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Biodiversity Dynamics and Conservation

Have the spawning habitat preferences of sardine (Sardina pilchardus) in the southern area off the Moroccan Atlantic coast (21-26∘N) changed in recent years?

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Sardine (*Sardina pilchardus*, Walbaum 1792) is one of the most exploited pelagic species along the northwest African coast. The main spawning occurs during the cold season (autumn–winter). Samples of sardine eggs were collected along the southern area of the Moroccan Atlantic coast (26–21∘N) through 13 surveys carried out during autumn–winter periods from 1994 to 2015. The present work focuses to investigate the inter-annual variability of the spawning habitat through spatial-temporal variability of sardine eggs distribution and densities using data collected over the period 1994-2015. Sardine egg production and centroid position were variable from year to year. A global quotient analysis on sardine egg densities in relation to sea surface temperature (SST) derived from *in situ* measurements showed that the spawning thermal window has been shifted to higher temperatures in the period of 2000's compared to the 1994-1999 period where the thermal spawning window of sardine was 16-18.5∘C. Generalized additive model (GAM) were used to detect the relationships between the sardine distribution (egg density and presence/absence data) and the relevant environmental variables. Three environmental variables (salinity, temperature and zooplankton biomass) were taken into account. Generalized additive models depicted significant relationships between the environment and eggs sardine density but not with eggs presence. Given that the study area is characterized by high mesoscale features and significant upwelling activities, the variability of upwelling processes could explain the changes of spawning ground position and thermal window.

Keywords: Sardine, Spawning habitat, Environment, Time series, Sea surface temperature.

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Genetic pattern of the population of Cyanoderma erythropterum and Mixornis gularis in the fragmented Singapore landscape

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Habitat modification and fragmentation associated with human population increase and development are thought to be one of the main reasons explaining the recent high increase of species extinctions. Fragmentation and habitat modification divide original populations into small subpopulations. Depending on the distance separating patches and the species tolerance level to the matrix between patches (such as open areas), those subpopulations can be completely isolated from one another. Due to its extensive loss of natural habitat and biodiversity, Singapore is a particularly interesting study case, thought to be representative of the future global situation expected especially for Southeast Asia, which shows the highest deforestation rate observed among tropical regions. Since the 19th century, Singapore's landscape has been extensively modified due to intensive deforestation and urbanization. Today primary forest and secondary forest represent only 0.2% and 4% of total area, respectively. Understorey species, such as babblers, being more sensitive to and more rapidly affected by habitat modifications, are an ideal model to study the effects of those modifications. Using genome-wide sequence data, we studied how fragmentation affects gene flow and connectivity among sub-populations to determine species dispersal capabilities and ecological characteristics that may influence susceptibility to extinction. We here present the genetic pattern of the population of two babbler species with different ecological requirement in the fragmented Singapore landscape. *Cyanoderma erythropterum* forest specific restricted to one reserve and *Mixornis gularis* highly edge-tolerant wide spread across Singapore.

Keywords: gene flow, connectivity, fragmentation

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Growth and reproductive biology of anchovy, Engraulis encrasicolus (Linnaeus, 1758) in the region of Essaouira

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Among the fisheries potential in Morocco, pelagic fish resources are the most abundant available biomass. Fishing focuses on anchovies, sardines, mackerel and sardinella. The aim of the present study was to study the reproduction, age and growth of the species of anchovy*, Engraulis encrasicolus* (Linnaeus, 1758), necessary for the evaluation of its stock and understanding of its dynamics population.
The age, growth and reproduction of anchovy, *Engraulis encrasicolus* (Linnaeus, 1758) were determined from samples (N = 626) collected in the region of Essaouira during the year 2014. The fork has varied between 10 and 17.5 cm and the Von Bertalanffy growth function, fitted to age-length data showed for males and females respectively results L∞ : 17.52; 17.53 cm and K: 0.66; 0.69 (yr-1). According to the size-weight relationship, the anchovy of the region of Essaouira has a growth isometry, the allometric coefficient b being equal to 3. The average sizes of the first sexual maturity corresponding to the point (L50) are 10.84 and 10.70 cm respectively for males and females.
The maximum age of anchovy in this region does not exceed 2 years. The sex ratio is in favor of females (46% males and 54% females).The average gonado-somatic ratio (RGS) of males and females increases in parallel. Anchovy can reproduce throughout our study period with a main spawn between June and August.

Keywords: Engraulis encrasicolus, sex ratio, gonad index, length, weight relationship, age, growth.

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Ectoparasites of Scorpionfish collected from Tunisian coasts off the Mediterranean Sea

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A parasitological survey of 841 Scorpionfish belonging to three species (259 *Scorpaena scrofa,* 276 *Scorpaena porcus* and 306 *Scorpaena notata*) caught among Tunisian coasts, were examined for an eventual ectoparasites infections, from October 2014 to November 2015
Fish were dissected and were examined under a binocular microscope. Nine ectoparasite species representing four taxonomic groups were recorded: Monogena (*Microcotyle algeriensis*), Copepoda (*Strabax monstrosus*), Isopoda (*Ceratothoa oestroides*, *Nerocila bivittata*, both Male and female of *Anilocra physode*, male of *Mothocya nana*, Praniza larvae *Gnathia* sp.), one species of Ostracoda (*Cypsridina* sp.) and Annelida (*Trachellobdella lubrica*).

The highest prevalences were recorded in: *Cypridina* sp. infesting the buccal cavity of *S. scrofa* (P=51%), *Strabax monstrosus* from the gills of *S. notata* (P= 49%) and Praniza larvae *Gnathia* sp. from the buccal cavity of *S. porcus* (P=47%).
Morphology, host, site of infection, prevalence and mean intensity of each parasite found during this survey are reported.

Keywords: Scorpionfish, Ectoparasites, Isopoda, Copepoda, Ostracoda, Annelida, Tunisian coasts

*Speaker

Functional rarity of coral reef fishes across space & phylogeny

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Functionally rare species can support unique functions for ecosystems. Moreover, identifying the distribution and drivers of functional rarity across space and time is of tremendous importance for conservation ecology. However, functional rarity remains an overlooked facet of functional diversity.
We used a worldwide coral reef fish database comprising 2073 species occurrences in 259 locations with complete information for 6 traits related to major ecological functions as well as a phylogenetic tree of all those species. Functional Rarity is defined as the originality of a species given its neighbor in a community. For each species we computed functional rarity, evolutionary distinctiveness and geographic range indices.

We found that evolutionary distinctiveness of a species does not correlate with functional rarity. Species restrictedness in space and functional distinctiveness let us classify species in different categories: functionally rare or common & geographically restricted or widespread at a global scale.
Our results show that the originality of a species by its traits cannot be estimated from its position in a phylogenetic tree. Our work also underlines the lack of IUCN assessments for functionally rare species. It could be used to prioritize species for which an assessment should be made.

Keywords: functional rarity, functional ecology, coral reef fishes, functional biogeography, rarity, biodiversity

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Birds communities structure through available energy

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Growing urbanization and agriculture intensification are major threats to biodiversity and ecosystem services worldwide. Energy availability is the basis of productivity and ecosystem functioning but it is reduced by intensification practices. However, few studies have examined the large scale response of the different components of biodiversity and functional diversity in particular to land use intensification. Using the French Breeding Birds Survey, coupled with a trait database, we investigated the variations in the functional structure of bird communities to several indicators of intensification as human appropriation of NPP (HANPP) and available energy (NPPeco), over agricultural and semi-natural landscapes. Specifically, we evaluated habitat specialization (CSI),average trophic position (CTrl), functional richness (FRic), evenness (FEve), divergence (FDiv) and dispersion (FDis) of these communities along a gradient of intensification.
Our results show that the facets of diversity respond differently to human appropriation. FRic, FDiv and FEve tend to decrease with NPPeco. Conversely, FDis tend to increase with NPPeco.

Habitat generalists with an intermediate trophic level dominate communities for intermediate levels of NPPeco, suggesting an ongoing biotic homogenization.
Overall, our results suggest that the impact of human appropriation highly varies across facets of biodiversity and ecological functions, highlighting the complex interactions between habitat, NPP and biodiversity.

Keywords: Birds, functional diversity, HANPP, intensification

*Speaker

Major threats that imperil insular ecosystems

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Islands are exceptionally rich reservoirs of biodiversity, despite covering only 5% of the global land surface. Around 50,000 to 70,000 vascular plant species are endemic to insular ecosystems. Most of these endemic species and ecosystems suffer from anthropogenic threats, affecting their environmental parameters and ecological integrity. These ecosystems are highly vulnerable compared to continental ecosystems due to species life history traits and communities properties. Therefore, we plan to characterize the past and current threats affecting island ecosystems. Firstly, based on the International Union for Conservation of Nature data, we determined the threats affecting 15 large, insular regions harboring 12,483 endemic species (including invertebrates, plants and vertebrates). First analyses reveal a spatial pattern of threats across the fifteen insular geographic areas and highlight co-occurrences between threats. Indeed, biodiversity of Pacific and Atlantic insular regions are mainly threatened by invasive alien species, except for the West Indies. The rest of insular regions, mostly located in Indian Ocean and near to the Asian coast, are predominantly threatened by biological resource use, agriculture and aquaculture. Respectively, biological resource use, agriculture and aquaculture and invasive alien species threatened insular endemic species. There is no significant difference between taxonomic groups. Following this, we propose to identify factors responsible of extinction risk in insular species by combining our dataset with species traits information (e.g. body mass, geographic range size). We expect that our results will help identify the insular geographic regions and communities most vulnerable to past and current threats, and thereby help prioritize conservation measures.

Keywords: Island, Global change, Endemic species

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Digging deeper: Impact of large ungulate populations on soil ecology

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Introduced non-native species are altering the ecology of natural communities at an unprecedented rate, threatening the services they provide, and becoming another driver of climate change. On the Canadian archipelago of Haida Gwaii in 1878, non-indigenous Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) were introduced, and in the absence of predators, deer populations have exploded, with detrimental impacts on native aboveground plant and animal communities. Knowledge on how deer affect belowground organisms and processes is lacking and needed, given the vital role soil organisms play in soil carbon storage and nutrient cycling and the consequent feedbacks to plant nutrition and growth. Deer may directly enrich soil through deposition of high quality litter and waste products. Conversely, their selective foraging increases the abundance of plants with lower quality litter, impacting soil productivity. To address these crucial questions we will compare soil organisms and processes between islands with and without deer and inside and outside deer exclosures. This study will fill a major gap in our knowledge about how introduced browsing mammals affect belowground processes. By quantifying the impact of deer and damage reversibility, it also aims to give clues for land-management strategies.

Keywords: deer, trophic cascades, aboveground belowground interactions, soil

*Speaker

Ecological changes along the transition from annual crops to perennial plantations in Northern Thailand

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During the past decades, rapid land-use change and agricultural intensification led to serious environmental degradation in South-East Asia. In particular, the expansion of rubber tree plantations caused important biodiversity losses and an increase of erosion processes. Weeds fulfill various ecosystemic services in the agroecosystem: they support biodiversity at higher trophic levels and enhance soil stability and structure; but intensive weeding practices have been shown to strongly affect their communities. Thus, enhanced weeds management by farmers could be a cost-effective mean to favour biodiversity conservation and erosion control. We studied variations of weed communities and soil physical properties along 4 land uses (rice, maize, young rubber plantation intercropped with maize and mature rubber plantations) in Northern Thailand. We found that weed communities were specific to land use, and that the interactions between weeds and soil were dependant on the community composition. Further experimentation will allow us to better understand the effect of weeds on erosion control.

Keywords: Weeds, community, erosion, soil

*Speaker

Distribution and composition of plant communities at the base of alignment trees in an urban zone in 2014

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Many studies show how quality of biodiversity influences the well-being of citizens. Nevertheless, little is known about the drivers that shape it in urbanized zones. Tree bases occupy a much reduced surface area, but are present in great number and arranged deliberately through spaces. They could play an important ecological role in the urban context which offers limited favorable spaces for the development of spontaneous flora. Our objective was to determine the factors influencing composition and dynamics of spontaneous vegetation around street trees.
We thus analyzed the data of floristic inventories growing at the base of 1474 trees in 26 streets in 2014 located in the district of Bercy in Paris.

Our results indicate that species richness and composition depended on the district scale (distance to green spaces), on the street scale, on tree base characteristics (tree base equipment), and on the plant biological characteristics (seed longevity in the soil bank).

The results of a software modeling metapopulation dynamics run on inventory data collected every year between 2009 and 2015 showed that for most of the species, tree bases were sinks for source populations growing in larger sites (e.g. parks) but for some other species, they also participate to the movement of species across the city (stepping stones).

This study showed that the tree bases are favorable habitats for a certain number of species and could be considered as corridors between more important green spaces like parks or gardens.
The results will define the best management plans for urban biodiversity.

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Keywords: Ecological role, metapopulation dynamics, species richness, spontaneous flora, tree bases, urban biodiversity, urbanized zones.

Social dynamic patterns may trigger population structure in Iberian wolves

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Population genetic structure has traditionally been considered the result of well establish behaviours (e.g. colonies), spatial restrictions or historical factors. Recently, natal habitat-biased dispersal and territoriality have been suggested has promoters of genetic partition in species such as wolves. A recent study showed that the Iberian wolf presents high level of genetic structure, with multiple geographic groups. One of these groups comprises packs present in Alto Minho (NW, Portugal), which has been the subject of an ecological and genetic monitoring program since 2007. We profited from this long-term project to investigate whether genetic structure is related to social dynamics of the packs. Thus, we aimed to reconstruct the recent genealogical history of packs and understand the dynamics of pack formation and maintenance in Alto Minho. Sampling comprises 1250 scat samples collected throughout 9 years, across the territory of six different packs. Based on the amplification of 19 microsatellites, we were able to identify 165 individuals. The genealogy of 5 packs was reconstructed, comprising more than 50% of the sampled individuals. Breeding pairs were formed by unrelated individuals and were the same over the monitoring period. Two different breeding pairs were observed in one pack before 2009, though we have no evidence that it happened simultaneously. This results show a clear evasion to consanguinity, but also that natal habitat-biased dispersal is common in Alto Minho, providing a first explanation for the observed genetic structure in Iberian wolves.

Keywords: Wolves, population genetic structure, relatedness, dispersion

*Speaker

Deadwood is the main driver of bird and bat communities in strict forest reserves

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Sustainable forest management aims to produce wood while preserving habitats for biodiversity, which is particularly challenging for vertebrates with local and landscape scale requirements, such as birds or bats. Managers need additional scientific evidence to help them balance conservative and integrative management methods. In this study, we evaluate the relative influence of management abandonment, stand structure and landscape features on bird and bat communities in 14 managed and unmanaged forests in France. Total birds and bats richness, richness for forest and threatened birds and edge-specialized bats significantly increased with total deadwood quantities. Richness of generalist, omnivorous and cavity-nesting birds was higher in unmanaged stands and richness of gleaner bats were positively influenced by the density of standing deadwood. Landscape variables had surprisingly little influence on the different ecological groups. Though the effects showed relatively limited magnitude, our study supports the value of deadwood and the importance of management abandonment for forest vertebrates. However, further analyses are needed to better understand the ecological role of deadwood as substrate provider. To be fully efficient, conservation strategies must be complemented by designating strict forest reserves because some target species groups depend on structural features found only at sufficient levels in those areas.

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Keywords: forest management, strict forest reserve, deadwood, species richness, birds, bats

Coming of garden birds in winter: impact of surrounding agricultural landscape

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The link between agricultural changes and bird population declines is well documented and investigations often focused on reproductive success. However, few studies investigated on survival and especially on winter although changes in practices make winter bird survival even harder, chiefly for seed-eating passerines, by reducing seed availability. Nevertheless, more and more people supply birds with food in their gardens so we expect those gardens to play a major role in maintaining populations by acting as havens, notably in an intensive landscape. Using for the first time the French Garden Birds program (a national citizen science program), we crossed bird winter counts with an agricultural intensity indicator (the Input Cost per hectare index - "IC/ha") to study the link between the coming of birds in gardens and the intensification of surrounding landscape. We found differences in phenology of visiting. In fact, the arrival of birds in gardens is faster in intensive landscapes. Furthermore, we found an interaction between the species degree of dependence to agricultural landscape and the IC/ha indicator. The arriving in intensive landscape is even faster for the more dependent birds. As some seed-eaters were recently placed on the French IUCN Red List of species of conservation concern, these results provide a glimpse of hope by suggesting that food supply, in winter in gardens, is not only a recreational activity but attracts seed-eaters and could help to improve their survival during the cold season, chiefly in an intensive landscape.

Keywords: Garden birds, winter, supplementary feeding, citizen science, agricultural intensity

*Speaker

Modeling the direct and indirect effects of copper on phytoplankton–zooplankton interactions

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Predicting the effects of pollution on community is difficult because of the complex impacts of ecosystem dynamics. To predict the effects of copper on plant-herbivore interaction in a freshwater ecosystem, we built a model that focuses on the interaction between an alga, *Scenedesmus sp.*, and a herbivore, *Daphnia sp.* Internal copper concentrations in *Scenedesmus* and *Daphnia* are calculated using a biodynamic model. We include two types of direct effects of copper on *Scenedesmus* and *Daphnia* that results from hormesis: a deficiency effect and a toxic effect. We perform a numerical analysis to predict the combined effects of copper and nutrient enrichment on the *Scenedesmus–Daphnia* interaction. Results show three types of outcomes depending on copper concentration. First, Copper may lead (1) to the extinction of all populations, (2) to only the extinction of consumer population, and (3) to the survival of the two populations. Second, copper has a stabilizing effect by reducing or suppressing oscillations. Third, copper opposes the destabilizing effect of nutrient enrichment. Our model shows that (1) *Daphnia* is more sensitive to copper when community interactions are taken into account than when analyzed alone and (2) counterintuitive effects may arise from the interaction between copper pollution and nutrient enrichment. Our model also suggests that single-value parameters such as NOEC and LOEC, which do not take community interactions into account to characterize pollutants effects, are unable to determine pollutant effects in complex ecosystems. More generally, our model underscores the importance of ecosystem-scale studies to predict the effects of pollutants.

Keywords: Ecotoxicology model, Predator Prey interaction, Copper, Eutrophication, Daphnia, Scenedesmus

*Speaker

Spatio-temporal evolution of thermal niches in lacertidae lizards in extreme environments in the Central High Atlas of Oukaimeden

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This work falls within the broader context of work on the evolution of thermal niches lizards Palearctic. This approach requires selecting species directly sensitive to environmental conditions (resources, climate) and then have a special indicator position in the ecosystem. To perform this, we worked on the species of Lacertidae lizards in the Central High Atlas Oukaimeden and focused to clarify the climate sensitivity and thermoregulation strategies in these sympatric species in different biogeographic affinities. We performed measurements of body temperature in the wild and in the laboratory, and we identified the temperature and humidity of caractéristiques microhabits and we estimated the loss of water through evaporation rates. The statistical analysis show no significant differences between these Lacertidae, and Atlantolacerta andreanszkyi owns the water loss rate highest evaporative. These key information can be the basis for understanding the response mechanisms of living organisms to global changes.

Keywords: Lacertidae, Biogeography, thermal preference, water loss, extreme environment, Oukaimeden.

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Community analysis of leaf litter-ants in forest fragments and rubber plantations in Xishuangbanna, Yunnan

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Assessment of biological diversity across different natural and anthropogenic habitats is fundamental to current global conservation efforts. Ants play important roles in ecological processes and are suitable as indicator species for assessing changes in habitat conditions and quality. Here we have investigated effects of forest conversion to rubber plantation on litter-dwelling ants in Xishuangbanna, Yunnan province. We compared species richness, diversity and community composition of litter-ants between forest fragments and adjacent rubber plantations. We collected a total of 1,562 ants representing 58 morphospecies. Ant species richness and Shannon-Wiener diversity index were significantly lower in rubber plantations than forest. In addition, species richness and diversity index were significantly and positively correlated with litter-depth in both rubber and forest. Litter depth exerted much stronger effect on species richness and diversity of litter ants relative to land use type. NMDS and ANOSIM analysis indicated that ant community composition was significantly different between rubber and forest, and the community dissimilarity among rubber plantations was larger than that of forests. We found four species that were significantly more common and abundant in forest fragments, whereas no such species was found for rubber plantations. In addition, we found greater abundance of "opportunist" group in rubber plantations. Our results showed that rubber plantations provide habitats for only generalist and opportunistic species and unsuitable to sustain biodiversity compared to forests. Thus, our study suggest that ongoing forest conversion to rubber plantations will adversely affect biodiversity in Yunnan.

Keywords: leaf litter, ants, forest fragment, rubber plantation, species richness, species diversity, community stracture, Xishuangbanna

*Speaker

Use of macrophytes allelopathy in the biocontrol of bloom forming Microcystis aeruginosa

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The use of macrophytes allelochemicals are recently considered a promising method to control harmful algal blooms (HABs). In this research, the allelopathic effect of two aqueous extracts of *Rananculus aquatilis* and *Nasturtium officinale* on *Microcystis aeruginosa* was assessed. Five treatments with leaves aqueous extractions (0.1%, 0.25%, 0.50%, 0.75% and 1%) and a control group were designed to investigate the effects on the growth, physiological and morphological changes of *Microcystis*. Total phenols, total flavonoïdes, tannins concentrations in the aqueous extracts were analyzed to reveal the potentially allelochemical compounds. The results showed that the growth of *M. aeruginosa* was significantly ($p < 0.05$) inhibited by the two macrophytes aqueous extracts in a concentration-dependent way. After 8-day exposure, the highest inhibition rates reached 100% in *R. aquatil*is and 74.75% in *N. officinale* aqueous extracts respectively. The chlorophyll *a* and carotenoids concentrations in *Microcystis* cultures decreased in the treatment groups. The contents of phycocyanin and allophycocyanin were also reduced in both the two treatments (1%, 0.75%). Several morphological changes of cells and colonies were notably observed in the treatment groups compared to the controls. The higher significant correlation obtained between the inhibition rates of the high concentration (1%) and flavonoïdes suggests that growth inhibition of *Microcystis* was more induced by flavonoids and probably by others allelochemicals in all tested aqueous extracts.

Keywords: Microcystis aeruginosa, Macrophytes, Allelopathy, Growth inhibition, Morphological changes, Allelochemicals.

*Speaker

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Spatial and vertical distribution of benthic communities in habitats frequented by shorebirds at Merja Zerga Lagoon, Moroccan Ramsar Site.

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Merja Zerga lagoon is a wetland of international importance for birds, located on the north-Atlantic coast of Morocco. It is a place of wintering, stop-over migration and reproduction of a large contingent of shorebirds. The diversity, abundance and distribution of these birds within the site are strongly related to the size of its mudflats and their richness in benthic macroinvertebrates which are prey of choice for these birds.
The aim of this study as a first step is to analyze the structure and spatial organization of macrobenthic fauna, in function of some mesological parameters and secondly to evaluate the importance and the vertical distribution of the fraction of the benthic macrofauna available to waders.

A total of 46 macrobenthic species were identified. The polychaetes, molluscs and crustaceans dominate the species richness, density and biomass of this community. The analysis of the results showed a strong spatial heterogeneity of the distribution of benthic macrofauna. The hydrological and sedimentary parameters as well as the presence or proximity of a seagrass are the main components that govern the structure and functioning of these communities. The vertical distribution showed a marked vertical stratification of the benthic population in terms of their species richness, density and biomass. The results show the importance the first slice located at the sediment-water interface in the functioning of the benthic ecosystem.
A mapping of the distribution of these macroinvertebrates can help managers of this wetland to identify functional zones with strong conservation issues for preservation of birds.

Keywords: Merja Zerga lagoon, macroinvertebrates, microdistribution, mesological parameters, avifauna.

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Cytogenetic study for six taxa of Origanum genus from Morocco

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The majority of *Origanum* species are important medicinal plants as well as culinary herbs and for that reason have great economical value. The cytogenetic studies about this genus are very scarce. Therefore the studies concerning chromosome number and genome size were very useful. These two approaches have been used to characterize 6 taxa of the genus *Origanum* occurring either in the wild or as cultivated in Morocco area. Despite of their high morphological and chemical variability as well as the large geographic range of distribution, all investigated taxa are diploid with chromosome number of $2n = 30$. The genome sizes are considered as small, and the mean values ranged from 1.43 pg/2C in *O. vulgare* subsp. *virens* to 1.53 pg/2C in *O. compactum*.

Keywords: chromosome number, genome size variation, Origanum

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Biodiversity of parasites in painted comber Serranus scriba (Teleostei : Serranidae) from Tunisia

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2

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In this survey 150 specimens of painted comber *Serranus scriba* (Linnaeus, 1758) were collected from two localities : the bay of Bizerte and the gulf of Tunis between February 2015 and August 2016. The analyse of parasitc diversity show a total of 14 parasite species belonging to different groups : 5 species of myxosporean from the gall bladder (*Ceratomuxa* sp. 1, *Ceratomuxa* sp. 2, *Ceratomuxa* sp. 3, *Ceratomuxa* sp. 4 and *Myxidium* sp.), one digenea from the stomach (*Derogenes* sp.), three nematodes larvae from the intestine and the body cavity (*Hysterothylacium fabri* Rudolphi, 1819, *Hysterothylacium* sp. and *Contracaecum* sp.), two copepods from the surface of the gills (*Lernanthropus scribae* Kroyer, 1863 and *Anchistrotos laqueus* Leigh-Sharp, 1935), two isopods collected from the gills, the buccal cavity and the fins (*Nerocila bivittata* Risso, 1816 and *Gnathia* sp.) and one hirudinea from the gills (*Trachelobdella* sp.).
Derogenes sp., *Contracaecum* sp. and all the myxosporean species found in the current study are considered new records for *Serranus scriba*.

The statistical test $\chi 2$ shows a significant difference ($\chi 2$ =9,88 ; ddl=1 ; P< 0.005) in the globale parasitic prevalence between the two simpling sites (bay of Bizerte and gulf of Tunis). Moreover, the copepode *Lernanthropus scribae* has the highest prevalence values (50.66%), while *Gnathia* sp. has the highest mean intensity (14,27) and abondance (3,42).

Keywords: Parasitofauna, Painted comber, New records, Prevalence, Intensity, Abondance, Tunisia

*Speaker

Body size is poorly predicted by climate and net primary production in temperate songbirds

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Body size decline has been proposed as a universal response to climate warming, but empirical evidence is controversial. We test whether body size is negatively related to temperature, or rather explained by variations in food availability in french songbirds. We also explore whether annual, population-level variations of mean body size are due to changes of juvenile size and/or size-dependent mortality over the first year.
We tested for relationships between wing length (n = 107,193) or body mass (n = 82,022) and local anomalies in temperature, precipitation and primary production during the breeding period for 41 species, from 257 sites, for juveniles and adults separately. For four species and 46 sites, we assessed whether changes in mean population body size over the first year of life suggested climate-driven size-dependent mortality.

Juveniles were larger in years with locally high primary production. This only explained 1% of interannual size variation. Adults did not respond to any variable. We found no evidence of climate-driven size-dependent mortality.
Our results support that body size is mainly driven by food availability during the period of growth in temperate songbirds. We suggest that former studies evidencing a hot-induced size reduction were biased towards organisms from hot climates, operating close from their upper thermal limit. In the temperate climate of France, recent temperature increases would not have been sufficiently extreme to select against large individuals. Temperate songbirds would indeed be more constrained by cold than by over-heating. Hence body size decline is not a universal response to climate warming.

Keywords: body size, bird, Bergmann's rule, heat diffipation, food availability, NDVI, temperature, precipitation, size, dependent mortality

*Speaker

Participatory breeding for diverse wheat mixtures

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Agriculture is facing major challenges today, such as the need to feed a growing number of people while decreasing input use in the context of an increase in environmental stochasticity. Agroecology is a way of answering these issues, promoting a more sustainable production, for example through organic agriculture. The development of agroecological practices is limited by a lack of varieties adapted to organic and low-input agriculture (conditions characterized by low or no use of chemical inputs to stabilize environmental variations and high field heterogeneity). Increasing plant diversity in fields, for example by cultivating heterogeneous populations or mixing varieties, is an interesting lever since it permits the stabilization of production, the optimization of resource use and pest and disease control. Since 2006 the DEAP team (INRA GQE le Moulon) and farmers from the Réseau Semences Paysannes are working in close collaboration on a participatory plant breeding project, aiming at developing heterogeneous populations adapted to each farmers' practices and environment. After developing interesting populations, farmers from our network often mix these populations and are wondering how to select on-farm for adapted mixtures. Several practices were identified, such as selecting spikes inside the populations before mixing, selecting inside the mixture, selecting both before and after mixing, adding populations through years. My pHD project aims at understanding the impacts of different selection practices by farmers on mixtures' performances.

Keywords: participatory breeding, on farm breeding, mixture, cultivated diversity

*Speaker

Humanities and Natural Sciences

Characterization of archaeological fibers by proteomic and stable isotope analyses.

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Fabrication of textiles is one of the first technologies. Strongly linked to the development of agriculture (cotton, flax...) and farming (wool), their study can provide new information on economic, environmental and socio-cultural practices. This study focuses on animal fibers from textiles and hair found in archaeological contexts. A double analytical approach is proposed based on the study of the hair principal protein: keratin. This protein can be characterized by proteomic technique using soft ionization mass spectrometry. Results are compared to the international databases to identify the species the protein belongs to. In parallel, isotopic analysis on carbon and nitrogen can be carried out bringing information on the diet, farming conditions and, to some extent, the geographical provenance of the animal. The results presented here come from two archaeological contexts providing well preserved fibers: the Northern coast of Peru and North-western China. The Peruvian sample includes the four different species of American camelids and come from different Pre-Hispanic sites. Their analysis aims to better understand the role of alpaca and llama wool in ancient Peruvian societies, and their use. The second area of interest is the KeriyaValley (Xinjiang, China), at the crossroad of different regions that became part of the Silk Road. There, various tombs dating from the Bronze and Iron Ages were found, providing hide and textile samples. The challenging distinction between goat and sheep fibers can be achieved by proteomics. Besides, the complementary analysis of wool stable isotopic composition may enable to observe species-related differences in herding practices.

Keywords: textile, animal fibers, proteomic, stable isotopes

*Speaker

Trophic levels study based on stable isotope analysis of tooth enamel (C & O) on a mammal collection from the Cambodian site of Boh Dambang

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A study of the trophic levels was performed on a collection of mammals from the Cambodian site of Boh Dambang in Southeast Asia. This karstic site presents an exceptional rich faunal assemblage, containing animal remains mainly accumulated during the late Pleistocene in spotted hyena dens, which are relatively few in Southeast Asia. Valuable information on the ecology and environment can thus be drawn by stable isotope analysis of tooth enamel on the different taxa present in the assemblage In an environment of low latitude like that of the Boh Dambang site is, the distinction between C3 and C4 plants allows a reconstruction of diet of the different taxa, 55% in the first case and 35% in the second. The diet of the spotted hyena is composed of herbivores eating C4 plants that includes the largest cattle gaur and water buffalo. Some taxa may also hold some clues hinting to a change of environment, based on a change in diet, as it is the case with the sambar deer.

Keywords: South East Asia, stable isotopes, hyena, Cambodia, trophic study

*Speaker

Dynamics of vegetation cover and exploitation of wood resources in Central Anatolia during the early Neolithic period : anthracological study of Asikli H́oýuk (Cappadocia, Turkey)

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The study of the charcoal remains from different archaeological contexts and levels at the Neolithic site of Aşikli H́oýuk (Cappadocia, Turkey) had two main objectives. The first was to reconstruct the vegetation cover around the site and analyze its evolution through time in relation to the increase of demography and major social changes taking place between the IXth and the VIIIth millennium cal. BC. The second was to explore different aspects of the exploitation and the use of wood resources. The taxonomic identification of more than 2600 charcoal fragments from 37 different archaeological contexts in levels 4, 3 and 2, allowed us to show the presence of a woodland composed of pistachios, almonds and deciduous oaks around the site, which is not currently present in Cappadocia. Pistachio wood was the main fuel used by the community. Furthermore, a small exploitation of a gallery forest was also observed. A preliminary dendro-anthracological study, based on a hundred of oak fragments, showed some particular characteristics linked to the preferential use of small diameters of wood (twings, branches and young trunks).This study must be pursued in order to define if these small diameters were caused by regular cutting (woodland management). Finally, the occasional use of decade wood was shown by the presence of insect and fungi attacks in some pieces of charcoal.

Keywords: Anthracology, Neolithic, Central Anatolia

*Speaker

How do people see biodiversity? The use of a digital identification key for a citizen science program.

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"Spipoll" is a French citizen science program about pollination. To assist the volunteers, a multi-access identification key is available on the Spipoll website. The pictures, identifications and series of steps followed by the participants have been recorded since September 2015.
These data allow to study the behaviour of the citizens when they observe an insect, and to deduce the taxonomic confusion and the misunderstanding of character states. The identification paths give elements on how the entomofauna diversity is perceived. Which morphological traits are chosen most frequently? Are the most noticeable characters selected to the detriment of those which need advanced entomological skills?
Here we show that some morphological parts are perceived more easily than others, and that people are sensitive to the quality of character descriptions in the keys. These elements must be taken in account in order to improve identification tools, in particular those used by the general public.

Keywords: Spipoll, identification key, citizen science

*Speaker

On the tracks of Neandertals: the first study of the footprints from Rozel (Normandy, France)

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Hominin footprints, and more particularly those associated with Neandertals, are very scarce in the fossil record. However, they give a unique point of view on dynamic moments of individuals' life that the fossil remains don't allow to obtain. Moreover, their study enables to get a lot of paleobiological information, for example about the anatomy or the composition of a group but also on the biomechanics of gait.
The Middle Paleolithic site of Rozel (Normandy), which was occupied by Neandertals between 85 000 and 65 000 years BP, have yielded over a hundred footprints since 2012 besides its consequent archeological material (stone tools, charcoal, animal remains,...).

We report here the results of the first paleobiological study dealing about these footprints. The analyses led according to a wide corpus of comparison and an unpublished methodological development, have shown that the footprints from Rozel are unique in the knowledge of hominin footprints. Indeed, these footprints represent the vast majority of the known footprints associated with Neandertals. Thanks to measures on footprints of anatomically modern humans and on those from Rozel, a minimum number of 9 individuals was determined. Furthermore, using footprint length to stature ratios, these individuals are estimated to have been between 0.69 and 1.86 m in height, suggesting a group of different ages from childhood to adulthood.
The knowledge gained constitutes a solid basis from which advanced studies have begun about the biomechanical walking patterns of Neandertals and their mobility.

Keywords: Neandertals, footprints, Rozel, height, gait

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Zooarchaelogical analysis of faunal remains from the ritual site of Pachacamac: first insights into the sacrifice of camelids

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Pachacamac is a major site of the Peruvian central coast, occupied from the fifth to the sixteenth century AD. This presentation will report the results of an on-going analysis of faunal remains recovered during the 2016 excavation campaign within the framework of the Ychsma Project. Amongst the considerable amount of material, an almost complete camelid skeleton in a very good state of conservation was discovered. The room 4 of the B15 building where it was located is a building that had a ritual function. Other offerings were found nearby: numerous bones of camelids but also of other species like guinea pigs or shells. The detailed zooarchaeological analysis that we carried out on the above mentioned camelid has enabled us to identify the species sacrificed, to estimate its age, to determine the colour of its hair, how it was sacrificed and its orientation and position within the context. The current study has provided preliminary insights into the practice of sacrifice and offerings of camelids (the most important domesticated species in Peru at that time) on the site of Pachacamac but also on the potential breeding practices. Such offerings of camelids on the central coast of Peru are not yet well documented and have only been so far the subject of a limited number of studies. The gained insights will be further corroborated by the continuation of the zooarchaelogical analysis of the faunal remains accumulated since the beginning of the Ychsma project in the late nineties.

Keywords: zooarchaeology, Peru, camelids, sacrifice

*Speaker

The Easter 'Bunny': exploring the bio-cultural history of the rabbit (Oryctolagus cuniculus) and the brown hare (Lepus europaeus)

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Easter is the most important event in the Christian calendar yet we know little about its origins, spread and adoption across Europe. Similarly, the animals associated with Easter – notably the rabbit (*Oryctolagus cuniculus*), brown hare (*Lepus europaeus*), and chicken (*Gallus gallus*) – have equally obscure histories. All of these are anthropogenic introductions to northern Europe but the timing and circumstances of their arrival are currently little understood. This paper will discuss my PhD research which forms part of the forthcoming Arts & Humanities Research Council (AHRC)-funded project, *Exploring the Easter E.g. – Shifting Baselines and Changing Perceptions of Cultural and Biological 'Aliens'*. I will discuss how osteological analysis of archaeological lagomorph (rabbit and hare) remains can be integrated with material culture, history, folklore and linguistics to provide new perspectives on the introduction of the brown hare and rabbit to Britain and their role in the development of modern Easter traditions.

Keywords: Easter, brown hare, rabbit, bio, cultural history, non, native fauna, zooarchaeology, linguistics, folklore

*Speaker

Historical and contemporary enlightenment from Confucian environmental ethics in the perspective of moral judgments and dimensions

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In the worldwide industrialization and globalization process, humankind is facing with severe challenges of global ecological crisis. In western perspectives, Aldo Leopold's and Roderick F. Nash's thought have been extensively studied and discussed in the environmental ethics studies. However the wisdom of Confucianism, especially the moral judgments and dimensions of Confucian environmental ethics has not been systematic investigated. This paper firstly introduced Confucian environmental ethics with review and comparison with Western perspectives. By comparison, The philosophy of "Unity of nature and Humankind" () provides the important historical care and clue for dealing with the relationship between human and nature. Also, based on "kindness to things principle" () ,"save things and compassionate the people" () and "using the natural resources according to their time"()this paper tries to sort out the moral of Confucian environmental ethics with reference to the personal environmental ethic behavior which effectively reduce the tension between human and nature. Confucian environmental ethics is grounded on human nature which is the essence of all things and it has the benevolence () which embraces unique and enriching ideas that the paradigm of dualism could not accommodate. As a result, a harmony relationship between humankind and nature through the general laws and basic experiences was observed in Confucianism Philosophy. The Confucian environmental ethics is a kind of harmonious ethics and has promising implications for the formulation of a new theory of environmental ethics showing eastern wisdom.

Keywords: Confucianism Philosophy, Confucian environmental ethics, Unity of nature and Humankind, moral judgments and dimensions, benevolence

*Speaker

Archaeozoological analysis of mammalian assemblage from the lower Pleistocene site Cooper's D (Bloubank Valley, South Africa): Implications for study hominin subsistence behaviors

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Cooper's Cave is located in the Cradle of Humankind (UNESCO), 1.5 km northeast of Sterkfontein, 1 km southwest of Kromdraai, approximately 45 km northwest of Johannesburg (South Africa). The Coopers D deposit, dated between 1.5 and 1.4 million years old by U-Pb, has yielded seven hominid specimens (six *Paranthropus robustus* and one unidentified hominid). A previous taphonomic study on a primate fossil assemblage suggests that *Parahyaena brunnea* is the main bone accumulating agent. Our study was focused on the identification of the taphonomic agent(s) responsible for mammal accumulation from Cooper's D and the palaeoecological context of *Paranthropus robustus*.
Zooarchaeological methods were conducted on 588 large mammal remains from Cooper's D East deposit. Taxonomic diversity and paleoecological reconstructions were undertaken using a database including 7 828 specimens from both East and West deposits.

We applied classical quantitative methods used for bone specimens (NISP, MNE, MNI). Paleoecological analyses were conducted using Fleming's histograms and the Simpson's Index to measure the taxonomic diversity. All of the 588 specimens were observed using binocular and DinoLite microscope.
This preliminary study permitted to confirm that brown hyena (*Parahyaena brunnea*) is the main accumulating agent of large mammal bones. Paleoecological analyses, made with methods unused so far in the context of South African sites, reconstructed a relative open savanna with some wooded zones and contributed to explore the context of hominin subsistence behaviors during Early Pleistocene.

Keywords: Prehistory, Paleoenvironment, Archeozoology, Paleoanthropology, Human Evolution, South Africa, Paranthropus robustus

*Speaker
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Predicting archeological boar's lifestyle from their remains : Calcaneum morphology as plastic marker of captivity

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The Neolithic revolution, which corresponds to the beginning of animal and plant domestication and to the shift towards a sedentary lifestyle that is the root of our societies, is considered as a major shift of the human history. Understanding the early stages of the process is necessary to conduct research on the domestication history, which involve being able to distinguish archaeological remains of wild animals from remains of individuals in the earlier stages of domestication.
This study aims to compare the calcaneum morphology from five fench wild boar (Sus scrofa) populations, two captive wild boar populations, and four domestic pigs. The goal is to determine if it is possible to distinguish wild boars, captive boar and domestic pigs, and then to apply these potential results on samples from 7 archaeological french sites from the Mesolithic and Neolithic periods. Analyses were made from coordinates of 958 landmarks placed on 64 calcaneus 3D models: 27 Wild, 20 captive, 4 domestic and 13 archaeological.
The results have shown that the plastic deformations caused by the captivity are similar to hereditary deformations from the domestication syndrome, and that these deformations consist mainly in a twist of the epiphysis. Finally, predictions confirmed wild lifestyle for specimens from Noyen 2, and for some of the specimens from Noyen 3 and Roucadour. They have instead determined that other specimens from Noyen 3 and Roucadour were probably rather captive or domestic, which can lead to change the assumptions about the arrival of domestic pig on these sites.

Keywords: pig, domestication, calcaneum, geometric morphometrics, archeozoology, neolithic transition, suidae

*Speaker

The effectiveness of place-based strategies on climate change communication

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With the Paris Agreement, countries have pledged to promote strategies and policies to substantially reduce their carbon emissions. To align public sentiment with potentially expensive climate mitigation policy, climate change education is considered an essential tool in tackling climate change, particularly for the young generation. However, a general lack of engagement is driven by the perception that climate change is irrelevant at local and individual scales with psychological distance. This study was conducted in 12 rural areas of China to compare the observed trends of extreme climatic events from local seniors to the meteorological data first. Also, based on a modified version of the Theory of Planned Behaviour, we implemented a new climate change educational programme that adolescents communicated with local seniors (aged $\geq$ 60 years) in focus groups to discuss local climate over the past decades. The results showed climate change can be observed and perceived by individuals in their own lifetimes. Importantly, based on mediation analysis, the shift in adolescent perceptions of climate change, such as concern and perceived behavioural control, translated into greater willingness to support climate change mitigation. Thus, we suggest that place-based strategies that highlight the relevance of global climate change through local impacts and individual experiences vis-a-vis intergenerational communication has considerable potential to promote greater engagement with global issue.

Keywords: Climate change, place, based strategies, intergenerational communication, behavioural intention

*Speaker

Changing crop biodiversity and resource use efficiency of traditional and introduced crops in the Indian Cold Desert: a case study from Lahaul Valley, Himachal Pradesh, India.

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Emphasis on market economy and motive of 'maximisation of profits' have changed the agrobiodiversity and agroecosystem management in Indian Cold Desert. These changes though benefitting people monetarily, have increased their vulnerability to market risks. In *Keylong* (Lahaul Valley, Himachal Pradesh) traditional cereal and medicinal cash crops (*Saussurea lappa* and *Inula* racemosa) are being replaced by introduced cash crops (pea, potato, cauliflower etc.). Crop biodiversity, its changing patterns alongwith Energy Use Efficiency and Monetary Analysis were the focus areas of this study. The entire cropped area is dedicated to cash crop cultivation, 93% of which is under introduced cash crops and only 7% under traditional varieties. It is interesting to note that traditional cereal cultivars have been completely wiped off from the system. Organic manure obtained from night soil and animal wastes accounted for 60% and 90% of total inputs in introduced and traditional crops respectively. Energy output/input for traditional crops was averaged at 1.6; for introduced crops it varied from 0.5 (cauliflower) to 1.8 (peas). Monetary outputs were comparable for both traditional and introduced varieties. Importantly traditional cultivars not only were more energy viable but also dependent on resources available locally. For purpose of food security and environmental conservation there is a need to establish balance between traditional and introduced crops. This will make farming sustainable in the cold desert environment where crop growth period is limited. Lahaul valley is landlocked due to heavy snow deposits at Rohtang pass (3978m) and remains accessible only for 5 months (July–November).

Keywords: Indian Cold Desert, traditional vs introduced crops, Energy and Monetary Efficiency, Lahaul Valley.

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Tracing the introduction of domestic animals in Austral Africa using paleoproteomics

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Reconstructing population migrations is a central question in archaeology. In Africa, the exact timing and route of migration of pastoral populations during the late Holocene remains an open question. Documenting the route of the first introductions of domestic caprines from Eastern to Southern Africa could give valuable information about these first pastoralists. Classical approaches of bone determination using comparative anatomy do not always succeed in distinguishing between close related species such as sheep (*Ovis aries*) and goat (*Capra hircus*) because of the high morphological similarities between the two species. Moreover, these archaeological remains are sometimes highly fragmented making distinction between domestic caprines and wild gazelles tricky. Here, we report the use of palaeoproteomics on caprine remains from the site of Leopard Cave (Namibia). This site was chosen because it gave the oldest caprines remains of Austral Africa. We intend to complete our dataset with other sites in Austral Africa in order to compare the results obtained for those sites and draw a map of caprine diffusion. Prior to any other analysis we estimated the amount of organics preserved in the remains using infrared spectroscopy (FT-IR). Based on the results, we concentrate on the extraction of structural proteins to characterize their sequences using mass spectrometry. The obtained results allow us to characterize unreported protein that could not only discriminate between the species, but also give information about their environment.

Keywords: Africa, domestication, caprines, paleoproteomics

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The first settlement of America, studies of external factors related to the phenotypic variability of Amerindian populations

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The first men to have colonized America went through Beringia and seems to have come from East Asia, but it is still to this day uncertain whether it was done through one or multiples migrations. For decades, researchers have been trying to address this problem through different methods. The first morphological analyzes were carried on the cranial variation, because it presents properties of heredity and plasticity. Here we will consider the mandibular variability and attempt to demonstrate if, when compared with the skull, it is possible to observe distribution patterns that reflect the history of peoples and their adaptations related to the environment. Our study is the first to integrate populations from the entire American territory and populations from East Asia and to use 3D geometric morphometric methods for analysis. This study on mandibles corroborates some observations on the cranial variability, including Amerindian "relics" populations. Although our results demonstrate that the skull is more susceptible to external influences, the mandibular morphological variation expresses a division by geographical areas between extreme environments and its study thus offers understanding for the history of populations in the context of the first peopling of America.

Keywords: Native american, first settlement, migration, geometric morphometric, 3D, mandibule shape, cold adaptation

*Speaker

Three-dimensional models of pre-Columbian skulls with cranial deformation, and the morphological implications to craniovascular system

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According to the descriptions supplied by Columbus and the chroniclers of the Indies, the Aboriginal groups of Central & South America, and Caribe, applied different techniques to transform the morphology of the skull. The pre-Columbian's deformed skulls from Cuba, present an oblique-tabular fronto-occipital artificial cranial warp, which is a cultural characteristic element of the Arawak–Taino indigenous communities. This type of cranial deformation was induced immediately after birth. Although, not all Taíno's skulls were deformed, this feature is typically used as a cultural identification of this population. This practice disappeared in the early years of Spanish colonization. Here we present three-dimensional reconstruct of five specimens from the Anthropological Museum Montané in University of Havana. This is the first time a 3D model of these fossils has been made, which have remained unstudied for the last decades. In order to compute the 3D reconstruction we used close range Structure-from-Motion photogrammetry technique. Our main goals were to identify the main deformations over the skull surface, and to investigate the implications of cranial deformations in the structure of the vessels through the analysis of craniovascular epigenetic traits.

Keywords: pre–Colombian, Arawak–Taino, cranial deformation, photogrammetry, craniovascular

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Woolly mammoth and Man at Krasnoyarskaya Kurya site, West Siberian Plain, Russia (excavation results of 2014).

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Detailed paleobiological and taphonomic analyses were carried out on the bone accumulations discovered during the 2014 excavations at the Krasnoyarskaya Kurya site, southeastern part of Western Siberia (Russia). The fossiliferous site contains three bone-bearing horizons. The middle and lower levels yielded exclusively remains of the woolly mammoth, *Mammuthus primigenius*. The middle level is a result of an *in situ* accumulation in alluvial sediments. At least three individuals are identified: a juvenile ($<$ 6 – 10 years old in AEY) of 1.8 m shoulder height and weighing 1 ton; a young adult (ca. 24 years old in AEY) and an old mammoth ($>$ 43 years old in AEY) of 2.9 m of shoulder height and 3.8 t. Their remains were buried in conditions similar to those of a floodplain scroll/natural levee or an islet. The lower level is composed of at least four animals: two juveniles ($<$ 6 - 10 years old in AEY) and two adults ($>$ 11 - 13 years old in AEY). Excavations between the years 2007-2010 had allowed the discovery of Palaeolithic artefacts in the lower level, which was formed in alluvial-lacustrine conditions. It is likely that at the beginning of spring, the oxbow lake had trapped woolly mammoths. Humans and carnivores had then sorted out and taken away any useful remains. Radiocarbon dating indicates that the mammoths died at the early phase of the Last Glacial Maximum, about 14C–20000 BP (˜ 24000 years cal BP) and were living in a steppe landscape dominated by grass-like vegetation.

Keywords: Paleobiology, Late Pleistocene, Russia, West Siberian Plain, Woolly Mammoth, Taphonomy

*Speaker

Reconstructing Late Holocene plant assemblages of the Naachtun Mayan city area (Petén, Guatemala): development of a new bio-proxy.

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The Petén rainforest, in the Guatemalan lowlands, is home to Mayan archaeological sites among the most known and studied (El Mirador, Tikal, Yaxha). Despite numerous studies undertaken on the Mayan societies, man-environment interactions still remain misunderstood. As part of the archaeological project "Naachtun-Peten Norte", we focus on reconstruction of landscape dynamics of Naachtun territory.
This Mayan classical site (150.CE – 950.CE) is bordered to the north by one large topographical depression, named *Bajo*, characterized by seasonal water stocks. In these environments, pollen is rarely preserved conversely to phytoliths which appear as a good alternative to reconstruct the local plant assemblages. However their taxonomic identification in the Mayan zone is poorly known.

In order to develop interpretations after fossil phytolith assemblages, we set up a preliminary study of the current vegetation in the Naachtun territory. This study is based on two criteria: the distribution of current plant communities and the link between phytoliths assemblages and associated vegetation. The aim is to understand the ecological signal of the phytolith assemblages preserved in the sedimentary record.
This study brings new data on the interpretation of phytolith assemblages in predominantly woody zones. Six great modern woody environment types have been described in Naachtun territory. Among those, five could be characterized with phytolith analysis. The Arecaceae and Poaceae phytoliths allowed notably distinguishing forest types whereas the phytoliths of woody dicotyledons (Globular and Sclereid types) provide limited ecological information. This work on central-american phytoliths contributes to develop a new palaeoenvironmental tool for studies

*Speaker

on palaeo-vegetation dynamic.

Keywords: Phytoliths, Environmental Calibration, Maya zone, Rainforest, Wetland

The origins of botany and landscaping in São Paulo, Brazil: Oswaldo Cruz Garden and the legacy of F.C. Hoehne

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Previously to the establishment of the São Paulo Botanical Garden; before the creation of the city-gardens by the Cia. City; and even before the neighborhood merged with the urban area of São Paulo capital city, the Oswaldo Cruz Garden was opened at Instituto Butantan. Although the Garden was originally created with the purposed of cultivating toxic and medicinal plants, it played a bigger role during its almost 100 years of history. In this work we aimed to shine a new light on history of the Oswaldo Cruz Garden analyzing it through the botanical and landscaping perspectives considering the historical background for its creation. Our results show that despite the usual association of Instituto Butantan with snakes and other reptiles, this was the birthplace of Botany as a science in São Paulo. Through the work of Frederico Carlos Hoehne, head of the Garden during its foundation, the area became relevant for the construction of the public space in the city during the beginning of the 20th century. The plant species originally cultivated in the area are still relevant for the urban arborization of the city and to other matters as well. Additionally, we highlight the role of the Garden as a place where scientific research and the communication with the public walk together.

Keywords: public space, urban arborization, science popularization, Botany, Landscaping, History

*Speaker

What if fishermen disappeared before the fish ?

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On Reunion Island is practiced the traditional fishing of "bichiques". This Malagasy term (= fry, small) refers to post-larvae of amphidromous gobies which recruit massively into rivers, where they are caught. Decline in post-larval abundance is a concern to their high economic and patrimonial value in addition to their ecological importance. Since 2014, fishing activity historically informal, is in the process of being regulated. This decision which does not receive the unanimous support of fishermen, reactivates the debate between actors.
The aim of this contribution is to confront perceptions and expectations of fishermen to those of the other stakeholders concerned, including the state.This qualitative analyse takes into account 30 semistructured interviews and is based on one year of field study at Reunion Island.
The results of the survey reveal the drifts of a pressurized socio-ecosystem in which everyone has their share of responsibility, from the consumer to the politician. The integration of fishermen into management indicates a positive change in the state strategy but some measures imposed are still far from reality in the field and lead to the persistence of disagreements.

Keywords: Bichiques, Reunion Island, Management, Stakeholders

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From smell to action, a study of smell-sensitivity and uses of nature

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In the 21st century, western societies appear more and more separated from nature, notably in urban contexts (Soga & Gaston, 2016). However, regular contacts with urban nature have been shown to have positive effects on human health, cognitive and psychological restoration (Bratman et al. 2012). The experience of nature is complex and multisensory. Sensory experience of nature has been studied mostly through vision and audition. In contrast, despite its importance in the construction of human self and identity, the sense of smell remains poorly included in the understanding of individual psychological relations to nature. In a quantitative study, we studied the individual relations between neurological and physiological smell sensitivity, affective and emotional connection to nature and actual sensory experiences in natural spaces. An online questionnaire combined a Chemical Sensitivity Scale (Nordin et al., 2003), the environmental identity scale (Clayton, 2003), and five questions assessing declared sensory uses of natural spaces in respondent's everyday life. Based on the answers from 500 French adult respondents, we showed that people who have a high smell sensitivity also have more sensory uses of natural spaces, and that this correlation is mediated by their environmental identity. This first result calls for a better understanding of the smell and sensory experiences of nature, on how these experiences can influence the way we interact with natural spaces, and of perspectives for nature spaces uses and management.

Keywords: human, nature relationship, experience of nature, sensory experience of nature, olfactory experience, smell sensitivity.

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An ethnobotanical study of wild medicinal and food plants used by local people of Tataouine in the south of Tunisia

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An ethnobotanical study was carried out in the years 2012–2014, during both dry and rainy seasons in Tataouin (south of Tunisia). We focused on plants used as medicines and/or food, in order to highlight the role of wild plants in the livelihood of local communities, and possibly to find out plants with potential pharmacological interest. Ethnobotanical data were recorded through semi-structured interviews, filed in a data base and quantitatively analyzed.
Informal interviews involving 32 informants provided data about 123 useful wild plant species that are distributed across 37 families and 104 genera.

A total of 297 citations were recorded, concerning 132 ethnospecies (folk taxonomic units not necessarily corresponding to single botanical species). For medicinal purposes, 59 ethnospecies (185 citations) were reported and 25 ethnospecies (68 citations) for food purposes. The main used parts resulted to be leaves followed by whole plant and seeds.
Results show that people living in Tataouine hold a valuable knowledge of the uses of plant resources and that some of the plants cited by the informants represent an important component of the local livelihood strategies.

Keywords: Tataouine, Tunisia ethnobotany, wild plants, pharmacological

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Systematics, Evolution and Comparative Anatomy

Species-specific AFLP loci resolving taxonomic uncertainty in Capparis species

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Capparis spinosa is a plant native to the Mediterranean region and used in agriculture, food industry, medicine and cosmetic. Due to free hybridization of different species and occurrences of intermediate forms, the taxonomic status of the *Capparis* species is controversial and unsettled. The aim of study was to assess the phylogenetic relationships between six morphologically distinct Caper species in order to resolve their classification ambiguities on the base of three primer combinations of amplified fragment length polymorphism (AFLP) markers. Out of 750 fragments generated 636 were polymorphic and 407 of them were restricted to a single species. The three AFLP primer combinations showed the same power to discriminate between the *Capparis* species. STRUCTURE and PCoA analyses clearly separated each species into a distinct genetic population. The UPGMA analysis grouped all the species into 3 main genetic groups: C1 presented *C. spinosa* subsp. *spinosa* var. *spinosa* and *C. sicula* subsp. *sicula*, procumbent species with persistent stipules that are slender and curved but not thorny; C2 grouped *C. ovata* subsp. *ovata* and *C. orientalis*, pendulous species with deciduous stipules that are slender and straight but not thorny; and C3 clustered *C. zoharyi* and *C. aegyptia*, erected species with evergreen stipules that are spiny, wide and crooked. Accessions from C1, C2 and C3 were mainly distributed in arid, sub-humid and semi-arid bioclimates respectively. Genetic studies on a large *Capparis* collection using these species-specific AFLP loci will help to assess the diversity within species and, phylogeography and hybridization between species.

Keywords: Capparis, AFLP, genetic distance, phylogeny, population structure.

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A head fit for big brains: the joint evolution of the human skull and brain

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Scientists have long favoured cranial features as clues to reconstruct the story of human evolution. This is because of the relative abundance of skulls in the fossil record, as well as the high number of diagnostic features observable on them. One major characteristic of human evolution is the development of large brains and of complex cognition. For this reason, the evolution of brains in fossil hominins and in *Homo sapiens* draws considerable scientific attention. The study of endocasts - their volume, general morphology, convolutional patterns, and the development of cognitive areas recognised in extant humans - may have little to tell us in terms of function, but it does allow for the identification of derived characters with potential phylogenic and evolutionary value. Because of the high morphological integration between the outer vault of the skull and the endocranium, it is difficult to list reliable independent diagnostic features for these two aspects of the head. The pressures on skull morphology may relate to environmental changes, diet, modifications in the sensory organs, brain development, or the use of articulate language, whereas the brain undergoes reorganisations which may be due to the development of cognitive areas. There is however very little literature concerning the joint evolution of the skull and endocast. We will present some morphometrical data derived from a sample of fossil and extant hominins, aiming at starting to clarify the relationship between the morphologies of the skull's outer vault and the endocranium throughout the evolution of the genus *Homo*.

Keywords: palaeoanthropology, human evolution, endocast, palaeoneurology, Homo, morphology, comparative anatomy

*Speaker

Distribution and infraspecific morpho-ecological variability of Ambrosina bassii L.(Araceae) an endemic of western-central Mediterranean aroid

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The monospecific genus Ambrosina is represented by Ambrosina bassii L., an endemic species of western-central Mediterranean mainly studied in Sicily and Corsica. The objectives of this study were to establish the distribution of this species and to determine its habitat and ecology in Tunisia. Moreover, the infraspecific diversity from recent and old collections throughout its range is characterized. The analyses of 8 leaf traits not considered by previous authors have uncovered the 4 varieties reported in this species and complete their morphological description.

The soil and climate conditions favorable to their development (bio-climate, rainfall, elevation, pH, texture, assets and total limestone content of the soil) are determined. If three varieties are widely distributed in all of the species' range, A. bassii var. angustifolia appears to be rare with
a very restricted distribution in Algeria.

Keywords: leaf morphology, ecology, Tunisia, varieties.

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Recent research on Gastrotricha (Metazoa), towards a better understanding of their evolution?

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Gastrotricha, or hairy-backs, is one of the main groups of Spiralia (Metazoa), the animal clade comprising, among others, annelids, mollusks and flatworms. These small aquatic, microscopic worms are often found in the interstices of sandy sediment, moving around by ciliary gliding. There are still relatively few studies conducted on this peculiar group, despite their putative key position in the Spiralia phylogeny. However, recent discoveries have added important knowledge to the understanding of the gastrotrichs, from their position in the Metazoan phylogeny to their taxonomy and inner anatomy: phylogenomic studies now place them as the sister group to flatworms, a result so far difficult to interpret morphologically. Furthermore, four new genera have been described over the last few years, giving a better understanding of the diversity of the group, which so far comprises only 800 described species. Last but not least, recent confocal microscopy studies have provided large amount of data on the anatomy of this group, revealing new characters of potential phylogenetic and functional importance. For instance, a brain nerve ring has now been recovered in many gastrotrichs, as well as anterior and posterior ganglia in some subgroups of gastrotrichs. These different results on gastrotrichs offer a sharper picture of the diversity and the evolution of this group. Together with other recent studies on the morphology and phylogeny of various Spiralia, they contribute to a better understanding of the evolution of this diverse group of metazoans.

Keywords: Phylogeny, Anatomy, Taxonomy, Protostome, Marine Biology, Gastrotricha

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Lower Miocene small rodents from Napak (Uganda) and their contribution to understanding paleoenvironments.

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Abstract The Early Miocene sites of Napak (Uganda) which have been prospected by the Uganda Palaeontology Expedition since 1985, have yielded abundant fossil remains, including a rich and diverse rodent fauna. Ever since the work of Lavocat (1973) on the East African Miocene rodents, which focused mainly on the Kenyan remains, but included some material from Napak discovered by Bishop during the 1950s and 1960s, few studies have been made on the Ugandan specimens. This lack provides motivation for further study of Napak micro-mammals, especially the abundant small rodents, which were collected at four sites, Napak IV, V, XV and XXX. The fossils are attributed to 7 species representing 5 families: Afrocricetodontidae (Afrocricetodon songhori, Protarsomys macinnesi), Myophiomyidae (Myophiomys arambourgi), Thryonomyidae (Paraphiomys hopwoodi), Kenyamyidae (Simonimys genovefae, Kenyamys mariae) and Sciuridae (Vulcanisciurus africanus). In addition, the fossil rodents associated with other fauna from the same localities suggest a more or less dense forest environment with clearings, and the probably presence of a humid climate at the time of deposition.

Keywords: Lower Miocene, Rodents, dentition, Napak, Uganda, paleoenvironment

*Speaker

Origin and early diversification of Caviomorpha (Rodentia, Hystricognathi)

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Despite their modern, Neogene and late Paleogene high diversity, the early evolutionary history of caviomorph rodents has long remained obscure. Until recently, the majority of Paleogene caviomorph assemblages has remained from high latitudes of South America (11/18) and only very few are known from lower latitudes (4/18). Recent field expeditions in Peruvian Amazonia have led to the discovery of more than twenty new caviomorphs-bearing localities in the regions of Contamana and Tarapoto. They document three South American Land Mammal Age of the Paleogene: Barrancan (late Middle Eocene; Contamana), Tinguiririan (Early Oligocene; Tarapoto) and Deseadan (Late Oligocene; Contamana). For the Barrancan, the caviomorph record has so far remained virtually undocumented. The systematic study reveals the presence of several new taxa. A cladistic assessment of the dental and cranial evidence was undertaken to investigate and formalize the phylogenetic positions of these new taxa in a high-level caviomorph phylogeny. A matrix was assembled in observing/describing 514 characters through a comprehensive taxonomic sampling (106 taxa) including extinct (a maximum of Paleogene taxa and several Neogene taxa) and extant (representatives of each family) species. The results show that these new taxa are either stem Caviomorpha or stem representatives of the extant superfamilies (Cavioidea, Chinchilloidea, Eretthizontoidea, and Octodontoidea). This phylogenetic context highlights the timing of the caviomorph superfamily cladogeneses.

Keywords: Peruvian Amazonia, Contamana, Tarapoto, Paleogene, phylogeny, adaptive radiation

*Speaker

New perissodactyls (Mammalia, Laurasiatheria) from early Eocene of the Paris Basin and their biogeographic implications

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The Perissodactyla – the group that includes extant horses, tapirs and rhinos - appeared during the Paleocene-Eocene transition and quickly spread in the Northern hemisphere. Their origin area is still debated but the hypothesis of an Asian origin is favoured. The recent discovery of new species of perissodactyls sheds a light on the biogeographic relations within this early group. The locality of Le Quesnoy has yielded one of the oldest and most complete fauna from earliest Eocene (MP7 biohorizon, France). We discovered two new perissodactyls that led to major implications for the biogeography of this group. The smallest species, *Pliolophus* sp. nov., is well represented by dental and postcranial elements. It presents resemblances with English species from MP8-9 biohorizon, but is different from MP7 species of Palette or Rians (Southern France). A size difference is observed between small Southern species and larger Northern species. This is consistent with the observed differences in faunal composition between the Paris basin and Southern Europe. As no physical barrier was present between North and South in France, a climatic barrier has been suggested in previous studies to explain this diversity. The second taxon described is the first European 'isectolophid', and gives us clues for a very early migration from Asia to Europe in perissodactyls history.

Keywords: Perissodactyla, early Eocene, biogeography, Pliolophus, Paris basin

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Study of a complete, mostly undescribed Oise amber spiders collection reveals a surprising diversity

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Oise amber (lower Ypresian, Eocene) is among the oldest cenozoic amber deposits. While insect inclusions from this formation are well studied, spiders are still poorly known, as only one study (Penney, 2007) had been previously led on some amber samples, revealing presence of eight spider families.
Present work took into account all 300 spider-bearing amber fragments registered in the collection. Inclusions got observed (after polishing) with a stereoscopic microscope and identified, when possible, to family level, based on morphological characters.

Eventually, 139 inclusions proved well-preserved enough to be determined, yielding 24 spider families, amongst which 16 are new for the deposit.

Oise amber represent oldest known occurrence for 8 of these families, and some truly interesting fossils have been discovered, like spiders preserved in mating or predatory interactions, or evidences for mimicry, phoresy and araneophagy.

In addition, this study opens very interesting perspectives, as it revealed a particular ecological and taphonomic characteristics for the amber deposit, and potentially new species and genera.

Moreover, its peculiar stratigraphic position, as one of the oldest cenozoic amber deposits, and seemingly in the very beginning of the cenozoic spider diversification, makes it really interesting to help understanding how this arachnid order overcame the Cretaceous/Paleogene mass extinction.

Keywords: Amber, Oise, Ypresian, Eocene, Spiders

*Speaker

Resolving incongruence among anatomical regions for basal mammal evolution

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Solving the evolutionary history of the Mesozoic mammaliaformes and understanding the timing of their radiation is a well-studied, yet still poorly resolved. Only morphological characters, many incomplete, are available for the phylogenetic reconstruction of these early taxa. Morphological characters have always combined without taking into account of the different rates of evolution between regional partitions which can lead to biases. To identify these problems, we conducted phylogenetic analyses on different partitions for a morphological dataset from Luo *et al.* (2015). Partitions were selected according anatomical regions (mandibular/dental; cranial and postcranial). We showed that cheek teeth and humero-scapular characters were bringing the strongest incongruence in the placement of monotremes and multituberculates. We find that removing them from the analyses is giving stronger support in the phylogeny. Moreover, these results give better confidence for dating analyses and ancestral state reconstructions. We find a rapid diversification just after the Trias-Jurassic boundary 200 million years ago. These results emphasize the importance of the Trias-Jurassic event in the diversification of mammals.

Keywords: Mammal evolution, Phylogenetic analyses, Morphological data, Incongruence

*Speaker

Cenozoic Batoid record from Contamana, Peru, with special focus on freshwater potamotrygonins (Chondrichthyes, Myliobatiformes) from the Pebas wetland system.

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Among the ichthyofaunal remains collected in the Tertiary deposits of Peruvian Amazonia, elasmobranchs show an unexpected richness of rays, gathering mostly potamotrygonins (river stingrays), but also pristids (sawfishes) and rhinopterids (cownose rays). Among the Potamotrygoninae subfamily and beyond the recovering of the middle Eocene Potamotrygon ucayalensis in the oldest levels, three new fossil species of Potamotrygon (P. contamanensis nov. sp., P. canaanorum nov. sp., and P. rajachloeae nov. sp.) are described from late Oligocene-late Miocene deposits along the Quebrada Cachiyacu, near Contamana, Peru. These new fossils fill a substantial gap in the sporadic fossil record of this exclusive freshwater elasmobranch subfamily, native to South America, thereby highlighting their ancient biological and ecological diversity. In the absence of sharks, the occurrence of obligate freshwater potamotrygonins and of other marine to brackish batoids along nine successive fossiliferous levels supports the predominance of fluviolacustrine environments in that region throughout the considered period, with a peak of marine influence around the middle-late Miocene transition, as recorded in other areas of Western Amazonia.

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Keywords: Batoids, Cenozoic, Peruvian Amazonia, Potamotrygoninae, Paleoecology, Paleoenvironment

The skull shape elongation in the crocodylians' natural history: An evolutionary trend explained by Seilacher's triangle

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The adaptationist paradigm of the Synthetic Theory has been criticized. A more pluralistic view suggesting that historical (phylogenetic) and structural factors may explain parts of the observed phenotypic variation has been proposed (Seilacher's triangle) but remains marginal. Here we perform a quantification of the phylogenetic, functional and structural components of crocodylians skull elongation. Snout elongation is a homoplastic feature in Crocodylomorpha and its adaptive significance is about hypothesis. Therefore, we defined three factors (historical constraint, structural constraint, adaption) hypothethically explaining the snout elongation. We assessed a "coefficient of skull lateral acceleration" in the stereotyped behavior in crocodylians during prey catching (the lateral bite) as a functional factor. We show that slender-snouted skulls are lighter and offer less drag than those with broad snouts during lateral bite. As a structural factor, we used Von Mises stresses, a good predictor of failure which assessed that slender-snouted skulls experience higher stresses during biting. Finally, we used Pagel's lambda to quantify the phylogenetic signal assuming both molecular and morphological calibrated trees. This phylogenetic test assesses if a feature evolves randomly or if the degree of relativeness between the species explains phylogenetic patterns. We conclude that crocodylian skull shape variation is the outcome of a mechanical trade-off between hydrodynamic efficiency and mass reduction for catching agile aquatic prey (functional factor) and strength for subduing and processing prey (structural factor).

Keywords: Historical constraints, Structural constraints, Adaptation, Crocodylians, Functional morphology.

*Speaker

New significant data on a vein fusion controversy documented in Stenosmylinae forewings (Neuroptera: Osmylidae)

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Among insects, the wing represents a substantial character system. Furthermore, it is the main one available for lithographic fossil record. The order Neuroptera (Holometabola) exhibits an extraordinary diversity of wing patterns that attests to an important accumulation of differentiations. Thus, the establishment of robust homology hypothesis on wing veins, determinant to investigate phylogeny and evolution of the group, raises some debates.
Currently, one of the most fruitful one concerns the veins MP (*Media posterior*) and CuA (*Cubitus anterior*, posterior to MP). Usually, MP forks in two stems : MP1 (*MP anterior*) and MP2 (*MP posterior*). However, the forewings of some subgroups exhibit a unique apparent stem MP. A first paradigm (1) suppose that MP is reduced in one stem in these wings, whereas an alternative one (2) propose that MP2 still exists but is inconspicuously fused with the vein CuA. An oblique vein between MP and CuA is interpreted in these wings as a particular cross-vein or as the base of MP2 by the paradigms (1) and (2), respectively. Due to lack of developmental and genetic knowledge on wing formation, the two hypotheses still coexist.
A comparative analysis, providing new observations and arguments, is proposed here. The intraspecific and intra-individual variability are investigated in four species (Stenosmylinae). Among three of them, some "unusual" morphologies are revealed and tend to refute the paradigm (1). Finally, a discussion is lead about the relevance of this character in phylogeny and the extrapolation of this result to other families concerned by the debate.

Keywords: Neuroptera, wing venation, vein fusion, intraspecific variation

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Phylogenetics of Sus strozzi and Sus minor: confirming a long debated hypothesis and comments on Sus taxonomy

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Sus is the most-species rich genus in the family Suidae, and is currently divided into the '*scrofa*' group, with *Sus scrofa* as its only member, and the '*verrucosus*' group, which includes species from South-east Asia. This division is mainly due to morphological differences, but recent molecular studies confirm the monophyly of both groups. *Sus minor* and *Sus strozzii* are two extinct European species. Taxonomists noted closer affinities between these two species and the *verrucosus* group, but a phylogenetic relationship has never been tested using cladistic methods. In this study we obtained data from the literature and collected new characters from museum specimens, integrated our morphological matrix with DNA sequences, and demonstrate for the first time that *S. strozzii* and *S. minor* are nested within the *verrucosus* clade. Furthermore, we show that the main character (i.e. the morphology of lower canine) used by some authors to distinguish the *scrofa* and *verrucosus* groups does not carry phylogenetic signal.

Keywords: Suidae, cladistics, homoplasy, Dasychoerus, phylogenetics, taxonomy

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Importance of the Quatrehomme Collection (Monnaye Museum, Meung-sur-Loire) in the French paleontological landscape

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François Quatrehomme (1910-1996) mainly searched for fossils in the Faluns of Touraine and of Blésois. This Middle Miocene formation is known for its abundant vertebrate remains. In 1996, he decided to bequeath his collection to the city of Meung-sur-Loire, where it has been hosted since 2005 (municipal museum La Monnaye). This collection is described by Ginsburg as "modest to very modest" and there is no accurate inventory. In order to highlight this collection and better understand its importance, an inventory of the terrestrial mammal remains is in progress.
Inscriptions on the specimens identify the localities (mostly quarries) and date the discoveries. In the current state of the inventory 30 different locations were identified, mostly in the Savigné-sur-Lathan Basin. 3.266 specimens, covering eight of the nine orders of terrestrial mammals found in the Faluns, are currently registered in the data set.

To date, the most impressive published Faluns mammal collection is the Hartmann one, hosted at the volunteer "Musée du savignéen" (Savigné-sur-Lathan). While this "huge" collection contains 1.475 mammal remains (marine and terrestrial), we estimate that the Quatrehomme collection encompasses more than 7.500 terrestrial specimens. Moreover, the Quatrehomme collection contains very rare and uncommon fossils. It is the largest known Faluns collection of *Pliopithecus* (25 specimens) and of Lagomorpha (1.354 specimens). Also, eight Tapiroidea specimens (including a jaw with teeth) and three *Chalicotherium* remains are inventoried.
This collection is now being studied in detail. In the next few years it will take a more prominent place in the French paleontological landscape.

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Keywords: Faluns, collection, mammals, Miocène, inventory, paleontological landscape

Phylogeography and evolutionary history of the Crocidura hildegardeae complex (Mammalia, Soricomorpha)

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Within hte family Soricidae, the genus *Crocidura* Wagler 1832 is one of the most speciose. Most of these species are from Africa and they are morphologically difficult to discriminate. Within the *C. hildegardeae* complex, three species are actually recognized (*C. denti, C. attila* and *C. hildegardeae*), but the validity of these species, their phylogenetic relationships and geographical distributions are unclear. To clarify these aspects, and to better understand diversification processes within this complex of species, we performed a phylogeographic study on the cytochrome b mitochondrial gene. Our results show that the complex C. hildegardeae is not monophyletic, but constitute a clade with the complex *C. poensis* (comprising the species *C. buettikoferi, C. foxi, C. nigierae, C. poensis, C. theresae, C. turba* and *C. wimmeri*). None of the three nominal species of the *C. hildegardeae* complex is monophyletic in our phylogenetic tree. Based on two molecular criteria (monophyly and genetic distance), we propose to recognise three species within this species complex. These three species have allopatric geographical distribution ranges: one is present in west-central Africa (Cameroo, Gabon, Congo, Central African Republic and eastern Democratic Republic of Congo), one is present in northern Zambia and southern Democratic Republic of Congo, and one is present in east Africa (Kenya, Tanzania, Burundi, Malawi and Zambia). Additional analyses including type specimens are necessary to verify how our findings relate to the already existing taxonomy for this group. We discuss the role of Pleistocene climatic fluctuations and rivers in the diversification of this complex of species.

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Keywords: Phylogeography, phylogeny, shrews, Soricidae, Crocidura, species complex, Taxonomy, Africa

Systematic reassessment of the earliest mammalian fauna (Saint-Nicolas-de-Port, Upper Triassic, France)

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The locality of Saint-Nicolas-de-Port (Upper Triassic, France) yielded the most important collection of earliest mammaliaforms. This collection includes more than three quarters of the available material for Triassic mammaliaforms, with representatives of all groups (morganucodonts, 'symmetrodonts', and haramiyids). However, despite twelve publications between 1978 and 1999, most of this material remains undescribed. After description of more than 450 molariform and premolariform teeth, 18 species and three indeterminate taxa are identified. Among morganucodonts, several genera known in other sites are described (*Morganucodon*, *Paceyodon*, and Paikasigudodon). Two new species are described (*Megazostrodon chenali* sp. nov. and *Rosierodon anceps* gen. et sp. nov.). Upper and lower molariforms of Brachyzostrodon are associated for the first time. Among 'symmetrodonts', one new species of Kuehneotherium, *K. stanislavi* sp. nov., and a new genus of Kuehneotheriidae, *Fluctuodon necmergor* gen. et sp. nov., are described. *Woutersia* is revised. The hitherto unknown upper molariforms of *Delsatia* are identified. Among haramiyids, the description of the material referred to *Thomasia* demonstrates the need for an exhaustive revision of the genus. *Theroteinus* is revised, with the erection of a new species, *T. rosieriensis* sp. nov. This study raised several issues on the systematics of earliest mammaliaforms, especially on definition of key taxa.

Keywords: Mammals, teeth, Upper Triassic

*Speaker

Early Cretaceous erymid fauna (Crustacea: Decapoda: Erymidae) from France

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Erymid lobsters (Crustacea, Decapoda, Erymidae) are relatively common and abundant in Jurassic rocks (*ca* 70 species) but are far less common in the Early Cretaceous with about 20 species only listed in Europe, North America, South America, Australia, Antarctic, Japan and Madagascar. A study of the nine species of erymid lobsters from the Early Cretaceous of France, is here presented. Based on new observations, the concepts of some erymid genera are updated and new diagnoses are proposed for *Eryma* Meyer, 1840, *Enoploclytia* M'Coy, 1849, *Palaeastacus* Bell, 1850, *Pustulina* Quenstedt, 1857 and *Stenodactylina* Beurlen, 1928, mainly based on the carapace groove pattern. The new genus *Tethysastacus* is erected on the basis of its very simple groove pattern compared to the previous genera and includes *Tethysastacus tithonius* (Van Straelen, 1936) n. comb. (Valanginian, France) as type species. Four new species from France are also presented: *Eryma vocontii* n. sp. (Albian) which extends the stratigraphic range of *Eryma* to the Albian, *Pustulina occitana* n. sp. (Berriasian), *Pustulina colossea* n. sp. (Hauterivian) and *Enoploclytia augustobonae* n. sp. (Barremian) which is the oldest known *Enoploclytia* representative.

Keywords: Crustacea, lobster, Mesozoic, new genus, new species, Western Europe

*Speaker

Comparative anatomy and phylogeny of the Forcipulatacean starfish (Asteroidea, Echinodermata)

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Among echinoderm groups, the use of both molecular and morphological data favoured the emergence of a comprehensive and operational systematics in Echinoidea and Ophiuroidea. Unfortunately we are far from reaching such a consensus in the Asteroidea, despite a background of 30 years of modern phylogenetic analyses. Debates on starfish phylogeny still oppose various hypotheses, each supported by both molecular data and morphological characters. Recent researches demonstrate that a large set of morphological characters can be defined from comparative anatomy of skeletal elements (ossicles) for phylogenetic purposes, describing ossicle shapes, articulations among ossicles, marks of soft tissues on the skeleton (e.g. tube feet or muscle insertions). Both extant and extinct taxa can be analysed conjointly in phylogenetic studies of ossicle characters, which may help with tree rooting and consideration of fossils. The superorder Forcipulatacea is one of the major monophyletic groups with about 400 extant species, morphologically well-delimited, and for which a few phylogenetic hypotheses are available for its internal relationships. We explored the diversity of morphological features expressed in the group, considering 21 extant species and 5 fossil forms. The anatomy was investigated from progressive dissection of specimens from the zoological collections of the Muséum National d'Histoire Naturelle, Paris. The comparative work allowed definition of about 70 characters, a majority being new (_˜33%) or reconsidering previous homology hypothesis (_˜42%). Four distinct taxon of each major clade of living forms (Velatida, Valvatida, Paxillosida and Spinulosida) were tested as outgroup for rooting.

Keywords: Asteroidea, Forcipulatida, Systematics, Phylogenetics, fossils

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How does the worm bite? The stomatogastric nervous system in Gnathostomulida

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Gnathostomulida is a small phylum of marine microscopic animals, characterized by the presence of cuticular jaws in their pharynx. Along with Micrognatozoa and Rotifera they constitute the clade Gnathifera, which is considered a sister group to all remaining Spiralia (annelids, mollusks, flatworms and their relatives) and hence might be important for understanding the evolution of this diverse group. The stomatogastric nervous system (SNS), innervating the pharynx and digestive tract, is present in several animal lineages and likewise reported from all gnathiferan phyla, where it comprise a pharynx-related ganglion and nerves. However, its presence in gnathostomulids has been contested by some authors. Our research on the nervous system of Gnathostomulida, based on immunohistochemistry and confocal laser scanning microscopy, confirmed the presence of a SNS in all major evolutionary lineages of Gnathostomulida. Moreover, we proved direct connection between the buccal ganglion and the brain, indicating at least a partial control of the former by the latter. The SNS consists of a simple buccal ganglion (with only about 40 cells), buccal nerves extending anteriorly along the pharynx, and sets of glandular and ciliated receptive cells with presumably receptive function, similar to the receptors known from rotifers and micrognathozoans. Our results show that the overall architecture of the SNS in Gnathifera is relatively conservative, most probably due to the crucial function of the SNS in jaw movement control, food uptake and processing. Eventually we will present preliminary hypotheses on the functionality of the SNS in Gnathostomulida and propose how to test them.

Keywords: Stomatogastric nervous system, Gnathifera, Spiralia, CLSM, immunohistochemistry, neuroanatomy

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Cryptic diversity under the leaf litter: flightless dance flies from Iberia are more diverse than previously known

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Among the widespread predator flies of the family Hybotidae (Diptera) there is a cluster of five species, currently comprising genera Ariasella and Pieltainia, characterised by wings extremely reduced or absent. They are endemic to the Iberian Peninsula and the Pyrenees. The study of these flies has always been hindered by their minute size (≈ 2 mm), secretive behaviour, habitat – among the leaf-litter of deciduous oak-forests – and taxonomy which is only superficially known and morphology-based.
In order to tackle these challenges, a molecular approach was applied to most of the known species in the complex as well as to newly sampled populations. A screening protocol using the 5' end of the mitochondrial DNA gene Cytochrome-oxidase 1 (the barcode region) yielded crucial information towards the understanding of the group.
Very high levels of genetic differentiation were found among populations, unveiling a cryptic diversity not previously acknowledged. Most interestingly, an improved morphology-based analysis is largely congruent with the genetic data. The description of additional species is required to accommodate this diversity.

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Keywords: Phylogeny, Morphology, Taxonomy, Insecta, Diptera, Cryptic diversity

Megaloolithid dinosaur eggs : scrambled parataxonomy and nesting strategies

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The detailed study of fossil dinosaur eggshells from Upper Cretaceous continental deposits from the Haţeg Basin (Romania), the Arc Basin and Argentina and from the Thanetian of the Rians Basin (France) was made in order to test the robustness of fossil eggs' parataxonomy and to reveal novel data on dinosaur palæobiology. μXRF, XRD and cathodoluminescence analyses attest a limited diagenesis on these fossils, which allow interpreting observed traits from a palæobiological point of view. According to their microstructure, analysed eggs mainly belong to the titanosaur-related Megaloolithidae oofamily. Measured histological variables analysed through PCA – clustering unveil a weak megaloolithid parataxonomy scheme which needs to include whole shell units morphology forming the eggshell in addition to descriptions. XRD analyses point to an almost pure calcite eggshell composition (LMC) as well as a preferential orientation of this calcite along the shell unit growth axis, the latter involving biomechanical properties of the egg. Water vapour conductance (GH2O) estimation of some fossil eggshells together with the corresponding porosity – modelled mass pairs suggest that Haţeg and Arc Basins titanosaurs burrowed their nest in humid conditions. The vegetation-mount hypothesis is rejected whereas a hydrothermal environment is proposed for the Argentinian sample.

Keywords: Megaloolithidae, titanosaur egg, parataxonomy, nesting strategy, Haţeg Basin, Arc Basin

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A model of Kinda baboon (Papio kindae) evolution and natural history: morphological consequences of feminization in the craniofacial skeleton

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Baboons (genus *Papio*) are large-bodied, terrestrial Old World monkeys that are widely distributed across sub-Saharan Africa and the Sinai Peninsula. They are characterized by body size sexual dimorphism, with males nearly 1.5 times larger than females. Additionally, males have extremely large canines and a correspondingly prognathic snout. However, one species, the Kinda baboon (*P. kindae*), differs from the others in demonstrating a reduction in these characteristically "baboon" traits. Unfortunately, Kindas are less well studied than other baboons. The long-term research camp in Kasanka National Park (KNP), Zambia established by AHW is the first to provide longitudinal quantitative data on Kinda ecology and social behavior. These data (reported previously) suggest Kindas differ greatly from other baboons, primarily in their social behavior. To augment these behavioral observations, we present preliminary results from a craniometric study on specimens from the KNP populations. Eight male skulls were collected opportunistically in the field and individuals range in age from juvenile to adult. Twenty-five linear measurements were recorded with calipers to quantify craniofacial size and shape variation. These data were integrated into a large analysis (N = 985) of other baboons that compares the distribution of craniofacial variation across multiple species, sex, and age cohorts. Small sample size and the absence of any female specimens precluded any statistical inference but exploratory data analysis methods were employed and observed patterns were used to formulate a model to potentially explain the differences in behavior and social structure in Kindas as compared to all other baboons.

Keywords: baboons, craniofacial, anthropology, Zambia, monkeys, variation

*Speaker

First record of Diplocynodon ratelii (Crocodylia: Diplocynodontidae) in the Czech Republic.

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The knowledge about the European extinct alligatoroids significantly increased during the last ten years, based on the erection of the two new species and the revision of the previously published taxa. The remains of the genus *Diplocynodon* are quite common in the northwest localities of Bohemian area, but they have only been referred at genus level due to the absence of skull material. Here, we report crocodylian remains from the Early Miocene of Most Basin (NW Czech Republic). Among available remains housed at the Paleontological collections of Wien University, we focus our study in two partial skulls, osteoderms and isolated vertebra. Our comparisons were based on alligatoroid taxa: *Diplocynodon ratelii* from the MN2 of Saint-Gerand-le-Puy (France) and the MN4 of Casots (Spain) and *D. ungeri* from the MN5 of Sch´onegg (Austria). According to the cranial and osteoderms features, they are attributed to the *Diplocynodon ratelii*, which is the only taxonomically valid species from the Early Miocene of Europe. The studied remains represent the first report of *Diplocyndon ratelii* in the Czech Republic, where only fragmentary postcranial and osteoderms of that genus from middle Eocene to Early Miocene had been previously reported. Furthermore, the studied remains open the door to discuss the geographical and temporal distribution of *Diplocynodon ratelii* in Eastern part of Central of Europe.

Keywords: Fossil alligatoroids, North Bohemian area, Most Formation, coal quarry, Early Miocene, cranial anatomy

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Fossil turtle remains from the Early Miocene (MN4) localities of Mokra Quarry (Czech Republic).

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The two fossiliferous karst localities of Mokra-Western Quarry, Czech Republic (MWQ, 1/2001 Turtle Joint and MWQ, 2/2003 Reptile Joint) have provided a rich herpetofauna (amphibians and squamates) from the Early Miocene (MN4b). Here, we describe the unpublished turtle material recovered from above-mentioned sites, as well as two other localities of equal age including the Turtle Cave (MWQ) and a karstic fissure no. 3/2005 (Mokrá Central Quarry, MCQ), which yielded two taxa attributed to *Ptychogaster* (*Ptychogaster*) cf. *buechelbergense* and *Testudo* (*Chersine*) cf. *angustihyoplastralis*. It is noteworthy that the presence of this ptychogasterid species was recently reported from several localities of NW Bohemia in Schaffer's PhD, but it has never been studied in detail. In turn, *Testudo* cf. *angustihyoplastralis* represents the first known record of this taxon in Czech Republic, and in fact, it is the second record of this taxon apart from the Austrian type-locality. Regarding the taxonomical adscription of the later, our revision of the holotype of *T. angustihyoplastralis* further indicates that this taxon should be attributed to the subgenus *Chersine*. The presence of this testudinoid fauna confirms various ecological environments as a dry karst landscape with open to dense steppe vegetation inferred for the heliophile testudinid, as well as a wooded and close to freshwater environment to the semi-aquatic ptychogasterid. Finally, the turtle remains reported from the Mokrá Quarry expand our knowledge on the composition of the fossil turtle assemblages within the territory of the Carpathian Foredeep (Central Paratehys) during the Early Miocene Climatic Optimum.

Keywords: Ptychogaster, Testudo, Chersine, testudinoids, Carpathian Foredeep, Central Paratehys, Moravian Massif

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Wet behind the ears? Underwater Directional Hearing in Protocetids

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Extant cetaceans are fully aquatic mammals which present deep modifications of their sensory organs, especially of the sound perception pathway. The archaeocetes, a paraphyletic assemblage of early diverging cetaceans, present a diversity of morphologies of the middle ear, documenting a variety of sound transmission mechanisms from a mostly terrestrial configuration to a fully aquatic layout. Protocetids are semi-aquatic archaeocetes known from the middle Eocene deposits. The auditory region of these so called "transitional" forms is only partly apprehended. Lutetian phosphate deposits of Kpogamé, Togo (46 - 43 Ma) yielded abundant material documenting the auditory region of protocetid whales including isolated bullae, petrosal and a skull fragment preserving a subcomplete petrotympanic complex. Detailed study of this material led us to reassess the original taxonomic attribution of these middle ear remains, first entirely attributed to *Togocetus traversei*, and to identify, on the basis of new bullar and petrosal characters, three different protocetid taxa: ?*Carolinacetus* sp., *Togocetus traversei*, and a Protocetid indeterminate (morphotype γ). CT-Scan investigation of the in situ petrotympanic complex reveals that protocetids retained a complete tympanic ring similar to that of terrestrial artiodactyls. Furthermore, the involucrum could probably articulate with the medial side of the ventral surface of the petrosal. Here, we will discuss the implication of this articulation, absent in fully aquatic cetaceans, and propose a new hypothetical hearing mechanism, that consists of a bimodal functioning of the petrotympanic complex allowing optimal directional hearing in both air and water in amphibious early cetaceans : the "Petrotympanic Switch Mechanism".

Keywords: Archaeoceti, Protocetidae, Petrotympanic complex, CT, scan, Hearing mechanism

*Speaker

Phylogenetics of Guinea yams and their wild relatives

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The yam genus (*Dioscorea* L.) comprises over 600 species. In Africa, the principle cultigens are the Guinea yams (*D. cayenensis* Lam. and *D. rotundata* Poir.). With the winged yam, originally from Asia, they are responsible for 95% of global production in West Africa and for yams being the fourth most important tuber crop in economic terms after irish potato, cassava and sweet potato.
Both guinea yams and winged yam belong to the Enantiophyllum clade of *Dioscorea*. Despite the economic and social importance of yam, species relationships among the closest relatives of Guinea yams are poorly understood. This is true both of the immediate wild relatives of *D. rotundata-cayenensis* that are still ennobled to form cultigens in some African cultures (*D. abyssinica* Hochst. ex Kunth, *D. praehensilis* Benth. and *D. sagittifolia* Pax) and more distantly related taxa with perennial tubers such as *D. baya* De Wild, *D. burkilliana* J.Miège and *D. minutiflora* Engl. Thus in order to recover the relationships of the guinea yams with their wild progenitors a phylogenetic analysis based on sequence data from six plastid genes using 46 accessions of *Dioscorea* containing 12 species making it approach species-level sampling of African Enantiophyllum was carried out. African Enantiophyllum was recovered as a monophyletic clade containing two subclades of species with annual and perennial tubers.
Wild relatives in general hold genotypes that can be used to breed resilient crop varieties. We anticipate that yam breeding will also benefit from the use of enhanced knowledge of yam's wild relatives.

Keywords: Enantiophyllum, Clade, Monophyletic, Plastid

*Speaker

The hoatzin, a bird like no other

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The hoatzin (Opisthocomus hoazin) is an amazing bird. Previous research has revealed that it has a specialized leaf-feeding diet associated with an enzymatic pre-stomach digestion, unique among birds.
This folivorous diet involves significant morphological changes because the leaves are digested by fermentation in an enlarged crop. This digestive system modification corresponds to an anatomical change of the sternum. The carina is reduced which leaves little space for the insertion of the pectoral muscles. Consequently, it has been suggested that the flying ability of the hoatzin is reduced.
Young hoatzins have a unique feature in birds, two claws on their wings that they use to climb. Indeed, hoatzin chicks jump from their nest into water and then climb back to the nest using their clawed wings to avoid predation. Recently obtained data for animals in the field demonstrate that the chicks move their wings with alternating movements when climbing, a locomotion mode ever observed in other species of birds.
The morphology of the Hoatzin has not been studied since the first descriptions in 19th century. The goal of the present project is to study the anatomical features of the Hoatzin thanks to new biological material that was obtained in the field in Venezuela. An ontogenetic series will allow us to describe the development of the musculoskeletal system in order to understand the evolutionary compromise between feeding and locomotion observed in this unusual bird.

Keywords: Opisthocomus hoazin, morphology, ontogeny, wing claws

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Phylogenetics relationships among the genus Gambusia Poey, 1854 (Actinopterygii, Poeciliidae,) in northeastern Mexican basins.

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Mexico is among the countries with the highest freshwater ichthyofauna endemisms around the world. This country counts with one hotspot in the Atlantic slope. Specifically, some authors have pointed out the region comprised by the basins of the Pánuco-Tamesí complex as a possible hotspot of numerous species. Among the freshwater ichthyofauna living there, the family Poeciliidae stands out due to its importance, being the genus Gambusia Poey, 1874 the most diverse of them all. This group has been poorly studied and all approaches have been based on morphological traits. Previous works suggested that Panuco Basin could constitute a new endemics hotspot for the Gambusia genus. Our aims were to establish the phylogenetic relationships of the genus in the Pánuco-Tamesí rivers basins as well as proposing biogeographical hypothesis that could explain the distribution of the genus in the region. To carry out the objectives, we used a multilocus approach by using two different markers (mitochondrial cytb and nuclear s7). We carried out delimitation species tests and divergence time estimations. Our phylogenetic analyses showed that the region under study presents a high divergence in the genus species as well as possible candidates to be described as new species. Lineages indentified in this study could have diversified during the orogeny uplift of Sierra de Tamaulipas and the formation of Sierra Madre Oriental during the Miocene. Sexual selection processes and climate fluctuations during the Pleistocene could have had influenced on the population structure of the species recognized on the Gambusia genus.

Keywords: Biogeographical hypothesis, Gambusia, Pánuco, Tamesí complex, phylogenetic analyses, delimitation species, Sierra Madre Oriental, Poeciliidae, Mexico.

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Giraffe Taxonomy: Two or Three Species Instead of Four?

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The taxonomical status of *Giraffa camelopardalis* (Linnaeus 1758) remains unchanged for the past 40 years by consisting only one species subdivided into several subspecies. Nevertheless, the number of distinct giraffe species has been highly debated since the beginning of the 19th century, leading to the description of many subspecies and up to three different species over time by considering solely morphological criteria like coat patterns, the number and appearance of ossicones and the geographic distribution across Africa. Over the last decade, several molecular studies tried to unravel this taxonomic issue. The most recent article of Fennessy and colleagues suggested the following four species: (1) northern giraffe - *Giraffa camelopardalis*, (2) reticulated giraffe - *Giraffa reticulata*; (3) Masai giraffe - *Giraffa tippelskirchi* and (4) southern giraffe - *Giraffa giraffa*. However, our separate Bayesian re-analyses of the markers used by this team reveal that the four putative species are in fact weakly supported by the data and show strong discordance between mitochondrial and nuclear results. Taxonomically, our reanalyses provide high support for the existence of rather two or three distinct giraffe species: one species including both northern and reticulated giraffes (*G. camelopardalis*), a second including all southern giraffes (*G. giraffa*) and a less supported subdivision of the latter one even into two distinct species (*G. tippelskirchi* and *G.giraffa*). Our analyses suggest as well that the evolutionary history of giraffes has been impacted by climatic changes during the Pleistocene epoch.

Keywords: Giraffa, species, subspecies, Africa, Pleistocene

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Hide and seek: The complex evolutionary history of green secondary plastids

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Photosynthesis in eukaryotes arose from the endosymbiosis between a cyanobacterium and a heterotrophic host. This primary endosymbiotic event gave rise to Archaeplastida, a supergroup composed of glaucophytes, Viridiplantae (Green algae and land plants) and Rhodophyta (red algae). In their turn, red and green algae established secondary endosymbioses spreading the ability to photosynthesize to other eukaryotic groups. During endosymbiosis, multiple genes of the alga were relocated to the host nucleus (Endosymbiotic Gene Transfer, EGT). Through the phylogenetic analyses of 85 EGT genes, we showed that extant phyla with green-alga derived plastids (chlorarachniophytes and euglenids) likely carried a red plastid that was later replaced by a green one. We propose that the former red plastid might have helped to establish the secondary endosymbiosis with a green alga.

Keywords: Plastid evolution, endosymbiosis, algae

*Speaker

Exploring the interplay between ontogenetic trajectories and morphological evolution in early amphibians: a geometric morphometric approach

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Temnospondyls were the largest amphibian clade during the Paleozoic and Mesozoic, with more than 300 species known to date. They lived in a wide range of habitats and presented different life cycles, including species with aquatic larvae that transformed gradually into aquatic adults, others with aquatic larvae that suffered a drastic metamorphosis that led to fully terrestrial adults, and neotenic species. Despite of this, the cranial morphology within the clade is largely conserved, especially the dermal skull roof. Herein, I address whether the ontogenetic allometric patterns of the skull roof in temnospondyls are also conserved or reflect the variety in ecological adaptations and life-cycles. Using geometric morphometric techniques, I computed the ontogenetic allometries of 13 temnospondyl species by multivariate regressions of shape on size and compared them by visual comparisons of deformation grids and by exploring the allometric space constructed from the slope coefficients of the regressions. A conserved pattern of morphological change during ontogeny is recovered across the clade and the distribution of the ontogenetic trajectories in the allometric space reflects neither ecological adaptations nor life strategies, but follows the phylogenetic relationships within temnospondyls. This conservatism in ontogenetic trajectories suggests strong constraints in cranial development and this, in turn, may explain the low morphological disparity in adult morphology.

Keywords: Temnospondyli, allometry, ontogeny, geometric morphometrics

*Speaker

New data on the Mesozoic radiation of chelonioids

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"Turtles" (Testudines) form a successful group of reptiles with several terrestrial, marine and fresh-water species. Their peculiar and somewhat constrained morphology (i. e. : carapace incorporating ribs, curved limbs, anapsid skull exempt of temporal fenestrae) and ecology has often obscured their relationships and, hence, their evolutionary history, notably in marine turtles (chelonioids). Modern chelonioids are divided in two clades (i. e. : shoft-shelled turtles and hard-shelled turtles) supported by distinct morphological and embryological characters. Their origin is traced back up to the Cretaceous, along with a series of extinct forms, many of which being collectively known as Protostegidae. Fossil evidence show that at least five clades of marine turtles were roaming the seas at the end of the Cretaceous. In fact, chelonioids appeared during the first stages of the Early Cretaceous and quickly exploded to reach a high level of disparity at the lowermost part of the late Cretaceous. Therefore, the Mesozoic radiation of chelonioids must have happened during the "middle" Cretaceous (especially the Aptian-Albian interval). However this radiation is poorly understood as the phylogenetic relationships of marine turtles are not resolved yet. Bringing new data may help resolve these issues, and it is the exact reason why the genus *Rhinochelys* is being investigated.

Keywords: Marine, Turtle, Chelonioidea, Phylogeny, Mesozoic, Cretaceous, Rhinochelys, Protostegidae

*Speaker

Evolutionary Changes in the Synarcual of Batoidea over Geological Time

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Batoidea (skates and rays) are the sister clade to Selachii (sharks) and are the most morphologically varied body forms amongst extant Elasmobranchii (Chondrichthyes). The synarcual (fused anterior vertebrae) is a synapomorphic feature amongst extant batoid species but does not appear in all extinct batoid groups; previous research into the batoid vertebral column has been limited to general morphology with no comparative study on the evolutionary changes of the synarcual over geological time.
This work details the structural changes of the synarcual since its first appearance in the fossil record (Lower Jurassic, _˜182.0 Mya), to modern batoids. Most of the observations were from macrophotography of fossil specimens from the Natural History Museum, London (NHMUK). The majority of the fossil specimens studied were from the Rhinobatidae (guitarfish) family (*Rhinobatos whitfieldi*, *R.maronita*, *R.intermedius*, *R.grandis*) and *Asterodermus platypterus*. Extant species (*R.formosensis*) were also studied and detail of the synarcual was collected through computed tomography (CT) scanned images which were 3-D rendered.
The results show that there is a progressive change in morphology, which included an increase in synarcual length, a decrease in number of centra enclosed within the synarcual, and the comparatively tighter articulation with the basicramium. This study shows that the synarcual has become increasingly important to the function of the batoid axial skeleton and largely influences the mode of locomotion and feeding mechanism. Future work will focus on examining the interspecific differences of the synarcual morphology between extant species.

Keywords: vertebrae, synarcual, chondrichthyans, elasmobranchs, batoids, morphology, evolution

*Speaker

Phylogenomics on the origin of eukaryotes

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The differentiation between prokaryotes and eukaryotes is probably the most important structural separation in the history of life. Among the eukaryotes we find a broad biological diversity that encompasses unicellular and multicellular, autotrophic and heterotrophic lineages. In fact, a large part of the eukaryotic biological diversity, especially that of protists, still remains to be discovered. The systematics and taxonomy of eukaryotes have undergone a great transformation with the appearance of molecular biological techniques, such high-throughput sequencing and single cell genomics. Because of these, several lineages of eukaryotes have been discovered and new clades and groupings have been created. But still many incertae sedis protists remain understudied (Apusomonadida, Ancyromonadida, Breviatea, Malawimonads, Rigifilida, Collodictyon, etc.). Also, the origin of the eukaryotic cell and the location of the root of the tree are the objects of intense scientific debate. Recently, molecular environmental studies such barcoding and metagenomics have provided the tools to discover prokaryotic lineages close to the root of eukaryotes (such as the Lokiarcheota), with gene contents previously thought to be eukaryotic innovations. The tree of life is in a continuous process of restructuring and needs to be resolved to infer such important evolutionary transitions, and trace back the original features of the Last Eukaryotic Common Ancestor. Molecular phylogenomics is one of the most reliable methods to resolve such questions, that will establish a framework to test eukaryogenesis hypotheses.

Keywords: concatenated matrix, single cell genomics, endosymbiosis, protistology, eukaryogenesis

*Speaker

Getting a handle on the transition from limb to fin: first description of the forelimb of a African protocetid.

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Cetaceans constitute a textbook example of secondary adaptation of tetrapods to aquatic life. This major event in the evolutionary history of mammals is often linked in literature to the transition from a limb to fin. However, limb bones are scarce in the fossil record of early cetaceans, and the transition from a limb adapted to an amphibious life to a fin adapted to a pelagic lifestyle remains poorly documented. The Protocetidae were the most diversified archaeocetes in terms of size and forms, and displayed a wide array of locomotor lifestyles from the amphibious basal forms to species fully adapted to pelagic life. Several authors proposed that they were not nearly as sophisticated swimmers as extant cetaceans, probably swimming by undulation of the body and tail or using alternate or simultaneous hind limb paddling. The discovery of new protocetid remains in Lutetian deposits in Senegal, including an almost complete forelimb, allows us to take a new look at this crucial step of the cetacean morphological evolution. The new remains were CT scanned and 3D models of the forelimb were performed. A morpho-functional study allowed us to compare the locomotory abilities of this specimen with that of other marine mammals. The mobile articulation of the elbow and the large muscular insertions on the pisiform bone and on ulna's olecranon show that the Senegalese protocetid used its forelimbs as powerful propellers during locomotion, a situation that recalls the one observed in extant Otariidae but contrasts with that of modern cetaceans

Keywords: Forelimb, Protocetidae, Senegal, Lutetian, Morphological evolution

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Sciuromorph limb bones: morphological adaptations to different locomotor behaviors

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Sciuromorph rodents evolved a variety of habitat related locomotor behaviors, with arboreality representing the plesiomorph condition, while semi-fossoriality and gliding evolved at least two times independently. This makes them an interesting clade for studying locomotion related morphological adaptations. We are looking for adaptations in scapular and femoral morphology. Both skeletal elements play an important role for the generation of propulsion and in digging behavior. Previous investigations suggest differences in attachment sites of limb retractor muscles. For example, the scapula of non-sciuromorph digging mammals is known to display a well-developed teres major attachment site. We use geometric morphometrics in combination with phylogenetically informed methods to analyze the complex shape and evolution of these limb elements. Bones from about 190 species are investigated. We use a MANCOVA to check for significant shape differences between locomotor groups while taking into account allometric and phylogenetic effects assuming a Brownian motion model of evolution. The femur displays a higher adaptive signal than the scapula, letting assume that the propulsive function of the hind limb is under stronger selective pressure regarding locomotor performance. However, our assumptions regarding adaptations in muscle attachment sites are only partly confirmed. As predicted by previous publications, the attachment site of the hind limb retractor gluteus maximus is relatively smaller in fossorial species. But unexpectedly, this is the case for the teres major fossa, too. This illustrates the necessity to investigate the interplay between form and function using experimental set-ups to fully understand morpho-functional adaptions.

Keywords: Sciuromorpha, rodents, locomotion, morphology, adaptation

*Speaker

Cranial morphology and disparity in the endemic Euplerids from madagascar (Carnivora, Mammalia): do they display a greater disparity than other carnivoran families?

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The Eupleridae are a monophyletic family of Carnivora (Mammalia) comprising 8 extant Malagasy endemic species. Their presence on the island is explained by a unique event of colonization from an African ancestor closely related to the Herpestidae (mongooses). The Eupleridae then experienced a diversification phase leading to species occupying extremly diverse ecological niches. In order to study this amazing diversity the aim of this work was to quantify the disparity of the Eupleridae and compare it to that of other carnivore families. Morphological variation was quantified using 3D geometric morphometrics on the cranium of 13 families of terrestrial Carnivora. Our results showed that Eupleridae display a high phenotypic disparity, but not as high as that of Mustelidae and Procyonidae. Moreover, the ecological characteristics of these species, such as diet and locomotor behavior did not seem to fully explain this significant disparity.

Keywords: Carnivora, Mammalia, geometric morphometry, skull, evolution

*Speaker

Earth and Planetary Sciences

CARTOGRAPHY OF THE HYDROGRAPHIC NETWORK; EFFECTS ON THE STRUCTURE OF THE PLATE OF KEM-KEM (SW ALGERIA).

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The Cretaceous plate of Kem-Kem of Cenomano-turonian age, is an important rock, tabular, semi-desert plate. Located in the southern part of the Basin of Doura.
The shredded aspect of this plate is due primarily to the unfavorable climatic conditions of the area and the long periods of believed of Daoura wadi, which caused a dislocation of the hydrographic network; but also with the nature of the grounds which are continental deposits "liking-sand-clays", not very resistant and which facilitates a strong erosion of the relief. It can be also due to the zones of weakness "faults" which would affect the plate and which would facilitate its erosion.

With an aim of defining the share of the structuring post-Cretaceous which affected the plate of Kem-Kem, a cartography and an analysis of the hydrographic network have been carried out.

The various directions which show us the tracing map and the hydrographic network obtained of the plate of Kem-Kem are for major the part concordant. The most important directions are NW-SE, N-S and the ESE-WNW. These preliminary results militate for the idea of recurrent faulting of the old accidents which have, certainly, guided Hercynian tectonics of the chain of Ougarta.

The detailed analysis of braided hydrographic network shows for the first time, a NW-SE shift of accidents, for the majorities, and a NE-SW direction for waterways.

Keywords: Kem, Kem, Cenomano, Turonian, cartography, hydrographic network.

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Paleoclimate reconstruction during the last two millennia in Morocco from high resolution speleothem records

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Two well dated speleothems oxygen isotope (δ18O) records sampled from Chaara cave in Northeastern Morocco are used to investigate variations in hydroclimate conditions during the last 2000 years. The new results shown in this work bring complementary proxies that confirm the previous North Atlantic Oscillation (NAO) reconstructed index during the last millennium and deliver new implications concerning its evolution extending back to Roman Warm Period (RWP). Our high resolution δ 18O records provide evidence of centennial and decadal variations that correlate with Mg and Sr paleorecords obtained from a speleothem at Piste cave, indicating regionally coherent variability during the last Millennium in the Northeastern Morocco. Evidence of dry conditions exist during the Medieval Climate Anomaly (MCA) period and the Climate Warm Period (CWP) and humid conditions during the Little Ice Age (LIA) period. Comparison with paleorecords indicates that the changes in moisture are mostly driven by the NAO. Persistent postivie and negative NAO conditions dominate the MCA and LIA respectively. In addition, our results highlight new evidence of the NAO evolution to beyond the last 1000 years. Positive NAO conditions recorded during the MCA persist crossing the Dark Age Cold Period (DACP) and negative NAO conditions seem to explain the negative trend of isotope values in the beginning of the RWP.

Keywords: Speleothems, oxygen isotope, Morocco, Hydroclimate, NAO

*Speaker

STRUCTURAL ANALYSIS AND PETROPHYSICAL PROPRIETIES OF THE BARREMIAN SANDSTONE-CALCAREOUS BAR IN AGADIR-ESSAOUIRA BASIN (MOROCCO) FOR HYDROGEOLOGICAL EXPLOITATION.

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The Barremian sandstone-calcareous bar in the Agadir Essaouira basin, with a thickness of 30 meters, is potentially the best reservoir in the Lower Cretaceous units. This study, based on a multi-disciplinary approach, aims to investigate the Barremian reservoir using structural analyses, petrographic and petrophysical characteristics. Petrographic studies showed that sandstones are characterized by mineral precipitation, dissolution and dolomite crystals replacing carbonates cement. Petrophysical measurements showed a primary permeability and porosity of about 50 to 1000 mD and 8 to 23 % respectively. Detailed fracture analyzes identify a major set of N105-130 direction and minor set of N20-30 direction in the North and the South flanks respectively in the South Atlasic fold, while the North Atlasic fold showed a major set of N80-100 direction and a minor set of N0-15 direction. The Barremain fractures are similar between the two synclines with an average of 11 fractures/m2. The general dip is towards the west, suggesting a flow direction in the reservoir towards the ocean. The results show that the Barremian unit is controlled by the early sedimentlogical processes of the clastic units and the intense fracture network enable water to circulate within fractures increasing the porosity. Chemical water analyzes reveal that the groundwater is enriched on (Ca2+ + Mg2+) and SO42- due water/rock interactions.

Keywords: Barremian, reservoir, syncline, fractures, permeability, groundwater.

*Speaker

Study of soil salinity in the Sed el Masjoune region (Central Bahira - Kalaa des Sraghna, Morocco)

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In Morocco, the surface area of saline soils rises to hundreds of thousands of hectares throughout the country, of which 10,000 hectares are in the Sed El Masjoune region. These saline soils are a hindrance to the growth or survival of most crops. Which limits agricultural development in this region, Within the framework of the management and the valorisation of these soils for a sustainable agricultural development and to arrive at strategies of their use, a qualitative study was carried out on the surrounding agricultural lands of the lake of Sed El Masjoune. This study allowed us to characterize the degradation and the salinity of the soils under the effect of the arid climate and the geomorphological and hydrogeological situation. The assessment of the current soil quality situation in this study area was carried to 48 points. The results show that these soils are affected by severe salinity and alkalinity problems; the salinity-alkalinity relationship of the soils studied shows that soil salinity accounts for 79% of the variability of alkalinity. It follows that the alkalinity of the soils studied can be explained mainly by the salinity of the soil. The current situation of salinity and soil fertility in the Sed el Mesjoune area is very worrying, requiring careful management of its water and soil resources for sustainable and environmentally friendly agriculture.

Keywords: Soil, Salinity, Alkalinity

*Speaker

LATE HOLOCENE PALYNOLOGICAL RECORD AND LANDSCAPE CHANGE FROM THE PIRAQUÊ-AÇU AND PIRAQUÊ-MIRIM ESTUARINE SYSTEM, ESPÍRITO SANTO, BRAZIL

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Piraquê-Açu and Piraquê-Mirim estuarine system (SEPAPM) is located next to the Aracruz City (19 57' S and 40 9' W), Espírito Santo State, Brazil. Palynological analyses were conducted based on two sediment cores (PA20 and PM1). The main purpose of the present study was to recognize and interpret the vegetation dynamics in the region around the collection site in the last 2000 cal yrs BP. The sediment cores were subsampled at each 10 cm depth. The samples were submitted to standard palynological processes. The PA20 sediment core obtained the oldest age of 1758±68 cal yrs BP at a depth of approximately 105-cm. However, the PM1 sediment core obtained the oldest age of ≈2071±82 cal yrs BP at a depth of 95-cm. The comparative record of the sediment cores demonstrated that palynomorphs deposition were directly influenced by local water circulation. Pollen analysis indicated the striking presence of mangrove vegetation, which is mainly characterised by the *Rhizophora* pollen type. The other vegetation communities underwent little variation over the studied period. The top sediment layers of both sediment cores are characterized by the presence of exotic pollen grains of *Eucalyptus*, introduced by humans, and by the decrease of the original vegetation.

Keywords: Holocene, estuarine sediments, palynological analysis, vegetation, environmental evolution.

*Speaker

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Monitoring land cover changes and mapping areas at risk of land degradation using remote sensing and GIS techniques: A case study of Geulmim Region, Morocco

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The study area is located in the South of Morocco, in the Region of Guelmim. It is located according to the following geographical coordinates: 28 ◦ 97' N and 10 ◦ 06' W.
Despite of the semi-arid climate, the region is exposed to the floods risk. In 2014, this sector was ravaged by inundation due to the intense rainfall which caused a lot of damages.

The main objective of this study is to detect changes in land cover and map areas vulnerable to the land degradation risks as a result of the floods that recently hit the Guelmim region South of the Morocco. The approach used is based on Multicriteria analysis using spectral index extracted from spatial data.
The results obtained show that the approach is very useful to detect the visible changes on the surface and mapping areas at risk of land degradation.

Keywords: Land cover, Change detection, land degradation risks, Multicriteria analysis, Spectral index, Guelmim, Flood.

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Exceptional preservation of crustaceans from the Jurassic Konservat-Lagerstʼatte of La Voulte-sur-Rhône (Ardèche, France)

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The fossil record is incomplete and is far from delivering a full picture of past biodiversity. Some localities yield exceptionally preserved fossils – displaying non-mineralized tissues and organisms and beautiful morphological details. The causes of such an exquisite preservation remain poorly known, it is unclear whether those sites truly are "windows to the past". We hereby propose to investigate the question through the coupled study of anatomy and mineralogy of exceptionally preserved shrimps within carbonate-rich concretions from the Jurassic Konservat-Lagerstʼatte of La Voulte-sur-Rhône (Ardèche, France). Various microscopy and spectroscopy techniques (incl. synchrotron light source) were used to assess the geochemistry and mineralogy of the fossils, in relationship with their anatomy. After studying a dozen of specimens with SEM-EDX (IMPMC) and some sections with coupled XRF and XRD (synchrotron SOLEIL), we were able to revise and more accurately describe the mineralogical phases forming the fossils, whether they are preserved in 3D or flattened in comparison with the sedimentary matrix surrounding them. These results allowed us to propose a new taphonomical scenario for La Voulte crustaceans. A study of the organic matter held within the fossils, and of its syngenicity is planned to more fully understand the processes leading to exceptional preservation.

Keywords: Preservation, Taphonomy, Crustacean, La Voulte, Jurassic, Geochemistry

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Implication for the use of benthic foraminifera as bio-indicators of pollution: The case study of the Northern coast of Sfax (South eastern Tunisia)

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The use of foraminifers as bioindicators of pollution in coastal and paralic environments has undergone a very fast development. Among various criteria, morphological anomalies are sometimes considered as pollution indicators. This paper presents a synthesis of the studies correlating foraminiferal assemblages and environmental concerns. A 30 m-long coring system was used to retrieve 3 sedimentary cores from the Northern coast of Sfax (SC12, SC9 and SC6) are used to monitor the response of benthic foraminifera to modern pollution and environmental stress. Sediment samples were separated immediately after collection for benthic foraminifera analysis. Binocular microscope and the Scanning Electron Microscope (SEM) were carried out to identify the most significant, normal or deformed, specimens. All observations confirmed that foraminifera may be used as indicators of pollution after deconvoluting from natural impacts. The most sensitive foraminifera identified in the study area are Ammonia tepida, Ammonia beccarii, Elphidium crispum, Peneroplis pertususles Miliolidae, Peneroplis pertusus et Rosalina sp and Peneroplis planatus. The morphological study of benthic foraminifera from surface sediments attests for the pollution of the actual coast. This pollution is recorded in the benthic foraminifera tests mainly as shell deformations, chambers or streaks or abnormal colors.

Keywords: foraminifera, bioindicator, morphological anomaly, Sfax Tunisia, Holocene

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The potential of dinosaur footprints for palaeoenvironmental and palaeogeographical reconstitutions in Morocco

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Dinosaur footprints have been used for many years as an important indicator to study of their locomotion, physiology and behavior. Recently, the scientists became also interested in their living environment. However, only few published works have proved the main use of dinosaur footprints in paleoenvironment and sedimentary sequences. Herein, we demonstrate that the Moroccan Mesozoic sediments have shown an important number of dinosaur footprints, with more than 94 sites reported. While most studies are essentially dedicated to the ichnology aspect, the main goal of this work is to: (1) create a database of the distribution of more than 3300 footprints through all the Moroccan territory, (2) study the composition of footprints substratum, through the analysis of thin sections (3) explore the local and regional mechanisms and processes responsible for the substratum creation and footrpints conservation in different environments, through the comparison of our thin section results with the stratigraphy and sedimentology reviews of each site. This new approach highlights the importance of Dinosaur footprints for palaeoenvironmental and palaeogeographical reconstructions.

Keywords: Dinosaur footprints, Morocco, paleoenvironment, palaeogeography

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Megacrysts in Tephra of The Manzaz Volcanic District (Central Hoggar, Algerian Sahara)

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The Manzaz volcanic district is a part of the Hoggar Cenozoic volcanic province. The Neogene volcanic activity was mainly caused by reactivation of mega-shear zones crossing the Tuareg Shield, trending either North-South, inherited from Pan-African transcurrent faults, or SE-NW and SW-NE, formed during the Mesozoic. Tephra, ash and tuffs, deposited by air-fall spread around the volcanic edifices. They contain megacrysts that are mainly cm-size brown Ti-rich amphibole (magnesio-hastingsite) and mm to 1 cm-size olivine (Fo94), clinopyroxene (diopside), titanite and plagioclase (oligoclase). Analysed crystals were sampled in the western zone of the district around Oukcem maar and Menzez strombolian cone, and in the central zone at the foot of V1 strombolian cone. Mineral major-element compositions, measured by electron microprobe (EPMA), were used to estimate thermodynamic parameters existing at depth.
The Al-in-amphibole geobarometer (Schmidt, 1992; Anderson & Smith, 1995) suggests one large, or several smaller reservoirs emplaced at a depth of 32 ± 2 km, which corresponds to the crust-mantle boundary under the district. The CpxBar geobarometer (Nimis & Ulmer, 1998) suggests, with a larger error of ± 6 km, additional reservoirs emplaced within the crust at a depth of 25 km in the west and only 10 km in the centre of the district.
The Ti-in-amphibole geothermometer (Féménias et al., 2006) indicates values of 1100 to 1000 ± 15 ∘C. Calculated temperatures are consistent with deep mafic liquids, which amphibole megacrysts crystallized from.

Keywords: Hoggar, Manzaz, Cenozoic volcanism, Geobarometer, Geothermometer, Megacrysts, Amphibole, Clinopyroxene

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GEOTECHNICAL CHARACTERISTICS OF THE LATERITE GRAVELS OF THE NKOLESSONG - NDING ROAD CORRIDOR (CAMEROON, CENTRAL AFRICA)

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Laterite gravel is the common soil mineral resource used for construction of road base and subbase layers in the Equatorial African area. However, the review of previous works indicates that laterite ore deposits with higher bearing capacity are uncommon. Our aim is to find a correlation between the California Bearing Ratio index (CBR), binding and determining in pavement structures design, and other physical/mechanical properties in order to facilitate the localization of such deposits. For this purpose, nearly 600 samples of lateritic grounds of the Nkolessong–Nding road corridor (89 km) were identified. The soils, collected between 10 and 150 cm depth at thirty sites, have an average density of 2.1 T/m3 for an average optimal water content of 12.13%. The evolution of the physical/mechanical curves of parameters reveals a correlation of quasi-proportionality between the optimal water content, the plasticity index and the liquidity limit, all three interdependent. The exploitation of the CBR values allowed a distribution into four categories: low (< 40), current (40£CBR< 50), specific (50£CBR< 65) and exceptional (^{3}65). From this categorization, the analysis of the physical parameters revealed a specific weight of reference of 2T/m3, determining a poor or exceptional material according to whether its density is lower or higher than this reference.

Keywords: Laterite gravels characteristics, California bearing ratio (CBR), pavement structure design.

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Spatio-temporal analysis of the Rhone channel morphology from Geneva Lake to the Mediterranean Sea

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This study is about the French Rhone riverbed longitudinal organisation and its evolution over a century, with a view to improve the management strategy for the sediments. It first describes the geographic, geologic and hydrologic peculiarities of the 512-km long fluvial system. Gravel mining, dikes construction, channelization and dams construction have simplified the lateral pattern of the channel, incised and paved the riverbed and impoverished the aquatic and riparian habitats. The thesis then more precisely characterizes the riverbed dynamics. It relies on bathymetric data collected since 1897 and on grainsize data collected specifically for this study from over 300 samples on the whole 512-km river length. An homogeneous sampling protocol was elaborated on purpose. The vertical bed evolution and grainsize distribution were analysed to assess the riverbed potential mobility, tributaries' sediment recharge and infrastructures' impact on sediment transport. It thus appears that 1) riverbed incision is mainly due to channelization, 2) hydroelectric dams partitioned the continuum with the accumulation of fine sediments in some backwaters and the pavement of bypassed reaches downstream of Lyon and 3) a residual dynamic persists during major floods, with moderate gravels transport. The data of paved reaches were used in a 1D hydraulic model to quantify transport capacity and bedload discharge, confirming the aforementioned results. This study helps formulate such recommendations for sustainable river management and ecological restoration as opening slush gates during floods, changing dams management instructions or reinjecting gravel.

Keywords: Rhone River, long profile, bedforms, grainsize distribution, homogeneous sampling protocol, transport capacity, gravel mining, dams, Girardon groynes system, ecological restoration

*Speaker

Lava flow mapping and surface estimation using radar coherence images

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Interferometric synthetic aperture radar (InSAR), more specifically calculation of coherence images, can be used to infer changes in the ground surface's geometry. If these changes come from the emplacement of a lava flow, coherence images can then be used to map the flow. For this purpose, we developed an algorithm which separates the lava flow pixels from the others depending on their median shade. After processing the picture, we get a map and a surface for a given date. By doing this for several dates, we thus can follow the time and space evolution of the lava flow. For the August – October 2015 eruption of Piton de la Fournaise, available InSAR data allowed us to map the lava flow at nine different dates between 08/29/15 and 11/01/15. We estimated the flow's surface for each date; at the end of the eruption, the total surface estimation is 4.251 106 ± 4.5 104 m^2. This work could be pursued to map active parts of the flow and to estimate the volume of emitted products.

Keywords: Piton de la Fournaise, volcanology, radar interferometry, InSAR, lava flow

*Speaker

Environmental conditions for the formation of silica-witherite biomorphs and relevance for microfossil identification in Archean cherts

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Hydrothermal environments were common in the Archean and formed a likely site for the origin and early evolution of life. Carbonaceous microstructures found in ancient hydrothermal cherts are difficult to interpret as remnants of early life, however, because abiotic artifacts in these rocks cannot easily be excluded.
Hydrothermal fluid-induced serpentinization of ultramafic crust can generate alkaline, silica-saturated fluids. It was shown that under these conditions complex carbonate-silica crystalline aggregates can self-assemble that display a myriad of life-like morphologies (so-called biomorphs). Such biomorphs may subsequently adsorb organics (hydrocarbons are formed by Fischer-Trosch type synthesis in these environments). Clearly, hydrothermal environments are complex systems where both living
and non-living entities could have been present.
In order to distinguish traces of life from abiotic artifacts, it is critical to describe precisely the diversity of microstructures that can arise abiogenically in these environments. In order to shed light on the environmental conditions of biomorph formation, we conducted witherite-silica biomorph synthesis experiments for a range of different pH values and BaCl2
concentrations, and we followed the evolution of the system with time. The biomorphs were observed with conventional Optical Microscopy and Scanning Electron
Microscopy.
These results show that various life-like structures (from fractal dendrites to framboidal aggregates and complex structures with continuous curvature) can form under a wide range of conditions. The distribution of morphological shapes depends on the characteristics of the fluids involved (cation composition, pH, dissolved CO2 content). The relevance of these morphologies for microfossil identification in Archean cherts will be discussed.

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Keywords: Biomorphs — Early Life — Micropaleontology —

Sunda shelf (SE Asia) subsidence inferred from coral reef morphology modelling

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Lithospheric vertical deformations have been responsible for major modifications of the SE Asia geography in the last 5 My. West and Southeast continental shelves seems to be dominated by subsidence, whereas myriad of islands emerged elsewhere. Such pattern of vertical ground-motions is reflected by the striking bimodal repartition of coastal geomorphologic features: uplifted reefal terraces, notches and cliffs are ubiquitous in central SE Asia and attest for a general uplift. Conversely emerged paleo-reefs are absent on Sunda and Sahul shelves and wide alluvial plains dominate coastal areas, although modern reefs are well developed over those platforms. Recent modelling predictions moreover suggest permanent post-Eocene dynamic subsidence of the Sunda shelf related to the activation of the Sumatra-Java subduction. Estimated rates are rare, except at the platform margin and in sedimentary basins.

In order to quantify the vertical rates, we used a probabilistic approach based on a model that reproduces coral reef morphology development trough time in response to sea level variations. The model takes into account growth reef rate, Quaternary sea level variations, sub-marine erosion and subsequent sedimentation. We match the reef morphology of the representative Belitung island (Sunda shelf), to extract the subsidence rates of the area. We find that the mean short-term subsidence rates range from -0.20 to -0.45 mm/yr. Considering low shelf bathymetry (up to 120 m), such subsidence rates suggest that Sunda shelf would have been permanently emerged until recently, even during periods of high SL, with probable first order impacts on the biogeographic and climatic evolution.

Keywords: Subsidence, Sunda shelf, Coral, Modelling, SE Asia

*Speaker

Building a new Taphonomic Model for Brazilian Mesosaurs Based on a Quantitative Perspective

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Given their abundance and wide distribution, mesosaurs have been extensively studied from different perspectives. Taxonomically robust, comprising three well-stablished genera, as well as stratigraphically significant, this taxon plays a major role in the correlation between marine paleofaunas of African and South American Lower Permian coeval strata. From a taphonomic point of view, however, little research effort has been spent on these reptiles. Despite the hundreds of partial or complete skeletons held in collections, the only current model for Brazilian mesosaur taphonomy is problematic because of internal inconsistencies. The model posits that these organisms underwent instant burial after death, followed by successive storms that would have reworked previously deposited carcasses, generating different degrees of skeletal disarticulation. Here I present a preliminary analysis showing an opposite taphonomic hypothesis involving a long floating phase before residence at the water-sediment interface as well as a more defined disarticulation phase rather than randomly scattered disarticulation events. The Beardmore method employed here is based on a quantitative correlation between degrees of articulation and completeness in nine different parts of the skeleton, providing a basis for understanding trends in carcass disarticulation. In a broader sense, this methods is a good tool for elucidating some aspects of fossil deposition, such as transport in the water column, average time before burial or even disarticulation within the sediment. Additionally, the new approach to Brazilian mesosaur fossil assemblages might improve our understanding of the depositional environment of the African portion of the Whitehill-Irati Sea.

Keywords: Taphonomy, Mesosauridae, Brazil, Irati, Beardmore method

*Speaker

Formation of dinosaur tracks in a surprisingly coarse substrate.

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Dinosaur tracks are common in continental sediments dated from the Triassic to the end of the Cretaceous. They are found in a variety of palaeoenvironments, ranging from mixed carbonated or siliclastic tidal flats to floodplains.
However they are mostly found in fine-grained sediments. This work focuses on an Upper Triassic outcrop in Ardèche (southeastern France) in which nearly 200 archosauromorph tracks were found in coarse-grained sandstones. They contain large (> 1 cm) detrital grains, some of which are associated with the tracks. The aim of our study is to determine how these tracks have been formed in such coarse sediment.

The track-bearing level is at the top of a high-energy, stacked, migrating fluvial system that deposited channelized coarse sandstone beds. This bed is overlain by a continuous, 50cm thick layer of green clay likely deposited in a floodplain.

Taphonomic observations provide evidence that these tracks are in fact undertracks, formed when the animals walked on the clay during an aerial exposure episode. Aerial exposure is documented by mudcracks and mudchips found on the track-bearing surface. The trackmarkers deformed through the clay this layer of coarse sandstones, which recorded undertracks. The foot pressure induced the formation of a clayey coating of the undertracks and injected material of the overlying layer onto the top of the sandstones.
Overall, despite the coarseness of the track-bearing surface visible today, we argue that the tracks were formed in a low-energy environment in which the clay layer was a key preservational factor.

Keywords: Ichnology, Dinosaur tracks, Taphonomy, Undertracks, Sandstones

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Fossilisation potential of fungi in Baltic amber

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Fossil material is very important for better understanding of phylogenetic relationships and evolution of any organisms. Unfortunately fungi, due to their low preservation potential are rare in the fossil record. Fossil resin, amber, is a very good source of knowledge about ancient biota, including mycocoenosis, because resin can preserve highly detailed external morphology of entrapted organisms. Hitherto, few species of fossil fungi were found and described from Baltic amber, dated for Eocene epoch, including two related with insects.
To examine preservation potential of fungi in Baltic amber I studied with light-microscopy inclusions shared by several Polish museums, Zoological Museum in Copenhagen and private collection in Hamburg.

During investigation I found filamentous fungal forms on plant remnants and dead arthropods, mostly representing saprotrophic anamorphic stages. Plant related fungi fossils are dominated by Trichocomaceae, however single well preserved hyphae with conidia represent structure similar to the recent genus *Periconia*. On insects inclusions I mostly found saprotrophic stages of entomopathogenic Hypocreales and Entomophthorales fungi on Diptera (families: Dolichopodidae, Mycetophilidae), Coleoptera (Carabidae) and ants (Formicidae).
Based on my results I can conclude that although hypha melanisation increase preservation potential of fungi, some delicate, weakly melanisated structures can also fossilize. Interestingly, among entomopathogenic fungi, I found only saprotophic stages, lacking any fossils of parasitic forms, what indicates that preserved infections developed after entrapment of the host insect in the resin either after its death or as a result of decreased immunity.

Keywords: Baltic amber, fossil fungi, taphonomy, preservation potential

*Speaker

Evolutionary Ecology

Genital bristles required for the male to position himself along the female axis during copulation

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Mating behavior is extremely stereotyped. In most Diptera the male and female body axes are aligned on top of each other, during copulation. How this perfectly symmetrical mating position is achieved is unknown. The hypandrial bristles are a pair of long stout sensilla (left and right) located in the internal structure of the male genitalia of several species of *Drosophila*. To test whether hypandrial bristles play a role during copulation two experiments were carried out. First, we removed by laser ablation left, right, or both (left and right) hypandrial bristles in *D. melanogaster*. Males were then placed with virgin females and their copulation was recorded. We found that males with a single bristle took significantly more time than males with two bristles to settle into a stable position on top of the female. Furthermore, one-bristle males tilted towards the contra-lateral side, relative to the ablated bristle.Second, we examined copulation of males originating from a stock of *D. melanogaster* flies with 0, 1 and 2 hypandrial bristles, using a *scute* mutant rescued by transgenic constructs containing part of the *scute* gene. Our results show that hypandrial bristles are mechanoreceptors implied in the formation of a perfectly symmetric male-female complex during copulation.

Keywords: Drosophila, copulation, hypandrial bristles, laser ablation, mating, transgenics

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Evolution of one-sided mating behaviour precedes evolution of asymmetric genitalia in the Drosophila nannoptera species group

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Left-Right asymmetry is observed in many animal species, and has evolved independently multiple times. In insects, evolution of genital asymmetries has been proposed to be associated with changes in mating posture but experimental evidence is scarce. The Drosophila nannoptera species group encompasses four described species, including three that have asymmetric genitalia: Drosophila acanthoptera (asymmetric aedeagus), Drosophila wassermani (asymmetric anal plates), Drosophila pachea (asymmetric genital lobes) and Drosophila nannoptera, which has fully symmetric genitalia. Previously we reported that D. pachea males adopt an asymmetric mating position on the female's right side. To examine whether mating behavior might have evolved after or before evolution of asymmetric morphology, we analyze copulation in 3 nannoptera species and in 7 related Drosophila species by video recording. Comparing across species, we found three specific changes on the mating behavior of the nannoptera group: i copulation duration is increased, ii. male bends dorsally over the female iii. the male position is deviated away from the female midline axis. Interestingly, Drosophila nannoptera males, which displays symmetric genitalia, usually mate right-sided. Strikingly, males of Drosophila machalilla (the closest related symmetric species), mate either right-sided or centrally. All together our data corroborates the hypothesis that the evolution of one-sided mating behaviour in the nannoptera species group has preceded the evolution of asymmetric genitalia.

Keywords: Asymmetry, Drosophila, genitalia, nannoptera.

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Insights from the shell proteome: biomineralization to adaptation

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Bivalves have evolved a range of complex shell forming mechanisms that are reflected by their incredible diversity in shell mineralogy and microstructures. A suite of proteins exported to the shell matrix space plays a significant role in controlling these features, in addition to underpinning some of the physical properties of the shell itself. Although, there is a general consensus that a minimum basic protein tool kit is required for shell construction, to date, this remains undefined. In this study the shell matrix proteins (SMPs) of four highly divergent bivalves (The Pacific oyster, Crassostrea gigas; the blue mussel, Mytilus edulis; the clam, Mya truncata and the king scallop, Pecten maximus) were analyzed in an identical fashion using proteomics pipeline. This enabled us to identify the critical elements of a "basic tool kit" for calcification processes, which were conserved across the taxa irrespective of the shell morphology and arrangement of the crystal surfaces. In addition, protein domains controlling the crystal layers specific to aragonite and calcite were also identified. Intriguingly, a significant number of the identified SMPs contained domains related to immune functions. These were often are unique to each species implying their involvement not only in immunity, but also environmental adaptation. This suggests that the SMPs are selectively exported in a complex mix to endow the shell with both mechanical protection and biochemical defense.

Keywords: Biomineralization, shell matrix proteins, basic shell forming tool kit, adaptation, bio-

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chemical defense

Born in the USA: a quantitative genetic study of the invasive tree Robinia pseudoacacia in Europe.

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Biological invasions are recognized as a major threat for native plant communities and ecosystems. Most of the biological invasion studies have been concentrating on ecological research, and the role of evolution was often overlooked. Indeed, adaptive evolution is often thought as a slow process. Nevertheless several studies documented fast evolutionary events leading to local adaptation in the invasive populations.

Robinia pseudoacacia (L.) was introduced to Europe from the USA at the beginning of the 17th century and is now considered one of the worst invasive species in Europe. In order to evaluate the mechanisms behind its invasiveness, both quantitative and population genetics studies are underway. Early development phenotypic traits were evaluated in European populations. A controlled experiment was set up using 2000 seeds from 10 populations in Southern France and 10 populations in Belgium. Seedlings were cultivated in two climatic chambers set at 18∘C and 22∘C. Both morphometric and life history traits were monitored.

Families exhibited a strong plasticity to temperature for all measured traits, the warmer environment being generally more suitable whatever their population of origin. No significant departure from neutral evolution was evidenced using a QST - FST comparison, however we showed that QST was lower than FST for all traits. Additionally, using structure analysis, large amount of admixture was detected among introduced populations although some differentiated populations can be detected, raising new hypotheses about genetic and evolutionary processes occurring during black locust invasion.

Keywords: biological invasion, Robinia pseudoacacia, local adaptation, phenotypic plasticity, QST, FST comparison, quantitative genetic, population genetics

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Colour competition in hummingbirds communities

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Colours in many animals result from the evolutionary interplay between natural selection (crypsis) and sexual selection (communication). Since colours are used in species recognition, co-occurring species should diverge in their colour signals, thus reducing sensory competition. The question of colour competition is largely overlooked, especially at large taxonomic level. Here, we tested this hypothesis at interspecific level using hummingbirds (Trochilidae) as a model group. This family presents iridescent colours (changing in hue with illumination or viewing angle) which are rarely-studied colours. We had data on local species assemblages for 113 species and 189 communities in Ecuador. We measured male plumage coloration of these species using goniospectrometry on museum specimens from Paris and Lyon collections. Using comparative analyses to take into account species relatedness, we found a high phylogenetic clustering of local communities, caused by a strong niche conservatism and a limited ability to disperse. But in spite of this phylogenetic clustering, we found no phenotypic clustering on colour traits,suggesting the existence of colour competition between sympatric species. This study is to our knowledge the first one to integrate accurate measures of iridescence to community ecology and may be the beginning to more studies on the evolution of complex visual signals and their interaction with ecological processes.

Keywords: hummingbirds, colour, competition, community, comparative analyses

*Speaker

Landscape influences the morphology of male common toads (Bufo bufo)

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In Europe, the recent agricultural intensification has strongly homogenised the landscape. This loss in habitat diversity and the use of agrochemicals are considered as major causes of the global erosion of biodiversity. Landscape changes may also favour phenotypic variation with divergences between populations even at a small spatial scale. We investigated this notion in the common toad (*Bufo bufo*), a species that inhabits a wide variety of rural habitats. Specifically, we compared the morphology of male adult toads from three contrasting landscapes: forests, traditional farming landscape (bocage) and intensive farmlands. Overall, individuals from open landscapes were larger and heavier, had longer hind legs and larger parotoid glands than their forest counterparts; suggesting that open landscapes positively influence body size in this species. However, toads from intensive farmland were less symmetrical, suggesting that these individuals may have experienced environmental stress during larval and/or post-metamorphic development. Overall, our results suggest that landscape-specific traits can influence the morphology of male toads in complex ways. Further studies are required to comprehensively assess the impacts of environmental and anthropogenic pressures on amphibians in agroecosystems.

Keywords: agroecosystems, amphibians, landscape homogenisation, morphology, fluctuating asymmetry

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Sex or food, what matters the most in the intimate relationship between Wolbachia and the parthenogenetic termite Cavitermes tuberosus?

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The termite *Cavitermes tuberosus* conditionally uses sexual and asexual reproduction to benefit from both strategies: workers, soldiers and dispersing reproductives are produced via normal sexual reproduction, whereas non-dispersing queens are produced asexually through gamete duplication. Thelytokous parthenogenesis can be encoded in the genome of *C. tuberosus*, or induced by maternally inherited bacteria such as *Wolbachia*, *Cardinium* or *Rickettsia*. By manipulating the reproduction of their hosts, reproductive parasites enhance their own transmission. We aimed at determining the presence and the potential impacts of reproductive parasites in *C. tuberosus*.
We collected 15 nests in French Guiana. All the nests screened were positive for *Wolbachia* infection based on 16S rRNA PCR. Conversely, nests were not infected by *Rickettsia* or *Cardinium*. Almost all individuals within a nest, whatever the caste they belonged, were infected.

Wolbachia strain was determined by sequencing six genes (16S rRNA and the five genes of the standard MLST protocol for strain determination in *Wolbachia*). Phylogenetic analysis unambiguously evidenced that one single strain, belonging to supergroup F, infected all nests. Sequences shared 99% identity with the *Wolbachia* strain from the bedbug *Cimex lectularius*. This *Wolbachia* haplotype is known to be essential for the host's growth and survival.
Overall, our results suggest an intimate symbiosis between *Wolbachia* and *C. tuberosus*, but its true nature, *i.e.* sex and reproductive manipulation or nutritional mutualism, remains unknown. Whole genome sequencing of *Wolbachia* will help to determine how the bacteria and the termite interact.

Keywords: Wolbachia, Termite, Parthenogenesis, Nutritional mutualism

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Effects of abiotic environment on the impact of a manipulative parasite on its host

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Many parasites are known to manipulate the behaviour of their intermediate hosts, supposedly in a way to increase their probability of transmission to their definitive host. This manipulation has been shown to vary in intensity at the intra-specific level. Considering the important effect of trophically-transmitted parasites on the modulation of trophic chains, understanding the variations of manipulation intensity and other infection parameters could lead to a better understanding of the dynamic of an ecosystem as a whole.
I tested the effects of two abiotic parameters, temperature and quality of food, on the success of infestation and the intensity of parasite manipulation. I conducted experimental infestations using the acanthocephalan *Pomphorhynchus leavis* and its intermediate host, the amphipod *Gammarus pulex*. We followed the development of parasites and the survival of hosts, and conducted metabolism and behaviour measures on infected and control hosts.
Despite a positive effect on hosts survival and parasites development, food level did not affect the intensity of manipulation. In addition, temperature was a strong determinant parameter for the speed of development of parasites. Those results suggest that variations in abiotic environment could have several effects on host-parasite interactions, leading to modifications at the scale of the ecosystem.

Keywords: manipulative parasites, gammarids, environment, acanthocephalan, parasitism, host

*Speaker

Comparison of the foraging strategies between juveniles and adults of a tropical seabird: the red-footed booby

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Foraging performances are poorly known in juvenile animals. In tropical waters, marine predators may use particular foraging strategies to minimize costs associated with low productivity and dispersed resources. Here we compare the foraging behaviour of juveniles and adults of a pan-tropical seabird: the red-footed booby. GPS loggers were fitted on birds breeding on Europa Island (Mozambique Channel) and the EMbC algorithm (Garriga et al. 2015) was used to determine the different behaviours adopted along tracks. We found that just after fledging, juveniles made a majority of intern flights on the island, probably to learn how to fly properly. During their first flights at-sea, they left the colony in groups of several individuals. Over time, they were observed leaving the colony more often alone. Juveniles came back to the colony earlier than adults because they needed to arrive before their parents to be fed. The duration and maximum range from the colony of juveniles was slightly increasing over time while remaining significantly lower than adult's values. Juveniles were more often intensively foraging and less often travelling than the adults. Frequency, duration and size of areas where birds are intensively foraging, called area-restricted search (ARS), were also different. To conclude, we observed a slightly increase in the foraging skills of the juveniles along the tracking period ($\approx$ 1 month) but they were still far from reaching the foraging skills of the adults.

Keywords: seabird, tropical, juvenile, foraging, red footed booby, EMbC

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Environmental changes and variations in dietary habits of Plio-Pleistocene Theropithecus (Primates: Cercopithecidae) from Omo Valley: contributions of Dental Microwear Textural Analysis

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The Shungura Formation, a geological unit situated within the lower Omo Valley in Ethiopia, has delivered major Plio-Pleistocene paleontological and archeological content, including numerous hominin and lithic remains. The spatial extension and chronological continuity of its sedimentary outcrops, notably between 3 and 2 Ma, has allowed to shed light on this critical period in hominin evolutionary history, marked by the transition from the genus *Australopithecus* to *Homo* and by the emergence of robust australopithecines.
Dental Microwear Textural Analysis (DMTA), an objective method to study microscopic texture of enamel occlusal facets produced during mastication of food items with various mechanical properties, has been proved to be effective in distinguishing among Primates with different diets. This analysis is performed on fossil specimens belonging to the most represented cercopithecid genus recovered in this geological formation: *Theropithecus*. Specimens included in the present study come from geological members B to lower G, covering a time window ranging from 3.44 to 2 Ma. Fluctuations of textural parameters between the geological members highlight variations in the intake of tough herbaceous monocots and softer herbaceous dicots.
In order to infer accurately the vegetation changes that took place in the paleolandscape of the ancestral Omo River, we linked these data with stable carbon and oxygen isotopic ratio already obtained from mammals enamel and paleosoils carbonates, along with palynological occurences and faunal dynamics. Reconstructing the Plio-Pleistocene environment of the lower Omo Valley offers major insights into key events of hominins evolution that took place during this time span.

Keywords: Theropithecus, Omo Valley, DMTA, diet, Plio Pleistocene

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Relative influence of cropping systems, injury profiles and institutional determinants on the spatio-temporal structure of bread wheat diversity in France

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In the current context of increasing climate instabilities and new pest pressures, *in situ* crop diversity has been recognized as a relevant way to avoid crop failure, ensure yield inter-annual stability while reducing the use of synthetic inputs. However, before implementing any future deployment of within-crop diversity, a detailed knowledge of the main drivers affecting this diversity appears necessary.
The temporal evolution of *in situ* genetic diversity of bread wheat has been previously shown to be spatially structured among regions in France over the period 1980-2006. Our study was carried out to identify the main drivers of this spatio-temporal structure of crop diversity at a fine spatio-temporal scale. We conducted a series of statistical analyses and expert surveys to identify the effects of three main categories of drivers: agricultural systems, pathogen pressures and institutional determinants of the formal wheat sector.

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We hypothesized that this set of drivers could have a higher explanatory power of the varietal diversity – i.e. based only on the varietal denomination which allows varietal choice by farmers – compared with the neutral genetic diversity. We confirmed that the main explanatory drivers – the cultivation area of bread wheat, the nature and the diversity of the preceding crops, and the pressure of some pathogens – explained the spatio-temporal structure of varietal diversity more than the genetic one.
We highlighted a correlation between bread wheat varietal and genetic diversity and a greater diversity of preceding crops, suggesting that more diversified agroecosystems seemed also promoted a higher within-crop diversity.

Keywords: Triticum aestivum L., varietal diversity, genetic diversity, temporal changes, spatial structure, cropping systems, preceding crop, pathogen pressures, institutional determinants of the formal wheat sector

Do males with higher mating success invest more in armaments?

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Variation in male reproductive behaviour may be a result of differential investment in traits involved in courtship and mating. Males with higher mating success would be expected to invest more in traits that facilitate mating, leading to steeper allometry of those traits with respect to body size. Across-population studies following latitudinal variation in male mating success are an excellent study system to address this question. In this study we used males of the damselfly Lestes sponsa to investigate whether the allometric patterns of the length and width of the anal appendages, used for grasping the female prior to mating, corresponded to male mating success. We hypothesised larger investment in the grasping apparatus, i.e. a steeper allometric slope, following higher mating success. Behavioural observations in field enclosures showed the highest mating success in the high latitude, while there were no significant differences between the central and low latitudes. We found positive allometry for the length of the anal appendages in high-latitude males, i.e. those males invested disproportionally more in the length of the grasping apparatus, while central- and low-latitude males did not show significant regressions of the traits on body size. Our results partially support our hypothesis, since high-latitude, more successful males invested more into the length (but not the width) of the grasping apparatus than central- and low-latitude males. Therefore, higher mating success might be facilitated by larger investment in armaments.

Keywords: male anal appendages, Lestes sponsa, allometry

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An endangered in the mountains: genomic diversity of the Pyrenean desman

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Next-Generation techniques have become a great tool to shed light onto the genetic structure of endangered species to help in their preservation. This is the case of the Pyrenean desman (*Galemys pyrenaicus*), which is a small semi-aquatic mammal endemic to the Iberian Peninsula whose populations have experienced a strong decline. Hence, the understanding of its genetic structure and evolutionary history is key to plan efficient conservation programmes. The main aim of this work was to study the population structure of the Pyrenean desman (*Galemys pyrenaicus*) using genomic sequences obtained from 26 samples from the whole distribution range using a double digest restriction associated DNA (ddRAD) protocol, which is a genome reduction approach used to sequence a large number of specific genomic fragments, optimized for small quantities of starting DNA. The genomic libraries obtained from this protocol were filtered with essential quality tests, the sex of the 26 individuals was determined and the proportion of heterozygous positions was estimated. Finally, the SNPs obtained shed light onto the population structure of the species. Although the sampling was scarce and some locations were not represented, we were able to test this NGS technique and shed light onto the population genomics of this endangered species. The results of this work could be used to develop new conservation strategies and, also, they open a promising path to perform deeper population genomic analyses with more sampling within this and other endangered species.

Keywords: Galemys pyrenaicus, ddRAD, SNPs, Conservation genomics, Genetic structure

*Speaker

Plastic exploratory response to maternal and direct water stress in the common lizard

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Behavioral plasticity in response to water constraints is still overlooked compared to other environmental factors like temperature. Still, it exists empirical evidence of morphological or life history traits plasticity shaped by the interaction between the maternal hydric environment and the juvenile's hydric environment. We got interested in the behavioral plasticity in response to maternal water restriction and different direct water availabilities. Half the pregnant mothers were water restricted compared to usual breeding water availability. We tested activity and exploratory behavior by recording videos of juveniles, in dry and wet soil conditions, at birth and at recapture after one year in semi-natural conditions. We mainly observed that animals explored more when they are in dry soil conditions at both ages, this is why we think it is a way to find a suitable habitat. We only observed that maternal water restriction enhanced thigmotaxis (i.e. the behavior described by a strong attraction to the walls) meaning that prenatal stress induced juveniles' anxiety. The low repeatability of behaviors across trials at birth and the absence of correlations between behaviors at birth and at at the yearling stage of life made us think that behaviors are highly variable at birth. We suppose that behavior has to be highly plastic to water constraits at birth to have the best response to a stressful environment (e.g. dispersal) and that consistent differences in behaviors, called personalities only develop later.

Keywords: exploration, water stress, behavior, thigmotaxis, personality

*Speaker

Ménage à trois - Parasitic fungus closes gap between two trophic levels

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Eutrophication processes in lakes become more frequent and severe, increasingly promoting cyanobacterial blooms. Zooplankton grazers often fail to exert an effective top-down control of cyanobacteria due to their inedible cell sizes, low nutritional value and the production of toxic compounds. Therefore, cyanobacteria are considered as trophic bottlenecks, decoupling primary and secondary production. However, field observations often report high biomasses of grazers during blooms, suggesting alternative sources of nutrition. One component that is usually overlooked in trophic interactions is parasitism. Only recently, the role of chytrids, parasitic fungi characterised by free swimming zoosporic stages that lethally infect their hosts, was acknowledged in aquatic food webs. In our study, we addressed the interface between predator-prey and host-parasite interactions by conducting a life-table experiment, in which we exposed the zooplankter *Daphnia* to diets consisting of either healthy cyanobacteria or chytrid-infected cyanobacteria, and additional treatments of purified chytrid zoospores and heterotrophic bacteria suspensions. *Daphnia* performed either better or equal on parasitised cyanobacteria than in the absence of infection. Results show that the improved fitness of *Daphnia* is attributed to three causes: (i) *Daphnia* feed on chytrid zoospores which, due to their higher nutritional quality, trophically upgrade cyanobacterial carbon, (ii) increased heterotrophic bacterial biomass, promoted by cyanobacterial decay, provides an additional food source for zooplankton, and (iii) infection-induced fragmentation of cyanobacterial filaments renders cyanobacteria more edible. Our results demonstrate that chytrid parasitism can sustain zooplankton under cyanobacterial bloom conditions, and exemplify the potential of parasites to alter interactions between trophic levels.

Keywords: lake eutrophication, food web interactions, host, parasite interactions, trophic levels, zooplankton, chytrids

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Ecology and reproduction biology of the black truffle Tuber melanosporum

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The black truffle *Tuber melanosporum* – the "black diamond" of French gastronomy – is an ascomycete fungus living in mycorrhizal symbiosis with tree roots. Few things are known about the ecology and biology of this iconic mushroom. The black truffle is potentially hermaphroditic but reproduction and formation of the edible organ, the ascocarp, require mating between individuals from opposite mating type: a *maternal* parent that forms the ascocarp flesh and a *paternal* one whose genes are only left in the meiotic spores within the ascocarp. Maternal genotypes are also found on the surrounding mycorrhizae, suggesting that maternal partners are established as symbiont on the host trees. In contrast, paternal genotypes are never found in mycorrhizae, and are more numerous and transient than maternal genotypes. Several questions arise therefore: what *are* the paternal partners (mycelium, spores...) and where do they come from? We conducted population genetics studies using microstallites which revealed a high level of inbreeding, raising the question of the existence of gametic gene flow. Another mysterious aspect of *T. melanosporum* ecology is the presence of an area at the base of the host trees characterized by few herbaceous species, called a *brûlé*. Not a lot is known about causes or consequences of the brûlé, but it has been shown recently that, unexpectedly, *T. melanosporum* may be detected molecularly and genotyped within the roots of the herbaceous plants. We want to elucidate what kind of interaction is involved in this particular niche and whether paternal partners could be there.

Keywords: population genetics, fungal ecology, ascomycete, life cycle, microsatellites

*Speaker

Seasonal changes in morphology and performance in insular lizards: plasticity or survival?

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Previous studies have established that cyclical variations in the environment have important consequences on organisms. In temperate regions drastic changes in food availability can often be observed between seasons and are often accentuated on islands. Moreover, aggression and competition for reproductive partners mainly take place during a single season. Bite force is a fitness relevant performance trait that may also show seasonal variation. However, whether these seasonal changes are correlated to changes in the morphology of the underlying muscles and bony structures remains unknown. Here we provide data on seasonal changes in bite force, muscles cross sectional area and cranial shape in lizards of the species P. sicula from a small island in the Adriatic. Both bite force and the mass and cross sectional area of the jaw adductor muscles change seasonally with animals having greater bite forces and muscles in late summer relative to spring. These changes are accompanied by changes in the shape of the cranium and the mandible. As bite forces are greater outside of the reproductive season it is unlikely that these differences are due to sexual selection acting on male competitive ability. However, whether these results represent plastic changes in morphology and function from one season to the next or rather reflect differential survival of animals with greater bite forces remains to be tested.

*Speaker

Keywords: Phenotypic variation, seasonal changes, bite force, functional anatomy, 3D skull reconstruction

Evolution of body size under temperature warming within predator-prey systems

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Individual body size is a key trait constraining interspecific interactions within food webs. It is particularly linked to individual metabolic rate. Because climate warming also affects metabolic rates, it creates direct selective effects on body size. Most experimental studies and empirical observations suggest that body size decreases under warming, though important exceptions have been noticed. Using a predator-prey model that is structured through the evolution of the predator body size, we try to reconcile these divergent results, by analyzing the conditions under which body size increases or decrease may be expected. Our model tackles three scenarios, linking predator attack rates to temperature changes in different ways (no thermal impact, exponential increase (Arrhenius function), modal function with a peak of attack rates at an optimal temperature). We then study the ecological and evolutionary dynamics of the system. The analyses reveal that evolutionary dynamics settle at a selected body size whose value only depends on the interaction rates (competition and attack rates). Only the third scenario is able to reconcile the seemingly opposite experimental and empirical results. Moreover, the general result of a decrease in body size may only be obtained if temperatures are above the species optimum, suggesting that current observations may concern systems that are already over-heating.

Keywords: Global warming, body mass evolution, adaptive dynamics, predator prey interactions, attack rate

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Dynamics of epistatic interactions under different environmental conditions in multicellular organism Caenorhabditis elegans

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Epistasis is the phenomenon of genes from different loci interacting with each other. It can be either positive (when double mutant shows less severe phenotype than it is expected based on single mutant phenotypes) or negative (when double mutant phenotype is more severe than expected from single mutant phenotypes).
Epistasis is commonly known to influence many evolutionary processes, such as speciation, evolution of sex, genetic drift and most importantly epistasis can affect response to directional selection. In theory, positive epistasis is expected to reduce effect of selection in eliminating mutations whereas negative epistasis enhances it.

The aim of our study is to test how epistasis changes under harsh environmental conditions. To examine it we use well known, multicellular model organism – *Caenorhabditis elegans*.

Our query genes are associated with such processes as DNA repair, DNA damage, oxidative stress or heat shock response. To obtain double mutants we are inactivating genes using RNA interference (RNAi). We are feeding singly-mutated worm strains with bacteria engineered to produce dsRNA. Data from single mutants (either mutated worm strains or generated by using RNAi on wild type strain) serves us to compute expected phenotype for double mutants. Then, we observe whether phenotype of double mutant differs from the expected value. Experiment is done simultaneously in control and stressed conditions.
We are hoping that our experiment will broaden our understanding of how dynamics of epistasis under environmental perturbations can affect evolutionary processes.

Keywords: epistasis, genetic interactions, Caenorhabditis elegans

*Speaker

Fluctuant Asymmetry of the Common Swift (Apus apus, Linnaeus 1758): A claim of value about the possible applications of population asymmetry parameters.

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For several years, researchers studying fluctuant asymmetry (FA) have been trying to find an individual asymmetry parameter and its relationship with fitness. However, recent studies have shown that such calculation was more complicated than what was suggested in the past. Alternatively, measuring FA at population level keeps being a relatively easy process, but it lacks the popularity possibly due to an insufficient emphasis of its possible applications.
On a population of 56 common swift carcasses, we carried out the asymmetry analyses of five traits: maximum cord (MC), third primary (P3), carpus, eye-beak distance and tarsus. Through an external exploration and following necropsy, we evaluated: age, sex, body condition (fat stock, musculature, weight), immunity (spleen mass) and stress (gut parasites, visceral gout, respiratory system damage).

Feather traits (MC and P3) were the only ones showing FA (normal distribution, mean=0). They were also the least asymmetric, probably due to their biological role. The interaction "body weight – spleen weight" was the only stress agent that had a significant influence on MC asymmetry. P3 was not influenced by any of the measured parameters. No individual was significantly more asymmetric, making fitness comparisons excessively complex.
Therefore, even though studies of individual asymmetry parameters have been very popular lately, FA analysis at population level are much easier to carry out and can be useful for identifying stressful environments that influence the common swift traits asymmetry. Also, since it is a widespread species, it could be a helpful parameter for habitat quality evaluations of humanized areas.

Keywords: Fluctuant asymmetry, Apus apus, environmental stress, body condition, immunity

*Speaker

Methods in Natural Sciences

A New Method for Understanding the Morphological Limitations of Short-Faced Temnospondyl Forms

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Skull shapes of short-faced temnospondyls show queer disparities. A new approach to compare the morphological limitations of those temnospondyl amphibians has been proposed. landmark based outline analysis, elliptical Fourier analysis, principle component analysis, construction of morphospace and analysis of convex hull area have been combined here using the R environment to develop this new method. Skull outlines of several brachyopid, chigutisaurid and plagiosaurid taxa as well as that of a few metoposaurids have been used for the pilot study. Morphospace and convex hull have been constructed from the skull shape outlines. Results depict sharp contrast between the morphospace and functional space in the case of brachyopids, chigutisaurids and plagiosaurids. Limitation of the available organismal designs helps to analyse the functional trait variation within this community. Forms with smaller orthogonal thickness of the posterolateral corners and forms with cheek emargination are less frequent in the geometric morphospace but prevalent in the functional space away from the main cluster. The convex hull area of the brachyopids are the largest with widely overlapping chigutisaurid forms. This indicates their close proximity in both morphological traits and functional space. Larger area in the convex hull depicts greater diversity but not greater frequency. Another highly conspicuous feature of the short faced forms are the orbits. In the morphospace of orbit outlines, the plagiosaurids occupied largest convex hull area followed by the brachyopids and the chigutisaurids. A similar study was constructed separately on the metoposaurids. No drastic disparity in the skull forms has been noted there.

Keywords: morphospace, convex hull, temnospondyl

*Speaker

Model organisms in ecology and environmental sciences: an epistemological perspective

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The expression "model organisms" generally refers to organisms studied to provide insights for biological knowledge. Some typical examples include the fruit fly *Drosophila melanogaster* and the laboratory mouse *Mus musculus*. Two aspects can be distinguished in the classical notion of model organism. First, organisms are "modeled" in laboratory: they are standardized and can be kept in experimental conditions. Second, they represent a "model" because knowledge acquired studying them can be generalized to other species. For example, the phenomenon of *crossing over* discovered on *Drosophila melanogaster* has been used as a model to describe genetic mechanisms in other taxa. Thus, in this notion, both a "technical" and "epistemological" dimension can be distinguished. In ecology and environmental sciences, some organisms are also currently used as intermediaries to acquire knowledge about natural phenomena. In terrestrial ecosystems, trees represent essential tools for paleoenvironmental reconstructions via the study of growth rings by dendrochronology. In marine environment, several organisms (for example corals, otoliths and bivalve mollusks) are used for paleoclimatology and ecology via the techniques of sclerochronology. The aim of this presentation is to ask whether the classical notion of "model organism" can be applied for this kind of organism used in ecology and environmental sciences. I will argue that this notion doesn't apply because, for several aspects, they differ from models used in experimental biology. I will propose that model organisms used in ecology and environmental sciences could be named *"in situ* biological models" to be distinguished from *in vivo* models used in experimental biology.

Keywords: model organisms, epistemology, dendrochronology, sclerochronology

*Speaker

Evidence of morphological divergence in cryptic Mecopoda species using landmark based geometric morphometrics on external genital characters

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Traditional morphometrics on the five acoustically divergent populations of *Mecopoda* found in south India failed to yield any evidence for a distinct morphological identity of the songtypes. In the zones of their sympatric distribution, it is impossible to differentiate females into songtypes as they do not call and males can be positively identified only by their calls. In the wild, therefore, the songtypes of *Mecopoda sp.* forms a cryptic species complex. The advent of landmark based geometric morphometrics allowed me to compare the shape of cerci and the subgenital plate of all the *Mecopoda* songtypes. My approach was successful in distinguishing the *Mecopoda* songtypes with 89 % correct assignment of songtypes analysed using a machine learning algorithm. I speculate that since these two external genital characters are involved in mating and have sensory roles, the genital characters themselves might be involved in assortative mating. The differences I have observed may be enough to cause each songtype to reject a different songtype during copulation and the discrimination will most likely be of tactile in nature. Further work will be needed to establish whether the morphological distinctiveness I have identified drives reproductive isolation or has evolved subsequently as a result of restricted gene flow and rapid evolution of secondary sexual morphological traits within song types.

Keywords: Mecopoda, geometric morphometrics, speciation, Random Forest analysis, morphological divergence, relative warp analysis

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Optimization of sampling designs in eco-epidemiological studies based on antibody detection in sentinel species: the case of large gulls

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Wildlife disease ecology has been getting more attention notably because of emerging diseases threatening both human health and biodiversity. Widespread and opportunistically feeding seabirds such as large gulls may be of particular interest as they have the potential to be used as sentinels for the monitoring of various infectious agents. However, to efficiently estimate epidemiological parameters of an infectious agent in a population, sampling designs should be optimized by considering the trade-offs between estimation reliability and sampling efforts. Using a simulation approach, we compare the potential efficiency of different field sampling designs based on the detection of antibodies to estimate epidemiological parameters. We notably compare the benefits of including the tracking of individual exposure in a capture-recapture framework to a cross-sectional study. Moreover, we considered testing for the presence of maternal antibodies in egg yolk to quantify the exposure of breeding females to infectious agents. Our results stress that the optimal protocol will depend in the main aim of the study, as well as on the ecology of the host, the dynamics of its immune response and that of the considered infectious agent in the host population. These results are discussed in the light of field data gathered in the context of a long term epidemiological monitoring program of a yellow-legged gull (*Larus michahellis*) population. This allows us to conclude that large gulls and other related species could be useful wildlife sentinels for tracking certain infectious agents, notably by using offspring sampling as an alternative to adult blood sampling.

Keywords: eco, epidemiology, maternal antibodies, immunoassay, sampling strategy, simulation, large gulls

*Speaker

Comparison of in vivo data and morphological models of bite forces in various rodents.

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Bite force is widely used as a whole organism performance trait, either using in vivo measurements or models based on physiological cross-sectional areas (PCSA). The few studies combining both types of data have usually shown fairly robust correlations at the interspecific level (still with some inconsistencies). However, studies at the intra-specific level remain scarce. To investigate the relation between in vivo and modeled bite force, at both the intra- and inter-specific levels, we measured in vivo bite force in fourteen species of wild or lab-reared murid rodents. We also produced models of bite force using the PCSA technique. We then compare both datasets, using means for the interspecific analysis and individual values at the intra-specific level. We also try to find ecological and environmental factors (including lab vs. wild) that may influence deviations from the model predictions.

Keywords: Bite force, PCSA, rodents, ecology

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Sigmoid functions in ecology: where are we and where should we go?

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Despite repeated commitments to protect biodiversity, its decline is still ongoing. In order to monitor biodiversity, indicators are related to the aspect of biodiversity that is under evaluation. Linear relationships have been widely studied but they come with their limits. Such limits have been recognized for long in Island biogeography and the ensuing species-area (and species-resources) relationships (SARs). Thus some non-linear functions are used in SARs but their properties are not always adequate with the studied relationship. Finally, non-linear relationships with random effects have been very little explored and still present many difficulties. In order to improve these techniques, we are currently studying in a Bayesian context existing, as well as new, sigmoid non-linear relationships on two biodiversity data sets. The sigmoid function is S form with two horizontal asymptotes and a center of symmetry at the inflexion point. We are currently studying four already known functions – the cumulative Weibull distribution with three and four parameters, the logistic and the extreme value functions – and two new for ecology sigmoid functions with four and five parameters. The interest of these new functions is that each parameter is graphically identifiable and so each aspect of the sigmoid shape can be modified. The five parameters function allows in addition to obtain a non-symmetric form of sigmoid. We believe that these functions have a certain interest in applied ecology thanks to their great flexibility and therefore their capacity to adapt to various ecological phenomena.

Keywords: biodiversity, indicators, Bayesian statistics, sigmoid curve, random effects, SARs, non, linear functions

*Speaker

A new method for the characterization of botanical resources used for traditional East Asian handmade papers

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We tested the performance of pyrolysis-comprehensive two-dimensional gas chromatography/mass spectrometry (Py-GCxGC/MS) in the course of our cultural heritage studies, and compared its potentialities for the characterization of botanical resources used for traditional East Asian handmade papers. The evaluation of Py-GC/MS and Py-GCxGC/MS was conducted in considering the number of detected peaks, the compounds separation, the sensitivity, and the identification of marker compounds. The results showed that the number of plant markers (triterpenes and phytosterols) detected in Japanese reference papers made of kozo (Broussonetia kazinoki Siebold & Zucc.), mitsumata (Edgeworthia chrysantha Lindl.), and gampi (Wikstroemia sikokiana Franch. & Sav.) was improved in the pyrolysis fingerprint. With a gain in sensitivity in the order of six, the case study of a museum sample confirmed that Py-GCxGC/MS is more efficient for a reliable identification of material origins of museum collections samples and/or archaeological samples where tiny quantities of materials are the rule. The present study has been successful in refining a micro-destructive method based on analytical pyrolysis for the characterization of botanical resources used for traditional East Asian handmade papers by pyrolysis-comprehensive two-dimensional gas chromatography/mass spectrometry.

Keywords: pyrolysis, comprehensive two dimensional gas chromatography, East Asian handmade papers, micro destructive analysis, botanical resources characterization

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Structural equation modeling of pro-biodiversity behaviors toward pollinators

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As individuals are more and more requested to take part in the environment's protection, understanding their motivations to do it might help designing relevant protection's programs. Theories such as Stern Value-Belief-Norm (VBN) theory or Ajzen Theory of Planned Behaviour (TPB) showed success in explaining pro-environmental behaviours. More recently, Structural Equation Modelling (SEM) allowed a new synthesis of these theories. Pollinators are one biodiversity object drawing attention nowadays and we choose them as focus for pro-biodiversity behaviours in our study.
We applied the work done in previous study, and the models synthetizing TPB and VBN. Some of these studies included habits related to the behaviour as direct predictors of it. We took into account more general habits (gardens habits, consumption habits related to biodiversity) in order to evaluate how a general orientation in favour of biodiversity will impact specific behaviours in favour of pollinators. We hypothesized that their places are as direct predictors of intention. We used a measure of concern for biodiversity to take into account VBN's awareness of consequences and ascription of responsibility toward the environment, in order to try to find a simplified way to express them for biodiversity.

The SEM partially validated our model. The structure resulting for the previous studies was validated with our data, including our simplification for the "level of concern for biodiversity". We validated the inclusion of pro-biodiversity consumption habits into the model. Inclusion of garden habits and phytosanitary related practices was not granted.

Keywords: structural equation modelling, pro biodiversity behaviors, theory of planned behaviour, value belief norm theory

*Speaker

Proteomics for archaeology: identification of small bovid dental remains from Leopard Cave, Namibia

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Distinguishing between goat (*Capra hircus*) and sheep (*Ovis aries*) bone remains is a tricky task in zooarchaeology due to high morphological similarities. In austral Africa, the distinction between the two species could give information about the first introduction of domestic animals in prehistorical societies. Here, we report the use of proteomics on three teeth identified as caprines and coming from the LSA site of Leopard Cave, Namibia. These remains were previously dated as the oldest of austral Africa (end of third millennium BP) by radiocarbon. Four modern samples of African small bovids (domestic and wild) were also included in the study for comparison. We first estimated the collagen preservation on small amounts of tooth powder by infra-red spectroscopy ATR-FT-IR. We then optimised the protein extraction based on a previously published protocol. The tryptic digest was analysed using nanoLC-nanoESI-MS/MS and MALDI-MS/MS. The resulted spectra were screened using Mascot and Peaks software. Beside the identification of the two chains of type I collagen, two non-collagenous proteins were also identified. We could not discriminate between the species based on the collagen peptide detected, due to low sequence coverage of both chains. However, it seems that alpha 2 HS glycoprotein and secreted phosphoprotein 24 present more variations between the bovid species, which was not reported in any previous paper. The results, although preliminary, suggest that the dental remains could in fact belong to a wild bovid species. Further analysis will be necessary in order to discriminate surely between the different bovid species of interest.

*Speaker

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Keywords: archaeology, mass spectrometry, Africa, sheep, goat

Identification of devitalization methods on trees which induce risks on dikes and dams

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The woody vegetation implanted on dikes and dams and is well known for many positive effects on these areas (bank stabilization, biodiversity, shade...). Thus, managers have left trees growing on these sites. But, recent studies show that trees and specially root system may cause various damages like uprising and deconstructions leading to various risks for hydraulic structures (internal and external erosion risks). Therefore, a strengthening of the regulation on dikes and dams forced managers and owners to ensure the control, the technical monitoring and the necessary maintenance of their structures. With the forbidding of the use of chemical products near watercourses, this thesis focuses on the search of alternative methods of devitalization of young trees. Indeed, regulations in constant evolution forced to change usual practices so managers are confronted to an important problem of vegetation development on their dikes and dams. It is urgent to set up preventive management techniques of young trees which potentially could constitute a risk when they grow up. The first axis consists to make a screening in greenhouse of possible and effective methods on various tree species found on hydraulic structures. The second axis aims to put in place selected methods on sites and, at the same time, optimize methods according to specific parameters. Management plans must be elaborated in order to conciliate security, environmental and landscape issues.The final goal of this applied research will be to propose to hydraulic structures managers new solutions both respectful of the environment and in accordance with regulatory framework.

Keywords: tree management, risks, tree devitalization, dikes, dams

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Importance of using Geographic Information System for the Middle Palaeolithic sites in Northern France. The example of Caours (Somme, France) and Beauvais (Oise, France).

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During the middle Palaeolithic, the northern France was only occupied by Neanderthals groups. However, successions of glacial and interglacial cycles explain a complex and discontinuous settlement, raising complication in the study of its dynamics at a regional scale. Therefore, some aspects of Neanderthals behaviour are still mischaracterize: in most cases, the function of the site and its territorial management over the northern France have to be specified. The spatial analysis of open air sites from northern France will help us to answer those questions. However, for Middle Palaeolithic sites, we can't see systematically on the field the spatial organisation directly, we sometimes need modelization. Therefore, we started to build a spatial analysis protocol adapted to this site and applied to such sites. The sites of Caours (Somme, France) and Beauvais (Oise, France) are two open air sites that are exceptionally well preserved and displaying a large amount of faunal and lithic rests. Both are perfect candidate to apply and test the new protocol. First results proved that for each site the existence of a spatial organisation as remains concentration zones. Then, we characterize this areas – number, distribution. Finally, we were able to associate them to human activity areas like hearths, butchery or knapping areas.

Keywords: Spatial analysis, Middle Palaeolithic, Neanderthal, Northern France, Archaeozoology, Hearth

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First paleohistological inference of resting metabolic rate in an extinct synapsid, Moghreberia nmachouensis (Therapsida, Anomodontia).

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The acquisition of mammalian endothermy is a major event in evolution of vertebrates since it modified the energetic relationships between organisms and their environment. While avian endothermy is assumed to occur at the archosauriform node, the acquisition of mammalian endothermy is poorly constrained both temporally and phylogenetically. Bone histology provides both qualitative and quantitative paleobiological information contrary to anatomical traits. It is a useful method to infer the bone growth rates and resting metabolic rates of extinct vertebrates. First, the histology of the Triassic Moroccan dicynodont *Moghreberia nmachouensis* indicates the presence of incipient fibro-lamellar bone (FLB) in humerus and femur suggesting a high growth rate. Observations on two related dicynodonts would imply increasing growth rates from *Moghreberia* to *Lystrosaurus* (well-developed FLB in femur and incipient FLB in humerus), to *Oudenodon* (well-developed FLB in stylopods). Moreover, we performed the first quantitative inferences of resting metabolic rates on fossil synapsids (*Moghreberia* as a model and *Lystrosaurus* and *Oudenodon* for comparative purposes) using quantitative histology (osteocyte lacunae size, shape and density) combined with phylogenetic eigenvector maps. Our inferences are consistent with the qualitative histology: the mass-independent resting metabolic rate inferred for *Moghreberia nmachouensis* (2.58 mLO2h-1g-0.67) is lower than the value inferred for *Lystrosaurus* (3.80 mLO2h-1g-0.67), which is lower than that inferred for *Oudenodon* (4.58 mLO2h-1g-0.67). Optimization of these inferences onto a phylogenetic tree of amniotes using the parsimony method allowed us to better constrain the temporal (more than 260 My ago) and phylogenetic (Neotherapsida) frames of the acquisition of mammalian endothermy.

Keywords: Dicynodontia, Endothermy, Fibrolamellar bone, Paleohistology, Phylogenetic eigenvector maps

*Speaker

Appearance management of 2.5D printing for accurate reproductions of artifacts from natural history and museum collections

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Most heritage pieces have a dimensionality that cannot be conveyed in a flat 2D print on paper or board, which is composed of varying depth and different appearance effects such as texture, sheen or luster.
The area of 3D prints had found a place in museums and cultural heritage centers with the scanning and replication of original pieces creating an alternative way of both viewing and experiencing their collections first hand. However technology advancements in 3D printing have concentrated on building functional objects where aspects such as color, detail resolution and other important material appearance properties have been neglected.

Here we present a relief or 2.5D printing technology that offers the subtleties that 3D printing lacks. We refer to 2.5D printing as the process by which a protruding surface is created by laying down successive thin layers of ink until a desired colored surface texture is achieved. The high accuracy of dot positioning and the size of its subset of colors make this technology suitable for aesthetic applications.

With 2.5D printing, new challenges arise as color is no longer the main parameter to assess quality and beautifulness of a reproduction, other aspects such as physical texture, detail rendition, glossiness and translucency are equally important.
In this presentation, we introduce 2.5D printing and expose the limitations of existing tools managing appearance going from 2D to 2.5D. Then we show methods for accurate control, prediction and measuring of aspects linked to the visual perception of a real object.

Keywords: 2.5D printing, visual appearance, cultural heritage, reproduction

*Speaker

Measuring physical performance and reaction to stress in mouse lemurs: bite force transducers, microphones and infrared cameras.

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Sexual size dimorphism is not common in strepsirhines but has been observed in wild grey mouse lemurs *(Microcebus murinus).* Sexual dimorphism in bite force was moreover observed in captivity and is determined by head dimension. This finding invited us to investigate the role of the ecological niche in differences between males and females, but no data on bite force in free-living animals are available to date. Prior field studies only focused on aging of grip strength in males and females, showing that wild males declined slightly, and that females were stronger than males in the grey mouse lemur. However, no sexual dimorphism was described in the other mouse lemur species.
Here, we collected data on a wild population of brown mouse lemurs (*Microcebus rufus*) in the rain forest of Madagascar using direct methods: bite force measurements with a portable bite force transducer, head dimensions, weight, and heart ratios using a microphone. We also conducted an explorative work with infra-red pictures aimed to test the correlation with the level of stress experienced during manipulation.
We found that brown mouse lemurs do not present sexual dimorphism in bite force and head width. Bite force was positively correlated with head width as previously demonstrated for grey mouse lemur. Interestingly, we found that heart ratio was negatively correlated with bite force, but also tended to be negatively correlated with maximum eye temperature, a known marker of response to stress in homeotherms. This help us to understand how this prey species reacts in stressful conditions.

Keywords: mouse lemur, bite force, eye temperature, heart ratio

*Speaker

Preliminary study on the microanatomical and geometrical characteristics in long bones shaft among mammals

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Bone microstructure in mammals provides evidences of tight functional and evolutionary relationships between the inner structure of bones and the organisms' lifestyle. Indeed, it has been shown that locomotion habits can be inferred given the microanatomical patterns, especially in long bones. Although most past studies were based on qualitative and quantitative analyses of transversal sections of the shaft on homologous plans, the variation of the inner structure all along the shaft and its quantification remains to be specified. We used a dataset representing a large diversity in ecology, microanatomy and morphology among mammals, in order to determine relevant quantitative microanatomical and geometrical parameters capable of describing at best the microstructural variations along the shaft. In this purpose, both femora and humeri of 16 mammal species were scanned using a microtomographic approach (CT scan), and reconstructed to analyze bones in three dimensions. We then precisely quantified and compared several parameters related to the bones' microstructure. Here we provide first conclusions of the relevance of these parameters, such as geometrical variation of shape along the shaft, or variation of the compacity. These study would allow us to conduct further comparative microanatomical studies within mammals.

Keywords: Bone, microanatomy, microtomography, 3D reconstruction, functional anatomy, mammals

*Speaker

Use of microtomography analysis as a tool to understand the interaction between parasitic plants and their hosts

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Parasitic plants are angiosperm species that attach to other plants, *i.e.* hosts, in order to obtain nutritional resources. The attachment is provided by an organ called haustorium, which bridges the parasite and the host, thus promoting the flux of various substances between the two plants. Despite carrying out the same basic functions in all parasitic angiosperms, haustoria can be greatly diverse among parasites considering its morphological and anatomical features. As a way to analyze this organ which "embodies the very idea of plant parasitism", we have allied traditional plant anatomy with the use of High Resolution X-ray Computed Tomography (HRXCT) providing a detailed three-dimensional understanding of the host-parasite interface. Our study included parasitic plants that infest the host stem by forming one or two general types of haustoria – terminal ones, and lateral ones. Additionally, different scanning methods and contrasting agents were tested in order to improve the detection of parasitic tissue within the host stem/root. A total of 12 species from 5 different plant families were analyzed. The results indicate that species that only form terminal haustoria have different infestation patterns within the host. On the other hand, species forming both haustorium types showed similar patterns of host stem infestation. The HRXCT proved to be a powerful approach to understand the haustorial system and the infestation patterns of parasitic plants. We hypothesize that the development of distinct types of haustoria could be related to other anatomical and physiological features of parasitic plants.

Keywords: haustorium, plant anatomy, microtomography, Loranthaceae, Viscaceae, Apodanthaceae, Cuscuta, Cassytha

*Speaker

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