, Germany. *Shedding light on the taxonomy of elusive rhizarian taxa illuminates rhizarian evolution and ecology.*

**Joaquina García Martín** - Council for Scientific Research, Madrid, Spain. *Disentangling the taxonomy of Physarales (Myxomycetes): an integrated approach using morphology and molecular data*

**Alexander Kundryavtsev** - Russian Academy of Sciences and University of Saint Petersburg, Saint Petersburg, Russia. *Current views on the evolutionary relationships in the naked lobose amoebae: do morphological traits still matter*

Closing remarks  
& Students Awards