MAX-PLANCK-GESELLSCHAFT

FRONTIERS OF SCIENCE SYMPOSIUM

November, 27 and 28th
Maksoud Plaza Hotel – São Paulo – Brazil

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1. Daniel Piechowski: The ´Internet of animals´

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Since ancient times humans realized that animals can detect natural phenomena that are out of reach for human observations. This has often been termed ´The 6th Sense of Animals´. Until recently, research towards this topic has remained anecdotal because wild animals could not be observed continuously. Modern bio–logging technologies now enable the remote observation of wild animals anywhere on earth, any time and for the entire life of individuals. Miniaturized onboard sensors measure environmental parameters such as temperature, air pressure, humidity or physiological parameters like heart rate and body temperature. In this way, wild animals are perhaps the best intelligent sensor network that ever existed. Furthermore, in recent years there was a breakthrough in our understanding of the sensing capabilities of animal collectives. Interacting groups of animals have emergent sensing abilities that cannot be predicted based on observations of individuals.
Via the international collaboration of animal ecologists we can now collect data on life processes on planet Earth. The electronic tags carried by animals allow them to communicate with us where they like to live, but also where they have problems and where they die. We are therefore able to, and have the responsibility, to protect animals as our friends and global watchdogs. Animal based information on zoonotic diseases, global and natural catastrophes will provide large benefit for humanity. I predict that the invaluable information gathered by our wild friends will also change the relationship between animals and humans.
At the same time, ICARUS, our new global IoT CDMA data link, established the ´Internet of Animals´ as a satellite-based two-way communication network.

2. Jose A. Marengo: Climate change in Metropolitan Areas: Experiences in the Metropolitan Area of Sao Paulo and in the city of Santos

National Center for Monitoring and Early Warning of Natural Disaters-CEMADEN, Sao Paulo, Brazil

Extreme rainfall extremes that trigger natural disasters are becoming more frequent and intense in many countries, particularly in large cities where people and assets are concentrated. In the Metropolitan Region of the city of São Paulo (MASP), heavy or extreme precipitation events have important effects on society. Flash floods and landslides, associated with intense, but often brief, rainfall events, may be the most destructive of extreme events, and observations since the mid-1930s in the MASP region have shown significant increases in total and heavy rainfall and decreases in light rain. This was probably due to natural climate variability, but with some signals of the urbanization effect. Model results also suggest an increase in total and heavy that may increase the risk of land-slides and flash flood until the end of the 21st century, particularly in vulnerable areas where population live in exposed areas.
In the city of Santos, in the coast of the state Sao Paulo, one of the larger ports in Latin America and additional risk are sea-level rise (SLR) and changes in intense rainfall from intensifying storms that pose a range of threats to natural and built environments in coastal zones around the city.
Therefore, studies on assessment of the risks due to exposure and sensitivity of metropolitan regions and coastal communities to intense rainfall events and subsequent floods and land slides as well as coastal flooding are essential for informed decision-making. Strategies for public understanding and awareness of the tangible effects of climate change are need in metropolitan regions. These could result in decisions about adaptation planning, which the community, including Sao Paulo and Santos municipal

governments, co-developed in a joint effort with natural and social scientists as well as decision makers at the government levels.

3. Jürgen Kesselmeier: The Amazon Tall Tower Observatory (ATTO): A unique instrument for Biosphere-Atmosphere research

Department Multiphase Chemistry. Max Planck Institute for Chemistry, Mainz, Germany

In the course of the last 10 years a tower with a height of 325 m was erected in the center of the Amazonian rain forest within the German-Brazilian "Amazon Tall Tower Observatory (ATTO)" project. This tower is a unique instrument for research of trace gases, aerosols, atmospheric structure, transport, and cloud formation in this tropical region. The ATTO-Tower is accompanied by two 80m towers for tracking the more local effects. The project is a close collaboration between the Max Planck Society and its two institutes, the Max Planck Institute for Chemistry (MPIC, Mainz) and the Max Planck Institute for Biogeochemistry (MPI-BGC Jena), the Instituto Nacional de Pesquisas da Amazônia (INPA, Manaus) and the „Universidade do Estado do Amazonas (UEA, Manaus). The research will contribute to our understanding of the carbon and water cycle, the exchange of green house and reactive trace gases between the forest and the atmosphere and their influence on atmospheric chemistry and physics with a special interest on aerosol production and cloud condensation. The measurements will be used for satellite data evaluation and help to improve climate modeling. Recent data obtained at this site show the needs for a more detailed knowledge of the composition of biogenically released volatile organics and transport processes in order to understand chemical reactivity leading to aerosol and cloud production. The measurements of greenhouse gases underline the clear decoupling of the trace gas transport at the upper height of 325 m from the surface layer which is in close contact with the forest canopy. The recent results confirm that the location and height of the ATTO-Tower match the needs to allow permanent and precise observations over such a large tropical forest system with global significance.

4. Paulo Artaxo: The complex functioning of the Amazonian ecosystem and recent changes due to anthropogenic and climate pressures

Institute of Physics, University of São Paulo

Amazonia is a live laboratory where the forest biology interacts with the climate in a complex set of processes. Forest biology, atmospheric chemistry and the physics of climate are closed linked. The ecosystem is suffering important anthropogenic pressures, from deforestation to climate change. In the wet season, a large portion of the Amazon region constitutes one of the most pristine continental areas, with very low concentrations of atmospheric trace gases and aerosol particles. However, land use change modifies the biosphere–atmosphere interactions in such a way that key processes that maintain the functioning of Amazonia are substantially altered. Furthermore, the region sustained a strong hydrological cycle that is maintained by large water vapor emissions from the forest as well as cloud condensation nuclei (CCN) produced from forest emissions and one important location of tropical deep convection. However, the vast forest–river system of Amazonia is changing due to expansion and intensification of agriculture, logging, and urban footprints. Indications that the hydrological cycle in Amazonia is being intensified in the last two decades add a key issue in the changes in Amazonia. Recently two strong droughts in 2005 and 2010 have received attention, as potential indicators of increase in climate extremes

in Amazonia that feeds back into the forest carbon processing. Amazonia stores a huge amount of carbon, and if anthropogenic changes and climate moves a fraction of this ecosystem carbon to the atmosphere, it can intensify global warming. Recent findings associated with aerosol and clouds shows that a component of the hydrological cycle is sustained by the production of large amounts of particles in the upper troposphere in Amazonia. In this talk, we will discuss the complex links between the hydrological cycle, carbon, climate and the human influences on key processes in Amazonia.

5. Sami Solanski: The sun, our star: solar research at the MPI for Solar System Research

The Sun is not only the best studied star, allowing us to understand physical processes taking place on all other stars, it is also the main energy source for Earth and its eruptions produce space weather that can also influence our technical systems. In this presentation a brief introduction to the Sun and its activity will be followed by an equally brief overview of the solar research being carried out at the MPI for Solar System Research.

6. Adriana Valio: Solar Radio Astronomy at CRAAM

Center for Radio Astronomy and Astrophysics Mackenzie Mackenzie Presbyterian University

Based on their timescale, emission from the Sun can be divided into three types. On a longer timescale of 11 years, there is the slowly varying solar irradiance that follows the solar activity cycle. A more rapidly varying radiation on timescale of weeks, known as quiescent emission, is related to the lifetime of active regions. Last but not least is the very abrupt emission produced by solar activity such as flares and coronal mass ejections on timescales of a fraction of a second to hours. All three kinds of behaviors can also be observed at radio wavelength, each being produced by different emission mechanisms. Emphasis will be given to the newest findings in solar radio astronomy by the Solar Group at CRAAM. These results were obtained mainly from two radio telescopes: the Submillimeter Solar Telescope (SST) operating at 212 and 405 GHz and the millimetric polarimeters, POlarization Emission of Millimeter Activity at the Sun (POEMAS) at 45 and 90 GHz.

7. Karl Menten: Submillimeter Astronomy – Dust, Gas and Star Formation in the Universe

Max-Planck-Institute for Radioastronomie, Bonn, Germany

Observations of the sky in the submillimeter wavelength range of the electromagnetic spectrum provide information on radiation from gas and dust in the interstellar medium (ISM). Thus they provide crucial information on the star formation process, which takes places in clouds of molecular gas in the densest regions of the ISM. In the submillimeter range, star formation can be studied in our own backyard, at distances of a few hundreds of light years, out to some of he farthest known objects with ages of only a few percent of that of the Universe. Submillimeter astronomy In the southern hemisphere started only in 2005 with the Atacama Pathfinder Experiment Project (APEX), which is operating a 12 m diameter telescope on the 5100 meter high Llano de Chajnantor in the Chilean Atacama desert. A collaboration between the Max-Planck-Society, ESO and the Swedish Onsala Space Observatory (OSO), APEX has

made a series of exciting, unexpected discoveries, Large area surveys of dust and gas emission over the whole southern Galactic plane and deep observations of cosmological Deep Fields have provided unbiased views of star formation in the Milky Way and at high redshift. In comprehensive follow up programs with APEX itself, but also with other observatories and at other wavelengths, the nature of the discovered sources is investigated. APEX has been a pathfinder not only for the Atacama Large submillimeter/Millimeter Array (ALMA), but also for the Herschel Space Observatory and the Stratospheric Observatory for Infrared Astronomy (SOFIA), which extend its coverage to shorter wavelengths not accessible from the ground, into the far-infrared. ALMA is presently revolutionizing submillimeter astronomy with unprecedented sensitivity and angular resolution. Nevertheless, the need for single telescopes allowing large area coverage with the next generation of detector arrays with many thousands of elements is as high as ever.

8. Jacques Lepine: The LLAMA 12m sub-mm radiotelescope in the Andes

LLAMA (Large Latin American Millimetric Array) is a joint Argentinean-Brazilian project of a 12m mm/sub-mm radio telescope similar to the APEX antenna, to be installed at a site at 4830 m altitude near San Antonio de Los Cobres in the Salta Province in Argentine, at 180 km from ALMA. The construction of the antenna by the company Vertex Antennentechnik was financed by FAPESP. The parts of the antenna are now at the site of the observatory; the final mounting will occur during 2019. The scientific cases for single dish and VLBI observations include black holes and accretion disks, the molecular evolution of interstellar clouds, the structure of the Galaxy, the formation of galaxies, and much more. The radio telescope will be equipped with up to six receivers covering bands similar to those of ALMA. At the very beginning of the operation, we will have 2 receivers, at band 5 (162-200 GHz) constructed by NOVA (Groningen, Netherlands) and band 9 (600-720 GHz) constructed by Chalmers University (Sweden). A holography system for the adjustment of the panels, using part of a system belonging to NRAO (USA) is being developped. About 2 years after start of operation, we expect to have additional receivers at band 1, band 2+3 and band 6 (ALMA deignations). The lowest frequency will allow it to be part of a VLBI network that will include the Chinese-Argentine Radio-Telescope (CART) and possibly the Itapetinga radio telescope near São Paulo. With band 6, VLBI observations could be made with ALMA, APEX and ASTE, and Northern radiotelescopes. In this way, LLAMA will be a seed for a Latin-American VLBI network.

9. Hajo Freund: Model Catalyst Design: A Materials Science Perspective at the Atomic Level

Max Planck Institute Fritz-Haber, Berlin, Germany

Understanding catalysis, and in particular heterogeneous catalysis, has been based on the investigation of model systems. The enormous success of metal single crystal model surface chemistry, pioneered by physical chemists, is an outstanding example. Increasing the complexity of the models towards supported nanoparticles, resembling a real disperse metal catalyst, allows one to catch in the model some of the important aspects that cannot be covered by single crystals alone. One of the more important one is the support particle interface. We have developed strategies to prepare such model systems based on single crystalline oxide films, which are used as supports for metal and oxide nanoparticles, whose geometric structure, morphology, electronic structure, as well as interaction and reaction with molecules from the gas phase may be studied at the atomic level. Using a number of examples we show how the knowledge gained may be used to design systems with predetermined properties.

10. Pedro Henrique Cury Camargo: Plasmonic Nanocatalysis: Merging catalytic and optical properties in designer nanoparticles

It has been recently demonstrated that the surface plasmon resonance excitation in metallic nanoparticles can accelerate several chemical reactions.1 This field, name plasmonic nanocatalysis has emerged as a new frontier in nanocatalysis which enables one to marry optical and catalytic properties at the nanoscale as well as using visible or near infrared light as a sustainable input to drive and control molecular transformations.2 In this talk, we will cover our recent developments from our group on the solution phase synthesis of well-defined plasmonic and plasmonic-catalytic nanoparticles. These developments include control over composition, shape, size, morphology, and metal-support interactions, and dispersion over support oxide materials in nanoparticle hybrids. Owing to their controlled features, these systems allow us to gain fundamental understanding on how several the physical, chemical, and optical properties that dictate activity in plasmonic nanocatalysis. Interestingly, examples on control over reaction selectivity, which remains a crucial challenge in plasmonic nanocatalysis, will also be covered.

11. Philip Russell: Photonic Crystal Fibres: The Story & the Science

Max Planck Institute for the Science of Light, Erlangen, Germany

In the mid-19th century, the Swiss scientist Daniel Colladon, followed by the Irishman John Tyndall, demonstrated that light – that ephemeral, ubiquitous and mysterious substance – could be captured in a jet of water and sent round corners. Ever since, scientists and engineers have been fascinated with the challenge of trapping and controlling light. The invention of the laser in the early 1960s inspired Charles Kao (2009 Nobel Prize) to suggest that a thin flexible fibre of glass might be used to trap and transmit light over long distances, thus predicting the modern telecommunications revolution.

Telecommunications fibre consists of a solid glass core 9 µm in diameter (1/10th the thickness of a human hair), surrounded by a glass cladding 125 µm in diameter. The 1990s saw the emergence of a new kind of optical glass fibre: photonic crystal fibre (PCF). With a two dimensional periodic lattice of microscopic features (usually hollow channels) running along its length, PCF is able to confine light tightly within a central hollow or solid core, greatly enhancing light-matter interactions. Solid-core PCFs are routinely used to transform invisible infrared laser pulses into white light 10 million times brighter than an arc lamp – a revolutionary new light source. Ultrashort pulses of light can be temporally compressed down to a single optical cycle in gas-filled hollow core PCF, underpinning a unique family of bright sources of deep and vacuum ultraviolet light. Compact table-top sources of x-rays, based on these new sources, are now a real possibility. Twisted PCF acts like an "optical impeller", forcing guided light into optical vortex with fascinating chiral properties. Small particles can be optically trapped and propelled over 100 m distances in hollow core PCF, and used as moveable point sensors for measuring temperature, vibration and radiation level. These are just a few examples of the myriad PCF-based innovations, many of which are moving into real-world applications.

In the talk I will introduce the field for non-specialists and touch on a number of the most exciting recent applications and developments.

12. Gustavo Wiederhecker: Nonlinear Nanophotonics

The interaction between light and phonons is strongly enhanced in micro and nanoscale optical cavities and waveguides. Such enhanced interaction enabled a range of novel functionalities based on sound-light interaction, such as generating radio-frequency signals, suppressing stimulated light scattering and probing mesoscopic phonon modes. In this talk I will discuss our recent progress in this field that relies on patterning standard dielectric nano waveguides and cavities to enhance or suppress the interaction between light and acoustic waves.

13. Michael Nicklas: Tuning of strongly correlated and topological material by external pressure

Max Planck Institute for Chemical Physics of Solids, Dresden, Germany

New quantum states of condensed matter are a fascinating research area, which is at the basis of modern solid-state physics. Unconventional phases, such as unconventional superconductivity and non-Fermi liquid phases, are typically observed in regions of competing energy scales, *e.g.* in the vicinity of magnetic instabilities. In these regions, only small changes of an appropriate external control parameter, such as pressure, can change the properties of a material fundamentally and lead the emergence of novel unconventional phases.
We use external pressure as a tool to tune deliberately the ground-state properties of strongly correlated materials to investigate the nature of novel unconventional phases without introducing additional disorder as in the case of chemical substitution studies. Even though, pressure allows tuning easily the properties of a material, the study of physical properties becomes more challenging due to the particular restrictions posed by the high-pressure equipment.
Here, I will give an exemplary overview on the results of pressure-tuning strongly correlated materials. Furthermore, I will present some recent results on topological materials.

14. Pascoal José Giglio Pagliuso: Low dimensionality and strong hybridization: key ingredients for finding new intermetallic superconductors

We will routes for finding novel intermetallic superconductors based on the properties of heavy fermions and FeAs-based superconductors. We introduce the flux growth technique as our main synthesis method and described the details of the single ion anisotropy of *f*-electrons in low symmetry systems. Then we discuss the rich doping and pressure phase diagrams of the heavy fermions superconductors $CeMIn_5$ (1-1-5) and Ce_2MIn_8 (2-1-8) (M = Rh, Ir and Co) and the evolution of their physical properties as a function of M and from the 1-1-5 to the 2-1-8 crystal structures. The connection of our results to the analysis of structurally related intermetallics superconductors motivate us to speculate about new routes for finding new superconductors using hybridization and low-dimensionality as the key elements.

15. Luana Pedrosa: Atomistic simulations of metal/water interfaces

Finding a solution to obtain energy in a more efficient and sustainable way is one of the most important technological and scientific challenges nowadays. Promising methodologies, like water-splitting and electrochemical devices, involve the interface between liquid water and a solid crystalline semiconductor or metal. However, from a fundamental point of view it is still a difficult task to fully understand these heterogeneous interfaces both experimentally as from a theoretical perspective. The progress in atomistic simulations, with the development of methodologies and the increase in computational power, have an important role in the advancement of this so called ab initio electrochemistry. This will allow for quantitative predictions, and thus material specific design. In this project we will study in detail the structure and dynamics of aqueous electrolytes at metallic interfaces including nuclear quantum effects and taking into account the effect of the electrode potential, in the presence of an external bias potential applied to the electrodes. In this way, we will have a better and more detailed description of the water/metal interface, allowing to predict the correspondence between the macroscopic voltage and the microscopic interfacial charge (re)distribution in electrochemical fuel cells.

16. Gustavo Rohenkohl: Long range brain conectivity durting active visual behavior

Our behaviour is often driven by visual cues. The transformation of sensory inputs to motor responses requires the effective transmission of the visual information from lower to higher áreas, to motor regions. Therefore, to fully understand brain function, we need to understand how distinct brain áreas communicate, and how their communication is flexibly modulated to enable behaviour. One fo the major current theories of neural communication proposes that effective communication between distinct brain áreas is mechanistically implemented by synchronizing their neural activity. In other words, neuronal groups should communicate more effectively if their optimal time window for input and for output are synchronized by coherent oscillations. This hyphotesis is known as 'communication-through-coherence' (CTC), and has received substantial support from numerous studies over the past decade. In this talk, I will present recent findings in support of CTC, as well as potential challenges that emerge when we try to explain brain communication at the fast timescale required by natural visual behaviour.

17. Nubia Barbosa Eloy: APC as an entry point study small molecule regulation of the cell cycle

The anaphase-promoting complex/cyclosome (APC/C) is a multi-subunit E3 ubiquitin ligase that plays a major role in the progression of the eukaryotic cell cycle. This unusual protein complex targets key cell-cycle regulators, such as mitotic cyclins and securins, for degradation via the 26S proteasome by ubiquitination, triggering the metaphase-to-anaphase transition and exit from mitosis. The identification of the complete set of genes encoding subunits of the APC in Arabidopsis suggests that the basic processes controlled by proteolysis mediated by ubiquitin in plants are similar to those of other organisms. However, results from several groups indicate that the APC has other specific functions in the regulation of plant development. During the last years, several molecular-biology tools have been extensively used in scientific research for identifying new function of proteins and metabolites. Still, the identification of metabolites, specially which control the cell cycle is not trivial and is characterized by piecemeal progress, especially in plants. In this project we aim to use metabolomics to identify and

characterize metabolites that bind to the APC in the model plant Arabidopsis, and to potentially define their roles in plant development.

18. Paul Heggarty: Linguistic and Cultural Evolution: What It Is, and What It Can Tell Us about the Prehistory of Latin America

Max Planck Institute for the Science of Human History, Jena

The MPI for the Science of Human History, as per its name, interweaves the humanities and hard sciences. The Dept of Linguistic and Cultural Evolution exploits the rich data on our past that lie encoded in our languages. They result from chains of cultural replication, generation by generation, over millennia. Indo-European, Austronesian, Arawak, Tupí, Quechua — every great family of languages once expanded and diverged out of a common ancestor. To biologists, the process is perfectly familiar: descent with modification.

This opens up language to powerful 'evolutionary' analysis tools from biology and mathematics. DLCE focuses on phylogenetic models, in a Bayesian inference framework. Once tailored to each other, from language data these models return language 'family trees' (expressed probabilistically). If calibrated in time and space, these trees can trace how, when and where language families and their speakers expanded through prehistory. The trees also give a reference framework onto which to map cultural variables — social complexity, belief systems, etc. — to recover how they too 'evolved' through time and space. All is done in concert with archaeology and ancient DNA, our sister departments.

After illustrations for Indo-European and the Pacific, we explore the potential in South America. Its acute linguistic diversity and great language families can make up for a shallow written history — but they are under-researched and heavily endangered. So we need data, fast. DLCE's suite of big data resources on the world's languages focuses not least on South America. And we need people: a new generation of linguists in South America, to be trained in the latest quantitative and modelling approaches, so rarely applied here yet. Prospects are good — but the time is now.

19. Mariana Filomena Sândalo: New methodologies for linguistic fieldwork on endangered languages in Brazil

The purpose of this talk is twofold: (i) to introduce early career researchers to the latest developments in data collection and linguistic research on native languages, and (ii) to pave the way for new uses of linguistic fieldwork, with mutual benefits for both linguists and the indigenous populations. Specifically, we will present/discuss possibilities of oral corpora elaboration and of conduction of experimental syntax on native languages of Brazil, reflecting the speakers' original intuitions and potentially revealing truly universal building blocks of language and cognition. All these new tools should feed into literacy projects for the local communities, raising their own meta-linguistic and cultural awareness (in a non-intrusive way).

One of our main goals is to train researchers to build up grammars of endangered languages of South America. A better study of the non-mechanical correspondences between European and native languages will also improve the training of language teachers for a better and more balanced bilingual education, with positive consequences for the teaching of/in the official language and the access of native language speakers to higher education. We expect thus the following contribution to social welfare:

a. knowledge spread/distributed to the local communities

b. language/culture preservation
c. The indigenous population will have an increased level of awareness and an active role in the (formal/systematic) study of their own language/culture/identity ('language belongs to people') and its popularization
d. improved bilingual education (also helps the teaching of/in the official language, access to higher education)
And we expect scientific benefits of experimental syntax allied to corpora elaboration on the native languages of Brazil. As a result of our work, we will discuss aspects of the syntax of Pirahã, a highly endangered Amazonian language, and show evidence against Everett (2012) that different grammars reflects how language is influenced by human societies and experiences (Sandalo el al 2018).

20. Cosimo Posth: The early differentiation of Central and South Americans

The early genetic diversification of Central and South Americans remains poorly understood because of a lack of ancient DNA more than a few thousand years old. We report genome-wide data from 48 individuals forming four parallel time transects in Belize, Brazil, the Andes (Peru and Northern Chile), and the Southern Cone (Chile and Argentina), each of which dates back to at least around 8,000 years. We show that the primary ancestral population of Central and South Americans radiated rapidly, followed by genetic continuity in the Central Andes and the Southern Cone in sharp contrast to Brazil and Belize. We find that ancient Central and South Americans are consistent with deriving nearly all of their ancestry from just one of the two early branches that primarily contributed to Native Americans today. Moreover, we document two previously undescribed gene flow events between North and South America e.g. one that provided new ancestry to southern Peruvians and northern Chileans by ~4,200 years ago and one that contributed to ~9,600 year old individuals from Lapa do Santo in Brazil. However, both groups derive from the same ancestral source as the great majority of other Native Americans. These results illustrate how fine-grained sampling of human remains through time and space in Central and South American has the potential to reveal when and where groups ancestral to present day people first began to be established in each region.

21. Diogo Meyer: Making inferences about natural selection using genomic data

Natural selection shapes genetic variation within human populations, as well as the differences between them. Although we can rarely witness genetic change driven by selection in the timescale of our lives, we can make inferences about its past action by examining genomic data from various human populations. I will present examples of how the analysis of genomewide datasets can allow us to identify genes that have experienced selection in our evolutionary history. I will also show that admixed populations offer some particularly interesting insights into the role of selection on a very recent timescale, drawing on examples from Brazilian populations. Finally, I will show how the study of selection can provide surprising insights, such as the notion that at the same time that advantageous alleles are driven to higher frequencies by natural selection, deleterious variants can also become more prevalent, as an incidental byproduct. The study of selection is an active are of research in human population genetics, showing rapid progress and contributing to the understanding of the history of our species.

22. Axel Boersch-Supan: The economics of individual and population aging: Lessons from international comparisons

Institute for Social Law and Social Policy of the Max Planck Institute

Population aging is one of the big challenges of the 21st century. More older individuals have to be financed and taken care of by fewer younger people. The expected demographic change is called an "age bulge", pension systems are "at the verge of collapse", economic growth of "Old Europe" will "come to a halt for decades" and society is expected to end up in a "war between generations". Much of this negative attitude is generated by a set of myths about individual and population aging that are not backed and often squarely contradicted by evidence. Demystifying aging by juxtaposing the myths with sober scientific evidence on the challenges and chances of aging is, as we claim, therefore one of the most important tasks of the economics of aging. This task is important since population aging requires adaptation through economic policy reforms which are frequently obstructed by such myths.

My contribution aims to show how important the communication of scientific evidence from the economics of aging is in order to demystify popular fallacies; to review where we stand in the more subtle mechanisms behind these fallacies and where more data and research is needed to fully understand the economics of aging; and to emphasize the link between theory, evidence, and political economy in the economics of aging. Demystifying aging is doable since there is a growing body of data at the macro and micro level, some specific to certain countries, but many also internationally comparable. The international dimension is especially valuable since learning about aging requires variation in aging, e.g. between "old" Europe and "young" Brazil.

23. Antonio Carlos Coelho Campino: Economics of Aging

In the last years the study of the generational economy has been developed, characterized by the study of the social institutions and the economic mechanisms used by each generation or age group to produce, consume, distribute and save resources. It also studies the explicit and implicit contracts that govern intergenerational flows.

In this sense, children receive transfers from both the State and the family. The economically active population will have higher income than their consumption and the elderly will depend on public transfers, family support and personal assets that they have accumulated during their professional lives.

In this presentation we will see what is known about the subject in Latin America and Brazil, exploring ECLAC studies, studies from professors Lee and Mason to Latin American countries and to Brazil and studies carried out by IBGE.

We will detail how the elderly have sought to protect and increase their income. In addition to retirement, the elderly have, in some cases, adopted additional work. In many cases the elderly have also benefited from the support of relatives. Few elders have sought to invest in improving their human capital by investing in their training and education. In the case of São Paulo, these strategies were well documented in the SABE survey - Health, Welfare and Aging, and we will use the results of theses and dissertations made using the results of this research.

In light of what is already known I will present new research topics that should be developed.

The final part will consist of proposing possible public policies.

24. Adam Antebi: Small nucleoli are a cellular hallmark of longevity

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Research in model organisms over the last several decades has revealed that animal lifespan is plastic and regulated by conserved metabolic signaling pathways, which work through specific transcription factors to extend life. Whether these pathways affect common downstream mechanisms remains largely elusive. Our studies demonstrate that NCL-1/TRIM2/Brat tumor suppressor extends lifespan and limits nucleolar size in the major C. elegans longevity pathways, as part of a convergent mechanism focused on the nucleolus. Animals representing distinct longevity pathways exhibit small nucleoli, and decreased expression of rRNA, ribosomal proteins, and the nucleolar protein fibrillarin, dependent on NCL-1. Fibrillarin is not only a marker but itself is a causal factor whose knockdown reduces nucleolar size and extends lifespan. Long-lived dietary restricted fruit flies and insulin-like-peptide mutants also exhibit reduced nucleoli and fibrillarin expression. Similarly, tissues derived from long-lived dietary restricted and reduced insulin/IGF signaling IRS1 knockout mice, and humans who undergo modest dietary restriction coupled with exercise display reduced nucleoli. We suggest that small nucleoli are a cellular hallmark of longevity and metabolic health conserved across taxa.

25. Marcelo Alves da Silva Mori: DecAI: Decoding Aging Initiative

Aging is a worldwide public health concern. Here I will present how my laboratory is tackling this issue using an international, cooperative platform to study the basic biology of aging, deciphering new evolutionary conserved pathways that control lifespan and studying ways to treat the general causes of age-related diseases. More specifically, I will present data on how small RNAs control metabolic function and susceptibility to age-related complications in C. elegans, mice and humans.

26. Heloisa Sobreiro Selistre de Araujo: The extracellular matrix in ageing, exercise and in the tumor microenvironment

The extracellular matrix (ECM) is the structural scaffold for body tissues, formed by a complex network of macromolecules such as collagens, glycosaminoglycans and proteoglycans. The ECM supports tissue volume, size and strength, and it is the basis for cell growth, division, and migration. However, ECM function is beyond structural and mechanical support. The ECM actively modulates cell behavior, polarity, differentiation, proliferation and survival, providing signals for activation of signaling pathways that determine cell fate. Many studies have demonstrated the key role of ECM and its interaction with the cells in a number of physiological and pathological processes. Drug design targeting the cell interaction with the ECM represents a new area in the frontier of knowledge. This project aimed to contribute for the knowledge of the ECM roles in the context of aging, in exercise as a form of prevention the deleterious effects of aging, and in cancer, due to the evident importance of these two areas (exercise and cancer) for human longevity. We used *in vitro* (cell culture), *in vivo* (in humans and in animal models) and *ex vivo* (human and animal tissues) models followed by functional analysis, imaging, protein and gene expression, among other techniques. Our experimental models include comparing young (3 mo.) and old rats (24 mo.), or estrogen removal in the function of heart, skeletal muscle, adipose tissue and tendon during resistance training. Dr. Mattiello's group studies comprise the influence of different modalities of exercise in humans of different age groups with knee osteoarthritis and metabolic osteoarthritis, which are

associated to body composition, loss of muscle mass and increased concentration of adipose tissue. These ageing-related chronic diseases can be modified by exercise, improving the quality of life of the patients as well as the progression of the disease. The subjects are evaluated by computerized tomography, muscular ultrasonography, and blood and urine biomarkers, at both pre and post-intervention. Dr. Cominetti's group studies the effects of natural or synthetic products on the inhibition of tumorigenesis and metastasis using syngeneic ortothopic mice models. In addition, the group also focuses on the biomarkers for ageing-related neurodegenerative diseases, such as Alzheimer's disease. The projects resulted in innovation products such as the deposition of two patents entitled: "*Device for detecting the ADAM10 biomarker for the diagnosis of Alzheimer's disease* (INPI #BR1020160181500)" and "*A pharmaceutical composition comprising [10]-gingerol and its use as antitumor and antimetastatic molecule* (INPI # BR 1020150240937)". Additional results will be presented and discussed.
Support: FAPESP 2013/00798-2.

27. Eduardo Arzt: Mechanisms involved in the expansion and control of neuroendocrine tumors

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Several novel pathways and mechanisms have been described recently to be involved in the control and onset of abundant neuroendocrine tumors.
Cellular senescence is a state of permanent and stable proliferative arrest in G1 phase of the cell cycle through activation of the p53/p21 and pRb/p16 signalling pathways. Oncogene-induced senescence (OIS) is a highly proliferative state, which mimics transformation, but this mitotic burst is gradually replaced by senescence. Several lines of evidence have implicated OIS as a vital cause of arrest of benign neoplasms. Pituitary tumors are mostly benign, non-metastatic and monoclonal neoplasms. IL-6 plays a key role in OIS induction indicating that IL-6 is a pleiotropic cytokine that can function as an autocrine or paracrine tumorigenic factor. IL-6 maintains pituitary tumoral senescence by its autocrine action, providing a natural model of IL-6 mediated adenoma OIS, which explains the benign nature of these abundant adenomas.
RSUME, the product of the RWDD3 gene, is induced by hypoxia and its expression is increased in pituitary tumors, in the necrotic inner zone of gliomas and in VHL tumors. RSUME enhances SUMO conjugation by interacting with the SUMO conjugase Ubc9. RSUME increases I□B levels and stabilizes HIF-1□ during hypoxia, leading to inhibition of NF-□B transcriptional activity, and increased HIF-1 activity and VEGF expression. RSUME inhibits the oncogene pVHL function, thus suppressing HIF-1 and 2□ ubiquitination and degradation. By this mechanism, it promotes the establishment and development of VHL- tumors.
The securin/cell cycle regulator Pituitary Tumor Transforming Gene 1 (PTTG) has an increased expression in a wide variety of human solid tumors. Its degradation by the ubiquitin proteasome system has been shown to be required for chromatid separation. Overexpression of human securin leads to transformation and tumor induction. No mutations, epigenetic modifications or other mechanisms that deregulate and explain its overexpression and action as an oncogene had been found so far. In the cycle phase M, sumoylation of PTTG prevents its degradation. Increased stability of PTTG caused by RSUME diminishes its degradation by the ubiquitin proteasome system and increases PTTG steady state levels providing a novel mechanism for PTTG oncogenic action.

28. Jörg Kobarg: The family of human cell cycle regulating Nek kinases: studying their signaling to find new anti-cancer inhibitors

UNICAMP , Faculdade de Farmácia e Instituto de Biologia (Dep. Bioquímica e Biol. Tecidual)

Members of the family of NEK kinases (NIMA related kinases) were identified as important regulators of cell cycle checkpoints, especially at the G2 to M phase transition. The family contains 11 members and is one of the least studied kinase families. Recent studies showed that they participate in mitosis, centrosome disjunction, primary cilia function, and in the signaling of the DNA damage response. These characteristics along with the fact that several NEKs were found to be over-expressed in cancer, or were shown to present elevated mutation rates, suggest that they are interesting candidates both in the diagnostic as well as in the therapy of cancer. In our work we currently focus on Nek1, 4, 5, 6 and 10. Representative results will be shown for Nek1, which we found to be over-expressed in thyroid cancer. We were able to show an involvement in the DNA damage respond and are currently developing new specific inhibitors based on the structure of the kinase domain. For other Nek family members we performed extensive protein interactomics studies and based on our results we were able to assign to a specific Nek a classical functional context previously known only for other Nek members. For example we were able to show an involvement of Nek5 in the DNA damage response, like previously found for Nek1. Furthermore, we could discover interesting novel functional contexts, such as a larger than expected involvement of Nek4, 5 and 10 in mitochondrial metabolism and turnover. Acknowledgements: I am greateful to the constant financial support by Fapesp (thematic project 17/03489-1) and CNPq.

29. Miriam Galvonas Jasiulionis: Murine models to explore melanoma progression and tumor microenvironment

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Cutaneous melanomas are extremely aggressive tumors, and although significant advances have been obtained with targeted and immune therapies, acquired resistance is still a common problem. Several molecular alterations have been described in melanomas; however, there is no integrated view about the alterations involved in different stages of melanoma genesis. In this context, the identification of molecular pathways altered during melanoma progression might contribute not only to a better understanding of melanoma biology but also to the discovery of both novel potential targets to therapy and biomarkers for prognosis and response to therapies. Our group has established and explored a murine model of malignant transformation and tumor progression consisting of: a spontaneously immortalized melanocyte lineage called melan-a; pre-malignant melanocytes named 4C, obtained after subjecting melan-a cells to 4 cycles of adhesion impediment; a non-metastatic melanoma cell line, 4C11-, obtained after a limiting dilution of spheroids formed by 4C adhesion impediment; and a metastatic cell line, 4C11+, obtained after spontaneously loss of p53 by 4C11- cells. This *in vitro* sequential model has been explored to obtain a comprehensive view of molecular alterations related to both early and late stages of melanoma genesis. In this regard, transcriptome (NanoString, and RNA-Seq), methylome (ERRBS), and miRnome (Taqman miRNAs arrays and NanoString) profiles were analyzed in each cell line in order to reveal molecular pathways dynamically altered during melanoma progression. By analyzing data of human melanoma samples obtained from TCGA, we found that the expression and the promoter methylation of a set of these genes in human melanoma samples correlate to melanoma patient survival, thus being promising prognostic factors for melanoma. Besides the intrinsic aspects of a tumor cell, the

context in which it relies is fundamental to define its fate. Our laboratory had established another murine model to evaluate the role of an acute inflammatory microenvironment on the destiny of a small number of tumor cells *in vivo*. The presence of a massive number of apoptotic cells in the microenvironment is associated with an intense inflammatory infiltrate, and determines the fast growth of a sub-tumorigenic dose of melanoma cells. This effect might be clinically relevant since radio- and chemotherapy induce cells to die by apoptosis, suggesting that if the treatment is not completely efficient a fast tumor relapse may occur. Studies aiming to identify the microenvironment players involved in this effect are also under investigation in our lab.
Supported by FAPESP and CNPq.

30. Christian Griesinger: NMR spectroscopy: natural compound configuration, droplets in immunology and neuroprotection

Max-Planck Institute for Biophysical Chemistry

Natural compound structure including relative and absolute configuration determination will be presented on some recent examples. With 1H RCSAs in deuterated alignment media it is possible to determine the configuration of 10 to 30 □g of isolated natural compounds.
Liquid liquid phase separation has been shown in several biological systems. NMR spectroscopy is well suited to characterize these largely intrinsically disordered phases. This will be demonstrated on the tripartite phase separated system of vesicles, SLP65 and CIN85 which are important for B-cell immunity.
Finally, we are additionally interested in a class of intrinsically disordered proteins that are important in neuro- and cellular degeneration, which form oligomers and fibrils. Interference with these aggregates specifically on the oligomer level proves to be a valid concept for treatment of devastating diseases such as Parkinson's, Alzheimer's, Creutzfeldt Jacob disease and Type II diabetes mellitus.

31. Roberto Kopke Salinas: Structural biology of the Xanthomonas citri Type IV Secretion System using solution NMR spectroscopy

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Bacteria use a variety of secretion systems to translocate macromolecules across the bacterial cell envelope. A total of five different secretion systems that span the outer and the inner membrane of bacteria have been characterized. They secrete substrates such as proteins or DNA, and in some cases inject them into a host cell. Therefore, secretion systems may be involved in various processes such as uptake or release of DNA, translocation of effector molecules, adaptation, among others. The Type IV Secretion System (T4SS) of the phytopathogen *Xanthomonas citri* translocates toxins that kill other gram-negative bacteria. The T4SS consists of the core complex that is embedded in the outer membrane, and the inner membrane complex. The core complex is a tetradecameric ring structure, formed by VirB7 and the C-terminal domains of VirB9 and VirB10. Even though the core complex makes a pore in the outer membrane, VirB7 and VirB9 are located in the periplasm. We previously solved the NMR structure of VirB7, and of the VirB7-VirB9 complex using solution NMR spectroscopy (Souza et al. 2011; Oliveira et al. 2016). We also used NMR to study a fragment corresponding to the N-terminal tail of VirB10 (Sgro et al., 2018). Despite being intrinsically disordered in solution, the VirB10 N-terminal fragment recognizes the N-terminal domain of VirB9. Interestingly, the N-terminal domain of VirB7 ($VirB7^{NT}$) and the C-terminal domain of VirB9 ($VirB9^{CT}$) display great flexibility in their free states, hence, they behave as intrinsically

disordered regions. Despite being very dynamic, VirB7^{NT} and VirB9^{CT} interact with each other forming a tight and rigid complex that is essential to the assembly and functioning of the *Xanthomonas* T4SS. We investigated interaction between VirB9^{CT} and VirB7^{NT} using chemical exchange saturation transfer techniques (CEST). These experiments revealed new ^{15}N and ^{13}CO chemical shift information about VirB9^{CT} in the unbound conformation, which could not be obtained in other way due to the intrinsic dynamics of the VirB9^{CT} domain. We designed more stable VirB9^{CT} mutants. Even though the stabilized VirB9^{CT} variants loose their ability to interact with VirB7^{NT}, they improved out understanding of the recognition mechanism between VirB7 and VirB9. Overall, these studies offered us a deeper view on the *Xanthomonas citri* T4SS.

32. Raghuvir Krishnaswamy Arni: Corynebacterium pseudotuberculosis: Oligomerization of the Arginine repressor and promiscuity in co-repressor binding.

Biosciences, Languages, and Exact Sciences Institute of the São Paulo State University

STRUCTURAL BIOLOGY § NMR spectroscopy: natural compoun configuration, droplets in immunology and neuroprotection – Christian Griesinger, Max Planck Institute for Biophysical Chemistry § Structural biology of the Xanthomonas citri typw IV secretion system using solution NMR spectroscopy Roberto Kopke Salinas, Institute of Chemistry of the University of São Paulo (IQ/USP) § Corynebacterium pseudotuberculosis:
oligomerization og the arginine repressor promiscuity in co-repressor bindinge

33. Paul Schulze-Lefert: Plant microbiota assembly and functions in plant growth

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We have previously shown that healthy roots of Arabidopsis thaliana, grown in natural soils, are colonized by a bacterial consortium with well-defined taxonomic structure. Members of this root microbiota belong mainly to the phyla Actinobacteria, Bacteroidetes, Firmicutes, and dominant Proteobacteria. A comparison of the bacterial root microbiota of A. thaliana with A. thaliana relatives, grown under controlled environmental conditions or collected from natural habitats, demonstrated a largely conserved microbiota structure with quantitative, rather than qualitative, species-specific footprints. We have isolated more than 8,000 A. thaliana root- and leaf-associated microbiota members as pure bacterial cultures, representing the majority of A. thaliana microbiota taxa that are detectable by culture-independent community profiling methods, and generated whole-genome sequence drafts for a core collection of 400 isolates. I will discuss how we utilize these biological and genome resources to explore the evolution and functions of one taxonomic core lineage of the root microbiota. Rhizobia are a paraphyletic group of soil-borne bacteria defined by their ability to induce nodule organogenesis in legume roots and fix atmospheric nitrogen for plant growth. In non-leguminous plants, species within the Rhizobiales order define a core lineage of the plant microbiota, suggesting alternative forms of interactions with plant hosts. We compared more than 1,300 whole-genome sequences of Rhizobiales isolates, including microbiota members from non-legumes, and show that the set of genes required for nodulation and nitrogen fixation in legume symbiosis was acquired multiple independent times within

each Rhizobiales sublineage. The majority of root-associated rhizobia colonize and promote root growth in the crucifer Arabidopsis without nitrogen fixation, indicating these are rhizobial traits of an ancestral root association. Thus, the capacity for nodulation and nitrogen fixation in legumes was likely acquired from a predisposed root association in multiple subsequent events, constituting an example of convergent evolution.

34. Fabio Marcio Squina: From renewables to value-added products using discovery-based omics of natural lignocellulolytic systems

Universidade de Sorocaba

Plant feedstocks are at the leading front of the biomass-to-bioproducts industries. These activities have the potential to promote economic, social and environmental development worldwide, through sustainable scenarios related to energy production and petroleum-based materials replacement. Enzymes are the key to unlock stored energy in plant biomass, providing adequate means to convert recalcitrant and insoluble feedstocks into simple compounds and further into high products. Our group has combined genomics, transcriptomics, proteomics and high-throughput screening approaches from diverse sources, such as fungi, termites, hyperthermophilic bacteria, microbial communities, and soil metagenome, to reveal novel biocatalysts and pathways involved in degradation or modification of lignocellulosic components. We have conducted studies to correlate the mechanism of action of enzymes with the structure, to understand the molecular features of biomass and enzyme interactions better. Furthermore, we have assigned enzymes to specific biotechnological applications and produced high-value chemicals from lignocellulose, such as natural probiotics, phenolic compounds, and antioxidant molecules.

35. Lothar Willmitzer: System-wide monitoring of protein-metabolite interactions

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Small molecules represent cellular building blocks and metabolic intermediates, but also regulatory ligands and signaling molecules that interact with proteins. Although these interactions affect cellular metabolism, growth, and development, they have been largely understudied to date. Starting from the assumption that small molecules in most cases will exert their function by binding to proteins, we developed a general and system-wide approach to identify small molecules candidates exerting a regulatory function. Central to this is the fact that small molecules bound to e.g. proteins will behave very different from free small molecules when applying any size based separation technique. To this end a cell-free supernatant (native lysate) is subjected to size-exclusion chromatography followed by quantitative metabolomic and proteomic analysis. Applying this approach to a cell-free extract from Arabidopsis thaliana cell cultures, (i) enabled us to compile a list of candidate protein partners for nearly 140 Arabidopsis metabolites (ii) allowed us to retrieve known protein–metabolite interactions (PMIs), validating our strategy and (iii) led us to the identification of previously unknown small molecules and their potential role. Thus this approach allows the unbiased system-wide monitoring of protein-metabolite interactions in an unprecedented manner.

36. Dirceu de Mattos Junior: Environmental physiology in a challenge grove

Dirceu de Mattos Junior, Agronomic Institute of Campinas (IAC)

Increases in productivity and food quality associated with economic-social growth and environmental security are challenges of the modern agriculture. In this context, nitrogen (N) use efficiency by crops and protection of plants under environmental stresses must be better studied. Citriculture, contributes to the production of fruits in various regions of the world, where population consumes either fresh fruit or juice. The yields of citrus orchards are largely regulated by the supply of N, whose additions vary between 180 and 220 kg ha^{-1} $year^{-1}$, and fertilization efficiency with N is below 50%. Comparing sweet orange and lemon trees, we verified a greater photosynthetic efficiency of the plant, obtained by unit of N, for the lemon tree. However, the origin of this efficient N use is not fully characterized. Moreover, climatic variations, a more recent issue on citrus production, with increases in air temperature up to 4 °C in spring and/or summer, coinciding with flowering and fruit set, have caused losses of citrus probably due to oxidative stress on leaves and damage to photosynthesis. Leaves close to flowers and fruits play an important role in the signaling of abscission zones. In this overall context, the evaluation of biochemical and physiological characteristics of citrus, correlated with intercellular diffusion and CO_2 carboxylation, carbohydrate balance, biomass allocation and generation of reactive oxygen species in the orchards will support the establishment of better citrus management strategies in new production environments.