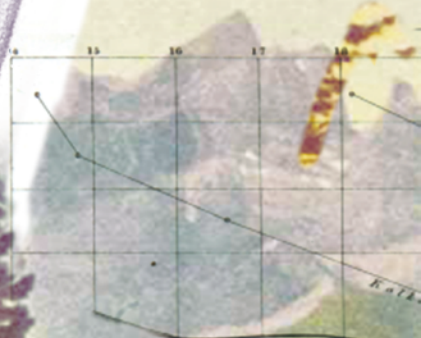


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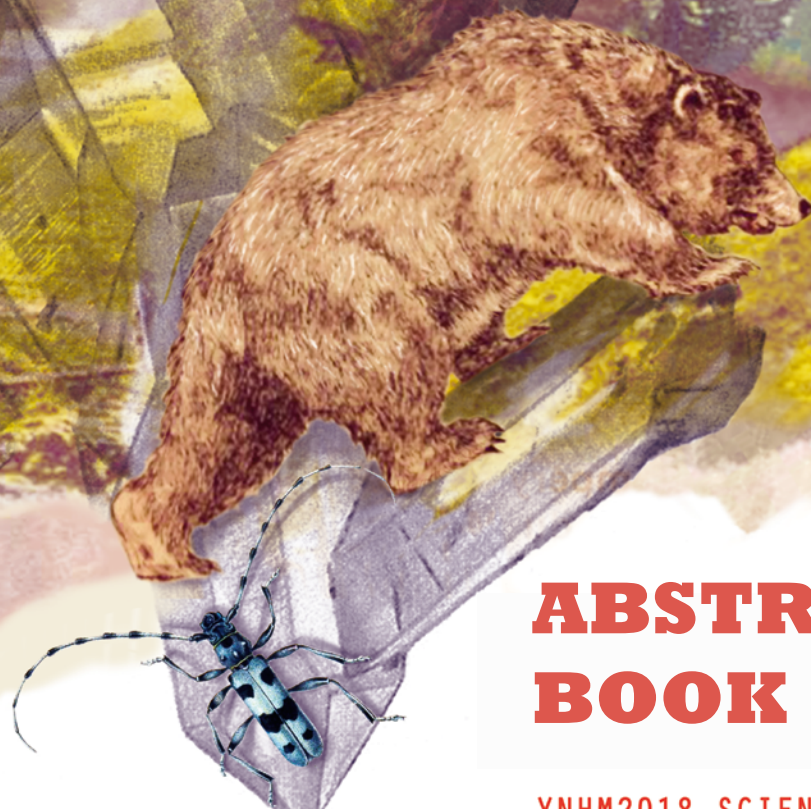
5TH

YOUNG NATURAL HISTORY SCIENTISTS' MEETING



ALPEN u. PYRENÄEN

Mont Blanc, 4801' i
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ABSTRACT BOOK

YNHM2018.SCIENCECONF.ORG





The associations **BDEM**, **Doc'Up**, **Symbiose 6** and **Timarcha** are pleased to welcome you to the 5th Young Natural History scientists Meeting at the **National museum of natural history (MNHN)** of Paris. We hope that this congress created for young scientists will provide you with the opportunity to present, possibly for the first time, your research in a relaxed but studious atmosphere. We believe that the YNHM is a great chance for everyone to have a first international congress experience.

We thank you all for coming and hope you will enjoy the conference and get opportunities for networking.

Faithfully yours,
The Organizing Committee

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We would like to thank the members of the six juries and all the guides of the excursions.

We also thank:

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Scientific societies



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Humanities and Natural Sciences

Hues of Namibia: characterization and provenience of Erongo rock art pigments

Guilhem Mauran ^{*† 1}, Matthieu Lebon ¹, Benoit Caron ², Alma Nankela ,
Florent Détroit ³, David Pleurdeau ¹, Jean-Jacques Bahain ¹

¹ Histoire naturelle de l'Homme préhistorique (HNHP) – Sorbonne Universités, Muséum National d'Histoire Naturelle (MNHN), Université de Perpignan Via Domitia, CNRS : UMR7194, Sorbonne Universités – 17 Place du Trocadéro, F-75116 Paris, France., France

² Institut des Sciences de la Terre de Paris (ISTeP) – Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR7193 – 4 Pl. Jussieu 75005 Paris, FRANCE, France

³ Histoire naturelle de l'Homme préhistorique (HNHP) – Sorbonne Universités, Muséum National d'Histoire Naturelle (MNHN), Université de Perpignan Via Domitia, CNRS : UMR7194 – 17, France

Erongo mountains, central Namibia, host numerous rock paintings. Archaeologists attribute them to San people, hunter-gatherers living in southern Africa for thousands of years. However, the lack of directly connected archaeological data maintains uncertainties about their chronology and attribution.

Since 2007, an archaeological franco-namibian team has excavated the site of Leopard Cave (Erongo), and unearthed coloured materials and tools bearing pigments' traces in layers dated back to approximately 3,000 BP. Together with the paintings on the site and its surroundings, these artefacts support the existence of a "chaîne opératoire" for rock art's pigments.

The study aims at providing new insights into the chronology and attribution of the paintings of Erongo mountains through analyses of rock art's pigments and study of archaeological coloured materials' provenience.

In situ non-invasive analyses of the paintings, field surveys of geological sources followed with structural observations, elemental and mineralogical analyses of all the material collected should permit to reach these aims.

As for the pigments' characterisation, the first results confirm the use of iron oxides, carbon and various white materials. Besides, first observations point to a rather local procurement's strategy with higher resemblances between the archaeological artefacts and the local geological sources than of the ones further away.

Dating the carbonaceous pigments and correlation of rock art pigments with archaeological materials will provide a chronological milestone for southern African rock art. Paired with the study of the pigments' provenience, it will provide key insights into the artists' socio-cultural environment, therefore, confirming or not the nowadays attribution.

Keywords: Archaeometry, rock art, pigments, provenience, San, Namibia

*Speaker

†Corresponding author

Exploration of the morphological diversity of mandible of dogs during Epipaleolithic until Bronze Age in Europe and Near and Middle East. Morpho-functional aspects link to dietary changes induced by man.

Andréa Filippo * ¹, Stéphanie Bréhard ², Raphaël Cornette ³, Anne Tresset ²

¹ Mécanismes adaptatifs et évolution, UMR 7179, CNRS, Funevol team (MECADEV) – Muséum National d'Histoire Naturelle (MNHN) : UMR7179 – 55 rue Buffon, Bat. Anatomie Comparée, CP 55, 75005 Paris Cedex 5, France., France

² Archéozoologie et Archéobotanie, UMR 7209 – Muséum National d'Histoire Naturelle (MNHN) : UMR7209 – 55 rue Buffon, CP 56, 75005 Paris Cedex 5, France., France

³ Institut de Systématique, Evolution et Biodiversité, UMR 7205 (ISYEB) – Muséum National d'Histoire Naturelle (MNHN) : UMR7205 – 55 rue Buffon, CP 56, 75005 Paris Cedex 5, France., France

The domestication involves changes in lifestyle of individuals that will cause changes in phenotype. For example, it has been established, that from the Neolithic some dogs, the first animal species domesticated, have been able to digest starch in large quantities. This new adaptation represents a crucial step in the evolution of the dog because it represents an adaptation to lifestyle of agricultural societies. As the structure of the masticatory apparatus is related to the type of diet, it is possible that the dietary change had an impact on the anatomy of the mandible. So, one of the goals of this study is to compare the morphological and morpho-functional evolution of the dogs mandibular apparatus link to the humans techno-economic evolution during Epipaleolithic until Bronze Age. To study the morphological diversity of mandible, traditional and geometric morphometric analyses were used on 627 mandibles of dogs and 94 mandibles of wolves from 36 archeological sites in Europe and Near and Middle East. These analysis showed the proximity between Paleolithic wolves and Mesolithic, Neolithic and Chalcolithic dogs in Europe. In addition, this study showed the development of new forms of dogs during the Neolithic and Chalcolithic in Europe. Moreover, after comparison with paleogenetic data, we assumed that the morphological and morpho-functional diversity of mandible of dogs were linked to the development of agriculture in Neolithic societies. This study highlights that there is a link between starch diet adaptations in ancient European dogs and a morphological specialization of the mandible.

Keywords: Dogs – Mandible – Diet – Evolution – Domestication – Morphometrics

*Speaker

Is the perception of urban biodiversity related to ecosystem services?

Chloé Duffaut ^{*†} ¹, Julien Gasparini ¹, Florence Brondeau ²

¹ Institut d'écologie et des sciences de l'environnement de Paris (IEES) – Université Pierre et Marie Curie - Paris 6, Centre National de la Recherche Scientifique : UMR7618 – UPMC, campus de Jussieu - Bât A - Paris (75005)UPMC, campus de Jussieu - Tour 56/66 - Paris (75005)AgroParisTech-INRA - Grignon (78)INRA - Versailles (78)IRD - Bondy (93)U-PEC - Créteil (94), France

² Espaces, Nature et Culture (ENeC) – Université Paris-Sorbonne, Centre National de la Recherche Scientifique : UMR8185 – Laboratoire Espaces, Nature et Culture (ENeC) UMR CNRS-Paris IV 8185 Maison de la Recherche 28 rue Serpente 75006 Paris, France

With increasing global urbanization, it becomes important to reconnect humans with nature in cities. In this context, ecosystem services can be a good way for this reconnection. In this study, we tested how knowledge of the ecosystem services provided by undesirable urban fauna might influence citizens' perceptions of this wildlife. To do so, we first tested the fertilizing effect of pigeons' guano as a potential ecosystem service. Then, we examined how this ecosystem service changed the citizen perception toward pigeon.

Guano's effects were tested on cherry tomato plants. Pigeons' guano was applied on 29 plants on early June, 2017 and the production estimators were compared to control 29 plants (without guano). Meanwhile, 200 urban citizens were asked with a questionnaire to know what they think about pigeons. Next year, 200 additional citizens will be sampled with the same questionnaire, but people will be informed on the fertilizing effects of pigeons' guano before answering and we will examine if the perception of the citizens will change.

First results show that tomato plants with guano have more flowers and are taller than those without guano. For questionnaires, we predicted that city dwellers will perceive pigeons more positively when they are aware of the service provided by them.

Our preliminary results support the first prediction of our hypothesis: pigeons' guano can be used by humans as a local fertilizer for urban agriculture and constitute thus an ecosystem service. We are still running the study to validate the second prediction on the human perception.

Keywords: urban ecology, ecosystem service, pigeon, guano, questionnaire, biodiversity's perception

*Speaker

†Corresponding author

Advocating, caring, knowing as many ways of relate to gardens' nature

Marine Leve ^{*† 1}, Carmen Bessa-Gomes , Emmanuelle Baudry ,
Anne-Caroline Prevot ¹

¹ Centre d'écologie et de sciences de la conservation (CESCO) – CNRS : UMR7204, Université Pierre et Marie Curie (UPMC) - Paris VI, Muséum National d'Histoire Naturelle (MNHN) – 55 rue Buffon 75005 PARIS, France

Gardens are enclosed spaces whose history has deep roots in humans' one. Nowadays, accession to private property is mainly considered an achievement in European countries, including France, and more specifically being owner of a detached house with a domestic garden. Low density housing, consisting of detached houses and associated domestic gardens is dominating in peri-urban areas such as peripheries of European large cities. In peri-urban areas, domestic gardens may be places of encounter with various elements of biodiversity and may then counteract the current ongoing extinction of experience of nature. This research questions the place of peri-urban inhabitants in relation to nature through the lens of their relationships with various biodiversity elements of the garden.

We used semi-structured interviews with 16 inhabitants of detached houses with domestic gardens in the South of the greater Paris. We elicited answers related to the place and roles of nature within their garden by asking them about the garden's history, presence and movements of animals and plants and activities within the garden (maintenance, wildlife stewardship, etc). We conducted a quantitative semantic analysis of nature-related words. Qualitative analysis was used to bring out descriptions of the interviewees' profiles.

Gardens are well identified as places where relations to nature may be constructed. From these relations we identified several ways to relate to the garden a whole, which do integrate the network of relations with each individual biodiversity element. Those include care, pro-environment advocacy, naturalist knowledge gathering.

Keywords: domestic gardens, biodiversity, interviews, peri, urban areas, representations

*Speaker

†Corresponding author

Vocal behavior and its correlation to mating success in humans

Alexandre Suire * ¹, Michel Raymond ¹, Melissa Barkat-Defradas ¹

¹ Institut des Sciences de l'Évolution [Montpellier] (ISEM) – Université de Montpellier, Centre National de la Recherche Scientifique : UMR5554 – Place E. Bataillon CC 064 34095 Montpellier Cedex 05, France

Introduction

Research in language evolution suggest that vocal control is the essential condition for the emergence of articulated language in humans and that sexual selection is its main evolutionary driver. Beyond the linguistic content of their speech, speakers of both sexes convey diverse biological and psychosocial information through their voice in order to exploit listeners' perceptions in the context of same-sex competition and mate choice. However, studies investigating the evolutionary benefits of modulating vocal behavior, specifically its correlation to mating success, are scarce.

Methods

We investigated the way French native speakers of both sexes vocally behave in courtship vs. competitive contexts using an experimental design based on a simulated dating game. We then assessed which vocal behavior, and in particular which of its acoustic features predicted mating success.

Results

Our results show that men who increased their speaking rate and reduced their speech duration had a higher mating success in the courtship context. In the competitive context, their mating success was predicted by a decrease of their pitch and a more monotonous speech. Women's mating success was predicted by a decrease of their pitch, an increase of vocal roughness and breathiness in the courtship context. In the competitive context, only an increase in both roughness and breathiness predicted mating success.

Discussion

Modulating vocal behavior has a direct benefit for speakers' mating success. It also reveals the existence of a vocal sexual dimorphism when seducing and competing for mates. We discuss our results in light of the emergence of human language.

Keywords: Sexual selection, vocal control, vocal behavior, mating success, human language.

*Speaker

In front of captive felines and primates: does welfare matter?

Sandra Simões ^{*† 1,2}, Anne-Caroline Prévot ³, Michel Saint Jalme ⁴

¹ Centre d'Ecologie et de Sciences de la COnservation (CESCO) – Muséum National d'Histoire Naturelle (MNHN), Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR7204 – 55 rue Buffon 75005 PARIS, France

² Center for Functional Ecology (CEF) – 3000-456 Coimbra, Portugal

³ Centre d'écologie et de sciences de la conservation (CESCO) – CNRS : UMR7204, Université Pierre et Marie Curie (UPMC) - Paris VI, Muséum National d'Histoire Naturelle (MNHN) – 55 rue Buffon 75005 PARIS, France

⁴ Muséum national d'histoire naturelle (MNHN) – Ministère de l'Ecologie, du Développement Durable et de l'Energie, Ministère de l'Enseignement Supérieur et de la Recherche, Muséum National d'Histoire Naturelle (MNHN) – 57, rue Cuvier - 75231 Paris Cedex 05, France

Nowadays, the concerning status of nature biodiversity and conservation measures implementations arises the importance of having institutions promoting animal welfare, management and public education about the importance of protecting wildlife. The zoo visiting experience goes accordingly with cultural connections people have with animals, bringing visitors close to nature by creating relatable naturalistic environments.

Many studies have addressed the side effects of animal welfare in captivity, such as stereotyped behaviour and the need for enriched exhibits. However, public's perceptions of animals' behaviours may not correspond to the welfare realities. This work aims to study visitors' reactions towards different species' exhibits, namely, felines (Snow leopard and Caracal) and primates (Bornean orangutan and L'Hoest's monkey), using bigger and smaller species of each animal category.

It was hypothesized that visitors are more likely to spend larger amounts of time in front of bigger animals, as well as when animals are displaying higher activity related behaviours, such as eating or playing. However, repetitive behaviour should trigger more negative reactions by the public since it may be identified as a stress behaviour.

Data collection occurred during two weeks and it was registered the time visitors spent in front of exhibits, reactions, group type and estimation of visitors' age.

First preliminary results point to higher time spent and positive reactions in front of the orangutan and leopard (i.e. the two largest species) but there were no differences in reactions regarding different animal behaviours. Obtained results may be related with cultural and phylogenetical relations between people and animals.

Keywords: Animal captivity, animal welfare, people perceptions, stereotyped behaviour, felines, primates

*Speaker

†Corresponding author

Potential involvement of human secreted group IIA phospholipase A2 in malaria

Mélanie Dacheux * ¹, Soraya Chaouch ¹, Amandine Labat ¹, Lhousseine Touqui ², Philippe Grellier[†] ¹, Gérard Lambeau ³, Christiane Deregnacourt[‡] ¹

¹ UMR 7245 - Molécules de Communication et Adaptation des Micro-organismes (MCAM) (MCAM) – Museum National d’Histoire Naturelle, Centre National de la Recherche Scientifique – 57 rue Cuvier 75005 Paris, France

² Institut Pasteur [Paris] – Institut Pasteur [Paris] – 25-28, rue du docteur Roux, 75724 Paris cedex 15, France

³ Institut de pharmacologie moléculaire et cellulaire (IPMC) – Centre National de la Recherche Scientifique : UMR7275 – CNRS-IPMC 660 Route des lucioles 06560 VALBONNE, France

Malaria is a disease caused by *Plasmodium* parasites among which *P. falciparum* is the most virulent human species. Most malaria cases are uncomplicated, but severe deadly cases can occur. Human group IIA phospholipase A2 (hGIIA sPLA2) is increased in the serum of malaria patients, especially in severe cases, but its role is still unknown. We used *in vivo* approach to further elucidate the role of hGIIA sPLA2 in malaria.

Transgenic mice for hGIIA sPLA2 (Tg) were infected with *P. chabaudi*, a murine malaria parasite which presents several common points with *P. falciparum*. hGIIA sPLA2 blood concentration in Tg mice increased along with parasitaemia. At the peak of infection, parasitaemia was 30% lower than in WT mice. Histological examination of the liver and kidneys showed less lesions and better recovery in Tg mice compared to WT mice. However, lesions in the spleen were more important in Tg mice, with a disorganization of the red pulp and white pulp and occurrence of extra-medullar hematopoiesis, as shown by immunohistochemistry. Injection of recombinant hGIIA sPLA2 to *P. chabaudi*-infected WT mice induced a decrease in parasitaemia, indicating a direct role of the enzyme in parasite development control.

All together, our results suggest that hGIIA sPLA2 might be an important player in the physiopathology of malaria.

Keywords: Malaria, *Plasmodium chabaudi*, human secreted group IIA phospholipases A2, transgenic mouse, histology

*Speaker

†Corresponding authors

‡

Contribution of human occupations study in Northwestern Africa: new dating results of the MSA/LSA Transition from El Harhoura 2 cave.

Eslem Ben Arous ^{*†1}, Qingfeng Shao ^{*2}

Mohammed El Hajraoui ^{*3}, Roland Nespoulet ^{*}

¹, Christophe Falgueres ^{*1}

¹ Muséum National d’Histoire Naturelle - UMR 7194 (MNHN) – Museum National d’Histoire Naturelle – 1, rue René Panhard, 75013, Paris, France

² Nanjing Normal University (NNU) – 1, Wenyuan Road, Nanjing 210023, China

³ Institut National des Sciences de l’Archéologie et du Patrimoine [INSAP] - Rabat – Morocco

Recent archeological discoveries in North Africa brought this area back to the heart of the debate on the origins of the Middle Stone Age/MSA and Later Stone Age/LSA human settlements. This cultural transition is characterized by major anthropological, paleoclimatic changes, and occurred in the Late Pleistocene. This study focuses on the chronology of the MSA/LSA Transition in the Temara region (Morocco - Atlantic coast, Northwestern Africa) well known for his high concentration of *Homo sapiens* occupations from 110 ka. Due to the paucity of reliable dating evidence, late Pleistocene models of modern human migrations within and out of Africa have proven difficult to describe spatially and temporally, and modeled mostly through genetic datasets. The purpose of this study is to define more precisely the chronological framework of human occupation in Northwestern Africa in order to discuss these models. Here, we present the series of 15 new ESR/US dates from a MSA sequence at El Harhoura 2.

ESR US method, commonly used to date human occupation, is based on the quantification of electrons trapped on mineral defects due to the natural radioactivity, is combined to Uranium-Series to build mathematical model of age. New results place the final MSA human occupation around 50 ka, previously situated around 70 ka, and reducing the timing between the last MSA occupations and LSA occupations. It will be premature to give an immediate answer to human migration models, these results must be confirmed, in the future, by using other results obtained by independent methods, like radiocarbon.

Keywords: North Africa, Human evolution, Middle Stone age, Dating methods

*Speaker

†Corresponding author

Systematics, Evolution and Comparative Anatomy

Transcriptomics help resolve phylogenetic relationships in ticks.

Pierre Charrier ^{*† 1}, Axelle Hermouet ¹, Caroline Hervet ¹, Olivier Lambert ^{1,2}, Albert Agoulon ¹, Stephen Barker ³, Dieter Heylen ⁴, Olivier Plantard ¹, Claude Risse ¹

¹ Biologie, Epidémiologie et analyse de risque en Santé Animale (BIOEPAR) – Institut National de la Recherche Agronomique : UMR1300 – ONIRIS : Site de la Chantrerie CS 40706 44307 Nantes cedex 3
Site de la Géraudière CS 82225 44322 Nantes cedex 3, France

² Centre Vétérinaire de la Faune Sauvage et des Ecosystèmes des Pays de la Loire (CVFSE) – Ecole Nationale Vétérinaire, Agroalimentaire et de l'alimentation Nantes-Atlantique – Centre Vétérinaire de la Faune Sauvage et des Ecosystèmes des Pays de la Loire, Oniris, Nantes, France

³ Department of Parasitology, School of Chemistry Molecular Biosciences, The University of Queensland – Department of Parasitology, School of Chemistry Molecular Biosciences, The University of Queensland, Brisbane, Qld, 4072, Australia

⁴ Evolutionary Ecology Group, Department of Biology, University of Antwerp – Evolutionary Ecology Group, Department of Biology, University of Antwerp, Belgium

Hard ticks are vectors of numerous pathogens responsible for human and veterinary diseases. In particular the *Ixodes* genus is distributed world-wide and comprises several species that transmit the Lyme borreliosis agent (*Borellia* sp.). To better understand evolutionary patterns in this genus (for example how genes related to blood-feeding evolved, and how fast did they change over evolutionary time), an accurate phylogeny of the whole group is needed (Chmelař, 2016).

Using high output sequencing technology (RNA-Seq), we investigated phylogenetic relationships in the group of hard ticks. Transcriptomes from 9 species in the *Ixodes* genus were sequenced and were combined with data obtained from Genbank for two other *Ixodes* species as well as 9 non-*Ixodes* tick species. We reconstructed transcriptomes for each species (20 in total), predicted their coding sequences and performed sequence comparisons among them in order to identify Single copy orthologs (SCO). Using Maximum-likelihood and Bayesian framework, we combined a supertree and a supermatrix approach to obtain a reliable scenario of the hard tick phylogeny (González, 2015).

If major nodes of the tree were well resolved, parts of the phylogenetic tree still remain difficult to resolve. Overall, our results confirmed previous work on ticks phylogeny (Burger, 2012) and brought new insight, in particular for the debated "ricinus complex" species (Xu, 2003). This work provides a better frame to study the evolutionary history of ticks, and will facilitate further analyses of phylogeny and gene evolutionary patterns.

Keywords: Phylogenomic, RNA, Seq, Transcriptome, Supermatrix, Supertree, Ticks

*Speaker

†Corresponding author

Phylogenomic reveals differences in the temporal and spatial diversification of two diverse families of moths

Pierre Arnal ^{*† 1}, Astrid Cruaud ², Marianne Elias ¹, Sabine Nidelet ³, Jean-Yves Rasplus ², Rodolphe Rougerie ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

² Centre de Biologie pour la Gestion des Populations (CBGP) – Institut national de la recherche agronomique (INRA) – 755 avenue du Campus Agropolis, 34988 Montferrier sur Lez, France

³ Centre de Biologie pour la Gestion des Populations (CBGP) – Centre de Coopération Internationale en Recherche Agronomique pour le Développement : UMR55, Centre international d'études supérieures en sciences agronomiques : UMR1062, Institut national de la recherche agronomique [Montpellier] : UMR1062, Université de Montpellier : UMR1062, Institut de Recherche pour le Développement : UMR1062, Institut national d'études supérieures agronomiques de Montpellier – 755 avenue du Campus Agropolis, 34988 Montferrier sur Lez, France

While insects represent more than half of earth biodiversity, little is known about the temporal and spatial dynamics of their diversification. Here we use a phylogenomic approach to investigate the long-term evolution of two diverse families of moths: The Saturniidae and the Sphingidae (about 5000 species). The two families are very popular and historically well documented, with a considerable amount of available distribution and life history. Using Next Generation Sequencing and Hybrid Enrichment to sequence Ultra Conserved Element (UCE) throughout the genome, we built a phylogeny of all extant genera (402 genera), which provides an unprecedented view of the evolution of these moths and allows us to investigate spatio-temporal patterns of diversification. We emphasize the efficiency of this method, even when applied to museum samples, as well as the robustness in the inference of phylogenetic relationships. This result is very promising for the generation of highly supported phylogenies in non-model organisms for which tissue samples can be mined from collections. In addition, we discuss the striking differences in terms of diversification and biogeographic patterns between the two families: while sphingids biogeography is mostly drawn by dispersal events, that of saturniid moths is mostly the result of vicariance. The fundamental differences in life-history traits are probably the reason of such contrasts: sphingids have better flight capacities and feed at adult stage while many saturniids species are polyphagous at larval stages and do not feed at adult stage. Overall, our results underline the major influence biological traits may have on families' diversification.

Keywords: Biogeography, Macroevolution, Next Generation Sequencing, Hybrid enrichment, Museum samples, Life history strategies

*Speaker

†Corresponding author

Terrestrial vs. arboreal: functional differences in the forelimb muscles of Carnivora

Maxime Taverne * ¹, Anne-Claire Fabre ¹, Marc Herbin ¹, Anthony Herrel ¹, Christine Böhmer ¹

¹ Muséum national d'histoire naturelle (MNHN) – Muséum National d'Histoire Naturelle (MNHN) – 57, rue Cuvier - 75231 Paris Cedex 05, France

The arboreal environment is a complex and irregular habitat which imposes significant constraints on the locomotor ability of vertebrates. It forces them to reach across discontinuities and to move on substrates of variable size and orientation. The associated selective pressures can result in morphological and anatomical changes. These adaptations have been well described in squamates but have rarely been quantified in mammals (except for primates), although the evolution of arboreality occurred independently in this group (including marsupials, rodents, primates and carnivorans). The aim of the present study was to understand the anatomical basis for climbing in different species of Carnivora, by comparing arboreal species and terrestrial species. Therefore, we investigated the myological response to the complex constraints imposed by the locomotion in trees. We explored the functional muscular characteristics of the forelimb, as it is a good indicator of lifestyle and locomotor mode in mammals. We performed quantitative dissections using a unique sample of 16 carnivoran species which represents a wide taxonomic, ecological and morphological diversity. A dataset including muscle mass, cross sectional area and fibre length was then acquired, and used to perform multivariate statistical analyses taking into account phylogeny. We here show that in Carnivora the locomotion in the arboreal environment is associated with a greater force producing capacity in three muscle groups (wrist rotators, elbow flexors and scapula protractors), increasing locomotor abilities of arboreal species to specific movements. This study provides new insights into the muscular adaptations in mammals linked with the conquest of the arboreal environment.

Keywords: Habitat, Convergence, Myology, Quantitative dissections

*Speaker

Do sexually dimorphic species have sexually dimorphic brains?

Anna Zango Palau * ¹, Anne-Claire Fabre ², Stefan Scheu ¹, Anthony Herrel ²

¹ Georg-August-Universität Göttingen – University of Goettingen, Untere Karspüle 2 - 37073 - Goettingen, Germany, Germany

² UMR 7179 - Mécanismes adaptatifs Évolution (MECADEV) – Museum National d'Histoire Naturelle - MNHN (FRANCE) – 57 rue Cuvier - 75231 Paris, France

Sexual dimorphism has been widely described in lizards and it has been attributed to differences in ecology, behaviour and reproductive roles of males and females. However, it has never been studied whether sexual dimorphism occurs in overall brain morphology. In this study, we compared relative brain sizes and brain shapes of males and females of two known sexually dimorphic species of lizard: *Gallotia galloti* and *Anolis carolinensis*. We performed geometric morphometric analyses to determine whether brains are sexually dimorphic focusing on the following brain regions: cerebellum, optic tecta, epiphysis cerebri, cerebral hemispheres and olfactory bulbs. Our results show that although relative brain size does not differ between males and females, there is sexual dimorphism on brain shape for both species. Males of both species have larger optic tecta than females, which could be related to visual assessment of sexual competitors or long-distance territorial displays. Contrary to our expectations, cerebella were larger in females. The cerebellum has been linked to spatial monitoring and thus would be expected to be larger in males which are territorial. However, enhanced spatial orientation abilities may be necessary for resource monopolization linked to egg production in females. To our knowledge, this is the first study that reports sexual dimorphism in brain shape in lizards. The fact that two distantly related species such as the ones included in our study present brain sexual dimorphism suggests that this phenomenon may be more widespread in lizards than previously thought.

Keywords: Sexual dimorphism, brain shape, lizards, geometric morphometrics

*Speaker

Limb functional shift between prosauropod and sauropod dinosaurs: Morphological changes among stylopod bones

Romain Pintore ^{*† 1,2}, Raphaël Cornette ³, Ronan Allain ⁴, Alexandra Houssaye ⁵

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

² Université Pierre et Marie Curie - Paris 6 (UPMC) – Université Pierre et Marie Curie - Paris 6 – 4 place Jussieu - 75005 Paris, France

³ Institut de Systématique, Evolution, Biodiversité - UMR 7205 (ISYEB) – CNRS : UMR7205, Muséum National d'Histoire Naturelle (MNHN), EPHE, Université Pierre et Marie Curie [UPMC] - Paris VI – 57 rue Cuvier, CP50, F-75005, Paris, France, France

⁴ Centre de Recherches sur la Paléobiodiversité et les Paléoenvironnements - UMR 7207 (CR2P) – CNRS : UMR7207, Muséum National d'Histoire Naturelle (MNHN), Université Pierre et Marie Curie [UPMC] - Paris VI – 57 rue Cuvier, CP38, F-75005, Paris, France, France

⁵ Mécanismes adaptatifs evolution - UMR 7179 (MECADEV) – CNRS : UMR7179, Muséum National d'Histoire Naturelle (MNHN) – 57 rue Cuvier, CP55, F-75005, Paris, France, France

Sauropodomorphs are herbivorous saurischian dinosaurs which lived from the Upper Triassic (220 Ma) to the Upper Cretaceous (65 Ma). They are particularly well known because most are giant quadrupedal land forms with elongated neck and tail. Indeed, sauropod dinosaurs were the largest animals to ever walk on Earth with both hind-limbs and forelimbs strictly adapted to high body mass support. Nevertheless, prosauropods dinosaurs, which are considered as ancestral relatives of sauropods, were smaller facultative or obligate bipedal forms with forelimbs displaying some grasping abilities. The postural transition which occurred between prosauropods and sauropods is therefore not only accompanied by changes of bone proportions because of an increase in body size, but also by changes of function in the forelimbs. The aim of this work is to qualitatively and quantitatively highlight these changes among stylopod bones, the upper part of the limbs, using geometric morphometrics. Data were first acquired by photogrammetry and then analyzed using 2D and 3D geometric morphometrics with anatomical landmarks and sliding semi-landmarks in order to well describe the biological shape diversity. Principal component analyses show that most of the variation involves the shape of the diaphysis, the width of the distal epiphysis and the size of the muscular attachments, being the fourth trochanter and the deltopectoral crest respectively referring to femora and humeri. Despite taphonomical bias that are discussed and that must be taken into account, results show that both approaches allow to see the postural transition from bipedal prosauropods towards quadrupedal sauropods.

Keywords: Sauropodomorph dinosaurs, Geometric morphometrics, Taphonomy, Photogrammetry, Graviportality, Stylopod bones

*Speaker

†Corresponding author

The imprint of climate in phylogenetic trees: a global analysis on the diversification of Tetrapod families

Théo Pannetier * ¹, Fabien Condamine ²

¹ Groningen Institute for Evolutionary Life Sciences [Groningen] (GELIFES) – P.O. Box 11103 9700 CC Groningen The Netherlands, Netherlands

² Institut des Sciences de l'Évolution [Montpellier] (ISEM) – Université de Montpellier, Institut de recherche pour le développement [IRD] : UR226, Centre National de la Recherche Scientifique : UMR5554 – Place E. Bataillon CC 064 34095 Montpellier Cedex 05, France

Climate plays a central role in the distribution and evolution of species diversity. The relationship between climate and diversity over long, macroevolutionary time has traditionally been addressed by analyzing patterns from fossil data. However, discontinuities in the fossil record of most groups have precluded the extension of this approach to more than a few lineages. Recent development of comparative phylogenetics have enabled to study past variations in the pace of diversification with reconstructed phylogenies. Such methods notably revealed a slowdown in diversification rates toward the present in most groups. Here, we investigated the role of climate on diversification using two models of diversification where variations in the rate of speciation is directly dependent upon fluctuations in either temperature or CO₂ concentration through time. We fitted these models to a set of 232 family-level phylogenies of Tetrapods. In 79 cases, the best model was a climate-dependent model, when compared to more classical models of constant rate and time-dependent speciation (temperature-dependency fitted best for 53 families, against 26 for CO₂). In phylogenies with temperature-dependent speciation, higher temperatures were associated with higher speciation rates. In other words, for these families we observe a slowdown in speciation rates matching the global cooling of climate observed over the past 65 million years. Our results show that climate is a potential driver of diversification over macroevolutionary time. This calls for further exploration of its importance relative to other biotic and abiotic drivers, such as competition or geographic vicariance.

Keywords: diversification, speciation rates, climate, phylogeny, macroevolution

*Speaker

The ancestor of buttercups and poppies: Flower evolution in Ranunculales

Laetitia Carrive ^{*†} ¹, Sophie Nadot ¹

¹ Laboratoire Écologie, Systématique, Évolution (ESE) – Université Paris-Sud - Université Paris-Saclay
– Bâtiment 360, rue du doyen André Guimier, 91405 Orsay, France

Ranunculales are an order of angiosperms comprising ca. 4500 species including common plants like buttercups and poppies. Their flowers are highly diversified and each of the seven families of Ranunculales is easily recognizable in the field. However some families lack floral synapomorphies and have unclear ancestral states, like Ranunculaceae (ca. 2500 species). Here we aim to use modern analytical methods to understand the specificities of Ranunculales flowers. Here we build a synthetic phylogenetic framework of the Ranunculales using already available sequences with 146 sampled species. In this framework, structural characters of the flower (such as differentiation, number of parts etc.) are reconstructed using Reversible Jump Monte Carlo Markov Chains. This Bayesian method integrates various sources of uncertainty (on the topology, the parameters, branch lengths etc.). The analyses reconstruct ancestral states by exploring all the model space and thus allow to examine and ponder a variety of different evolutionary scenarios for each character.

We expect to reconstruct the ancestral states of 35 characters at the scale of the order, each family and other critical nodes. We also expect to produce for each studied trait an evolutionary scenario that could account for the extant diversity from the reconstructed theoretical ancestor of Ranunculales.

This order is the sister-group of all other Eudicots, and thus has a key position to understand floral evolution in all Eudicots. Our results will allow a deeper understanding of the floral changes that took place at the base of this clade, which is the largest one within angiosperms.

Keywords: Ancestral states reconstruction, RJMCMC, Angiosperms, Macroevolution, Ranunculaceae

*Speaker

†Corresponding author

Integration and allometric dynamics during development and its relation with morphological evolution in *Schizanthus* (Solanaceae) flowers

Javiera Chinga ^{*† 1}, María Pérez ¹

¹ Pontificia Universidad Católica de Chile (UC) – Alameda 340, Santiago, Chile

Floral integration studies usually focus in two aspects: covariation and functional fitting among adult organs and integration as an evolutionary route to modularity and diversification. In contrast, little is known about how changes of integration during ontogeny (ontogenetic integration) and their underlying cellular dynamics (ontogenetic allometry) relate to morphological evolution. In this study, we explored how these developmental changes are related with adult morphologies and/or inter-specific differences in 6 species of *Schizanthus*, and if these changes appear homogenously during development or at particular moments. First, we calculated integration and allometric slopes using the entire ontogenetic data. Then, to explore possible changes during development, we used overlapping ontogenetic windows to calculate integration level during development without defining any previous ontogenetic stages. Allometric slopes were calculated at early and late ontogeny. Overall, ontogenetic integration changes were congruent with adult morphologies but did not explain differences among species. Changes related to adult morphologies occurred at different bud size in 4/6 species and appeared early in ontogeny in all but two species, in which they appeared later. Ontogenetic allometry at early development was congruent with inter-specific differences but not with adult morphologies, while the contrary occurred during late development, where allometric patterns were congruent with adult morphologies in all but one specie. Independently of the stage, organs which appeared later in development had higher allometric slopes, which may represent a development constraint. In conclusion, ontogenetic integration and allometry changes are congruent with adult morphologies and interspecific differences, which appeared at different moments during development.

Keywords: Ontogenetic integration, ontogenetic allometry, morphological evolution, flower evolution, *Schizanthus*, developmental constraints.

*Speaker

†Corresponding author

Biodiversity Dynamics and Conservation

Combining statistical and mechanistic models to unravel the causes of mortality causes within rear-edge beech population

Cathleen Petit ^{*† 1}, Sylvie Muratorio , François Lefevre , Hendrik Davi

¹ Unité de Recherches Forestières Méditerranéennes (URFM) – Institut National de la Recherche Agronomique : UR0629 – Domaine saint Paul, 84000,Avignon, France

Several studies report increasing dieback of trees over temperate forests, a major issue in ecology is to understand the mortality physiological drivers. In this study we combine statistical and mechanistic models to investigate the causes of mortality in a major European tree species (*Fagus sylvatica*) at its south margin range, based on individual monitoring of 5600 trees since 2003. First we used logistic regression and survival analysis to characterise the respective effects on individual mortality by exogenous (competition) and endogenous (size, defoliation, fungi presence) biotic factors. Then the effect of annual climatic factors on mortality at population scale. Secondly, we used a process-based model CASTANEA to simulate over time the development of beech trees with different individual characteristics (height, diameter and leaf traits) in different environmental conditions to mimicking the surveyed population. The first analysis shows that a combination of exogenous (climatic and biotic) and endogenous factors caused tree mortality. Drought was associated to increased mortality at population level. At individual scale, crown defoliation and the *Oudemansiella mucida* (fungi) presence were both found to be early signs of mortality. We found that the competition increase the mortality at early life stage and suggest that mortality is driven by light competition. Secondly, we will compare the simulations of CASTANEA model with these statistical predictions, and investigate if extremely low hydric potential occur when mortality is caused by drought. With the combination of these two methods we hope to better understand the whole process driving tree to death.

Keywords: Mortality, *Fagus sylvatica*, Tree, Mechanistic model, Longitudinal analysis

*Speaker

†Corresponding author

Natural History of Ants: What We (do not) Know about Trophic and Temporal Niches of Neotropical Species

Felix Rosumek ^{*† 1,2}

¹ Technische Universität Darmstadt (TU Darmstadt) – Schnittspahnstr. 3, 64287 Darmstadt, Germany

² Universidade Federal de Santa Catarina [Florianópolis] (UFSC) – Trindade, Florianópolis - SC, 88040-900, Brazil

Our understanding of the natural history of Neotropical ants is limited, due to lack of descriptive efforts and widespread use of morphospecies in literature. Use of trophic resources and period of activity are two central niche aspects little explored for most species. This work aimed to broadly review the literature and provide empirical field data on these aspects for 23 species. The fieldwork was carried out in the Atlantic forest of southern Brazil. A community-level design was used, but results were analyzed from a single-species perspective. Trophic and temporal niches were assessed with pitfall traps and seven kinds of bait representing natural resources. Most species broadly used the resources, but pronounced quantitative differences were found. *Odontomachus chelifer* (Latreille, 1802) and *Pachycondyla striata* Smith, 1858 were relatively well studied and field data matched previous accounts. They were the only species that consistently used large prey, and avoided complex sugars. *Wasmannia auropunctata* (Roger, 1863) used feces as its sole trophic resource, a novel behavior for this prominent invasive species. The six *Pheidole* species had no previous records and presented quantitative differences in resource use. Most species had no strong preference for period of activity. *Camponotus zenon* Forel, 1912 was nocturnal and *Crematogaster nigropilosa* Mayr, 1870, *Linepithema iniquum* (Mayr, 1870) and *Linepithema pulex* Wild, 2007 were diurnal. Complementary methods, context-dependence and descriptive studies have a central role in the understanding of ant natural history. Community assessments can contribute significantly to this knowledge if researchers also pay attention to the individual species involved.

Keywords: Formicidae, Atlantic forest, Pheidole, Wasmannia auropunctata, Pachycondyla striata, Odontomachus chelifer

*Speaker

†Corresponding author

Forecasting the potential impacts of environmental change on Iberian plants of conservation concern

Cristiana Alves ^{*† 1}, Rita Sousa-Silva ², Bruno Marcos ¹, Damien Georges ³, Angela Lomba ¹

¹ InBIO/CIBIO- Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Vairão, Portugal (InBIO/CIBIO) – Rua Padre Armando Quintas, nº 7 4485-661 Vairão Portugal, Portugal

² Department of Earth and Environmental Sciences, KU Leuven (KU Leuven) – BE-3001 Leuven, Belgium, Belgium

³ Laboratoire d'Écologie Alpine (LECA) – Université Joseph Fourier - Grenoble 1 : CNRS-UMR 5553 – bat. D - Biologie 2233 Rue de la piscine - BP 53 38041 GRENOBLE CEDEX 9, France

Worldwide, halting biodiversity loss is a challenge to be tackled. Climate and land-use change (CLUC) are among the major drivers of species decline, expected to drive species' future range. Understanding how CLUC may affect species in the future is thus of utmost importance to anticipate further biodiversity loss. This is especially critical for species of conservation concern, known to be more prone to extinction under environmental change.

Here, we study how CLUC may affect the future distribution of plants of conservation concern in the Iberian Peninsula. Species occurrences were gathered from: (1) herbarium records from Portugal and Spain, (2) Portuguese Report on Threatened Plants and the (3) Inventario Español de Especies Terrestres. For each species, current and future distributions were modelled and projected under three contrasting CLUC scenarios of change. Results, expressed as range changes were analysed: (i) for each individual species; and, (ii) considering groups of IUCN risk categories, for each individual set of models (climate versus land-use), and for differences between them.

Overall, our results depict coherent trends in the distribution of the targeted species under contrasting scenarios of CLUC change. Results showed that under climate change three species are likely to face extinction, while under land-use change scenarios, some may expand their suitable habitat.

Anticipating changes in the distribution of plants species is essential to support a holistic approach to adaptive management programs, in the context of the reporting of species for IUCN assessments, with high potential to foster targeted monitoring and cost-effective conservation actions.

Keywords: Conservation monitoring, environmental change, IUCN, Risk assessment, Plants, Scenarios of change

* Speaker

† Corresponding author

Landscape characteristics and prediction of leopard cat (*Prionailurus bengalensis euptilura*) road-kills in the Republic of Korea

Kyungmin Kim ^{*}1, Hortense Serret ¹, Céline Clauzel ², Yikweon Jang[†] ¹

¹ Division of EcoScience, Ewha Womans University – 52, Ewhayeodae-gil, Seodaemun-gu, Seoul 03760, South Korea

² Laboratoire Dynamiques Sociales et Recomposition des Espaces (LADYSS) – Université Paris Diderot - Paris 7 – 31 Rue du 4 Septembre, 75002 Paris, France

Road-kill is one of the main reasons of population decline for threatened or endangered species. Among the number of factors impact on road-kills, three are known as the major: landscape characteristic, habitat connectivity, and road features. Our aim in this study is to predict the road-kill locations of the endangered leopard cat using the three major factors.

We examined the three factors for 235 road-kill data of the leopard cat on highways in South Korea. First, we analyzed the landscape components for each road-kill point and highways. Second, we used a graph-theory approach to assess road-kill risk according to the connectivity values of the links between habitat patches. Furthermore, we analyzed the traffic volume and the number of lanes to understand road features for road-kill occurrence

The three major landscapes around road-kills were forest (40.7%), rice paddy (24.6%), and field (14.0%). The results of the graph modelling allowed us to select the most dangerous roads according to landscape connectivity. Then, the analysis of the road-kills frequency according to both traffic volume and the number of lanes allowed us to select the roads corresponding to these characteristics on a map.

By overlapping and mapping each result together, we generated a road-kill prediction map of leopard cat in the Republic of Korea. We expect this map can contribute to make more robust conservation policies on endangered species and to prevent road-kills

Keywords: Leopard cat, endangered species, road, kill, conservation, prediction map, Republic of Korea

*Speaker

†Corresponding author

Parasites affect their hosts through many ways: virulence, vulnerability, behavior and energy

Loïc Prosnier ^{*† 1}, Nicolas Loeuille ¹, Christophe Piscart ², Vincent Médoc ^{1,3}

¹ Institut of Ecology and Environmental Sciences - Paris (iEES-Paris) – Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR7618, Institut de recherche pour le développement [IRD] : UR242, Université Paris-Est Créteil Val-de-Marne (UPEC), Institut national de la recherche agronomique (INRA), Université Paris Diderot - Paris 7, Sorbonne Universités – 4 place Jussieu, 75005 Paris, France

² Université Rennes 1 - UMR 6553 ECOBIO (ECOBIO) – CNRS : UMR6553, Université de Rennes I – 263 Avenue du Général Leclerc Campus de Beaulieu, Bât 14A 35042 RENNES Cedex, France

³ Institut des Neurosciences de Paris-Saclay (Neuro-PSI) – Centre National de la Recherche Scientifique : UMR9197, Université Jean Monnet [Saint-Etienne], Université Jean Monnet [Saint-Etienne] – 23 rue du Dr. Paul Michelon, 42100 Saint-Etienne, France, France

Parasites are important components of ecosystems, altering life history trait and many interactions among species. Such modifications imply different types of mechanisms. Parasites are known for their effects on fecundity and mortality of hosts (virulence effects) that affect basic parameters of population dynamics. Parasites also modify the vulnerability to predation (interaction effects) thereby affecting ecological networks. Previous modelling works showed that these two effects may constrain coexistence and stability within trophic systems. However works rarely study these effects simultaneously. In the present study, we investigate their relative importance for a host-parasite interaction. We use *Daphnia magna*, infected by bacteria that induce the White Bacterial Disease (WBD), a parasite known for their virulence effects, and undergoing predation by European minnow (*Phoxinus phoxinus*). We measure how parasites modify fecundity, mortality, activity (speed, time of activity), energetic content (carbohydrate, lipids and proteins) and vulnerability to predation (preference and search time of predator) in short experiments. Results show that WBD reduce survival of *Daphnia*, but have little effects on their fecundity, and reduce their activity. Thus, energetic contents should be modified. Therefore, we may expect that parasite increase vulnerability of host by modifying its appearance and behavior. We predict alteration in the diet of predators as prey profitability is affected by the parasite. Consequently, parasites may have important effects in trophic systems, involving bottom-up effects (parasited-prey becoming more or less profitable) and trophic cascades (by modulating trophic interactions). Parasite effects therefore go beyond those expected based on simple virulence effect.

Keywords: *Daphnia magna*, White Bacterial disease, European minnow, diet preference, energetic content, swimming behavior

*Speaker

†Corresponding author

Sexual segregation in red deer: a question of food?

Fernanda Fernandes Garcia ^{*† 1}, António Alves Da Silva ¹, José Paulo Sousa ¹, Joana Alves ¹

¹ Centre for Functional Ecology (CEF) – 3000-456 Coimbra, Portugal

Sexual segregation is a common phenomenon among vertebrates and dimorphic animals. To date, no complete agreement on its definition has been achieved, and there are still numerous unanswered questions. Our study aims to evaluate if feeding behaviour of red deer males and females could explain sexual segregation by testing one of the hypotheses that have been postulated to explain it: forage selection hypothesis (FSH). We collected samples of faeces from red deer by direct observations in the study area Lousã Mountain, and from hunted animals. Faecal samples were analysed using the microhistological technique. The diet was evaluated in terms of composition and diversity. Males and females have different nutritional needs, and our results demonstrate that both sexes had differences considering the composition of food ingested. These differences may be a consequence of the sexual body-size dimorphism of the species. Males ingested more arboreous species, possibly due to their ability to browse, and to their larger body size. Our results also showed that the food overlap index between males and females is lower when sexes are segregated, as predicted. In conclusion, foraging ecology could be behind the sexual segregation, however not in accordance with all the predictions of FSH. So, answering the question: is sexual segregation a question of food, although males and females seem to be different food consumers, from our results, these differences are not sufficient to explain all patterns of sexual segregation exhibit by this population, and more factors should also contribute to this phenomenon.

Keywords: Cervus elaphus, sexual segregation, habitat segregation, forage selection hypothesis, feeding behaviour, microhistological technique

*Speaker

†Corresponding author

The contribution of seed bank mapping to conservation programs: The case of *Lythrum thesioides*.

Antoine Gazaix ^{*† 1,2}, Patrick Grillas^{‡ 1}, Perrine Gauthier^{§ 2}, John D. Thompson ²

¹ Tour du Valat – La tour du Valat – Le Sambuc 13200 Arles, France

² Centre d'écologie fonctionnelle et évolutive (CEFE) – CNRS : UMR5175, Université Montpellier II - Sciences et techniques, Université Montpellier I, Université Paul Valéry - Montpellier III, École Pratique des Hautes Études [EPHE] – Campus CNRS - 1919 route de Mende - 34293 Montpellier cedex 5, France

Mediterranean temporary ponds are characterized by an alternation of winter flooding and summer drought. These environmental conditions have contributed to the presence of a specialized flora, dominated by annual species with high fecundity and large perennial seed banks. A very particular annual plant only found in this habitat is *Lythrum thesioides* which currently has only 2 populations known worldwide, which occur south of Nîmes. One population was discovered in 2010 following an environmental impact assessment for the high speed train line currently being constructed from Nîmes to Montpellier. The aim of this study is to identify the germination conditions for *L. thesioides* and to map the viable seed bank of the species in the wetland area of this population. Seeds are probably quite deep because of historical ploughing in the area. Soil core samples (5cm diameter) were collected at 93 different points in the site, over a 15m x 15m grid. Each point was sampled to a depth of 5cm and 10 points were sampled to a depth of 30cm. The number of germinating seeds was used to assess the seed bank. We found a very small seed bank: only 9 samples contained germinating seeds of *L. thesioides*, with a density of 509 to 7132 seeds/m⁻². The highest density of seeds was found outside of the area occupied by the adult plants. Our results of seed bank size and distribution are critical information for conservation programs of this and other annual plants of temporary ponds.

Keywords: conservation, restoration ecology, seed bank, germination, temporary pond

*Speaker

†Corresponding authors

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Earth and Planetary Sciences

Insect folivory patterns in late Eocene coastal lowland riparian associations from central Germany

Christian Müller ^{*† 1}, Torsten Wappler ², Lutz Kunzmann ³

¹ Christian Müller (1) – Senckenberg Natural History Collections Dresden, Königsbrücker Landstraße 159, D-01109 Dresden, Germany, Germany

² Torsten Wappler (2) – Hessisches Landesmuseum Darmstadt, Friedensplatz 1, D-64283 Darmstadt, Germany, Germany

³ Lutz Kunzmann (1) – Senckenberg Natural History Collections Dresden, Königsbrücker Landstraße 159, D-01109 Dresden, Germany, Germany

The Cenozoic lignite-bearing formations from the central German Leipzig Embayment are well-known for their rich fossil plant assemblages, which mainly represent former riparian and swamp vegetation. Mineral tissue dissolution by migrating humic acids caused the widely absence of vertebrate fossils; the record of invertebrates is also rare. That phenomenon leads to the loss of important ecological information and environmental reconstructions based so far on plant ecology and sedimentology.

The investigation of 1588 late Eocene leaf compressions from the Luckenau Clay Complex (open-cast mine Profen, Sachsen-Anhalt, Germany) revealed a broad variety of insect damage types (DT's). We used these traces to evaluate: **(1)** the diversity of insect folivores based on the diversity of DT's (26 different DT's observed), **(2)** host plants (18 taxa) and their plant defense mechanisms, **(3)** damage frequency (6.1% for bulk sample), **(4)** proportion of functional feeding groups (4.8% external foliage feeding, 1.3% galling, 0.13% mining, 0.13% sucking).

The overall highest diversity of DT's (7.83 ± 2.10 at 20 leaves) and damage frequency (33.3%) was detected on the evergreen, arboreal species *Sloanea nimrodi* (Elaeocarpaceae). That pattern is explained by the broad variety of habitats for different insect groups on arboreal plants. In contrast the predominant species of the assemblage, *Rhodomyrtophyllum reticulosum* (Myrtaceae), is characterized by a low diversity (0.59 ± 0.88 at 20 leaves) and frequency (2.3%) of DT's. This pattern is explained by effective plant defense strategies. Altogether the study provided new ecological insights, mainly about the trophic relation and interaction between plants and insect herbivores.

Keywords: plant insect interaction, late Eocene, leaf compressions, insect damage types, riparian forest, trophic structure

*Speaker

†Corresponding author

The effect of sulfate on biomineralisation by foraminifera

Caroline Thaler * ¹, Marc Dellinger ¹, Delphine Dissard , Guillaume Paris , Arul Marie ², Sophie Berland ³, Annachiara Bartolini ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Muséum National d'Histoire Naturelle (MNHN) – 63 rue Buffon, Paris, France

² Molécules de Communication et Adaptation des Micro-Organismes (MCAM) – Museum National d'Histoire Naturelle, Centre National de la Recherche Scientifique : FRE3206 – 57 rue Cuvier 75005 ParisCNRS/MNHN, France

³ Biologie des Organismes et Ecosystèmes Aquatiques (BOREA) – Muséum National d'Histoire Naturelle (MNHN), Université Pierre et Marie Curie (UPMC) - Paris VI, Institut de recherche pour le développement [IRD], CNRS : UMR7208 – 43, rue Cuvier, CP 32, 75231 Paris Cedex 05, France

CO₂ storage in carbonates is considered to be one of the major process controlling climate variation and ocean pH on earth. Most carbonates are precipitated by organisms, among which foraminifera whose contribution to carbonate formation can reach 80% of the total amount of carbonates deposited. Several carbonate biomineralization crises, linked to volcanic activity, have occurred during earth geological history. The high amount of sulfur injected in the atmosphere-ocean system during these volcanic episodes, provoking ocean acidification and sulfate concentration rise, has been suggested as one of the triggering mechanisms for these crises. In that context, we decided to study the impact of sulfate on foraminiferal biocalcification. 3 species of Foraminifera were grown in laboratory in artificial seawater with variable sulfate concentrations. The media was isotopically labelled with ³³S in order to study the fate and the incorporation of seawater sulfate in the foraminiferal cell and carbonate test (shell) by NanoSIMS analysis. We developed a protocol permitting to observe simultaneously fixed foraminiferal cell with preserved carbonate test in thin or ionically milled sections. We found that sulfate seawater isotopic composition is faithfully recorded in the shell. Our results also permit to discuss how sulfate is incorporated in the organic matter and in the cristalline phase of the foraminifera. This study demonstrate that foraminifera do record sulphate concentration or isotopic variation in their cell or in their test, and could be used constitute good proxies to trace back sulphate variation in paleoseawater.

Keywords: foraminifera, carbonates, sulfate, biomineralisation, isotopic labelling, geochemical proxie

*Speaker

High resolution taphonomic analysis of shell beds in the Holocene sedimentary deposits in southern Brazil

Luiz Pereira ^{*†} ¹, Milene Fornari[‡] ², Juliana Leme[§] ³, Andre Azevedo[¶] ³,
Fernando Erthal^{||} ⁴

¹ Bonn Universität [Bonn] – Sigmund-Freud-Straße 25, 53127 Bonn, Germany

² State University of São Paulo (UNESP) – Praça Infante Dom Henrique, s/n - Parque Bitaru, São Vicente - SP, 11330-900, Brazil

³ University of São Paulo (USP) – R. do Lago, 562 - Vila Universitaria, São Paulo - SP, 05508-080, Brazil

⁴ Universidade Federal do Rio Grande do Sul [Porto Alegre] (UFRGS) – Av. Paulo Gama, 110 - Bairro Farroupilha - Porto Alegre - Rio Grande do Sul, Brazil

The Holocene sedimentary succession in southern Brazil represents a transition from an open bay depositional system to the actual lagoonal environment caused by sea level oscillations which are recorded in extensive mollusc shell bed deposits. The high detailed taphonomic analysis of these shell beds are an excellent approach to study in detail sea level changes caused mainly by the interplay of sedimentary supply and accommodation rates. The objectives of this work consist 1) to correlate taphonomy of shell beds with facies association and 2) to determine the relationship of taphonomic damage and sediment (the role of substract).

The large number of shells permit to apply robust statistical methods as NMDS (non-metric multidimensional scaling) in software R which correlates the taphonomic damage patterns (disarticulation, bright, encrustation, bioerosion, predation, abrasion, corrosion, periostracum loss, margin modification, colour alteration) with the sediment type (sand, silt and clay) and then permitting the correlation with sedimentary facies.

The partial results permit to conclude that the fossil record does not change linearly through time, and distinct grain sizes produce different taphonomic patterns (fine sand is strongly correlated with corrosion and medium sand is strongly correlated with periostracum loss). Furthermore, abrasion damages are more related to opened bay environment while corrosion is more related to closed lagoon environments.

Keywords: Shell beds, Taphonomy, NMDS, Time Averaging, Holocene, Facies Analysis.

*Speaker

†Corresponding authors

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Geochemical analysis of the Devonian fossilized fauna from Hamar Laghdad Massif (Anti-Atlas, Morocco)

Aleksander Majchrzyk ^{*† 1}, Antoni Lewczuk ¹, Łukasz Czepiński ²,
Wojciech Pawlak ², Paweł Mazur ¹, Krzysztof Staniszewski ¹

¹ Institute of Basic Geology, Faculty of Geology, University of Warsaw – Żwirki i Wigury 93, 02-089 Warszawa, Poland

² Department of Paleobiology and Evolution, Faculty of Biology, University of Warsaw – Żwirki i Wigury 101, 02-089 Warszawa, Poland

Hamar Laghdad Massif, lying in the Moroccan Anti-Atlas Mountains is the place of long-term interest to geologists and paleontologists. The famous carbonate mud buildups called Kess-Kess are exposed within this region. Hydrothermal activity occurring in this area during Early and Middle Devonian had remarkably influence in the genesis of these forms. The environment related to the hydrothermal activity often support exceptionally high biological productivity. In the Hamar Laghad area plentiful fossil fauna is represented mainly by trilobites and corals. The goal of this study is to examine the influence of hydrothermal activity on geochemistry of fossil fauna skeletons from mud buildups as well as to confirm reports of unusually colored fossils (especially phacopid trilobites) from the overlying strata called "Red cliff". Authors have conducted a wavelength-dispersive X-ray spectroscopy (WDS) analysis in an electron microprobe (EPMA) to examine the chemical composition of samples collected during the field work. WDS analysis showed that tabulate corals skeletons from mud buildups are enriched in iron (comparing to carbonate matrix and trilobites from same strata). Such enrichment can be explained by precipitation of iron in skeletal structure of corals during their lifetime in the area of hydrothermal activity. Alternative explanation are diagenetic factors which, however, not seems to influence on trilobites' geochemistry. Due to these analysis authors have also confirmed speculations of manganese and iron impurities in *Barrandeops* cf. *granulops* trilobites from "Red cliff" strata (Klug et.al. 2009). These impurities are responsible for the green color of *Barrandeops* eye lenses.

Keywords: Hamar Laghdad, Devonian, Corals, Trilobites, WDS, EPMA

*Speaker

†Corresponding author

Taphonomic study of a pleurosternid turtle shell from the Lower Cretaceous of Angeac-Charente (South-West France)

Jordan Gônet ^{*† 1}, Lee Rozada^{‡ 1}, Ronan Allain^{§ 1}, Renaud Bourgeois[¶]

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

Abstract

The feeding behavior of crocodylians, in addition to the characteristic marks it leaves on bones, leads to the formation of particular assemblages by accumulation of carcasses at the bottom or on the edges of watering places, making crocodylians important taphonomic agents. Here, we report the taphonomic study of a Pleurosternidae (*Pleurosternon bullockii*, Owen, 1842) turtle shell, discovered in 2014 at Angeac-Charente in south-western France, wearing numerous crocodyliform marks (259 marks).

Our work mainly consisted in the painstaking observation, the listing and the identification of all bone modifications on the fossils. We observed each plate of the carapace and the plastron in ventral and dorsal view using a binocular magnifier and a raking light.

The shell shows a range of tooth marks left by a crocodyliform (bisected pits, hook marks, etc.) Several elements point at *Goniopholis* as the most likely author of the marks and support the use of the "nutcracker" technique (Milàn *et al.*, 2010). The look of some other marks suggests that they may have healed or suggests a bacterial or fungal infection.

Numerous other isolated turtle remains and some bones of ornithomimosaur dinosaurs from Angeac-Charente wear marks from crocodyliform attacks. Extend this study to the other turtle remains and, in a general way, to the other taxa on the site could permit to learn more about the paleoecology of the crocodyliforms of the Early Cretaceous of this region of the world.

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Keywords: turtle, pleurosternid, taphonomy, crocodyliform, nutcracker, infection

*Speaker

†Corresponding authors

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Impact of organic matter chemical transformations on shale porosity during the confined pyrolysis of organic rich shales: a complement to the observations of natural systems

Amélie Cavelan ^{*† 1}, Mohammed Boussafir ¹, Olivier Rozenbaum ¹,
Claude Lemilbeau ¹, Fatima Laggoun-Défarge ¹

¹ Institut des Sciences de la Terre d'Orléans - UMR7327 (ISTO) – Bureau de Recherches Géologiques et Minières (BRGM), Institut national des sciences de l'Université : UMR7327, Université d'Orléans : UMR7327, Centre National de la Recherche Scientifique : UMR7327 – Campus Géosciences 1A, rue de la Férollerie 45071 Orléans cedex 2, France

Recently, there is a growing recognition of thermal maturity involvement in the development of the organic matter (OM) porosity in gas shales, and thus, in their gas storage capacity. Therefore, a better understanding of the role of OM chemical transformations on shale porosity during maturation is required. For this purpose, the porosity of immature (Kimmeridge Clay, UK) and gas-mature organic rich shales (Vaca Muerta, Argentina) was first characterized. Then, artificial thermal maturation of immature shales using confined pyrolysis experiments was performed to follow the evolution of porosity from the early oil-window to the dry gas-window. Porosity before and after maturation was measured by low pressure nitrogen adsorption and evaluated as function of both thermal maturity and shale composition (XRD, Rock Eval analyses, Organic petrography...). The OM chemical transformations were investigated by GC/MS analysis of oil and gas generated during pyrolysis experiments. First results revealed that the OM porosity, non-existent in immature shales, seems to grow during thermal diagenesis to become predominant in natural mature rocks. According to pyrolysis experiments, the development of the OM porosity appeared in relation with the production of gas from the end of the oil-window. This could be probably caused by reorganizations of the kerogen and residual bitumen structures that would occupy mineral interparticular pores during the oil-window. Moreover, variations of the pore size versus organic carbon content and thus, OM composition in general, suggest that small variations in OM composition could have a great influence on pores genesis during maturation. Future investigations should clarify this.

Keywords: gas shale, porosity, confined pyrolysis, thermal maturity, low pressure nitrogen adsorption, GC/MS

*Speaker

†Corresponding author

Structural geology coupled with Raman geothermometry and $^{40}\text{Ar}/^{39}\text{Ar}$ dating in the south of the Menderes Massif, Turkey

Morgan Bezard ^{*†}, Vincent Roche ^{1,2}, Laurent Jolivet ³, Stéphane Scaillet ⁴

¹ Bureau de Recherches Géologiques et Minières (BRGM) (BRGM) – Bureau de Recherches Géologiques et Minières (BRGM) – 3 Avenue Claude Guillemin, 45100 Orléans, France

² Centre National de la Recherche Scientifique (CNRS) – Centre National de la Recherche Scientifique – 1A Rue de la Ferrollerie, 45100 Orléans, France

³ Université Pierre et Marie Curie - Paris 6 (UPMC - ISTeP) – Université Pierre et Marie Curie - Paris 6 – 4 place Jussieu - 75005 Paris, France

⁴ Institut des Sciences de la Terre d'Orléans (ISTO) – Université d'Orléans, CNRS : UMR7327, INSU, Bureau de Recherches Géologiques et Minières (BRGM) – Campus Géosciences 1A, rue de la Férollerie 45071 Orléans cedex 2, France

The Menderes Massif is a metamorphic core complex that show marks of a complicated poly-metamorphic evolution. Indeed, in this massif can be observed high pressure-low temperature parageneses contained within high temperature-low pressure (Barrovian) metamorphic rocks. In this presentation, we combine structural data and field observations with Raman Spectroscopy on Carbonaceous Material (RSCM) and try to understand the evolution of the whole massif through its various metamorphic phases. Our results prove the existence of a Shear Zone close to the city of Selimiye in the southern Menderes, with a top-to-the south sense of shear. RSCM data show that this shear zone was at some point a low angle fault (detachment) that forbid the creation of a geothermal gradient during its activity. Furthermore, RSCM data show that locally the sedimentary cover of the Menderes Massif can preserve HP-LT parageneses from the Barrovian metamorphism. RSCM results also display peak temperature found within the whole massif that are generally lower than different P-T calculations realized by several authors. In addition, samples from several key areas were prepared and sent to irradiation for $^{40}\text{Ar}/^{39}\text{Ar}$ dating. The new geochronological data will bring temporal constrains to the setting of the Menderes Massif as well as its relation will the surrounding Lycian Nappes and Cycladic Blueschist Unit. Current *in-situ* analysis show that deformation has a strong influence on the argon retention of the micas contained within the shear-zone. These results will soon be completed with step-heating dating covering the Selimiye Shear-Zone.

Keywords: Menderes Massif, Selimiye shear, zone, Metamorphism, Raman spectroscopy, Ar/Ar dating, Structural analysis

*Speaker

†Corresponding author

Evolutionary Ecology

Arabidopsis thaliana root growth under simulated microgravity

Miguel Valbuena ^{*† 1}, Lisa Tordjman, Isabel Le Disquet ¹, Marco Da Costa ², Eugenie Carnero ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle, CNRS UMR 7205 ISYEB – 57, rue Cuvier - 75231 Paris Cedex 05, France

² Institut Jean-Pierre Bourgin (IJPB) – Institut National de la Recherche Agronomique : UMR1318, AgroParisTech – INRA Centre de Versailles-Grignon, Route de St-Cyr (RD10), 78026 Versailles Cedex, France

In the context of the space conquest, plants will constitute a life support system for long-term space missions which will provide oxygen and food. In this perspective, the spatial environment's effect, and more particularly the microgravity effect on plants, must be studied. This work concerns the action of microgravity on the development on *Arabidopsis thaliana* plant model at the level of its main roots. This study was carried out in three parts: (i) measuring the root length of plants grown in simulated microgravity, (ii) characterizing the action of microgravity on the cell cycle and (iii) observing the action of microgravity on the elongation of differentiated cells. The length of the roots subjected to microgravity, measured by DIC filter microscope, was shorter than the control 1g. The action of microgravity on the cell cycle was analyzed by flow cytometry, expression of marker genes encoding the proteins of cell-cycle regulation by PCR quantitative and transgenic plant lines by histoenzymological test of glucuronidase. The results showed a dysfunction in the cell cycle and more particularly in the G1 / S phase in microgravity. Cellular elongation and ploidy, measured by flow cytometry, showed a decrease in the index of endoreplication of differentiated cells from plant in microgravity. Based on these results, we can conclude that microgravity disrupts the cell cycle, in particular by slowing down the G1 phase, decreasing the meristematic cell rate of proliferation and decreasing the endocycle index. These processes contribute to a decrease of the plant root growth subjected to microgravity.

Keywords: Microgravity, plant development, root, cell cycle, cell division, cell differentiation

*Speaker

†Corresponding author

The mystery of the albinos orchids

Félix Lallemand ^{*† 1}, étienne Delannoy ², Marc-André Selosse ^{3,4}

¹ Institut de Systématique, Évolution, Biodiversité (ISYEB – UMR 7205 –CNRS, MNHN, UPMC, EPHE) (MNHN ISYEB) – Muséum National d’Histoire Naturelle (MNHN) – 45 rue Buffon, CP 50, 75005 Paris, France, France

² Institute of Plant Sciences Paris-Saclay IPS2, CNRS, INRA, Universités Paris-Diderot, Paris-Sud, Évry, Paris-Saclay – Institut National de la Recherche Agronomique - INRA – Batiment 630, CS80004, 91192 Gif sur Yvette cedex, France

³ Institut de Systématique, Évolution, Biodiversité (ISYEB – UMR 7205 –CNRS, MNHN, UPMC, EPHE), Muséum national d’Histoire naturelle, Sorbonne Universités (MNHN ISYEB) – Muséum National d’Histoire Naturelle (MNHN) – 45 rue Buffon, CP 50, 75005 Paris, France, France

⁴ Department of Plant Taxonomy and Nature Conservation, University of Gdansk – Wita Stwosza 59, 80-308 Gdansk, Poland

Mycorrhizal symbiosis allows plants to grow by exchanging photosynthetic sugars for nutrients with soil fungi. However, some plants also get carbon (C) compounds from their mycorrhizal partners. The resulting nutrition, mixing photosynthetic and fungal C, is called mixotrophy. In some mixotrophic orchids species, albinos individuals devoid of chlorophyll sporadically grow without being affected by their inability to photosynthesize. This provides a unique opportunity to study the physiological alterations associated with changes in the balance between the two C sources in mixotrophic species.

Thanks to the help of the Société Française d’Orchidophilie, we sampled leaves of spontaneous albinos mutants for three orchid species in different locations in France and Luxembourg. By carrying out for the first time an integrated metabolomic and transcriptomic analysis, we compared the nutrition of albinos individuals to their green counterparts.

Preliminary results suggest major changes in nitrogen and lipids metabolism. The glyoxylate cycle is also strongly up-regulated, providing a major anabolic pathway, which compensates the absence of photosynthetic sugars. Which compounds are transferred from the mycorrhizal fungi to the albinos plant remains a pending question, to which we expect to bring an answer soon. By combining our results with already published work on albinos roots, we should be able to draw a comprehensive view of how these mutants survive by feeding on their mycorrhizal fungi. We would then be able to infer the physiological adaptations of mixotrophic species, and, in a broader context, to better understand the functioning and the evolution of mycorrhizal symbiosis.

Keywords: mycorrhizal symbiosis, mixotrophy, albinos, orchids, metabolism, transcriptomic

*Speaker

†Corresponding author

Evolution of transparency in mimetic Lepidoptera

Charline Pinna ^{*† 1}

¹ Institut de Systématique, Evolution, Biodiversité (ISYEB) – CNRS : UMR7205, Muséum National d’Histoire Naturelle (MNHN) : UMR7205, EPHE, Université Pierre et Marie Curie [UPMC] - Paris VI
– 45 rue Buffon 75005 Paris, France

Although apparently simple, transparency, which is traditionally considered as a camouflage strategy, has mostly been studied in water and is barely investigated on land, where it is rare. Lepidoptera are generally coloured due to the scales covering their wings, which have multifunctional roles (coloration, thermoregulation, hydrophobia). Nonetheless, multiple species have totally or partially transparent wings. Intriguingly, some of these species are also aposematic (they harbour conspicuous coloured patterns that warn predators of their toxicity) and converge locally in colour patterns, forming mimicry rings. Here we address the questions of how transparency is achieved in clearwing species, and whether optical properties of transparent areas are convergent among comimetic clearwing species. For 57 Lepidopteran species, belonging to 11 different mimicry rings, we quantified light transmission of transparent areas on wings with a goniospectrophotometre and we characterized the structures (scales and nanostructures) on the membrane with SEM images, while taking into account phylogenetic relationships. To our knowledge, this is the first comparative study of terrestrial transparency. We show that light transmission increases when membrane coverage decreases and also when the membrane is covered with nanostructures, suggesting that transparency arises as a consequence of modifications of wing structures (scales and membrane surface). However, we show no clear convergence of optical properties among comimetic species. These results suggest that although transparency might be involved in the aposematic signal, the optical properties are not. They could rather be involved in communication between butterflies through the formation of iridescent patterns in the transparent areas for example.

Keywords: Lepidoptera, transparency, mimicry, aposematism, comparative analyses, optics

*Speaker

†Corresponding author

Selection for mutual mate choice can inhibit speciation

Thomas Aubier *^{1,2}, Hanna Kokko³, Mathieu Joron²

¹ Institut de Systématique, Evolution, Biodiversité (ISYEB) – Museum National d’Histoire Naturelle, Université Pierre et Marie Curie - Paris 6, Ecole Pratique des Hautes Etudes, Centre National de la Recherche Scientifique – UMR 7205, France

² Centre d’Ecologie Fonctionnelle et Evolutive (CEFE) – Université Paul-Valéry - Montpellier 3 : UMR5175, Centre international d’études supérieures en sciences agronomiques : UMR5175, Ecole Pratique des Hautes Etudes : UMR5175), Institut national de la recherche agronomique [Montpellier] : UMR5175, Université de Montpellier : UMR5175, Centre National de la Recherche Scientifique : UMR5175, Institut de Recherche pour le Développement : UMR5175, Institut national d’études supérieures agronomiques de Montpellier, Centre international d’études supérieures en sciences agronomiques : UMR5175, Centre international d’études supérieures en sciences agronomiques : UMR5175, Ecole Pratique des Hautes Etudes : UMR5175, Centre international d’études supérieures en sciences agronomiques : UMR5175, Centre international d’études supérieures en sciences agronomiques : UMR5175 – 1919 route de Mende - 34293 Montpellier cedex 5, France

³ Institute of Evolutionary Biology and Environmental Studies - University of Zurich – Winterthurerstrasse 190 CH-8057 Zurich, Switzerland

Understanding what promotes speciation is a major challenge in ecology and evolution today. Assortative mating – the tendency of individuals of similar phenotype to mate together – is well-known to generate reproductive isolation between diverging taxa. Usually, assortative mating is thought to operate only via female choice, and most models make this assumption. Yet, premating isolating barriers, e.g. in *Heliconius* butterflies, are also based on *male* preferences for courting similar phenotypes.

By extending a classic population-genetics model, we are the first to describe the evolution of assortative mating, where both female and male mate choice can evolve independently, and feedback to each other.

Our results are surprising. One would expect mutual mate choice to enhance reproductive isolation between diverging taxa. On the contrary, we show that selection for mutual mate choice often leads to temporary bursts of gene flow that inhibit differentiation. Under selection for mutual mate choice, premating isolation could be more dynamic and reversible than what is possible to detect using previous models. This is because choosiness in one sex influences selection on choosiness in the other sex, with some asymmetry, ultimately leading to episodes during which no sex is choosy and gene flow is unrestricted.

These results are really important, because they may upturn the way we view the process of speciation and our empirical appreciation of the stages along the so-called speciation continuum. ‘Back and forth’ cyclical divergence, rather than steady increase in divergence, may in fact characterize the process of diversification in the living world.

Keywords: speciation, gene flow, mate choice, sexual selection, theory

*Speaker

Do different light conditions influence warning signal efficacy in the color polymorphic wood tiger moth males?

Francisko De Moraes Rezende ^{*† 1}, Johanna Mappes ¹, Ossi Nokelainen ¹

¹ Department of Biological and Environmental Science, Centre of Excellence in Biological Interactions, University of Jyväskylä – Jyväskylä, P.O. Box 35, 40014, Finland

Aposematism, the defense strategy in which prey warn predators of their unprofitability, has ecological consequences such as decreased predation and it can lead to evolutionary change. Polymorphism is not expected in warning signals because predators tend to learn to avoid a single signal faster than multiple signals. However, signal variability might emerge due to different signals being more efficient, and thus selected for, under different environmental conditions. This local selection may facilitate signal variability at the population level. The aposematic wood tiger moth (*Arctia plantaginis*) exhibits warning signal polymorphism; males of this species show yellow and white hindwing types. Both morphs inhabit environments with different light conditions, which could lead to differential signal efficacy and predation risk. This project investigated the effects of different light conditions in this species' predation rates and their consequences to signal polymorphism. Dummies mimicking yellow and white colored morphs were placed in open and shaded forest environments for three days and the number of bird attacks on the dummies was quantified. The attack rate was low (3.8% of the dummies were attacked), which is expected for aposematic species. We found that moth survival was not significantly influenced by light environment nor by morph color, which contradicts previous findings. This suggests that light conditions do not significantly influence the predation suffered by these morphs. Thus, alternative factors such as differential reproductive success, predator cognition or variable predator communities may be more important in maintaining this species' signal polymorphism.

Keywords: environmental heterogeneity, warning coloration, signal polymorphism

*Speaker

†Corresponding author

Disposable soma theory patterns in oxidative balance of thermally contrasted arctic charr populations

Ayala Loisel ^{*† 1}, Martin Daufresne ¹, Lisandrina Mari ², Emilien Lasne ^{2,3}

¹ Centre d'Aix-en-Provence [IRSTEA] (IRSTEA) – Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture – 3275 Route de Cézanné CS 40061, 13182 Aix-en-Provence Cedex 5, France

² Centre Alpin de Recherche sur les Réseaux Trophiques et Ecosystèmes Limniques (CARTEL) – Institut National de la Recherche Agronomique : UMR0042, Université Savoie Mont Blanc – Station d'Hydrobiologie Lacustre 75 Av. de Corzent Thonon les Bains F-74203 France, France

³ Institut national de la recherche agronomique [Rennes] - UMR ESE (INRA - UMR ESE) – Institut national de la recherche agronomique [Rennes], UMR ESE – 65 rue de Saint-Brieuc 35042 Rennes Cedex, France

Warming modulates ecological traits and strategies of species in many ways. However the underlying mechanisms of these modifications still remain poorly understood. Aquatic ectotherms are particularly sensitive to an increase in temperature because of enhanced metabolism and risk of anoxia. This induces an extra production of reactive oxygen species (ROS) which lead to ageing, senescence and mortality by a rise of oxidative stress as stated by the free radical theory of ageing. According to the disposable soma theory (DST), individuals should favor reproduction at the expense of self-maintenance when the risk of mortality becomes too high. If increasing temperature promotes senescence and mortality, such a pattern should be observed in ectotherms in a warming context.

Here we propose to study the resource allocation trade-off between soma and germen of a stenotherm fish *Salvelinus alpinus* in thermally contrasted populations, in Allos Lake (cold) and Sainte-Croix Lake (warm). We compare oxidative damages (TBARS) and enzymatic (SOD activity) and total (TROLOX concentration) oxidative defenses in muscles (soma) and gonads (germen).

We observe higher rate of damages in muscles of individuals from Sainte-Croix, which suggests an early senescence, but no differences in gonads. We found higher activity of SOD in gonads of females from Allos but higher TROLOX in muscles and gonads in females from Sainte-Croix. Our findings suggest that the DST could apply under warming. This provides new insights regarding the impacts of global warming on individuals and population dynamics, leading to adoption of "life fast, die young" strategies.

Keywords: oxidative stress, trade, off, disposable soma theory, arctic charr, temperature, ectotherm

*Speaker

†Corresponding author

Linking wing shape and flight behaviour in *Morpho* butterflies

Camille Le Roy * ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

Morphological diversity in *Morpho* butterflies wings is dominated by the opposition of wing shape of species mostly flying in the canopy to that of species living in the understory. This divergence goes beyond the phylogenetic signal, which points at a role for natural selection in wing shape evolution. Theoretical aerodynamics predicts that the more elongated wings found in the canopy species confer a higher efficiency to gliding flight, while rounded wings found in the understory species improve the maneuverability of flapping flight. However, whether wing shape and flight behaviour have coevolved in response to contrasted selective pressures exerted by these two micro-habitats remains to be investigated.

Here we quantified flight behaviour between canopy and understory species, and compared the flight parameters extracted from their three-dimensional flight trajectories. We then precisely quantified wing shape variation of the filmed specimens using geometric morphometrics to investigate the association between wing shape and flight behaviour.

We showed that rounded-wing-shaped understory species display rapid flap-gliding flight at low height, in agreement with a putative adaptation to constraining dense environment. Conversely, the large triangular wings of the canopy species *Morpho cisseis* are associated with a slow flight composed of longer gliding periods at relatively high height, in agreement with patrolling behaviour at the canopy level. Discordance with our hypothesis is however found in other *Morpho* species.

Our study uncovers diversified flight behaviours among *Morpho* species, challenging the classical, binary opposition between understory and canopy species, stressing the need to identify selective forces acting on flight performance.

Keywords: *Morpho* butterfly, wing shape, habitat selection, flight kinematics, aerodynamics, geometric morphometrics

*Speaker

Methods in Natural Sciences

Multivariate methods and the genetics of shape: an empirical approach in the study of the skull

Ceferino Varón-González ^{*†} ¹, Nicolas Navarro ^{2,3}

¹ Institut de Systématique, Évolution, Biodiversité – Museum National d’Histoire Naturelle - MNHN (FRANCE) : UMR7205 – 42 rue Buffon, CP50, F-75005, Paris, France, France

² Biogéosciences [Dijon] (BGS) – Université de Bourgogne, Centre National de la Recherche Scientifique : UMR6282 – Université de Bourgogne - 6 boulevard Gabriel - 21000 Dijon, France

³ EPHE - PSL Research University – École Pratique des Hautes Études [EPHE] – 6 bd Gabriel 21000 Dijon, France

The genetics of craniofacial shape is a controversial topic with a high social impact. While some authors have detected many genomic markers associated to skull shape, some others claim that the interactions among genes (i.e. epistasis) are more important in the generation of shape. However, the methods used to analyse the genotype-phenotype map influence the results and therefore our vision about this topic. Here, we revisited a published dataset where multiple univariate linear models had been used to identify genomic regions associated to skull shape in mice. Instead, we applied a multivariate generalized linear model for each genomic marker as well as other multivariate methods to compare our results and the univariate ones. The addition of dimensions to the analyses can blur the statistical signal: few significant markers in the univariate analyses were lost in a multivariate approach. However, most of the times the statistical power increases: we were able to detect many more genomic regions associated to craniofacial shape and to propose a bigger set of candidate genes. Multivariate approaches are equivalent to univariate ones based on the use of principal components just when the genomic regions studied have a very large and specific effect. Our work stresses the importance of multivariate approaches to study the genetics of shape despite its difficulties. Multivariate techniques do improve the statistical power in shape analyses and can be important for our view about its genetic component, as we have shown in mice.

Keywords: geometric morphometrics, shape, genetics, genome, wide association study, skull, multivariate

*Speaker

†Corresponding author

The importance of being random! Taking full account of random effects in nonlinear hierarchical Bayesian models

Ugoline Godeau ^{*† 1}, Tiffani Pozzi , Christophe Bouget ², Jérémy Piffady ³, Frédéric Gosselin ⁴

¹ Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture - IRSTEA (FRANCE) (IRSTEA) – Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture - IRSTEA (FRANCE) – Irstea Domaine des Barres 45290 Nogent-sur-Vernisson, France

² Ecosystèmes forestiers (UR EFNO) – Irstea – Domaine des Barres, F-45290 Nogent-sur-Vernisson, France

³ Milieux aquatiques, écologie et pollutions (UR MALY) – Irstea – 3 bis quai Chauveau - CP 220, F-69336 Lyon, France

⁴ Ecosystèmes forestiers (UR EFNO) – Irstea, Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture - IRSTEA (FRANCE) – Domaine des Barres, F-45290 Nogent-sur-Vernisson, France

In ecology, the statistical analysis of data based on hypotheses is very frequent and enables us to understand the relationships between biodiversity and the environment. Bayesian methods are increasingly being used because of their flexibility and because they can handle complex analyses, with for example non-linear or hierarchical random-effects models (latent variables used to capture the structured part of variability). In ecology, random effects in curve-based models are usually only incorporated on the intercept and rarely applied on the other parameters of the curve. However, this kind of application is of great interest, allowing a real variation of the shape of the curve over space or between groups.

Our study consisted in developing a model linking the quantity of dead wood to the species richness of saproxylic beetles in French forests. Our hypothesis was that this relationship varied between forests. We looked at different link functions and applied various settings of forest random effects, in a Bayesian framework.

We found that the application of random effects had a non-negligible effect on the results of the models. First, for a given function, the more complete model - with random effects on all parameters and correlation between them – performed best or equally best than any other model. Secondly, adding random effect allowed here to reveal a clearer form of the underlying relationship than without any random effect. Therefore, we believe ecologists should consider a more complete use of random effects in their models so that more robust conclusions can be drawn.

Keywords: Nonlinear, hierarchical models, Random effects, Bayesian

*Speaker

†Corresponding author

Bioaccumulation of metals in bats: the use of fur and wing as non-lethal samples

Rúben Mina * ¹, António Alves Da Silva ¹, Tiago Natal Da Luz ¹, João A. Cabral ², Paulo Barros ², José Paulo Sousa ¹, Joana Alves ¹

¹ Centre for Functional Ecology (CEF) – 3000-456 Coimbra, Portugal

² Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB) – 1013 5001-801 Vila Real, Portugal

Given the conservation status of many bat species, and the need for large-scale studies, there is an increasing need for developing non-invasive tools to assess whether metal accumulation is one of the factors associated with the declining of the bat populations. Thus, the aim of this study was to validate the use of non-lethal samples to determine the bioaccumulation of metals in bats. For that, the concentration of 10 essential and non-essential metals (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Se and Zn) was measured in internal organs (bone, brain, heart and liver) and in external tissues (fur and wing membrane skin) collected from bat carcasses of four insectivorous bat species (*Hypsugo savii*, *Nyctalus leisleri*, *Pipistrellus pipistrellus*, *Pipistrellus pygmaeus*). Correlations between metal concentrations in external tissues (non-lethal samples) and metal concentrations in internal organs (lethal samples) were established. The significance of the correlations was evaluated individually for each metal, and all the possible combinations between the tissues sampled were considered. In general, for the different metals analyzed, fur and wing membrane were the samples that showed the highest concentrations. Some good correlations were found between the metal concentrations in external tissues and the metal concentration in internal organs. All the biological samples showed similar response patterns in terms of metal accumulation, except the bone for some metals. In conclusion, fur and, especially, wing membrane demonstrated to be suitable biological matrices to evaluate metal exposure in bats, and may be useful to predict endogenous metal concentrations in these species.

Keywords: Chiroptera, bioaccumulation of metals, fur, non, lethal samples, wing membrane

*Speaker

Investigating pastoral mobility of Mongolian domestic horses using GPS tracking and stable isotope ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) analysis of tail hair

Nicolas Lazzerini * ¹, Antoine Zazzo ¹, Laurent Simon ², Aurélie Coulon ^{3,4}, Sébastien Lepetz ¹

¹ Archéozoologie, Archéobotanique: Sociétés, Pratiques et Environnements (AASPE) – Centre National de la Recherche Scientifique - CNRS : UMR7209, Museum National d'Histoire Naturelle - MNHN (FRANCE) – CP 56, 55 rue Buffon, F-75005 Paris, France

² Laboratoire d'Ecologie des Hydrosystèmes Naturels et Anthropisés (LEHNA) – Centre National de la Recherche Scientifique - CNRS : UMR5023, Université Claude Bernard - Lyon I – 3-6, rue Raphaël Dubois 69622 Villeurbanne Cedex, France

³ Centre d'Ecologie et des Sciences de la CONservation (CESCO) – Museum National d'Histoire Naturelle, Université Pierre et Marie Curie - Paris 6, Centre National de la Recherche Scientifique : UMR7204 – 55 rue Buffon 75005 PARIS, France

⁴ Centre d'Ecologie Fonctionnelle et Evolutive (CEFE) – Université Paul-Valéry - Montpellier 3 : UMR5175, Centre international d'études supérieures en sciences agronomiques : UMR5175, Ecole Pratique des Hautes Etudes – 1919 route de Mende - 34293 Montpellier cedex 5, France

For pastoralists, movements between pastures are necessary in order to secure food access to livestock. In mountainous areas, this is usually done along an altitudinal gradient. The origin of vertical mobility is not well known, and different studies have attempted to infer past altitudinal mobility through isotope analyses of archaeological teeth. Although the method can detect large-scale migrations, its potential for characterizing small-scale movements of livestock remains unclear. To assess the reliability of this approach, we combined GPS tracking and high-resolution isotopic analysis of three domestic horses of three herders from Mongolian Alta'i. GPS collars were scheduled to record animal location every 13h during 15 months. Tail hair were collected and longitudinally sampled to provide high-resolution isotopic records of their diets. During this period, the three horses moved 9, 13 and 14 times between pastures located between 1500 and 3000 m a.s.l. and stayed between 9 and 149 days on each of them. This mobility frequency is higher than what models commonly describe for Inner Asia. Variations in carbon (4.4 on average) and nitrogen (6.3 on average) isotopic values were detected along tail hair. While some isotopic excursions could be linked to animal movements, others were more difficult to assign. This could be either due to the lack of isotopic heterogeneity between pastures or to insufficient residence times to allow record of the pasture signature in hair keratine. These preliminary results highlight the difficulty to discriminate vertical mobility isotopically in the context of C3-dominated mountain steppe ecosystems.

Keywords: pastoralism, Mongolia, GPS, stable isotopes, hair keratin, horses

*Speaker

What is the impact of preparation bone deformations in a morphometrical study?

Fanny Pagès ^{*† 1}, Anne-Claire Fabre ¹, Anthony Herrel ¹, Anick Abourachid ¹

¹ UMR 7179 - Mécanismes adaptatifs Évolution (MECADEV) – Museum National d’Histoire Naturelle
- MNHN (FRANCE) – 57 rue Cuvier - 75231 Paris, France

The hoatzin is the only folivorous bird with a unique digestive physiology which implies modifications of scapular girdle. The project aim is to quantify these bone morphologies and to compare them with a large sample of species with different ecology (diet and locomotion). To do so, a geometric morphometric approach is performed. However, in most studies, measurement quality is tested, but material quality is rarely discussed. Yet, these bones have undergone physical or chemical treatments during preparation that could affect bone shape in a significant way. Here, we assess the effect of bone deformation induce by osteological preparation. To quantify the distortions, we performed a 3D geometric morphometric analysis on bones of scapular girdle belonging to 19 quails (*Cortunix cortunix*) that were identically prepared. Then, a principal component analysis was performed on symmetrized and non-symmetrized data in order to visualize the effect of distortion of the bones during the preparation on the distribution of the individuals. We quantify intra-individual and inter-individual variabilities. Our first results show that deformations and variability are not the same according to bones. We also show that for some bones, the distribution of the individuals does not vary considerably between symmetrized and non-symmetrized data. Thus, deformation during preparation does not seem to drive the shape variation in our dataset which is promising for our future comparative analysis. However, in order to minimize the effects of preparation, it seems necessary to test bone deformation and then work on shape data that are symmetrized in future morphometric studies.

Keywords: osteological preparation, birds, scapular girdle, deformation

*Speaker

†Corresponding author

A new approach for environmental monitoring using remote sensing techniques

Marcjanna Jedrych * ¹

¹ University of Warsaw – ul. Krakowskie Przedmieście 30 00-927 Warszawa, Poland

Remote sensing techniques in previous studies have been proved as an accurate way of environment monitoring. Various height levels and methods of its acquisition make them useful in global, regional and local scale. Unfortunately free data (i.e. Landsat imagery) are not accurate enough for precise monitoring of areas with high biodiversity.

European Union efforts to develop earth observation systems and invention of COPERNICUS programme resulted in launching Sentinel-2 in 2015. This satellite, with good spatial (10-30 m), spectral (12 bands) and temporal resolution (5 days) can solve the problem of local-scale environmental monitoring.

A case study were performed in order to evaluate possibilities of monitoring highly diverse mountain vegetation communities in Karkonosze Mountains (Poland). 7 vegetation classes were chosen to classify, using three supervised classifiers: Maximum Likelihood, and machine learning algorithms - Support Vector Machine and Random Forest. Furthermore, the impact of data spectral space compressing was evaluated. Obtained results (expressed in overall accuracy, OA) were high. The best classification was performed using SVM classifier with spectral space reduction (OA – 81,86%). Accuracies for every class were analyzed too. The best classified classes were homogenous forests, rock and scree vegetation and subalpine dwarf pine. In contrast, the worst accuracies were obtained for diverse classes such as subalpine tall-forbs.

Results of the case study indicate big potential of Sentinel-2 data to environmental monitoring. Next studies should focus on fusion of Sentinel-2 data with hyperspectral sensor, (i.e. EnMAP) to improve its spectral resolution and possibilities to distinguish communities with similar reflectance.

Keywords: remote sensing, environmental monitoring, Sentinel, 2, vegetation, classification, Earth Observation

*Speaker

New insights in the measurement and characterization of iridescent colours

Hugo Gruson * ¹, Christine Andraud ², Marianne Elias ², Claire Doutrelant ¹, Doris Gomez ¹

¹ Centre d'Écologie Fonctionnelle et Évolutive (CEFE) – CNRS : UMR5175, Université Montpellier II - Sciences et techniques, Université Paul Valéry - Montpellier III, École Pratique des Hautes Études [EPHE], Institut de recherche pour le développement [IRD] : UR251 – Campus CNRS - 1919 route de Mende - 34293 Montpellier cedex 5, France

² Muséum national d'histoire naturelle (MNHN) – Ministère de l'Écologie, du Développement Durable et de l'Énergie, Ministère de l'Enseignement Supérieur et de la Recherche, Muséum National d'Histoire Naturelle (MNHN) – 57, rue Cuvier - 75231 Paris Cedex 05, France

The colour of some objects, such as opals, peacock feathers or soap bubbles, changes depending on the angle of observation. Such colours are called iridescent. Iridescent colours are fairly common in natural objects but until recently they have been poorly understood. Biologists have indeed been lacking the tools to properly measure and study iridescence. The challenges to work on iridescence can be divided in two categories: (i) Technical challenges: because of the nature of iridescent colours, measurements require higher control of experimental conditions than for non iridescent colours. (ii) Conceptual challenges: identify variables to describe iridescence in a relevant and reliable way. Here, I present the outcome of intensive collaboration between several labs including both evolutionary biologists and optics physicists. We developed a method to measure iridescence in a repeatable way using a goniospectrometer. Using the case study of hummingbird feathers, I also propose 3 variables to summarize the characteristics of iridescent colours. This study can serve as the groundwork for more projects capturing the full complexity of iridescent colours in life sciences.

Keywords: structural colouration, iridescent colours, optics, spectrometry, repeatability, measurements

*Speaker

POSTER SESSIONS

Humanities and Natural Sciences

Species diversity of medicinal plants with capacity antivenom against scorpion species in Morocco

Btissam Bouimeja ^{*† 1}, My Abdelmonaim El Hidan ¹, Oulaid Touloun ², Mehdi Ait Laaradia ³, Hicham Berrougui ², Abderrahman Chait ³, Ali Boumezzough ¹

¹ Laboratory Ecology and Environment (L2E), (URAC 32), Cadi Ayyad University, Faculty of Sciences Semlalia, Marrakech (L2E) – Prince My Abdellah, B.P. 2390, 40000, Morocco

² Polyvalent Laboratory in Research Development LPVRD, Department of Biology, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal. – Mghila BP: 592 Beni Mellal, Morocco

³ Laboratory of Pharmacology, Neurobiology and Behavior, Department of Biology, Faculty of Sciences Semlalia University Cadi Ayyad, Marrakesh, Morocco (LPNC) – Prince My Abdellah, B.P. 2390, 40000, Morocco

In comparison with the other Maghreb countries, Morocco remains the richest from the point of view of floristic wealth.

Total Moroccan flora is currently represented by 4200 species and subspecies with 940 genera and 135 families (IbnTatou and Fennane, 1991). It is very surprising for its richness and the diversity of its origin. Indeed, the biogeographic and ecological conditions of these regions are favorable to both the Mediterranean-Saharo-Sindian, Saharo-Syrian and Saharo-Syrian-Sudano-Decanian flora (Ozenda, 1958, Ozenda, 1991 and Bellakhdar, 1992).

The medicinal plants are available locally and used widely by traditional healers, therefore need attention in those aspects. Wide arrays of the plants and their active principles have been evaluated for pharmacological properties useful in the treatment of scorpion sting. However, numerous unexplored plants are claimed to have definite role in this issue and need to be further studied. This study is an attempt to present a comprehensive account of numerous Moroccan plants used in the treatment of scorpion sting in any form; like topical application for local pain relief, oral formulation for pain relief and venom neutralization purpose.

So Analysis of Moroccan floristic diversity revealed that phytotherapy against scorpion stings used 19 species belonging to 10 families. The most used genera are Hammada, Danthonia, Helianthemum, Euphorbia and Asiragallus.

Keywords: Diversity, Medicinal plants, Scorpion sting, Anti, scorpion venom, Phytotherapy.

*Speaker

†Corresponding author

Chinese Silk Industry and the Domestication of Silkmoth Species

Tong Bao ^{*† 1}, Katarzyna Walczynska ², Jiexiu Zhai ³

¹ Steinmann-Institut, Abteilung Paläontologie, Universität Bonn – Nussalle 8, 53115 Bonn, Germany

² Institute of Oceanography, University of Gdansk – Al. Pilsudskiego 46, 81-378 Gdynia, Poland

³ Graduate School of Systemic Neurosciences, Ludwig-Maximilians-Universität München (GSN-LMU) – Grosshaderner Str. 2, 82152 Martinsried-Planegg, Germany

Silk is a natural protein filament, composed mainly of fibroin and produced by larvae of certain Lepidopteran species, e.g. *Bombyx mori* (the domestic silkworm), *Bombyx mandarina*, *Hyalophora cecropia*, *Antheraea pernyi* and *Samia Cynthia*. For centuries, silk production stood as one of the pillar industries of both the domestic economy and international trade in China. Archaeological evidence indicates that the use of cocoons of the silkworm *Bombyx spp.* to produce cloth began at least from the Yangshao culture (4000-3000 BC) and Longshan period (3500-2000 BC). Until today, the Chinese silk industry, with its outstanding quality and diversity, still maintains prosperous and holds a leading position internationally. During domestication, the life history of *B. mandarina* (the wild silkworm) changed dramatically, including the degeneration of flight ability, the change of larval foraging habit, as well as in its morphology. The specialization of some morphological structures, e.g. the decrease of olfactory sensilla number in antennae which leads to lower sensitivity of certain environmental odorants, also shows an adaption for domesticated life. In the new era of genetic engineering, with the rapid development and application of versatile and powerful genome editing tools, e.g. ZNF and CRISPR, the domestication process is far more targeted and accelerated. Both the efficiency and quality of silk production could be engineered by desire with much more modifiable features than ever before.

Keywords: silk, Chinese silk industry, silkmoth, *Bombyx mori*, domestication, genetic engineering

*Speaker

†Corresponding author

Seasonal changing of olfactory secretome in ewe

Paul Cann ^{*† 1}, Chrystelle Le Danvic ², Matthieu Keller ³, Patricia Nagnan-Le Meillour ¹

¹ Unité de Glycobiologie Structurale et Fonctionnelle UMR 8576 CNRS/Université de Lille1/USC INRA 1409 – Université Lille I - Sciences et technologies – Bâtiment C9 Université de Lille - Sciences et Technologies F-59655 Villeneuve d'Ascq CEDEX, France

² ALLICE – Université Lille I - Sciences et technologies – 149 rue de Bercy, 75595 Paris, France

³ Behavioral Reproductive Physiology, UMR 6175 INRA/CNRS/University of Tours – Institut national de la recherche agronomique (INRA) – UMR 6175 INRA/CNRS/Université de Tours, 37380 Nouzilly, France., France

Sheep species displays a seasonal breeding characterized by a period of sexual activity followed by a period of sexual rest. During the female anoestrus, the perception of the odour of a sexually active ram induces reactivation of ewe gonadotropic axis, leading to oestrus. Changes in olfactory system have been reported according to this switch, but more likely at central nervous steps than at peripheral level of odours detection, partly realised by odorant-binding proteins (OBP). We suggest that in sheep, the olfactory secretome is mainly composed of OBP isoforms, as it was demonstrated in pig species (Nagnan-Le Meillour et al., 2014), and that its composition could vary according to the physiological status of the animal. So, the aim of our study is to compare ewe olfactory secretome between the anoestrus and oestrus periods. Proteins extracted from nasal mucus of two ewes were analysed by 2-dimensional electrophoresis followed by Mass Spectrometry analysis (MALDI-TOF/TOF and Nano-LC-MS/MS) and compared between the two sexual periods. We report here the first identification of ewe olfactory secretome and its variation between oestrus and anoestrus periods. Our results comfort the hypothesis that the sensory equipment of ewe is under control of its physiological status, some proteins being specifically expressed at oestrus time, possibly to increase the detection of sexually active ram odour.

Keywords: *Ovis aries*, Olfactory Secretome, OBP, Mass Spectrometry

*Speaker

†Corresponding author

On the tracks of Neandertals: The contribution of an experimental analysis on footprints to the knowledge of the biological features of the Rozel hominins

Jérémy Duveau ^{*† 1}, Gilles Berillon ¹, Corentin Biets ², Gilles Laisné ,
Lancelot Lefevre ², Christine Verna ¹, Dominique Cliquet ³

¹ Histoire naturelle de l'Homme préhistorique (HNHP) – Museum National d'Histoire Naturelle, Université de Perpignan Via Domitia, Centre National de la Recherche Scientifique : UMR7194 – Institut de Paléontologie Humaine 1, rue René Panhard 75013 Paris, France

² Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

³ Direction Régionale des Affaires Culturelles de Normandie (DRAC Normandie) – DRAC - Service Régionale de l'Archéologie – 13 bis, rue Saint-Ouen - 14052 CAEN cedex 4, France

Hominin footprints provide a direct point of view about the locomotor behaviours and the biological features of disappeared individuals. During the last years, different hominin footprint sites have been discovered such as the French Pleistocene site of Rozel which delivered about 300 footprints associated with Neandertals. In parallel of these recent discoveries, an important development of acquisition techniques and experimental approaches took place.

We report here the results of an experimental study in order (1) to find a potential link between the footprint sizes and the stature of the individuals and (2) to apply this relationship to a sample of the most complete footprints coming from a same occupation layer from the site of Rozel. For that, the footprint lengths were measured *in situ* and from 3D models for 24 individuals, between 1 and 36 years old, who performed trials in different ways (habitual walking, slow and fast running).

The preliminary results show a strong relationship between footprint lengths and stature but also statistical differences between footprint lengths and the associated foot lengths. Linear regression equations allow to estimate stature between less than 1 m and more than 1 m 70 for the sample of the Rozel footprints.

This study allows to precise some biological information on the hominin who lived at Rozel 80 000 years ago but must be weighted according to the different body proportions having existed during the human evolution whose impact will be clarified thanks to future analysis.

Keywords: footprints, experiments, stature, Rozel, Neandertals

*Speaker

†Corresponding author

Looking inside rodent teeth: $\delta^{18}\text{O}$ analysis used to reconstruct the environment of MIS 3 in Northeastern Iberia

Mónica Fernández García ^{* 1,2}, Aurélien Royer ^{3,4}, Emmanuelle Stoetzel ²,
Christiane Denys ⁵, Juan Manuel López-García ⁶

¹ Sezione di Scienze Preistoriche e Antropologiche, Dipartimento di Studi Umanistici, Università degli Studi di Ferrara (UNIFE) – C/ so Ercole I d'Este 32, 44121 Ferrara, Italy, Italy

² Muséum national d'Histoire naturelle (MNHN) – CNRS UMR 7194, Institut de Paléontologie Humaine – Musée de l'Homme, Palais de Chaillot, 17 place du Trocadéro, 75016 Paris, France, France

³ Ecole Pratique des Hautes Etudes – Laboratoire EPHE PALEVO – Ecole Pratique des Hautes Etudes, 21000 Dijon, France, France

⁴ Laboratoire de Géologie de Lyon – CNRS, UMR 5276 – Université Lyon 1 and Ecole Normale Supérieure de Lyon, 69622 Villeurbanne, France, France

⁵ Muséum national d'Histoire naturelle (MNHN) – CNRS UMR 7205 ISYEB – 55 rue Buffon, 75005 Paris, France, France

⁶ Institut Català de Paleoecologia Humana i Evolució Social (IPHES), Zona Educacional 4, Campus Sescelades URV (Edifici W3), 43007 Tarragona, Spain. – Spain

Small mammals (insectivores, bats and rodents) are one of the most useful tools to reconstruct Quaternary environment. Recent studies have demonstrated the relation between the stable oxygen isotopes (mainly $\delta^{18}\text{O}$) from biogenetic phosphates from rodent teeth with the $\delta^{18}\text{O}$ from meteoric water; that at the same time can be potentially related with palaeotemperatures. This work explores the palaeoenvironment reconstructions based on the $\delta^{18}\text{O}$ composition of phosphates from enamel of rodent teeth (mainly Murinae and Arvicolinae) to approach to the Marine Isotope Stage 3 (ca. 60-30 ka) in Northeastern Iberia. Fourteen new $\delta^{18}\text{O}$ analyses from current samples are presented, complemented with forty-six $\delta^{18}\text{O}$ analyses previously published. We propose methodological basis to approach to small mammals assemblages through $\delta^{18}\text{O}$ analysis in Iberia, territory with unique environmental conditions related to its geographical location, orography and peninsula character. This methodology is test on Xaragalls cave (Vimbodí-Poblet, Tarragona), a paleontological site from MIS3, with an abundant small mammals assemblage, where fifty-one $\delta^{18}\text{O}$ analyses have been performed on *Apodemus sylvaticus* incisors. The results denote a global stable climatic period in coherence with previous studies, but this work underlines climatic instability on levels C7, C6 and C4, in comparison with levels C8 and C5, more temperate. It is concluded that the $\delta^{18}\text{O}$ analyses approach allows us to increase our knowledge about the palaeoecology of MIS3 paleontological and archeological sites from Iberia and complement other methods based on small mammal's faunas, introducing aspects such as climatic instability events, aridity or seasonality of the accumulations.

Keywords: small mammals, stable isotopes, geochemistry, palaeoclimate, Late Pleistocene

*Speaker

How do fishing practices influence sperm whale (*Physeter macrocephalus*) depredation on demersal longline fisheries?

Anaïs Janc *¹, Gaetan Richard , Christophe Guinet , John P.y. Arnould , Maria Ching Villanueva , Guy Duhamel , Nicolas Gasco , Paul Tixier

¹ Centre d'études Biologiques de Chizé - UMR 7372 (CEBC) – Université de La Rochelle, Centre National de la Recherche Scientifique : UMR7372 – 405 Route de Prissé la Charrière, 79360 VILLIERS-EN-BOIS, France

Marine mammal depredation on fisheries is a worldwide issue involving socio-economic and ecological consequences. Longline fisheries are the most impacted by odontocete depredation. While technological means have provided limited efficacy in reducing depredation, this study examined the fishing practices influencing both the proportion of depredated longline sets and the amount of fish removed by whales.

We used an 8-year dataset from the Patagonian toothfish longline fisheries operating in Crozet and Kerguelen Economic Exclusive Zones and GLMMs to investigate sperm whale depredation.

Sperm whale depredation occurred on 61% of 5,260 sets in Crozet and 41% of 16,902 sets in Kerguelen, and resulted in estimated toothfish losses of 266 tons and 1,281 tons, respectively, in the two areas. The probability of depredation decreased in winter months, increased with depth fished and decreased when vessels travelled over distances of > 60 km from fishing grounds with encountering depredation. These findings suggest the natural spatio-temporal distribution of whales and their ability to follow vessels over limited ranges influence the number of captured fish removals. The amount of depredated toothfish decreased with the speed at which longline sets were hauled and increased with the soaking time of sets suggesting that whales may depredate sets during both hauling and soaking operations.

Together, these observations indicate that rate of depredation may be influenced by both aspects of sperm whale ecology and by the conditions of fishing operations and a combination of these factors could be employed to implement strategies of avoidance in all fisheries facing depredation impacts.

Keywords: Depredation, demersal longline, sperm whale, Patagonian toothfish, avoidance, changing fishing practices

*Speaker

Ecotherapy: What are the effects of nature on human well-being?

Marie Larcher Essamet *¹

¹ Biodiv'Air'Santé – Biodiv'Air Santé – 9 rue André DARBON, 33300 Bordeaux, France

In a few decades, we became a species in a modern civilization which staying 80 % of our time inside, so reducing outdoor activities and contact with nature. Yet more than 99,99 % of our evolutionary history was for the contact with natural environments. This fast change of lifestyle brings us to stressful situations and several negative effects on our health. To counter these effects, a practice emerges again: Ecotherapy. Ecotherapy is a concept of care based on the idea that the man and nature can be each other cured with various ways. So, even if culturally this therapy is old, it was only in these last decades that the positive relations between nature and the human health were rediscovered. My scientific research work is to demonstrate the positive effects of an ecosystem on the well-being of people affected by various pathologies: Alzheimer, burn-out. The study, in collaboration with multidisciplinary team, takes place in ecotherapeutics park near Bordeaux build specifically for these patients. A clinical and sociology trial, sociology will take place over 4 years on a group of patient. After this study, we expect to prove the positive aspects of an extended contact with nature will prevent symptoms, but also of improving the health of this patient. In the medium term, this type of therapy can help in the development of a partnership between the manager of biodiversity and the health care. In the long term, parks ecotherapeutics can be created within big cities to prevent the citizens of the diseases bound to stress

Keywords: Ecotherapy, Health, Nature, Park, Psychology, Alzheimer

*Speaker

Palynological history of human settlement near the Lake Mlynek

Antoni Lewczuk ^{*†} ¹, Krzysztof Bińka ²

¹ University of Warsaw, Faculty of Geology – ul. Żwirki i Wigury 93, 02-089 Warsaw, Poland

² University of Warsaw, Faculty of Geology – ul. Żwirki i Wigury 93, 02-089 Warszawa, Poland

The palynological study of a Lake Mlynek, located in the Mazurian Lake District, the Northern Poland, revealed history of settlement in this area since antiquity to modern times.

64 samples for pollen analysis were collected from bottom sediment near the northern bank of the Lake Mlynek. They were prepared in the laboratory using standard palynological procedures - treatment with hot 10% KOH, the cold hydrofluoric acid for two days, and finally Erdtman's acetolysis has been applied.

In the palynological succession five clear pollen zones were distinguished (M1, M2, M3, M4, M5). M1 and M3 represent natural forest communities and the M3 can be connected with the so-called Migration Period. Pollen zone M2 reveals deforestation during Roman Period, probably caused by people of the Wielbark culture. In turn, M4 pollen zone seems to be similar to the M2 in the magnitude of human impact; however its location suggests the Prussian settlement – probably the tribe called Pomesanians. They built impressive stronghold on the northern bank of the Lake Mlynek. The latest zone represents the period since the expansion of the Monastic State of the Teutonic Order in the XIII century until the present day. The prospective aim of the study is to understand the historical aspect of settlement in the area mentioned and its impact on the environment of Lake Mlynek.

Keywords: Poland, Palynology, Mazurian Lake District, Lake Mlynek, Archeology, History

*Speaker

†Corresponding author

Morphological distinction between sheep (*Ovis aries*) and goat (*Capra hircus*) using the petrosal bone. Application on French Protohistoric sites.

Christophe Mallet ^{*†} ¹, Raphaël Cornette ², Jean-Luc Guadelli ³

¹ Mécanismes adaptatifs : des organismes aux communautés (MECADEV) – Museum National d’Histoire Naturelle : UMR7179, Centre National de la Recherche Scientifique : UMR7179 – UMR 7179, 1 avenue du Petit Château 91800 Brunoy, 55 rue Buffon 75321 Paris Cedex 5, France

² Institut de Systématique, Evolution, Biodiversité (ISYEB) – Museum National d’Histoire Naturelle, Université Pierre et Marie Curie - Paris 6, Ecole Pratique des Hautes Etudes, Centre National de la Recherche Scientifique – UMR 7205, France

³ De la Préhistoire à l’Actuel : Culture, Environnement et Anthropologie (PACEA) – Université de Bordeaux, Centre National de la Recherche Scientifique : UMR5199 – Université de Bordeaux Bâtiment B8 - CS50023 Allée Geoffroy Saint Hilaire 33615 PESSAC CEDEX, France

Often present in the archaeological record but rarely studied in archaeozoology, the petrosal part of the temporal bone provides important distinctive features allowing specific determination, despite an unattractive and confusing morphological variability. This study proposes to use this bone to untangle the question of the distinction between sheep and goat – two close taxa that are usually difficult to distinguish in the fossil record. We evaluated our method on Protohistoric specimens found in sites from Southwestern France in addition to a modern reference sample. Anatomical description and diameter measurements defined on the medial side proved to be relevant to discriminate those caprines, even on the fossil record, characterized by a high frequency of breakage. Our results highlighted the importance of reducing the size effect by transforming the data because of the great variability of the petrosal. We applied the k-Nearest Neighbour method which proved the efficiency of our measurements to classify these species. This study brings into question the origin of intra-specific morphological variability, probably due to ontogenetic development and breeds. It also raises questions on the identification of the domestication processes through the use of the petrosal bone.

Keywords: Petrosal bone, sheep, goat, Neolithic, Protohistory, domestication, Southwestern France

*Speaker

†Corresponding author

Gamers like it green: The significance of vegetation in online gaming

Minh-Xuan Truong *¹, Anne-Caroline Prévot^{1,2}, Susan Clayton³

¹ Centre d'écologie et de sciences de la conservation (CESCO) – CNRS : UMR7204, Université Pierre et Marie Curie (UPMC) - Paris VI, Muséum National d'Histoire Naturelle (MNHN) – 55 rue Buffon 75005 PARIS, France

² Laboratoire Parisien de Psychologie Sociale (LAPPS) – Université Paris Nanterre : EA4386 – Université Paris Ouest Nanterre La Défense 200 avenue de la République 92001 Nanterre cedex, France

³ College of Wooster – Wooster, Ohio, United States

Modern lifestyles have increased a separation between humans and nature, while also integrating technology into daily life. The use of technology has not only supplanted people's traditional experiences with nature but begun to change them: through videos and documentaries, we can discover windows opened onto wilderness, landscapes, places and species we would not be able to reach and see otherwise. Even videogames contribute to this phenomenon. Can gaming play a role in the relationship between humans and nature? The current study focused on how players relate to nature in the world's number one online role-playing game, the World of Warcraft (WoW). We distributed an on-line questionnaire to 1173 French-speaking gamers to assess their preferred landscapes in the virtual environment, their relations to nature in real life and their motivations to play. The results indicate that players prefer virtual areas displaying a significant amount of green vegetation and specific open landscapes, but that this preference is not related to their connectedness with nature, nor to their motivation to play, which is mostly escaping from their daily life. We showed also that people that declared being motivated to play for nature-based reasons are those that declare being less connected with nature in the real life. We discuss these results as a reflection of biophilia in a virtual context, i.e. an attraction to virtual landscapes that are healthy and full of vegetation, when it has become difficult to reach such landscapes in real life.

Keywords: Virtual experience of nature, Biophilia, Online universe, Virtual, nature, Video games, Connection to nature

*Speaker

Systematics, Evolution and Comparative Anatomy

Application of geometric morphometrics to analyze allometry in Dice Snake *Natrix tessellata* (Reptilia: Natricidae)

Ali Bagherian Yazdi ^{*†}, Fereshteh Noroozitayola

¹ Dept. of Biology, Faculty of Science, Golestan University – Gorgan, Iran

Allometric changes in shape were analyzed in Dice Snake *Natrix tessellata* (Laurenti, 1768) using geometric morphometrics. The pattern of allometry was visualized by thin plate splines (TPS) analysis. Three views of snake's heads were photographed and 90 landmarks were fixed in images from dorsal, lateral and ventral views of head with 36, 30 and 24 landmarks respectively. To explore how shape varies with size, a multivariate regression on centroid size was performed using the scores of all partial warps (PWs) from all three views. For all three views, the null hypothesis of isometry was rejected (i.e., allometry was present) since the multivariate regressions were statistically significant (dorsal view $F= 5.4$, $P< 0.000$; lateral view $F=8.1$, $P< 0.000$; ventral view $F= 4.5$, $P< 0.000$). The amount of shape variation accounted for by the regressions were 7, 10 and 6 percent in dorsal, lateral and ventral views respectively. In dorsal view the most prominent transformations relative to size are narrowing the frontal scales specially in posterior position and shorter parietals in bigger snakes. For lateral view in larger individuals, eyes are relatively smaller and the main changes in ventral shape with size are a relatively narrower snout and wider parietals. Geometric morphometrics allows the visualization of the allometries of particular shape components that would probably remain undetected by a conventional morphometric analysis.

Keywords: Allometry, Dice Snake, *Natrixtessellata*, Geometric morphometrics, snake

*Speaker

†Corresponding author

Hidden Genetic Diversity in Lichen Forming Fungal *Aspiciliella intermutans* complex (Megasperaceae, Ascomycota)

Zakieh Zakeri ^{*†}, Pradeep K. Divakar ², Volker Otte

¹ Senckenberg Museum of Natural History – Am Museum 1, 02826 Görlitz, Germany

² 2. Departamento de Biología Vegetal II, Facultad de Farmacia, Universidad Complutense de Madrid – Madrid 28040, Spain

Aspiciliella intermutans (Nyl.) M.Choisy is a poorly known saxicolous lichen and this name is applied to material with a high morphological variation. There is no intensive taxonomical investigation of this variate taxonomic group. *A. intermutans* complex is characterized by its white-grey to brownish areolate thallus; ellipsoidascospores, 8 per ascus: 23-34 × 9-15 μm; small and straight conidia: 7–9 μm; norstictic acid or its derivatives as the major secondary compound and the center of its distribution in Atlantic-Mediterranean regions. In this study candidate samples from Europe and Asia mostly from Iran and Caucasia were studied based on morphological, chemotaxonomic and molecular characters. ITS, nuLSU, mtSSU and MCM7 were used as molecular characters. Single-locus gene trees and a four-locus concatenated phylogeny were constructed to assess species inside of this species-complex. We also used a combination of phylogenetic strategies to examine species boundaries in the *A. intermutans* complex applying coalescent-based approaches and other recently developed DNA-based methods. Species boundaries were inferred from molecular data using three coalescent-based species delimitation methods; PTP, ABGD and GMYC and from species trees reconstructed with two different algorithms; *BEAST and BP&P. The preliminary results showed that the sampled specimens of the *A. intermutans*-complex belong to at least five distinct species-level lineages and we propose seven instead of the three currently accepted species in the new resurrected genus *Aspiciliella*.

Keywords: lichens, *Aspiciliella*, *A. intermutans*, taxonomy, phylogeny, chemotaxonomy, species delimitation and cryptic species

*Speaker

†Corresponding author

Morphological evolution of male sporangiophores in Cupressaceae

Christoph Elpe ^{*†1}, Thomas Stützel ¹

¹ Ruhr University Bochum, Department for Evolution and Biodiversity of Plants (RUB) –
Universitätsstraße 150, 44801 Bochum, Germany

Male cones in Cupressaceae feature a simple structure with a central stalk and attached sporangiophores bearing microsporangia. However, it is controversial whether male cones are simple flowers or a reduced inflorescence. Latter is supported by similar walchian fossil cones (Voltziales) showing reduced branched structures with stalked sporangia. We investigated male cones of Cupressaceae for a better understanding of their evolution from fossils to extant genera. We sampled cones from 35 species covering 25 of in total 29 genera. SEM was used for morphology and stained serial sections were made for anatomical results. For character-plotting, a phylogeny at the generic level was reconstructed using MrBayes v3.2.6 and character states were plotted using Mesquite v3.31.

In ancient lineages (Taxodiaceae), sporangiophores bear sporangia at the distal end of the abaxial side; in modern Cupressaceae, sporangia are attached more proximal to the abaxial side of the stalk. Cones of *Taxodium* represent an intermediary state, having two rows of sporangia. True peltate sporangiophores were found only in genera of modern Cupressaceae, and sporangiophores partly reduced in *Juniperus oxycedrus* except for stalked sporangia. In addition, stalked sporangia were also found in *Fitzroya*.

A morphological transition took place in the evolution of sporangiophores: a phylloid tip and distal sporangia are likely ancestral; the shift in the attachment of sporangia went along with the evolution of peltate tips in several genera. Abaxial stomatal bands and stalked sporangia are similar to fossil inflorescences of *Darneya* (Voltziales) and support a possible reduction to simple male cones of extant Cupressaceae.

Keywords: character evolution, Cupressaceae, fossils, male cones, phylogeny, sporangiophores

*Speaker

†Corresponding author

Patterns of ray flower formation in Apiaceae subfamily Apioideae

Jakub Baczyński ^{*† 1}, Regine Claßen-Bockhoff ²

¹ University of Warsaw Biological and Chemical Research Centre, Department of Molecular Phylogenetics and Evolution – ul. Żwirki i Wigury 101 02-089 Warszawa, Poland

² Johannes Gutenberg-Universität Mainz, Institute of Organismic and Molecular Evolution – Bentzelweg 2, D-55099 Mainz, Germany

Pseudanthia are highly modified inflorescences which superficially resemble an individual flower. The most notable example is the capitulum of Asteraceae, but similarly complex structures evolved independently among many lineages of angiosperms.

One of such lineages is the carrot family (Apiaceae) with pseudanthia derived from its characteristic inflorescence of an umbel composed of umbellets (compound umbel). The complex structure of the umbel allows for pseudanthium to be formed on different levels of its organization (umbellets or umbels) and with a use of both floral and extrafloral organs. In advanced umbellifers it is usually pronounced by development of enlarged monosymmetric flowers located at the periphery of reproductive unit (so-called "ray flowers"). In this study, alcohol-preserved buds of three species of Apiaceae with vastly different architecture of compound umbel, were observed using the scanning electron microscope. For the first time, initiation patterns and development of ray flowers was subjected to a detailed analysis.

The results show that the level on which ray flowers are formed is probably determined on the earliest stages of inflorescence development. The peripheral florets within the respective reproductive units are promoted from the very beginning and the enlargement of petal wings may result from the prolonged retention of this stimulus. The basis of peripheral promotion may be to ensure the additional protection of developing bud but also to create enough space for subsequent fractionation of the meristem centre. The process of ray flowers development in Apiaceae resembles that described from Asteraceae, suggesting that similar genetic mechanism may underly it.

Keywords: Apiaceae, Apioideae, inflorescence, pseudanthium, ray flowers, development

*Speaker

†Corresponding author

What's the point? Form and function of the caudal barb in stingrays

Jules Chabain * ^{1,2}, Matt Kolmann ², Adam Summers

¹ Institut des Sciences de l'Evolution - Montpellier (ISEM) – CNRS : UMR5554, Institut de recherche pour le développement [IRD] : UMR226, Université Montpellier II - Sciences et techniques – Place E. Bataillon CC 064 34095 Montpellier Cedex 05, France

² Friday Harbor Laboratories (FHL) – 620 University Rd, Friday Harbor, WA 98250, United States

Animal weaponry are diverse and serve a variety of roles; from the asymmetrically-sized and largely-ceremonial chela of fiddler crabs, to the venomous spurs of male platypuses, these structures can defend against predators, intimidate rivals, or attract mates. Stingrays (Myliobatiformes) are the most ecologically-diverse lineage within the modern elasmobranchs (sharks and rays) and have an enlarged, venomous caudal barb formed from hypertrophied dermal denticles, which these rays use to defend themselves from predators. Barbs display diverse morphologies. We used micro-computed tomography to examine barbs from over 60 species, representing the major families in Myliobatiformes; including Potamotrygonidae (Potamotrygon, Plesiotrygon), Dasyatidae (Dasyatinae, Neotrygonidae), Myliobatidae (Rhinoptera), Urotrygonidae (Urotrygon, Urobatis), Urolophidae, and Gymnuridae . As expected barb shape was distinctive with each species, with previously undescribed variation in morphometry and meristics. For example, the spine of *Paratrygon aiereba* is distinguished by large rounded base, with large bilaterally symmetrical central serrations, and an overall teardrop shape. In contrast, the spine of *Plesiotrygon iwamae* is largely covered by small disorderly serrations, along a uniform beam-like shape. In cross section, barb morphology is also variable and can be oval, triangular, or more complex. We used a phylogenetic framework to assess the variability of barb shape stems from inheritance or if there is an ecological signal as well. We generate functional hypotheses to explain barb morphological diversity using analogies with edged weapons, different sword and arrow shapes, which are specialized for either slashing or puncture.

Keywords: Batoid, Morphology, Stinger

*Speaker

Study of a skull and a mandible of Palaeotheriidae (Perissodactyla) of the Eocene green sands of Anjou: comparative anatomy and stratigraphic position

Léa De Brito * ¹, Constance Bronnert ², Guillaume Billet ², Grégoire Métais ²

¹ Université Pierre et Marie Curie - Paris 6 (UPMC) – Université Pierre et Marie Curie - Paris 6 – 4 place Jussieu - 75005 Paris, France

² Centre de recherche sur la Paléobiodiversité et les Paléoenvironnements (CR2P) – Museum National d'Histoire Naturelle, Université Pierre et Marie Curie - Paris 6, Centre National de la Recherche Scientifique : UMR7207 – 8 rue Buffon, CP 38, France

A new Palaeotheriidae (Mammalia, Perissodactyla) skull and mandible from the Natural History Museum of Angers have been described and identified. During the Cenozoic, Paleotherids were a family of hippomorph perissodactyls distributed throughout Western Europe. They were present from the end of the Bartonian to the lower Oligocene. The specimen certainly comes from the site of " la Roche-Ragot " (Maine-et-Loire, France) excavated by Léonard Ginsburg in 1978, and from the same layer of green clay sands he studied. Its description and comparison allow to include it in the genus *Palaeotherium*, and exclude it from the genus *Plagiolophus*, in particular by the study of metric ratios. The nasal notch that extends to the third premolar, well molarized premolars, prominent parastyles, very hypsodont teeth, the presence of a mesostyl from the fourth premolar and an advanced orbit until the first molar indicate that this specimen belongs to *Palaeotherium crassum*. The subspecies of *Palaeotherium* are delimited by very small variations in the diagnoses, which did not make it possible to identify the subspecies of this specimen. It represents the first occurrence of *Palaeotherium* in northwestern France, and expands the already extensive geographical distribution of this genus. The layer is dated from the upper Eocene, but the stratigraphic position of the specimen is uncertain. This identification, as well as the associated vertebrate fauna (*Diplocynodon* sp., *Hyaenodon requieni*, *Anchilophus radegondensis*, *Plagiolophus annectens*), suggests a dating to Priabonien (33,9 - 37,2 Ma), more particularly to the biohorizon MP19 where *Palaeotherium crassum* is usually found.

Keywords: Maine et Loire, Priabonien, Perissodactyla, Palaeotherium, Cuvier, Green clay sands

*Speaker

Is that a monster? A teratological Turkish population of Ranunculaceae: *Delphinium turcicum*.

Felipe Espinosa Moreno ^{*† 1}, Thierry Deroin ¹, Wei Wang ², Kun-Li Xiang ², Myreya Pinedo ³, James Bing ⁴, Zeki Aytac ⁵, Sophie Nadot ⁶, Florian Jabbour ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75005 Paris, France

² University of Chinese Academy of Sciences [Beijing] – Beijing 100049, China, China

³ Pontificia Universidad Javeriana – Carrera 7 No. 40 - 62, Colombia

⁴ Naturalis Biodiversity Center [Leiden] – Darwinweg 2, 2333 CR Leiden, Netherlands

⁵ Gazi University – Gazi Üniversitesi Rektörlüğü 06500, Turkey

⁶ Université Paris-Sud - Paris 11 (UP11) – Université Paris-Sud - Paris 11 – Bâtiment 360 - 91405 Orsay cedex, France

The Turkish endemic *Pseudodelphinium turcicum* (Ranunculaceae) was described by Vural et al. in 2012 based on a single population found in the salt lake basin of Tuz Gölü, Konya Province. Although the authors noticed morphological similarities between the specimens and the genera *Delphinium* and *Garidella*, they highlighted unusual features, which led them to describe a new genus name consisting of a single species, *P. turcicum*. We carried out morphological, anatomical, and palynological studies on individuals of this species. We also conducted a molecular phylogenetic analysis to identify the closest relatives of this species. Using this combination of approaches, we showed that the species belongs in *Delphinium* subg. *Delphinium*, distributed (exclusively or not) in Mediterranean and adjacent regions; it is more precisely sister to two Turkish species (*D. virgatum* and *D. venulosum*). We conclude that it is an unusual population of *Delphinium* presenting a modification on floral structure and symmetry that has been maintained in the wild for at least two decades. We provide hypotheses concerning the identity of the floral organs, as well as an explanation for the origin of the floral teratological characters.

Keywords: Anatomy / *Delphinium* / morphology / palynology / peloria / *Pseudodelphinium*

*Speaker

†Corresponding author

Influence of distribution, diet, and body size in the morphospace of Columbimorphae

Cesar Augusto Espinoza Campuzano ^{* 1}, Matt Friedman ², Roger Benson ¹

¹ Department of Earth Sciences [Oxford] – South Parks Road, Oxford OX1 3AN , UK, United Kingdom

² Museum of Paleontology and Department of Earth and Environmental Sciences, University of Michigan – 1109 Geddes Ave, Ann Arbor, MI 48109, United States

Pigeons and doves (Columbiformes) is a diverse order of 310 species of non-passerine birds that have a nearly global distribution, they are included in Columbimorphae along with the Pteroclidiformes. Pigeons and doves possess historical importance, *Columba livia* was used by Charles Darwin as a model to comprehend the effects of artificial selection. A cornerstone concept of the theory of natural selection.

Despite the importance and repeated study of *Columba livia*, relatively less attention has been paid to the natural variation of Columbiformes, which contain interesting species like the Dodo and the Rodriguez solitaire and present a wide range of distributions, sizes, and foraging habits. Here we describe the morphospace of these birds and examine the way in which this morphological variation might be related to body size, allometry, distribution range, and diet.

Methods: To characterize the morphospace of Columbiformes we used 92 μ CT scans of 64 different species of 43 genera of Columbiformes. The 3D models were landmarked and analyzed in a geometric morphometric framework. To test the influence of different variables in the cranium shape, we utilized multivariate statistics from the "morphometric toolkit" that have recently been designed to handle the multivariate datasets characteristic of geometric morphometrics.

Results and discussion: Columbimorphae present a really conservative skull shape, however, we have observed changes in morphology that might be explained by different foraging strategies or by island species exploring new areas of the morphospace. There is also a distinct area of the morphospace occupied by the Pteroclidiformes compared with Columbiformes.

Keywords: Geometric Morphometrics, Columbiformes, pigeons, diet, distribution, allometry

*Speaker

Simplify and become a parasite. Lessons from Laboulbeniomyces (Ascomycota, Fungi).

Michał Gorczak ^{*† 1}, Marta Wrzosek ¹

¹ Department of Molecular Phylogenetics and Evolution, University of Warsaw – Żwirki i Wigury 101, 02-089 Warsaw, Poland

Laboulbeniomyces is a class of ascomycetous fungi consisting of two groups with strikingly different biology and morphology. One of them -Laboulbeniales are obligate biotrophic ectoparasites of arthropods. Over 2100 species in 140 genera are described, but many more species await discovery. Laboulbeniales have a number of characters that makes them unique among ascomycetes: determinate growth, lack of hypha and absence of an asexual stage. Being a difficult and unculturable group, they were poorly represented or omitted in major phylogenetic studies resolving evolutionary relationships in fungi. Moreover even less is known about their free-living, hyphal sister group – Pyxidiophorales.

In this study molecular phylogenetic approach was used to investigate relationship between different groups of Laboulbeniomyces. Phylogenetic trees were generated using RaxML and MrBayes based on three rDNA markers: SSU, LSU and ITS.

Analyses revealed unexpected new clades and its unresolved relationship with other Laboulbeniomyces. It also showed that representatives of Pyxidiophorales are more common in both the environment and the Genbank database than previously thought.

Here we would like to present possible evolutionary scenarios of transition from polymorphic hyphal organism to obligate ectoparasite with special focus on lifecycle and mode of life. We propose that peculiar lifestyle of Laboulbeniales evolved because their hyphal ancestors were already preadapted by mycoparasitism and insect dispersal.

Keywords: fungi, insects, parasite, evolution, coevolution, phylogeny

*Speaker

†Corresponding author

Hox gene expression in postmetamorphic juveniles of *Terebratalia transversa* (Brachiopoda: Rhynchonelliformea)

Ludwik Gasiorowski ^{*† 1}, Andreas Hejnol ¹

¹ Sars Centre for Marine Molecular Biology, University of Bergen (UiB Sars Centre) – Thormøhlensgate 55, 5006 Bergen, Norway

In most species of Bilateria, Hox genes (encoding conserved transcriptional factors) are clustered together on chromosomes and exhibit the spatiotemporal colinearity, i.e. order of their expression follows their position in the genome. In some bilaterians this canonical colinearity is disrupted by e.g. addition or insertion of new developmental stages or by cooption of Hox genes in morphogenesis of evolutionarily novel structures. In brachiopods, a spiralian clade of marine animals with unstable phylogenetic position and superficial similarity to bivalves, the colinearity of Hox genes expression is distorted in the larvae, which correlates with the partial disruption of the Hox cluster. However, information about expression of Hox genes during and after metamorphosis in brachiopods is altogether lacking. Using mRNA *in situ* hybridization we are aiming to describe the postmetamorphic Hox gene expression in *Terebratalia transversa*, one of the best-studied species of brachiopods. There are three possible patterns, which have to be considered: 1. Postmetamorphic juveniles exhibit classical colinearity, what could imply that distortion of Hox genes expression in larvae results from the insertion of this stage to the brachiopod life cycle; 2. Patterns observed in larvae persist throughout metamorphosis and are retained by juveniles, suggesting that metamorphosis in brachiopods, despite being rapid, is of non-catastrophic type because most of the adult organs preexist in the competent larvae; 3. Hox genes expression in juveniles is neither colinear nor similar to the patterns observed in larvae. Results of ongoing investigation will allow us to discriminate between these three possibilities and discuss their evolutionary consequences.

Keywords: Lophophorata, metamorphosis, Hox genes, EvoDevo, spatiotemporal colinearity

*Speaker

†Corresponding author

The morphogenesis of the bract-scale complex of *Abies* and *Picea* – work in progress

Julian Herting * ¹, Thomas Stützel ¹

¹ Ruhr University Bochum, Faculty for Biology and Biotechnology, Department for Evolution and Biodiversity of Plants (RUB) – Universitätsstraße 150, 44801 Bochum, Germany

Today, the general bauplan of the female pinaceous cone is well understood, although its ontogeny remains oblivious. Each cone consists of a number of bract-scale complexes, with a subtending bract and a seed scale supporting two ovules, which is historically interpreted as a lateral axis. Additionally, the pinaceous seed cone has been used as a model for all conifers. Ontogenetic studies on Cupressaceae however revealed that their seed scales emerge from at least two different morphological structures. This resurfaces the question whether the seed scales amongst pinaceous genera have different origins, as well.

Here we examine the morphogenesis of the bract-scale complex in *Abies koreana* and *Picea sitchensis*. We use scanning electron microscopy and stained serial sections to track anatomical and morphological development.

On the one hand, the bract-scale complex of *Abies* and *Picea* may develop similarly to *Pinus* from a common primordium, like described in a previous study. On the other hand, the formerly described may not be the case and develop from two primordia. The first case would show that the bract-scale complexes in Pinaceae are very likely homologous and therefore supports the current understanding. However, the second case would challenge the current understanding by inferring different origins of the bract-scale complex within the Pinaceae. This can ultimately lead to reevaluating the understanding of Pinaceae evolution.

Keywords: Anatomy, bract, scale complex, morphology, morphogenesis, Pinaceae, seed cones

*Speaker

Study of foraging behavior of honeybees (*apis mellifera* L.), using the melissopalynologic analysis of loads pollen, in Azilal Morocco

Abderrahim Ihitassen * ^{1,2}, Younes Belrhazi ², Ismail Bettar ², Fouad
Msanda ³

¹ Laboratory of Biotechnologies and Valorization of Natural Resources (LBVNR) – Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

² Laboratory of Applied Geology and Geo-environment, (LAGGE) – Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

³ Laboratory of Biotechnologies and Valorization of Natural Resources (LBVNR) – Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

Bees harvest pollen using various structural and behavioral adaptations. For them, pollen is the only source of protein. This work aims to understand the foraging behavior of bees by identifying plants used as sources of pollen, using the melissopalynological analysis of loads pollen, in the region of Azilal, Morocco. The harvesting of five hives for three periods of 3 days to 10 days apart, show a diversity of eight colors. The melissopalynological analysis of these loads shows that there is a close link between the color of a load and its pollen composition. During the foraging season, a colony diversifies its pollen resources. The yellow loads are dominated by *Plantago sp.*, the orange loads by Type *Chrysanthemum* (Asteraceae) or by Brassicaceae, the brunettes by the genus *Genista sp.*, the green by *Silene sp.*, *Reseda sp.* or *Singuisorba minor*, the dark color by *Papaver sp.* and the beige by *Genista sp.*, *Singuisorba minor* and the Brassicaceae. For each loads of different harvests, there is always a dominant pollen type, which means that foraging does not happen at random and associations are chosen.

Keywords: honeybee, foraging behavior, melissopalynology, pollen loads, Azilal Morocco.

*Speaker

Diachronic analysis in biogeography : a cladistic approach

Artemis Korniliou ^{*† 1}, René Zaragüeta Bagils ¹, Bouziane Khalloufi ²

¹ Laboratoire Informatique et Systématique (LIS) – CNRS UMR 7205 ISYEB, Université Pierre et Marie Curie - Paris 6, Muséum National d’Histoire Naturelle (MNHN) – Université Paris 06 4, place Jussieu, 75005, Paris, France

² Laboratoire Informatique et Systématique (LIS) – CNRS UMR 7205 ISYEB, Université Pierre et Marie Curie - Paris 6, Museum National d’Histoire Naturelle - MNHN (FRANCE) – Université Paris 06, 4 place Jussieu, 75005, Paris, France

In historical biogeography, the incorporation of temporal information has been considered as problematic. In this study, relationships between biogeographical areas are inferred from taxa of different ages. No theoretical or practical development has yet allowed this analysis to become operational. Studies particularly deal with synchronic analysis, which are based only on the age of contemporary data (based on taxa with the same age). We show that diachronic analyses are possible, within the framework of the cladistic theory, if biogeographical areas are distinguished from geographical areas. We apply our theoretical proposals to an empirical example in order to investigate the relationships between biogeographical areas which are regarded as related to Gondwana breakup. Distribution of fossil and recent data from Africa, South America and Oceania are used in order to carry out a biogeographical analysis, using Lisbeth with PAUP. The strict consensus of an exact analysis is not fully resolved. Nevertheless, it permits to correlate some nodes of the areagram, corresponding to vicariant and allopatric events, to geological events.

Keywords: Historical biogeography, Diachronic biogeography, Cladistics, Systematics, Vicariance, Biogeographical area

*Speaker

†Corresponding author

Morpho-functional study of the stylopod in Rhinocerotidae : a 3D approach

Miranta Kouvari * ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

The form of the limbs is often related to the mode of locomotion, regime and size of animals. The morphological diversity of the stylopod of Rhinocerotidae and its relation to other Perissodactyla is the focus of this study. With the use of photogrammetry and geometric morphometrics I studied the 3D variation of forms of femuri and humeri of the five extant Perissodactyla as well as nine extinct species. I also integrated two species of Meridiungulata as it is the sister-group of Perissodactyla according to recent studies. The diversity of form was analyzed by multivariate analyses and then was put in relation to locomotion, regime, habitat and size. Locomotion seems to be the primary factor that distinguishes the different forms, with a different Impact on anterior and posterior limbs. The most intense morphological change is found in bipedal locomotion, found in Chalicotheria of this study. In Rhinocerotidae, the regime and habitat seems to be the most important factors influencing the diversity of forms, as grazers have differentiated humeri of those of browsers. The effect of size was also regarded: only the humerus showed a potential relationship between its size and form as its size was found to have a significative positive correlation with the widening of the distal epiphysis as well as the reduction of the trochlea. This was a preliminary study of the morphological diversity of Perissodactyla, so further statistical analysis on more specimens should be made in the future.

Keywords: Rhinocerotidae, Functional Morphology, Morphometrics, Stylopod, Humerus, Femur, Perissodactyla, Photogrammetry

*Speaker

Origin of the pharyngo-hyal: synapomorphy of Holocephali?

Rohan Mansuit*¹ , Alan Pradel ¹

¹ Centre de recherche sur la Paléobiodiversité et les Paléoenvironnements (CR2P) – Museum National d’Histoire Naturelle : UMR7207, Université Pierre et Marie Curie - Paris 6, Centre National de la Recherche Scientifique : UMR7207 – 8 rue Buffon, CP 38, France

Among vertebrates, the gnathostomes represent a clade that is characterized by the presence of jaw. This group is subdivided into two main clades: Osteichthyes (bony fishes and tetrapods) and Chondrichthyes. The latter comprise two groups: Elasmobranchii (sharks, rays, sawfish) and Holocephali (chimaeras). Gnathostomes have segmented visceral arches, which are differentiated from anterior to posterior in a mandibular arch, a hyoid arch and branchial arches. According to the widely admitted hypothesis, visceral arches are serial homologues, so that the elements of each arch share a common history. While epi- and cerato- elements are present in all arches in all gnathostomes, the pharyngo- element has a different distribution. This dorsal bone is absent on the hyoid arch whereas it is present on branchial arches in all gnathostomes, except the extant chimaeroids which have this bone on the hyoid arch. Consequently, it might represent either a neof ormation in the Holocephali, or a serial homologue of pharyngobranchials present in the common ancestor of all gnathostomes and secondarily lost in all the other lineages. This question about the history of the pharyngo-hyal is not yet resolved. Here we discuss this question by studying the anatomy of visceral arches and associated structured (muscles, nerves and blood vessels) of the dogfish (*Scyliorhinus canicula*) and the elephant fish (*Callorhynchus milii*) using 3D, Synchrotron imaging techniques.

Keywords: Chondrichthyes, Holocephali, visceral arches, 3D modelling

*Speaker

Birds neck modularity : A 3D morpho-functional approach

Olivia Plateau^{1,2 *}, Christine BÖHMER¹, Anick ABOURACHID¹, Raphaël CORNETTE²

¹ UMR 7179 CNRS/MNHN,

² UMR 7205 CNRS/UPMC/MNHN Muséum National d'Histoire Naturelle Paris, France– 57 rue Cuvier - CP 50, France

Birds are an important model to study evolution according to life style and niche occupation. Because their evolutionary history is fairly well documented, from earliest and cursorial theropod dinosaurs to extant neortithes, the modern birds. Comprising more than 10 000 species, birds behaviors and habitats are indeed extremely diversified.

Birds neck is extremely variable in form and function due to the high shape variability of its vertebrae. In contrast to the limited variation in number of cervical vertebrae in many other tetrapod, the number of cervical vertebrae in birds varies from 10 to 26. First descriptive, comparative and functional studies, showed that birds have 3 morphological regions linked to neck mobility. Others studies have shown that these three anatomical regions of the avian neck are ambiguous. Moreover, these studies of vertebrae have been performed in 2D whereas the shape of the vertebrae and the movement of the neck are typically in 3D. Birds vertebrae remain poorly studied due to their shape complexity.

The goal of this study is to understand birds vertebrae shape, modularity of the neck and the link with functional aspect using 3D geometric morphometrics of surfaces and curves.

Keywords: Aves, Cervical vertebrae, Comparative morphology, 3D geometric morphometrics

*Speaker

Extant and Past Biodiversity of Giraffes

Alice Petzold * ¹, Alexandre Hassanin ¹, Michel Saint-Jalme ¹, Jacques Rigoulet ¹, Anne-Sophie Magnant ¹

¹ Muséum National d'Histoire Naturelle (MNHN) – Museum National d'Histoire Naturelle – 57, rue Cuvier - 75231 Paris Cedex 05, France

The number of giraffe species has been highly debated since intensified explorations of sub-Saharan Africa in the 19th century caused an exponentially growing number of specimens in European museums. The investigation of those specimens led to the description of many subspecies and up to three different species by considering solely morphological criteria. Currently, the genus *Giraffa* is considered to comprise only one species and nine subspecies (IUCN). The severe decline in giraffe population numbers by 80% over the last decades prompted some research on the phylogenetic relationship among subspecies, illustrating between some of them a significant divergence that might indicate their distinct species status. However, definitive conclusions are limited due to sampling flaws and an impeded extension of sample quantity due to e.g. political unrest in the respective country, administrative obstacles like the Nagoya protocol or meanwhile non-existent populations.

The molecular work with historical specimens offers a unique opportunity to reveal ancient gene flow as well as to fill sampling gaps of meanwhile inaccessible or even extinct groups. Hence, we provide the first study dealing with mitochondrial DNA sequences obtained from historical giraffe specimens, including individuals from potentially extinct populations that have not benefited from being sampled so far. Thereby, we discovered a new, but extinct subspecies of giraffes and revealed some nomenclatural inconsistencies for subspecies meanwhile placed in synonymy. Our project aims to better understand the phylogeography of giraffes and provides results that will have important consequences on their taxonomy and consequently on the conservation of subsisting wild populations.

Keywords: Giraffa, natural history collection, historical DNA, conservation genetics

*Speaker

Intraspecific variation of the sea urchin *Hemicidaris intermedia* from Late Jurassic of the Holy Cross Mountains, Poland

Justyna Rabińska * ¹, Mariusz Czajka ¹

¹ Faculty of Geology, University of Warsaw – Żwirki i Wigury 93, 02-089 Warsaw, Poland

The subject of this project is the biometric study of *Hemicidaris intermedia* from Kimmeridgian (Late Jurassic) Malogoszcz quarry of the Holy Cross Mountains. We measured and used statistical methods to demonstrate our test results. The obtained measurements will be used to analyse the ontogenetic development (such as development of the apical disc in relation to age of sea urchins in our case). We will also study interspecific variations which is broaden knowledge about this type.

The main methods applied to the study included: (1) measuring the height, the diameter and the size of the following elements: the periproct, the apical disc, the peristome, ambulacral and interambulacral zones, and (2) the statistical analysis of the measurement results (variation explained by regression – growth process and residual variation).

The expected result of this study is to affirm the interdependence of the taken measurements, of which the size of the periproct and of the peristome, i.e. their height and diameter, appear to be the most interesting from the research point of view. We will intend to give the proof fore the possibility of determining the individual age basing on the size of endoskeleton parts (as apical disc or peristome).

Keywords: Echinoidea, sea urchins, The Holy Cross Mountains, intraspecific variation, ontogenetic development

*Speaker

The diversity of fossil fungi in Baltic amber

Marta Tischer * ¹, Michał Gorczak ¹, Julia Pawłowska ¹, Katarzyna Szczepaniak ², Marta Wrzosek ¹

¹ Department of Molecular Phylogenetics and Evolution, University of Warsaw – ul. Żwirki i Wigury 101, 02-089 Warszawa, Poland

² Museum of the Earth, Polish Academy of Science – Aleja Na Skarpie 20/26, 00-488 Warsaw, Poland

Baltic amber is a common and well studied European fossil resin, dated to Eocene epoch. It is widely accepted that it was produced in Fennoscandian forest, likely by trees from family Sciadopityaceae. Detailed inclusions of preserved entrapped organisms, represent an extensive diversity of arthropods and plants but also poorly documented fungi. Hitherto, few species of fossil fungi were found and described from Baltic amber (none from Polish collections). Our research focused on light-microscopy of previously selected inclusions in Baltic amber specimens shared by collections of three largest Polish museums (Museum of Amber Inclusions in Gdansk, Natural History Museum in Kraków, Museum of the Earth in Warsaw) and private collection of Mrs. and Mr. Hoffeins (Germany). During the investigation we predominantly found and described several early life stages of entomopathogenic fungi resembling genera *Zoophthora* and *Simplicillium* as well as entomophilous fungi like *Scopulariopsis* on insects remnants. The another numerous represented group in the studied material were filamentous fungal forms with conidiophores, which occurred in humid soil litter habitats. We also recorded specimens of saprotrophic organism related to plants and detritus, eg. *Periconia*-like and *Penicillium*-like forms, which are the first and the oldest known representatives of those genera in the fossil record. This study substantially increases knowledge on the ecological and taxonomical diversity of eocenic fungi in Fennoscandian forest, which so far was neglected due to difficulties with interpretation of the available material.

Keywords: fossil fungi, Eocene, Baltic amber, succinite

*Speaker

Phylogeny of *Festuca amethystina* group (Poaceae): searching for the reasons of variation in the polyploid complex of grasses

Przemysław Tomczyk *[†] ¹, Agnieszka Rewicz ¹, Tomasz Rewicz ², Paweł Wasowicz ³, Marcin Kiedrzyński ¹

¹ Laboratory of Plant Ecology and Adaptation, Faculty of Biology and Environmental Protection, University of Łódź, Łódź (Poland) – ul. Banacha 12/16, 90-237 Łódź, Poland, Poland

² Department of Invertebrate Zoology and Hydrobiology, Faculty of Biology and Environmental Protection, University of Łódź, Łódź (Poland) – ul. Banacha 12/16, 90-237 Łódź, Poland, Poland

³ Icelandic Institute of Natural History, Akureyri (Iceland) – Borgum vid Nordurslod, 600 Akureyri, Iceland, Iceland

Grasses are plant which achieved ecological success – are widespread all over the world and occur in very diverse habitats. The main reason of this adaptability is probably the high genetic plasticity. It is interesting why some closely related species strongly differ in adaptability and geographical range and which genetic mechanisms are responsible for that ecological success? The model group of species have been chosen for studying such topics. Group includes taxons with very small range of occurrence (e.g. *Festuca tatrae* – endemic for the Western Carpathians), and more widespread species (such as *Festuca amethystina* – with diffuse occurrence in the Central and the South-Eastern Europe). The first step to solve described problems is to clarify phylogenetic connections between species and its cytotypes. For example, there are suggestions that *Festuca tatrae* is an ancestral species for tetraploid cytotype of *Festuca amethystina*, but this is questionable for some part of its range. Moreover connections between cytotypes of *Festuca amethystina* are unclear.

DNA was isolated from leaves collected during own field studies and from specimens deposited in herbaria. DNA was multiplied by PCR reaction using 3 organellar markers: matK, psbA-trnH, rbcL and trnL-F. PCR products were sequenced, and received sequences are analyzed with using the MEGA software. There was also an attempt to calibrate the molecular clock. Obtained data shows phylogenetic connections between taxons in studied group and between genetic differentiation and geological events. Results are important for the further studies about evolution, adaptability and phenotypic differentiation of this group of grasses.

Keywords: phylogeny, adaptability, polyploid complex, speciation, molecular ecology, Poaceae

*Speaker

[†]Corresponding author

Morphogenesis and evolution of male cones in Pinaceae (work in progress)

Rebecca Tuttaß * ¹, Christoph Elpe ¹, Thomas Stützel ¹

¹ Ruhr-University Bochum, Faculty of Biology and Biotechnology, Department for Evolution and Biodiversity of Plants (RUB) – Universitätsstraße 150, 44801 Bochum, Germany

In contrast to the condensed inflorescences of female cones of Pinaceae, male cones are interpreted as unbranched structures. However, morphogenetic studies of male cones are still required. Therefore, this research focuses on morphogenesis in *Larix*, *Abies* and *Tsuga*. Samples were taken in regular intervals over 20 months in the botanical garden Bochum. Morphogenesis was analysed via SEM and serial sections using light microscopy. For an evolutionary interpretation, a phylogeny at generic level was reconstructed with six molecular markers.

The phylogeny offers two major clades: *Abies* and *Tsuga* as part of clade 1, *Larix* as part of clade 2. Pollen cones consist of a central axis and spirally arranged microsporangioophores, which generally bear two abaxial sporangia (rarely three in *Larix* and *Tsuga*) and an adaxial scutellum. In early stages, cone apices are dome shaped and increase in height in *Tsuga* and *Abies*; whereas, apices are conical and increase in width in *Larix*. In all genera, sporangioophores develop laterally as roundish primordia. Subsequently, a phylloid tip develops on the adaxial side which remains small in *Abies* and *Tsuga*, but strongly enlarges and differentiates into bladder-like structures in *Larix*. After sporangioophore development, the apex remains and no terminal sporangioophores develop.

Cone apices differ between *Larix* and *Tsuga/Abies*, which corresponds to their phylogenetic relationship. However, sporangioophores seem to develop equally and the absence of terminal sporangioophores does not falsify the theory of true microsporophylls. *Larix* seems to show some development discrepancies and the anatomical origin of bladder-like structures will be further examined.

Keywords: *Abies*, *Larix*, morphogenesis, *Tsuga*, phylogeny, scanning electron microscopy

*Speaker

Molecular Phylogeny of the Philippine *Tarenna* Gaertn (Rubiaceae)

Sarah Grace Zamudio ^{*† 1,2}, Cecilia Banag ^{3,4,5}

¹ The Graduate School, University of Santo Tomas (UST) – Espana Blvd., 1015 Manila, Philippines

² Centro Escolar University (CEU) – 259 Sen Gil Puyat, Makati, 1203 Metro Manila, Philippines

³ Department of Biological Sciences, College of Science, University of Santo Tomas (UST) – Espana Blvd., 1015 Manila, Philippines

⁴ University of Santo Tomas Herbarium (USTH), Thomas Aquinas Research Complex, University of Santo Tomas (UST) – Espana Blvd., 1015 Manila, Philippines

⁵ Plant Sciences, Research Center for the Natural and Applied Science, Thomas Aquinas Research Complex, University of Santo Tomas (UST) – Espana Blvd., 1015 Manila, Philippines

The genus *Tarenna* Gaertn., under the tribe Pavetteae, is composed of 200 species mostly occurring in the continental Africa, Madagascar, the western Indian Ocean islands, Asia and the Pacific region. Previous studies revealed that the genus is polyphyletic, based on its differences with its morphological characters. The polyphyly of the genus was further supported by the results of a recent molecular study on the members of tribe Pavetteae, revealing an unclear relationship between the Madagascan and Asian-Pacific clades of *Tarenna*. Considering that most studies failed to include any Philippine representatives of *Tarenna*, we investigated the evolutionary history and relationships among *Tarenna* species known from the Philippines. Here, we utilized both morphological and combined molecular data to establish the phylogenetic relationships among Philippine *Tarenna* species and to confirm its taxonomic position within the tribe Pavetteae. The addition of the Philippine samples of *Tarenna* supports the circumscription of *Tarenna* s. str. (de Block *et. al.*, 2015) is nested within the Asia-Pacific clade as revealed in the bayesian inference, parsimony, and maximum likelihood analyses using combined ITS and *trnT/rps16* datasets. It also confirmed that the Philippine *Tarenna* species does not constitute a natural lineage. This study provided critical insights on the phytogeographic patterns of *Tarenna* in the Indomalayan-Australasian regions as well as the evolutionary history and relationships among Philippine *Tarenna* species.

Keywords: ITS, monophyletic, Pavetteae, polyphyletic, rps16, *Tarenna*, *trnT*, F

*Speaker

†Corresponding author

Biodiversity Dynamics and Conservation

The occurrence and the diversity of the Mediterranean fruit fly (*Ceratitis capitata*) entomopathogenic fungi in *Argania spinosa* and citrus orchards soils

Ayoub Hallouti * ¹

¹ Laboratoire de Biotechnologies Microbiennes et Protection des Végétaux (LBMPV) – Université Ibn Zohr, Faculté des Sciences, BP 8106, Agadir, Maroc., Morocco

The present study forms part of biological control against the medfly (*Ceratitis capitata*) and seeks to isolate and determine the diversity of the medfly entomopathogenic fungi in soil samples collected from *Argania spinosa* forest, in different localities of Souss-Massa-region. Search and isolation of the the indigenous populations of *the* medfly entomopathogenic fungi was carried out by using larvae of this pest as baits. In order to select the fungal strains with significant pathogenic powers, the fungal isolates are tested against the medfly larvae and pupae. The degree of virulence was estimated by the ability of the fungus to induce the disease or the death of the insect and also by calculating the lethal time 50. A total of 29 strains were isolated from baits. Identification of the isolated strains revealed that *Fusarium* was the most frequent genera with 44.8%, followed by *Aspergillus* with 13.79%. In the other hand, the strains of *Beauveria bassiana*, *Trichoderma harzianum*, *Metarhizium anisopliae* and *Scopulariopsis* sp. were very rare. The pathogenicity tests results were clearly demonstrated the sensitivity of medfly to the tested fungal strains and particularly to strains of *Fusarium* sp. and *Scopulariopsis* sp. that have shown high mortality rates (more than 84%) and to *Trichoderma harzianum*, *Scedosporium* sp. and *Ulocladium* sp. with more than 70% mortality for the two tested concentrations (10^5 and 10^6 spores/ml). All these results confirm the presence of entomopathogenic fungi in Argane soils, and prove the potential of entomopathogenic fungi for biocontrol of the Medfly under laboratory conditions.

Keywords: Entomopathogenic fungi, *Ceratitis capitata*, biological control, *Argania spinosa*.

*Speaker

Interspecific aggregation of necrophagous diptera larvae

Larissa Komo ^{*† 1}, Valéry Hédouin , Charabidzé Damien

¹ Unité de Taphonomie Médico-Légale (UTML) – Université Lille II - Droit et santé : EA7367 – Place de Verdun 59045 Lille, France

Aggregation is one of the most basic social phenomena and often correlated with collective benefits (Allee effect). The present study analysed interspecific aggregations between larvae of three common blowfly species (*Calliphora vicina*, *C. vomitoria* and *Lucilia sericata*) in order to test (i) if they aggregate together, (ii) if aggregation behaviour differ between species and (iii) if the benefits of aggregation outweigh the costs of competition.

A round arena was prepared out of an agar-liver medium. Two upended Petri dishes containing each 50 maggots of a different species were placed upon it on opposite sides, thus forming two separate aggregates. After 3 hours, 100 new maggots were placed between those aggregates. After 20 more hours, all individuals were counted under and in close proximity to the Petri dishes plus in surroundings.

On average, 96% of the later added maggots moved to one of the pre-existing aggregations (n=68), highlighting a collective and interspecific choice. Thereby, the aggregation spot with *C. vicina* was preferred over spots of *L. sericata* and all the more over *C. vomitoria*. Finally, maggots never aggregated separately by species.

These results underline the existence of interspecific collective strategies in necrophagous blowfly larvae (Boulay et al., 2016). Benefits of interspecific aggregations seem to prevail the costs of competition, suggesting the existence of mutual benefits in development, e.g., due to an easier excess to nutrients. Current experiments implemented by the authors will demonstrate the differences in development time as well as mortality rate of those maggots in single- and mixed-species aggregations.

Keywords: blow fly larvae, aggregation, mixed, species group, gregariousness, collective behaviour

*Speaker

†Corresponding author

Colonization of the European mesic pine forest by the alien oak species (*Quercus rubra* L.)

Anastazja Krzyżanowska ^{*† 1}, Beata Woziwoda ¹

¹ Department of Geobotany and Plant Ecology, Faculty of Biology and Environmental Protection, University of Lodz, Poland (FBEP UŁ) – ul. Piłarskiego 14/16, 90-231 Łódź, Poland

We studied the distribution and spread of introduced *Q. rubra* in the native Scots pine forest (in Central Poland). Northern red oak was mapping in 3300 one-square-metre subplots, in transect lines which crossed pine monoculture. Specimens growing under shrubs, in *Vaccinium myrtillus* clumps, and in open area were distinguished to study nurse plant” effect. The number of germinated and non-germinated acorns deposited in one site was noted and the type of acorn deposition site was described. Data analyses were conducted in R software and Statistica programmes. Red oaks (n=663) occurred in clusters distributed unevenly in 14% of subplots. Generally, the closer to roads and to seed source, the higher number of oaks. The number of specimens noted under shrubs and in open space was almost equal (47% and 49% of all oaks, respectively). However, *Q. rubra* occurred in 65% of all available subplots with shrubs, in one tenth of open area subplots and in just 3% of bilberry subplots. It means that seeds were deposited by acorn consumers/dispersers non-randomly, and/or the most suitable condition for acorn germination and early seedling growth were under shrubs what can be read as ”nurse effect”. The directed acorn dispersal was also confirmed by seeds number deposited in one site under shrubs, both in spacious moss caches and in corridors of rodents. However, the older specimens, the higher proportion of oaks growing in open area, what indicates that sites which are safe for seeds are not necessarily safe sites for emerging seedlings (a seed-seedling conflict).

Keywords: acorn dispersal, nurse effect, burial effect, zoochory, plan invasion

*Speaker

†Corresponding author

Parasites to replace pesticides: Nematodes as a bio-control against a major forest pest

Sophie Labaude * ¹, Rosie Mangan ¹, Sarajane Quinn ¹, Christine Griffin[†]

¹ Department of Biology, Maynooth University – Maynooth, County Kildare, Ireland

Large pine weevils (*Hylobius abietis*) represent a major pest for conifer forests. Current methods of control include use of chemicals. In addition to the important economic costs associated to these methods, pesticides are a major threat for the environment. To reduce the use of pesticides, new biological methods need to be developed. Nematodes are parasitic worms that are already used as biocontrol against other invertebrate species. *Steinernema carpocapsae* can use pine weevils as hosts, killing them shortly after infection. The potential use of this species as biocontrol has been investigated for several years, with convincing results. The last field trials aimed at optimizing the application method of nematodes. Pine stumps infected with weevils were treated in four different ways. A suspension of nematodes was poured either directly on the stump or on the soil around it. For half of the stumps, a wetting agent was added to the suspension. The effectiveness of the treatments was assessed by the destructive sampling of stumps and recording the parasitism rate of nematodes among weevils. Following the nematode treatment, up to 82% of weevils were killed by the nematodes. The addition of a wetting agent did not improve the efficiency of the treatment. However, its efficiency depended on the application method, with more parasitized individuals found when the suspension was poured around the stumps. Our results confirm the efficiency of using nematodes. Along with results from previous studies they will lead to the implementation of a new effective biocontrol method against large pine weevils.

Keywords: Biocontrol, entomopathogenic nematodes, pest, large pine weevil, parasites

*Speaker

†Corresponding author

Activity budgets of rewilded Asian elephants in a new model of conservation

Elodie Massiot ^{*† 1,2}, Chelsea Greer ^{1,2}, Rebecca Winkler ³, Sarah Blaine ³, Liv Baker^{‡ 1,2,3}

¹ Institute for Compassionate Conservation – New York, United States

² The Centre for Compassionate Conservation – University of Technology, Sydney, Australia

³ Mahouts Elephant Foundation – London, United Kingdom

Asian elephant populations have suffered a rapid decline, principally due to habitat loss and poaching. In southeast Asia, more elephants live in some form of captivity than in the wild. Most of these elephants are in the tourist industry, where they work and perform. This elephant tourism model induces poor welfare for elephants in disharmony with their fundamental needs. Moreover, the drive for captive elephants drives free-living populations to the brink. Rescue, rehabilitation, and rewilding of captive elephants offers a necessary and compassionate model for conservation in the Anthropocene. This new model permits the conservation of both Asian elephants and native forest. The aim of this preliminary study is to understand the behavioural needs of rewilded elephants. For this purpose, we assessed the activity budgets of 4 Asian elephants, rewilded to native forest habitat in northern Thailand. This family group was studied between July and October, 2017. *Ad libitum* focal sampling in sessions of 30-60 minutes were conducted to collect 25 hours of behavioural data/elephant. In comparison to data on captive elephants from the literature, preliminary results (18.5% time/individual) show a higher proportion of time allocated to locomotion (19.7%) and complex foraging behaviours (50.9%) for rewilded elephants. Importantly, feeding behaviour is entangled with food selection and preparation (13.3%), as well as, grooming (6.7%) and exploration (2.5%). Due to lack of choice and mobility, such complexity is not possible for elephants in tourism. Rewilding Asian elephants restores natural skills and behaviours, and bolsters the health of wild populations.

Keywords: *Elephas maximus*, rewild, activity budgets, conservation, welfare, elephant tourism

*Speaker

†Corresponding authors

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The joint distribution of zoochorous plant species in the presence of wild ungulates

Ushma Shukla ^{*† 1}, Björn Reineking ², Christophe Baltzinger ¹

¹ Irstea - UR Ecosystèmes forestiers (UR EFNO) – Institut national de recherche en sciences et technologies pour l’environnement et l’agriculture - IRSTEA : UREFNO – Irstea Domaine des Barres F-45290 Nogent-sur-Vernisson, France

² Université Grenoble Alpes, Institut national de recherche en sciences et technologies pour l’environnement et l’agriculture (Irstea, Grenoble) – Institut national de recherche en sciences et technologies pour l’environnement et l’agriculture - IRSTEA : UREMGR, Université Grenoble Alpes [Saint Martin d’Hères], Université Grenoble Alpes [Saint Martin d’Hères] – Université Grenoble Alpes, Irstea, UR EMGR, 2 rue de la Papeterie BP 76, 38402 St-Martin-d’Hères, France, France

Plants are sessile and depend on animals (through zoochory) and other vectors (like wind, water, etc.) to be dispersed to new, suitable areas. Spatially, zoochorous plants can gain advantage in two ways – being close to where animals move or being close to other fruiting individuals, i.e. in ‘fruiting neighbourhoods’. Additionally, ecological filtering by animals of specific plant traits also impacts the overall plant assemblage. Few studies have looked at the distribution of both epi- and endo-zoochorously dispersed plant species simultaneously, and therefore may underestimate the role of ecological filtering of specific plant traits by the dispersal process and its impact on the overall species assemblage pattern. We will consider a joint species distribution approach to study the effects of animal presence and environmental factors on zoochorous species assemblage. Specifically, we are interested in the following questions (1) Do zoochorous plant species indicate presence of ‘fruiting neighbourhoods’ in their distribution, i.e., do zoochorous species tend to occur in clustered patterns? How correlated are the probabilities of co-occurrence of these species? (2) Does animal presence/intensity of use in the area correlate with the presence of these ‘fruiting neighbourhoods’? To address this, we will use data from field surveys for vegetation and animal signs, information from GIS and remote sensing layers (such as landscape topography, vertical forest structure, water sources, salt licks, etc.) and weather information to model the joint distributions.

Keywords: zoochory, joint species distribution, species assemblage, biotic interactions

*Speaker

†Corresponding author

Meroplankton diversity and seasonality in the high Arctic

Katarzyna WALCZYNSKA ^{†1}, Tove GABRIELSEN ², Marta RNOWICZ ³, Janne SOREIDE ², Agata WYDMANN ¹

¹Department of Marine Plankton Research, Institute of Oceanography, University of Gdansk

²Biology Department, The University Centre in Svalbard (UNIS)

³Ecology Department, Institute of Oceanology, Polish Academy of Sciences (IO PAS)

Marine invertebrates display the variety of developmental modes. Indirect development with a pelagic larval stage is regarded as the most widely spread among benthic marine invertebrates. Larvae have a high importance in the ecosystems. Structure of benthic communities is determined by the supply of recruits, transport mechanisms, settlement success and post-larval processes. That is why the understanding of benthic community dynamics without the knowledge of larval ecology is almost impossible.

As meroplankton community in the polar regions has been poorly studied, we performed one of the first year-round studies in Isfjorden, the largest fjord of Western Spitsbergen (Svalbard Archipelago). Larvae were collected in all seasons by standard plankton nets and by diver-towed nets above the sea bottom. Entire meroplankton community was analysed morphologically and some larval groups were analysed by molecular methods, as small size of the larvae does not allow on identification to the species level. Morphological data showed pronounced seasonality of larvae and temporal succession of particular groups. Summer community was dominated by Bivalves and Echinoderms, which were present in autumn, as well as Bryozoa. In winter larvae were scarce, while spring was dominated by Cirripedia. So far, DNA barcoding was applied to Cirripedia and Echinodermata larvae. Most of them was identified to the species level and their relation to environmental conditions was verified, which is particularly important, as polar regions are the most influenced by ongoing global change: water temperature will have an impact on water mass transport, thus on meroplankton, their distribution and reproductive cycles.

Keywords: Meroplankton, larvae, Arctic, DNA barcoding, climate change, biodiversity

[†] Corresponding author

Earth and Planetary Sciences

Impact of green rust structure on anion exchange processes

Myriam Agnel ^{*† 1}, Sylvain Grangeon ², Christophe Tournassat ^{1,2}

¹ Institut des Sciences de la Terre d'Orléans, UMR 7327 Université d'Orléans/CNRS/BRGM – ISTO
Orléans – 1A rue de la Férollerie, 45071 Orléans cedex, France

² BRGM – BRGM – 3 Avenue Claude Guillemin, Orléans, France

Layered materials such as clay minerals or oxides contribute significantly to soil reactivity because of their large specific surface area that promotes adsorption/desorption reactions. Among them, Fougèrite is a Fe(II)/Fe(III) layered double hydroxide that was identified twenty years ago in hydromorphic soils. Fougèrite has a layer structure resembling that of the so-called Green Rust (GR) whose color is due to the mixed Fe valence in their structure. GR layers are positively charged because of the presence isomorphic substitutions (e.g. Fe³⁺ in place of Fe²⁺) and possibly vacancies. Layer charge compensation at the mineral scale is ensured by anions located in the interlayer space. These interlayer anions can be exchanged with anions present in surrounding pore water. Consequently, GR participate to the biogeochemical cycling of anions in the environment, including nutrients or pollutants. In this study, we carried out a detailed analysis of green rust structure in order to better quantify these biogeochemical cyclings. In particular, we performed laboratory and synchrotron experiments that allowed deciphering the mechanisms of chloride for sulphate exchange. The effect of particle size was investigated using two types of samples, one being nanometric and the other one micrometric, that we synthesized and characterized. It could be demonstrated that sulphate replaces chloride in the interlayer space. These experiments shed light on the relationship between structure and reactivity of these phases.

Keywords: Hydromorphic soils, green rusts, anion exchange, XRD, synchrotron

*Speaker

†Corresponding author

Palaeoenvironmental reconstruction and integrated stratigraphy of Upper Cretaceous sedimentary rocks deposited on the North German epicontinental shelf

Michaela Berensmeier ^{*† 1}, Bettina Dölling ², Christian Linnert ³, Markus Wilmsen ¹

¹ Senckenberg Naturhistorische Sammlungen Dresden, Museum für Mineralogie und Geologie (SNSD) – Königsbrücker Landstraße 159, 01109 Dresden, Germany

² Geologischer Dienst NRW (GD NRW) – De-Greiff-Str. 195, 47803 Krefeld, Germany

³ Ruhr University Bochum (RUB) – Universitätsstraße 150, 44801 Bochum, Germany

Three drill cores of Cenomanian–Coniacian sedimentary rocks from the southwestern margin of the Münsterland Cretaceous Basin (MCB, NW Germany) have been logged in detail and interpreted by their facies development and stratigraphy. The studied lithologies are characterized by transgressive conglomerates, glauconitic sandstones (greensands) and spiculitic, silty-sandy marls. Based on characteristic components and fabrics, nine facies types have been differentiated. These facies are associated with inner to proximal middle shelf depositional settings, which are illustrated in a ‘five-component’ facies model. The integrated approach of bio- (mainly calcareous nannofossils) and sequence stratigraphy resulted in the calibration and correlation of the studied strata. The identified 3rd-order depositional sequences are stacked into two 2nd-order cycles and separated by significant sequence boundaries. The herein presented study provides a better understanding of depositional environments and sedimentary dynamics at the southern margin of the late Cretaceous epicontinental sea in northwest Germany. However, the sedimentary setting cannot be explained by the doctrine of uniformity alone because of the massive formation of greensands in nearshore environments.

Keywords: Late Cretaceous, transgression, Münsterland Cretaceous Basin, microfacies, calcareous nannofossils

*Speaker

†Corresponding author

Fossil spiders as a proxy : reconstructing Oise lower Ypresian ecosystem characteristics through comparative multivariate analyses

Benjamin Carbuccia * ¹

¹ Muséum national d'histoire naturelle (MNHN) – Ministère de l'Ecologie, du Développement Durable et de l'Energie, Ministère de l'Enseignement Supérieur et de la Recherche, Muséum National d'Histoire Naturelle (MNHN) – 57, rue Cuvier - 75231 Paris Cedex 05, France

Family-level and, when possible, lower rank taxonomy, has been led on the 154 well-preserved enough spider inclusions from Oise amber (lowermost Eocene, 55-53 Ma B.P.) stored in the MNHN (Paris, France) collections.

After last year's overview and present identifications, the spider paleodiversity in Oise amber now includes 26 families. Statistical estimators predicted a diversity about thirty families, which presently allow us to consider Oise spider fauna as fairly well-known.

In order to extract information on paleoecology and spider macroevolution, we used statistical comparative analyses on 19 extant and 10 fossil faunal assemblages. Because of the high number of absences, non-symmetrical correspondence analysis has been the preferred method.

Ypresian Oise ecosystem has been reconstructed as a hot tropical environment, with a very wet season; a strong affinity with Palaeotropical and Australasian extant faunas has also been highlighted. These results match the statistically untested previous ecosystem reconstructions.

The habitat sampled by Oise amber seems to be higher strata of an open, evergreen forest.

Furthermore, the analyses highlight a marked difference between Mesozoic and Cenozoic faunas, that have been attributed to a major diversification of some spider groups, Dionycha in particular, between terminal Campanian and lowermost Eocene. Besides, the middle Eocene Central European spider assemblages seem fairly distinct from Oise fauna, which could be caused by lower Eocene major climate change.

This work is a first, surprisingly conclusive try, that is intended to be improved and extended, notably by an enrichment of the faunal samples, and the use of additional methods and taxa.

Keywords: Ypresian, paleoecology, spiders, faunistics, macroevolution, amber, taxonomy

*Speaker

Evolutionary investigation of the biomineralization of dolomite by EPS-forming bacteria from Lagoa Vermelha in Rio de Janeiro, Brazil

Bianca BRENHA ^{*1}, Douglas GALANTE² and Mónica SÁNCHEZ-ROMÁN³.

¹ Institute of Biology, University of Campinas; Brazilian Synchrotron Light Laboratory - LNLS/CNPEM

² Brazilian Synchrotron Light Laboratory - LNLS/CNPEM

³ Vrije Universiteit Amsterdam – VU/Faculty of Earth and Life Sciences

The precipitation of dolomite in the Earth's modern sedimentary environments occurs, for the most part, mediated by microorganisms. The way in which bacteria are capable of facilitating or inducing mineral precipitation has not yet been fully elucidated. However, it is known that extracellular polymeric substances secreted by bacteria facilitate the mineral nucleation and precipitation by creating an ideal physico-chemical environment for mineral formation, in this case, of dolomite. The secretion of EPS is widespread among microorganisms and can perform several roles, including a common mechanism for protecting extremophiles from adverse conditions. In the present project, the bacterial capability of bioprecipitation of dolomite was investigated and will represent a major step towards understanding the biomineralization phenomenon occurring in extreme environments since a geomicrobiological and biogeochemical perspective. The samples collected in Lagoa Vermelha (Araruama, RJ) was used for isolation and subsequent identification by 16S rRNA of EPS producing bacteria at CNPEM in Brazil. The ability to produce bioprecipitates, will be studied by analytical techniques as X-ray diffractometer and scanning electron microscope at Vrije Universiteit Amsterdam in The Netherlands. Then, the isolates will be submitted to environmental simulations, varying UV radiation and salinity, the resulting samples will be analyzed to evaluate the survival of the colonies according to the different parameters by counting colony forming units. In this way, it will be possible to verify if bacteria capable of precipitation of biominerals, like dolomite, are more tolerant to conditions of extreme environments, in relation to the others that live in the same environment.

Keywords: Bioprecipitation, Dolomite, Extremophiles

*Corresponding author

Rift related sedimentary and fluids evolution: the case study of the Alpine Tethys rifted margin

Théobald Guffon ^{*† 1}, Emmanuelle Laizay ^{* ‡ 1}, Charlotte Ribes ¹, Nicolò Incerpi ¹, Anne Marie Karpoff ¹, Gianreto Manatschal ¹

¹ Institut de Physique du Globe de Strasbourg – Institut de Physique du Globe de Strasbourg, UMR7516 CNRS / Université de Strasbourg / EOST – 1 rue Blessig 67084 Strasbourg, France

In the last decades several studies described the tectono-stratigraphic evolution of continental rifted margins, which led to a complex final architecture characterized by four main domains: the proximal margin, the necking zone, the distal margin and the ocean-continent transition. Nonetheless, both the sedimentary and fluid flow evolution, related to the extensional rifting phases, are still poorly constrained.

The aim of this multidisciplinary study is to combine sedimentology, petrography and geochemistry in order to link the sedimentary and fluid histories along with the rifted margin evolution.

The study areas belong to the Austroalpine and Penninic units exposed in the Central Alps at the border between N Italy and SE Switzerland, where remnants of the Adriatic paleo-rifted margin are spectacularly preserved.

This work, based on detailed fieldwork, is divided in 2 projects:

The project A focuses on the first sediments deposited over the exhumed mantle domain such as: radiolarites, sedimentary breccias and alteration sediments. The aim is to figure out the complex interaction between biogenic production, hydrothermal activity and detritism.

The project B focuses on fluid circulation in pre- and syn- tectonic sediments in two areas belonging to the former proximal and distal domains. The aim of the study is to understand the fluid activity in different rifting settings dominated by different rift-related structures. These structures may play a key role in determining the geochemical characteristics of the fluids. The final purpose is then to combine different approaches to improve the comprehension of the tectono-sedimentary and fluid evolution of a rifted margin.

Keywords: Fluids, Sediments, Rifted margin, Alpine Tethys margin, Austroalpine unit, Penninic unit

*Speaker

†Corresponding authors

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Metals anomalies in foraminiferal shells as indicators for industrial pollution: a case study from the Mediterranean coast of Tunisia.

Ali Lamourou ^{*† 2,1}, Jamel Tourir ², Nathalie Fagel ¹

² Laboratory 3E (Water-Energy-Environment) – National School of Engineers of Sfax (ENIS),
University of Sfax, 3038 Sfax, Tunisia, Tunisia

¹ AGEs, Argiles, Géochimie et Environnement sédimentaires – Department of Geology, University of Liège, B18, Quartier Agora, 14 Allée du 6 Août, B-4000 Liège, Belgium, Belgium

In recent years we have been witnessing a considerable growth of industrial facilities along coastal areas. Some of these have major economical and national importance yet their operation can introduce a wide range of chemicals that might contaminate the coastal area and impact local ecosystems and our health. Among some of these harmful chemicals are metals that are introduced to the coastal environment by some of these facilities. Here we present a novel approach for monitoring low-level industrial pollution in coastal environments based on anomalies in metal concentration within foraminiferal shells. The comparative study between the faunal content and the heavy metals enrichments in each sample displayed positive character indicating the worsening of the environmental conditions. Sediment cores retrieved along the northern coast of Sfax (Southeastern Tunisia) are used to monitor the response of benthic foraminifera to modern pollution and environmental stress. 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 pertusus*, *Miliolidae*, *Peneroplis pertusus*, *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.

Keywords: Benthic foraminifera, Abnormal tests, Holocene, Bio indicators, Sediments, Sfax Tunisia

*Speaker

†Corresponding author

New data on the vertebrates from the Anoual Syncline (Eastern Morocco): implications for African and Gondwanan vertebrate evolution throughout the Jurassic-Cretaceous transition

Maxime Lasseron *¹, Emmanuel Gheerbrant¹, Nour-Eddine Jalil^{1,2}, Ronan Allain¹, Jean-Claude Rage¹, Hamid Haddoumi³, Samir Zouhri⁴

¹ Centre de Recherche sur la Paléobiodiversité et les Paléoenvironnements (CR2P) – Université Pierre et Marie Curie (UPMC) - Paris VI, CNRS : UMR7207, Muséum National d'Histoire Naturelle (MNHN) – 8 rue Buffon, CP 38, Paris, France

² Université Cadi Ayyad (UCA) – Avenue Abdelkrim El Khattabi, Marrakech, Morocco

³ Université Mohammed Ier (UMP) – Boulevard Mohammed VI, Oujda, Morocco

⁴ Université Hassan II Ain Chock (UH2C) – route de l'université, Casablanca, Morocco

The Jurassic-Cretaceous transition is a critical period for continental vertebrate evolution. It is time of emergence of some major modern terrestrial vertebrate groups and of the angiosperms, in the key paleogeographic context of Pangea fragmentation and early evolution of Gondwanan and Laurasian faunas.

This work aims to improve our very poor knowledge of Gondwanan and especially African faunal evolution at this time, with the study (systematics, biodiversity, paleoenvironment, paleobiogeography and biostratigraphy) of the two successive Moroccan microvertebrate faunas of Ksar Metlili (Early Cretaceous?) and Guelb el Ahmar (Middle Jurassic) from the Anoual Syncline, which are among the richest known for the Mesozoic of the whole Gondwana.

More than 24,500 microvertebrate remains, representing 28 species of 8 main groups, from selachians to mammals, were identified and studied using comparative anatomy, taxonomic, taphonomic and statistical approaches. The Ksar Metlili fauna includes remarkable taxa such as the oldest therian mammals from Gondwana (and the richest Mesozoic mammal assemblage), a basal ornithopod, some of the last known non-mammalian cynodonts, a possibly freshwater teleosaurid crocodylomorph, and some of the scarce choristoderan reptiles and albanerpetontids amphibians known from Gondwana. A large scale faunal comparative study of Ksar Metlili demonstrates noticeable Laurasian affinities (if not a vicariant Pangean inheritance) but few Gondwanan ones, suggesting peculiar paleobiogeographical relations of Africa within Gondwana at the Jurassic-Cretaceous transition. Finally, faunal similarities between Guelb el Ahmar and Ksar Metlili question the Early Cretaceous age of the latter, and instead advocate a more likely Jurassic and at least a Late Jurassic age.

Keywords: microvertebrates, Jurassic/Cretaceous transition, Morocco, Africa, Gondwana, paleobiodiversity

*Speaker

Evolutionary Ecology

Why do *Pheidole oxyops* ants place feathers around their nests?

Inácio Gomes ^{*†1}, Diogo Santiago ², Heraldo Vasconcelos ³

¹ Universidade Federal de Viçosa (UFV) – Viçosa/MG, Brazil

² Universidade Federal de São Carlos (UFSCar) – São Carlos/SP, Brazil

³ Universidade Federal de Uberlândia (UFU) – Uberlândia/MG, Brazil

The ant species *Pheidole oxyops* has the behavior of placing feathers on the edge of their nests entrances. Due to this habit, we aim to answer the question: why do *Pheidole oxyops* ants place feathers around their nests? We tested two hypothesis (1) *P. oxyops* use feathers for obtaining water, as feathers may act as night moisture retainers and (2) *P. oxyops* use feathers for arthropod attraction, due to its essentially carnivore diet and its particular nest structure, which acts as pitfall traps. We collected data from a natural reserve in the Brazilian savanna. To test hypothesis (1), we chose 28 nests of *P. oxyops* and removed feathers from their edges. After 24h, we placed hydrophilic cotton balls around 14 nests (treatment group). Cotton balls were moistened every 12h, during 72h to act as a water source for ants. In the other group, new feathers were removed during the same 72h (control group). Hereafter, a full hand of new feathers was offered to all nests. We expected that the control group would collect more feathers, as it had a lower water supply. To test hypothesis (2), we established two plots with 20 pitfall traps in each one. In each plot, 15 feathers were placed around 10 randomly selected traps. We expected that feathers around pitfalls would result in a capture of more species and higher abundance of arthropods. Only hypothesis (2) was accepted. These results indicate that feathers enhance the capture rate of arthropod prey by *P. oxyops*.

Keywords: *P. oxyops*, feathers, ants, behavior, prey capture, water supply

*Speaker

†Corresponding author

Behavioral ecology of necrophagous Diptera larvae: adaptative strategies to carrion ecosystem

Quentin Fouche ^{*† 1}, Valery Hedouin ¹, Charabidze Damien ¹

¹ EA 7367 - Unite de Taphonomie Medico-Legale (UTML) – Université de Lille, Droit et Santé – Place de Verdun 59045 LILLE, France

Animal adaptations are closely related to their living environment. In carrion ecosystem, animals face strong environmental pressures linked to the ephemeral and unpredictable nature of carrions. To adapt to these constraints, they have to locate and consume the carcass quickly for fulfilling their development before carrion disappearance. In calliphorid flies, larvae develop on carrion and form large masses gathering hundreds to thousands of individuals, which often include several species. These aggregations increase larval development speed and survival (Allee effect). Moreover, necrophagous larvae secrete antimicrobial compounds, allowing them to compete with microbes for carrion consumption. The aim of this PhD project is to study insects' behavioral adaptations to carrion ecosystem, focusing especially on the gregarious behavior of necrophagous Diptera larvae. First experiments studied the effect of interspecific cues on the behavior of larvae placed in binary choice tests. Results demonstrated that larvae leave a mark locally which is retentive, has an interspecific range and whose the effect increases with its concentration and varies between species. According to the self-organization theory, this larval mark can promote interspecific aggregations. One benefit of such gathering could be to outcompete microbes by sharing antimicrobial defenses between species. To test this hypothesis, coming experiments will compare larval fitness in controlled environments varying according to the bacterial concentration, the larval density and the species composition. If the fitness is greater in interspecific groups reared in bacterial-infected environment, then it will be the first demonstration that an Allee effect can be achieved through interspecific aggregations and social immunity.

Keywords: behavioral adaptation, blow fly larvae, interspecific aggregation, Allee effect, self organization, interkingdom competition

*Speaker

†Corresponding author

Pre-existing differences in fertility signals give workers the upper hand in reproductive hierarchies of *Neoponera Apicalis* Latreille, 1802, Hymenoptera, Formicidae

Romain Honorio ^{*†} ¹, Stéphane Chameron ², Nicolas Châline ³

¹ Institut d'Ecologie et des Sciences de l'Environnement de Paris (iEES) – Centre National de la Recherche Scientifique : UMR7618 – UPMC, campus de Jussieu - Tour 34/44 - Paris (75005), France

² Laboratoire d'Éthologie Expérimentale et Comparée (LEEC) – université Paris 13 : EA4443 – UFR Lettres, Sciences de l'Homme et des Sociétés, Université Paris 13, 99 avenue Jean-Baptiste Clément, F-93430, Villetaneuse, France

³ Departamento de Psicologia Experimental, Instituto de Psicologia (IPUSP) – Universidade de São Paulo, SP, Brazil, Brazil

Dominance hierarchies often regulate the conflicts associated with resource acquisition inherent to social groups. In the species *Neoponera apicalis*, a linear hierarchy between workers quickly establishes when the queen disappears in order to regulate the open conflict for male production. This final bout of reproduction increases the colony fitness and because the worker force cannot be replaced, prompt conflict resolution is needed to optimize the group reproduction. Hierarchies are established through ritualized agonistic interactions between the workers, with the winners succeeding high ranks and subsequent access to reproduction. Nonetheless, a recent study showed that idiosyncratic differences related to fertility already exist in the presence of the queen, leading to the hypothesis that these differences might influence victory in the fights that follow the queen loss and favour the access of certain individuals to the top of the hierarchy. In this study, we sought to characterize the influence of the initial heterogeneity in ovarian development and its correlates (chemical and behavioural) on the establishment of reproductive hierarchies among groups of orphaned worker. We monitored the chemical profile of workers before and after hierarchy establishment and followed four groups of 15 individually marked workers for 10 days after experimental queen removal. We observed aggressive behaviour and recorded winners and losers to establish workers' ranks in the hierarchy using the glicko rating method. Dissections allowed the assessment of ovarian activation. The observation of the dynamics of agonistic behaviour confirmed the rapidity of hierarchy establishment over a period of 48h after the queen loss. The analysis of the cuticular profiles revealed that tricosane (nC23) is a putative fertility signal highly correlated with ovarian development.

*Speaker

†Corresponding author

Interestingly, the relative amount of tricosane on the cuticle before and after the establishment of the hierarchy was also correlated with the rank achieved within the hierarchy and the intensity in the expression of agonistic behaviour, suggesting associated differences in individual motivation to fight. Thus, our study experimentally shows for the first time that differences in ovarian activity between workers, in the presence of the queen, result in chemical signalling related to the regulation of the dominance/submission behaviours expressed during the establishment of the hierarchy. This enables the most fertile workers to access higher ranks in the hierarchy more easily and quickly and monopolize reproduction accordingly, maximizing the global reproductive success of all individuals in the group while minimizing the costs associated with the expression of agonistic behaviour.

Keywords: ants, reproductive hierarchy, agonistic interaction, chemical signal

Can climate affect the seeds size of common weed? A case of the *Capsella bursa-pastoris* (L.) Medik.

Patryk Mieszkowicz *¹, Liudmyla Zavialova², Oksana Kucher³,
Kiedrzyński Marcin⁴, Rewicz Agnieszka^{† 4}

¹ Student Research Group Botanical Section, Faculty of Biology and Environmental Protection, University of Lodz – Banacha str. 12/17, 90-237 Lodz, Poland

² Department of Systematics and Floristics of Vascular Plants, M.G. Kholodny Institute of Botany NAS of Ukraine – Tereshchenkivska str. 2, 01004 Kyiv, Ukraine

³ Department of Geobotany and Ecology, M.G. Kholodny Institute of Botany NAS of Ukraine – Tereshchenkivska str. 2, 01004 Kyiv, Ukraine

⁴ Department of Geobotany and Plant Ecology, University of Lodz – Banacha 12/16, Łódź 90-237, Poland

Larger seed size may be a response to both competition and stress that provides comparable survival advantages along environmental gradients. The main goal of this work was to investigate the phenotypic plasticity of *Capsella bursa-pastoris* seeds in throughout the range of the species. Data on size and morphological variation of seeds of this common weed are scarce in the literature. Our study aimed at: i) analyzing the variability of the traits of seeds compared to climatic parameters, ii) checking if the seeds morphometric traits could be significant in analysis of intraspecific variation.

Seeds were (146 populations from 26 countries) collected during field trips spanning 2015-2017 and obtained also from Herbaria (AAH, KW, KWHA, KWHU, S, SO, TAM). Four biometric traits with the use of a Nikon SMZ-800 dS-fi optical stereomicroscope were analyzed: length, width, perimeter and area as well as seed mass. Seeds sculpture were analysed with using a scanning electron microscope (SEM, - Phenom Pro X). Localities were described with using nineteen climatic parameters from the WordClim database.

We assumed, that morphological variation of investigated traits depends on environmental conditions. Local impact and available resources have stronger impact on plant grow and the metric characteristics of the seed. Different forms of plants (winter-annual, spring-annual, ephemeras) are grow in the different environmental conditions. The winter-annual form can be overwinter in the flowering phase. According to this peculiarities of life-history traits of *C. bursa-pastoris* plants the length, width, perimeter and area of the seed ratio can ring the changes on.

Keywords: *Capsella bursa, pastoris*, shepherd's purse, variability of seeds, WordClim, taxonomy, ultrastructure

*Speaker

†Corresponding author

Protection of Orchidaceae species vs nature reserves of Central Poland

Aleksandra Nowacka * ¹, Paulina Grzelak ², Agnieszka Rewicz ³

¹ Student Research Group of Biologist Botanical Section, Faculty of Biology and Environmental Protection, University of Lodz, Banacha str. 12/17, 90-237 Lodz, Poland – Banacha str. 12/17, 90-237 Lodz, Poland, Poland

² Society of Landscape Protection, Wigury str. 12 a, 90-301 Lodz, Poland – Wigury str. 12 a, 90-301 Lodz, Poland, Poland

³ Department of Geobotany and Plant Ecology, Faculty of Biology and Environmental Protection, University of Lodz, Banacha str. 12/17, 90-237 Lodz, Poland – Banacha str. 12/17, 90-237 Lodz, Poland, Poland

Introduction: *Orchidaceae* is a cosmopolitan plant family which contains the greatest estimated number of species among all vascular plants. On the other hand, this is also the most endangered species group all over the world. The aim of this research was an analysis of the *Orchidaceae* species occurrence in 87 nature reserves in Central Poland. We have posed following questions: 1) which species are the most often and which are the most rarely met in the studied nature reserves, 2) which habitats are the most popular and attractive for *Orchidaceae* species in these nature reserves, 3) is the group of species occurring in the reserves similar to species occurring in the whole area of Central Poland and in Poland, 4) does protection of nature reserves help to keep *Orchidaceae* species.

Method: Analysis for this research has been prepared in the period as of November 2016 until February 2017. Data for this analysis of the occurrence of *Orchidaceae* species in the nature reserves of Central Poland has been collected from the reserves' protection plans, literature and oral information.

Results: A number of 14 species belonging to 7 genders has been described from the studied nature reserves (comparing to 26 species occurring in the area of Central Poland and 46 occurring in Poland). The most common species was *Epipactis helleborine* described in 27 nature reserves. The rarest species, with only single locations, were: *Cephalanthera damasonium*, *Corallorhiza trifida*, *Epipactis atrorubens*, *Epipactis purpurata*. *Orchidaceae* species have not been found in 46 nature reserves.

Keywords: Orchidaceae, nature reserves, Poland, flora, protection, *Epipactis helleborine*

*Speaker

The effects of inbreeding depression on phenotypic plasticity of parental care

Tom Ratz * ¹, Jacob Moorad , Per Smiseth

¹ Institute of Evolutionary Biology, University of Edinburgh (IEB) – Charlotte Auerbach Road, Edinburgh, EH9 3FL, United Kingdom

It is well known that inbreeding has negative impacts on traits related to reproduction and survival. There is growing evidence that the severity of this inbreeding depression is context-dependent, and that its expression is often amplified in stressful environments. It has been hypothesised that inbred individuals are less able to cope with extreme environments because they show decreased phenotypic plasticity in response to changes in their environments compared to outbred ones. This hypothesis, however, has received little attention and, thus far, developmental plasticity is the only type of plasticity for which inbreeding depression has been explored. It therefore remains unclear whether inbreeding could affect traits with reversible plasticity, such as behaviours, where flexibility in changing environments may have major consequences for fitness. Parental care is a key trait in this context, because parental decisions in response to the social environment, such as brood size may be critical for the fitness of the parent and its offspring. Here we investigate the consequences of inbreeding on plasticity of parenting behaviour across different brood sizes in male and female parents using the burying beetle *Nicrophorus vespilloides*, a species where both parents provide care and are also known to respond strongly to variation in brood size. This study is the first to investigate how inbreeding affects reversible behavioural plasticity and the dynamics of flexible parenting. In theory, inbred individuals are predicted to show a lower plastic response to variation in brood size than outbred individuals because of their lower ability to detect and/or respond to environmental cues due to inbreeding depression. As female burying beetles provide on average more care than males, females may be expected to be able to adjust their care across a wider range and show higher levels of plasticity independently of their inbreeding status.

Keywords: Flexible parenting, genotype, by, environment interaction, inbreeding, social environment

*Speaker

Sex is just about abandoning yourself

Océane Seudre ^{*† 1}, Alice Namias ², Guillaume Dasilva ¹, Olivia Gardella ³, Pierre-Henri Gouyon ¹, Manuela López Villavicencio ^{‡ 1}

¹ Institut de Systématique, Évolution, Biodiversité. UMR 7205 CNRS, MNHN, UPMC, EPHE (ISYEB) – Museum National d’Histoire Naturelle - MNHN (FRANCE) – 57 rue Cuvier, CP 39, 75005 Paris, France

² PSL Research University (PSL) – Ecole Normale Supérieure de Paris - ENS Paris – 46 rue d’Ulm 75005 Paris, France

³ Facultad de Agronomía - Universidad de Buenos Aires – Capital Federal San Martín 4453 C1417DSE Buenos Aires, Argentina

The majority of eukaryotes engage in sex, at least occasionally. Why maintain this costly behavior? The evolution of sex has been amongst the most debated issues in evolutionary biology, especially when considering the pros and cons of recombination. In particular, the conditions in which its benefits would be sufficient enough to avoid asexual lineage invasion in the short term lacks clarification. The abandon-ship hypothesis states that recombination is a way for organisms to ” abandon themselves ”, providing an opportunity for low-fitness individuals to get rid of deleterious allelic combinations in a stressful environment. We aimed to test this hypothesis by using the filamentous fungus *Aspergillus nidulans* as it’s capable of both outcrossing and haploid selfing.

Two of the five strains used in the current study exhibited an increase in their outcrossing rate when crosses took place under stressful conditions compared to non-stressful ones. When the genetic distances were investigated, it was found that lower outcrossing rates always involved genetically distant strains.

These findings (i) reinforce the abandon-ship hypothesis: ” sex is worth it when you’re stressed!” (ii) suggest that mechanisms of reproductive isolation could act in *Aspergillus nidulans*: ” this doesn’t work with everybody! ”. To uncover more about this abandoning story, we suggest a deeper investigation of compatibility and mate choice issues, which would be made possible by a broad population analysis.

Keywords: evolution of sex, outcrossing, sexual reproduction, abandonship, homothallic species

*Speaker

†Corresponding authors

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Do the red wood ants (*Formica polyctena*, *F. rufa*, *F. pratensis*) have fungal symbionts?

Igor Siedlecki ^{*† 1}, Alicja Okraśińska ¹, Julia Pawłowska ², Marta Wrzosek ¹

¹ Department of Molecular Phylogenetics and Evolution, University of Warsaw – ul. Żwirki i Wigury 101, 02-089 Warszawa, Poland

² Department of Molecular Phylogenetics and Evolution, University of Warsaw – Żwirki i Wigury 101, 02-089 Warsaw, Poland

Recent studies have shown that ant-fungi interactions may be much more common, than previously thought. The character of those relations may range from parasitic (*Pandora formica*; *Ophiocordyceps unilateralis*) to mutualistic (carton ants and Chaetothyriales; Attini and Lepiotaceae). While there are examples of ant-parasitic microfungi in the temperate climate, the mutualistic relation between these two groups have not been observed yet. The purpose of this study was to investigate the mycobiota of the red wood ants (*Formica polyctena*, *F. rufa*, *F. pratensis*), in order to find potential fungal species, whose presence in the colony may be beneficial for the ants. In this work 589 ants from 23 ant nests were analyzed. Dead individuals were placed on culture media (SDA, YEA) and then the fungal colonies, which grew from the ants' cadavers were identified. Fungal isolates were assigned to 120 morphotypes. The strains from the genus *Penicillium* were the most frequently isolated. The yeasts from genera *Schwanniomyces* and *Debaryomyces* were found on the ants from 55% of the anthills. Some unusual species from Mucoraceae and Mortierellaceae families were found, including the discovery of a new fungal species: *Mortierella formicae* sp. Nov., associated with *F. pratensis* ants. The phylogenetic analyses showed that all *Mortierella* strains found on ants belong to 'lignicola' clade. While the production of gemmae (big, swollen cells filled with oil droplets) is characteristic for this fungi group, the unique character of *M. formicae* is to form a dense and thick clusters of those enlarged cells.

Keywords: *Mortierella formicae*, 'Formica rufa' group, symbiosis, *Penicillium*, *Schwanniomyces*, ant, fungi interactions

*Speaker

†Corresponding author

Impact of predation risk on bird growth and the development of thermoregulation

Jakub Vrana ^{*† 1}, Nikola Kolarova ^{*}

¹, Vladimir Remes ^{*}

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¹ Department of Zoology and Lab of Ornithology, Faculty of Science, Palacky University – 17. listopadu 50 771 46 Olomouc, Czech Republic

Growth of young plays a key role in future survival and reproduction of all individuals. Growth rate of body mass and extremities, and development rate of physiological functions (e.g. thermoregulation) are plastic and can respond adaptively to many ecological and behavioural factors. We thus studied an impact of predation risk on the growth of several biometrics (body mass, tarsus and wing length) and the development of thermoregulation in young Great Tits (*Parus major*). Our study was conducted in flood-plain forest near Grygov (coordinates: 49.54N, 17.31E, altitude: 204 m., Olomouc district, the Czech Republic) in 2015-2017. We displayed stuffed models of sparrowhawk (*Accipiter nisus*, adult predator), great-spotted woodpecker (*Dentrocopos major*, nest predator) and song thrush (*Turdus philomelos*, control) while playing their voices from a portable loudspeaker. The nestlings were weighed and measured on days 6, 10 and 14 after hatching. Measurement of body temperature was made daily from day 4 to day 14 after hatching and a homeothermy index was used as an indicator of thermoregulatory ability. We found faster growth of tarsus and wing length under higher risk of adult predation. However, the development of thermoregulation was slower for both predator treatments. Overall, our results reveal complicated relationships between various traits in avian ontogeny and shed light on the evolution of bird ecology and physiology.

Keywords: life, history, post, natal growth, predation risk, thermoregulation, birds, Great tit

*Speaker

†Corresponding author

Plant evolution further threatens declining pollinator populations

Avril Weinbach ^{*† 1,2}, Nicolas Loeuille ¹, Rudolf Rohr ²

¹ Institut of Ecology and Environmental Sciences, Paris (iEES - Paris) – iEES - Paris – Université Pierre-et-Marie-Curie (UPMC) Bâtiment 44-45 - 4e étage Case Courrier 237 4, place Jussieu 75252 PARIS cedex 5, France

² Ecology Evolution, Department of Biology, University of Fribourg (UniFr) – Department of Biology Ecology Evolution Chemin du Musée 10 CH-1700 Fribourg, Switzerland

Recent pollinator population declines raise concerns for the future of the pollination service. It also strongly affects the evolution of plant-pollinated species. We wonder if plant evolution can help maintaining plant-pollinator coexistence in this pollination crisis context. We build a simple pollinator-plant model that assumes an allocation trade-off between the attractiveness of the plant (e.g. nectar production, flower shape and size) and its intrinsic growth rate. Using eco-evolutionary dynamics, we investigate the evolution of plant investment in attractiveness and its consequences on species persistence, biomasses production, and interaction intensity (as a proxy for pollination services). Especially, we study the role of the allocation trade-off shape and the mutualistic interaction asymmetry on the eco-evolutionary dynamics. First, we show that only a concave allocation trade-off allows the existence of evolutionary stable strategy with coexistence of both the plant and the pollinator. Second, a decreasing intrinsic growth of pollinator population (modeling the current population decline) is most likely to results in a plant-driven disappearance of the mutualistic interaction accompanied by the extinction of the pollinator population. However, asymmetry in mutualistic interaction that is beneficial for the pollinator might help maintaining its population. Therefore, our model undercover that in addition to the direct effects due to changes in ecological dynamics, pollinator populations may be further weakened by evolutionary trajectories in the plant populations. Our results also suggest that if actions are taken to save endangered pollinator populations, they need to be enforced early enough to prevent potential negative effects of plant-driven evolution.

Keywords: mutualistic interactions, adaptive dynamics, plant attractiveness, pollinator decline, evolutionary murder, asymmetrical interactions

*Speaker

†Corresponding author

Host specificity of fig-pollinating wasp associated with the breeding system of host *Ficus*

Li-Yuan Yang ^{*† 1}, Carlos Machado , Wan-Jin Liao , Da-Yong Zhang

¹ Li-Yuan Yang – Xian, China

Differences in breeding system are associated with correlated ecological and morphological changes in plants. In *Ficus*, dioecy and monoecy are strongly associated with different suites of traits (tree height, population density, fruiting frequency, pollinator dispersal ecology). Conducting a meta-analysis of molecular data from pollinators of 119 fig species we found notable differences in the origin of co-pollinators between monoecious and dioecious figs. In monoecious figs, the co-pollinators result from either host switching (co-pollinators show non-sister relationships in phylogeny) or duplication (i.e. pollinator wasp speciation within the same host fig species; co-pollinators show sister relationships in phylogeny), while the co-pollinators in dioecious figs are due only to duplication. Because the host switching indicated loosen of specificity, these evidence imply that the fig-fig wasp specificity in dioecious figs is stricter than in monoecious figs. Speciation pattern was the first example to test the specificity biased between two breeding system of *Ficus*. Furthermore, using the phylogenetic data of 200 *Ficus* species, we found the loosen host specificity of fig pollinating wasps associated with monoecious figs caused the more hybridization and species diversify in monoecious *Ficus*. Using the fig-fig pollinating wasp system, this work presented how the plant traits affect the pollinator behavior and in the meantime, the pollinator behavior influent plant speciation.

Keywords: Breeding system, Cospeciation, *Ficus*, Fig pollinating wasp, Host specificity, Hybridization

*Speaker

†Corresponding author

Methods in Natural Sciences

Reassessment of the phylogenetic position of the large-sized armadillo *Dasypus bellus*† (Xenarthra) thanks to microtomography and to a new coding protocol using geometric morphometrics

Rémi Lefebvre ^{*† 1,2}, Guillaume Billet ¹, Lionel Hautier ³

¹ Centre de recherche sur la Paléobiodiversité et les Paléoenvironnements (CR2P) – Museum National d’Histoire Naturelle, Université Pierre et Marie Curie - Paris 6, Centre National de la Recherche Scientifique : UMR7207 – 8 rue Buffon, CP 38, France

² Mécanismes adaptatifs : des organismes aux communautés (MECADEV) – Museum National d’Histoire Naturelle : UMR7179, Centre National de la Recherche Scientifique : UMR7179 – UMR 7179, 1 avenue du Petit Château 91800 Brunoy, 55 rue Buffon 75321 Paris Cedex 5, France

³ Institut des Sciences de l’Évolution [Montpellier] (ISEM) – Université de Montpellier, Institut de recherche pour le développement [IRD] : UR226, Centre National de la Recherche Scientifique : UMR5554 – Place E. Bataillon CC 064 34095 Montpellier Cedex 05, France

The phylogeny of long-nosed armadillos, nowadays only represented by the genus *Dasypus*, represents an example of the recurrent conflict within placental mammals between morphological-based and molecular-based studies.

An ongoing project, which combines comparative anatomy, geometric morphometrics and phylogenomics, is challenging the traditional species delimitation of extant long-nosed armadillos, suggesting a taxonomic review of the most widespread species, the nine-banded armadillo (*Dasypus novemcinctus*). With this new framework, the phylogenetic position of the largest-sized fossil, *Dasypus bellus*†, is reconsidered.

To do so, we first used X-Ray microtomography, which allowed to find new characters on internal structures, and to extract 3D models of skulls. Second, we highlighted main shape differences of our sample thanks to geometric morphometrics. In order to use this information for phylogenetic reconstruction, we developed an innovative coding protocol using standardized distances between selected landmarks as continuous characters. Our phylogenetic analysis of a pre-existing matrix completed with the newly defined traits permits to find that *Dasypus bellus* is comprised in a clade containing subgroups from the debated *Dasypus novemcinctus* species complex. The herein proposed protocol permits to search and to code characters on subtle-variations traits that would probably not be detected without using geometric morphometrics. The method provides clearly defined and repeatable continuous characters, and avoids methodological issues encountered by other landmark-based phylogenetic methods. Moreover, it accounts for size effects linked to allometry during the coding step. Finally, implications of the present study for the long-nosed armadillos phylogeny and potential developments of the protocol proposed here will be discussed

Keywords: phylogeny, geometric morphometrics, landmarks, internal anatomy, armadillos

*Speaker

†Corresponding author

COMPARISON OF METHODS FOR ASSESSING THE STATUS OF THORNBACK RAY

Florianne Marandel ^{*† 1}, Pascal Lorance ¹, Olivier Berthele ¹,
Jean-Baptiste Lamy ², Sabrina Le Cam ², Robin Waples ³, Verena
Trenkel ¹

¹ Institut Français de Recherche pour l'Exploitation de la Mer - Nantes (IFREMER Nantes) – Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) – Rue de l'Île d'Yeu - BP 21105 - 44311 Nantes Cedex 03, France

² Institut Français de Recherche pour l'Exploitation de la Mer - La Tremblade (IFREMER La Tremblade) – Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) – Avenue de Mus de Loup, 17390 La Tremblade, France

³ NOAA - Northwest Fisheries Sciences Center (NWFSC NOAA) – 2725 Montlake Blvd E, Seattle, WA 98112, United States

As for many more species of sharks and rays, populations of the thornback ray (*Raja clavata*) declined during the 20th century. Estimating the status of these species can be challenging due to low samples sizes in monitoring programs. We will present the results from applying traditional and genetic methods for estimating the population status of thornback ray (*Raja clavata*) in the Bay of Biscay. A Bayesian state-space model provided biomass trajectories based on commercial landings and research vessel CPUE. The results confirmed the depletion of the population but were also highly uncertain due to uncertainties of catch and survey data and lack of biological knowledge. Using simulations, we evaluated the conditions for using effective population size (N_e) to inform on population status. We focused on suitable sampling designs and the maximum population size for which sufficiently reliable estimates might be obtained. A large genetic data set was simulated and used for estimating N_e with two methods (Linkage Disequilibrium and Temporal). First results indicated a high estimation bias (underestimation with Linkage Disequilibrium, overestimation with temporal method), with low precision even for small absolute population sizes (1 000 individuals). These results compromise the estimation of N_e from empiric data. Both assessment methods suffer from a lack of precision, moreover genetic method suffers from severe bias whereas traditional method suffers from lack of reliability of time-series of catch data and high variance in survey data. However both are able to reflect situations where populations 'conservation is a concern.

Keywords: skates and rays, Bayesian modelling, effective population size, Linkage Disequilibrium, Temporal method, management

*Speaker

†Corresponding author

Contribution of Geographic Information System in definition of human activity areas in Middle Palaeolithic. Examples of Caours and Beauvais (France).

Gwénaëlle Moreau * , Gwénaëlle Moreau * † ¹, Jean-Luc Locht ²,
Marylène Patou-Mathis ³, Patrick Auguste

¹ Service de Préhistoire, Université de Liège (BELGIUM) (Ulg) – Université de Liège, Service de Préhistoire, Place du XX août, 7 (bât. A1) B-4000 Liège, Belgium

² Laboratoire de géographie physique (LGP) – Ministère de l'Enseignement Supérieur et de la Recherche Scientifique – bat. Y 1 Place Aristide Briand 92195 MEUDON CEDEX, France

³ Histoire naturelle de l'Homme préhistorique (HNHP) – CNRS : UMR7194, Muséum National d'Histoire Naturelle (MNHN) – Institut de Paléontologie Humaine 1, rue René Panhard 75013 Paris, France

During the Middle Palaeolithic, northern France was occupied only by Neanderthal. Confronted with an important climatic instability, they had to adapt their way of life and territorial and primary resources management. The study of human settlements and their function in a territory allow a better comprehension of this problematic, essential for this old periods. The intrasite spatial analysis will help us to answer those questions through the description of human activity areas and their interactions, which lead to precise the site's function in a territory. 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 based on a Geographic Information System and rely on sites of Caours and Beauvais (France). They are two open air sites that are exceptionally well preserved and displaying a large amount of faunal and lithic rests. Our protocol's aim is showing the existence of a spatial organisation in form of artefacts concentration area. We first hypothesize with mesh analysis – or density, widely used in archaeology. Nevertheless, this method is limited by subjective choices like that of the mesh analysis. For that reason, we decided to use two other methodologies based on artefacts density but also on the distance between each other: The K-mean Clustering and The Kernel Density Estimation. Then, we will specify these areas function in a life space and their interactions through the spatial distribution of different lithic artefacts and faunal remains.

Keywords: Spatial Analysis, Human Activity Area, Middle Palaeolithic, Northern France, Geographic Information Systems, Archaeozoology

*Speaker

†Corresponding author

A new archaeo-entomological approach from insect's remains found in Newcaledonian cave-dwelling guanos

Jérémy Rollin * ¹, Anne-Marie Sémah ², Romain Garrouste ³, Denis Wirmann ⁴

¹ Muséum national d'Histoire naturelle (MNHN) – Muséum National d'Histoire Naturelle (MNHN), CNRS UMR 7205 ISYEB, UMR 7194 - Histoire Naturelle de l'Homme Préhistorique – 57 Rue Cuvier, 75005 Paris, France

² LE LOCEAN (UMR) – LOCEAN UMR 7159 (IRD, UMR 7194 - Histoire Naturelle de l'Homme Préhistorique – 32, avenue Henri Varagnat 93143 Bondy Cedex, France

³ Institut de Systématique, Evolution, Biodiversité (ISYEB) – CNRS UMR 7205 ISYEB – 43 rue buffon, Paris, France

⁴ LE LOCEAN (LE LOCEAN) – LOCEAN UMR 7159 (IRD – 32, avenue Henri Varagnat 93143 Bondy Cedex., France

Paleoenvironmental studies in New Caledonia allow to characterize guano records as high-resolution environmental archives. The first results of a multidisciplinary guano studies (pollen, d13C, dD and *n*-alkane, Wirmann et al., 2015 ; Sémah et al., 2016 ; Wirmann et al., 2016; Wirmann et al., 2017) highlight the link between strict environmental parameters and predator's diet. Among the several disciplines used to reconstruct the environment from guano, paleoentomology is not usual. Poverty of these studies are explained by the taxonomic complexity of the high fragmentation rates, and lack of ecological data about endemic tropical species. Here, we test the validity of paleoentomological analysis as new environmental proxies. Two kinds of guano were studied: that of the salanganes, *Collocalia spodiopygia*, insectivorous and diurnal and from bats, *Micropterus robustior*, insectivorous and nocturnal. To overcome difficulties, we developed unconventional technical and statistical methods in paleoentomology (Rollin, 2017). First, taxonomically identified insects were used as bioindicators and calibrated statistically with palynological and isotopic data to identify climatic parameters during guano accumulation. Secondly, metabarcoding analysis complements the taxonomic method and identifies the metagenomics perspectives in this context. The last method consists in infrared spectroscopy analysis of chitinous remains. The analysis could reveal relationships between the different guano samples. The results show the possibilities offered by the conjunction of these methods. Pluridisciplinary studies initiated by LOCEAN UMR and the plant/insect associations makes it possible to identify the seasonality and the origin of the environmental changes. Finally we propose these methods as proxy for paleoenvironmental reconstitution, to the benefit of the scientific communities.

Keywords: Paleoentomology – Paleoenvironment – Guano – Taxonomy – Metagenomic – Infrared

*Speaker

List of participants

A

- Abdellah Kouali
- Abgrall Corentin
- Adetola Oyewo
- Aghraz Abdellah
- Agnel Myriam
- Ahr Noelle
- Ait Laaradia Mehdi
- Ait Rahou Youssef
- Aladini Mathilde
- Alliouche Faiza
- Almeida Liliana
- Alves Eduardo
- Alves Cristiana
- Ameer Meriem
- Anna Kondratyeva
- Arkam Majdouline
- Asouam Saadia
- Aubier Thomas
- Aubree Flora
- Ayach Ayoub

B

- Baali Ayoub
- Baczyński Jakub
- Bagherian Yazdi Ali
- Bah Boubacar
- Bao Tong
- Bärenstrauch Margot
- Bastin-Helene Lucie
- Bauret Lucie
- Bekkouche Nicolas
- Belgarn Abdelali
- Belhsaien Kamal
- Ben Abdelhamid Sofien
- Ben Arous Eslem
- Ben Bakrim Widad
- Ben Saad Chiraz
- Benjlil Hinde
- Berensmeier Michaela
- Bettenfeld Pauline
- Bezard Morgan
- Bihadassen Brahim
- Bonade Morgane
- Bouarakia Oussama
- Bouimeja Btissam
- Boukour Basma
- Bouskri Ghizlane
- Boutoumit Soilam

- Bouzahi Jaouad
- Boyle Michael
- Brassard Colline
- Brenha Bianca
- Brondeau Florence
- Bronnert Constance
- Bry Ika Karolina

C

- Cann Paul
- Carbuccia Benjamin
- Carrive Laetitia
- Cavelan Amélie
- Chabain Jules
- Chanca Ingrid
- Charikki Yassine
- Charrier Pierre
- Chau Christine
- Chinga Javiera
- Chummun Valentine
- Costa De Sousa Julia
- Costard Vincent
- Czajka Mariusz
- Czepinski Lukasz

D

- Dacheux Mélanie
- Danecka Weronika
- Dardouri Sana
- Daschek Eva
- Daugustin Thiebaut
- Davesne Donald
- De Moraes Rezende Francisko
- De Moura Cordeiro Thuany
- De Wijze Daniel
- Delamare Irina
- Delaunay Mathilde
- Demay Justine
- Deregnaucourt Isabelle
- Djahnit Nora
- Doukilo Ibtissam
- Dubied Morgane
- Duffaut Chloé

E

- El Azhari Abdellah
- El Ghadraoui Ayoub
- Elloumi Amira
- Elmansour Taoufiq Elhakim

- Elmoslih Abdelkhaleq
- Elpe Christoph
- Escobar Maria Isabella
- Espinoza Campuzano Cesar Augusto
- Ezzaky Youssef

F

- Fau Marine
- Fernandes Garcia Fernanda
- Fernández García Mónica
- Filippo Andréa

G

- Gabrielle Martin
- Ganzar Khadija
- Gasiorowski Ludwik
- Gastineau Adrienne
- Gazaix Antoine
- Godeau Ugoline
- Godlewska Olga
- Gomes Inácio
- Goncalves Adèle
- Gônet Jordan
- Gonzalez Brett
- Gorczak Michał

- Greblo Katja
- Gruson Hugo
- Guffon Théobald
- Guillaud Emilie
- Guiraud Marie

H

- Han Bin
- Han Qiyun
- Herting Julian
- Hong Zhilai
- Honorio Romain
- Hullot Manon

I

- Ihitassen Abderrahim
- Isaza-Toro Estefania

J

- Janc Anaïs
- Jauvion Clement
- Jedrych Marcjanna
- Jeong Dami
- Jolochin Gabriela

K

- Kermarrec Lou
- Khalil Zahra
- Khalloufi Bouziane
- Khammassi Mohamed Ghazi
- Kherroubi Mounir
- Khiraoui Abdelkarim
- Kim Kyungmin
- Knouz Najat
- Komo Larissa
- Korniliou Artemis
- Kouassi Christelle
- Kouvari Miranta
- Kunneriath Madhavi

L

- Labaude Sophie
- Laghzaoui El-Mustapha
- Laizay Emmanuelle
- Lallemand Felix
- Lamourou Ali
- Larcher Essamet Marie
- Lasseron Maxime
- Lau Seng Teck
Avester
- Laure Meleh
- Lazzerini Nicolas
- Le Meillour Louise
- Lefebvre Rémi
- Levé Marine

- Levé Marine
- Lkebir Noura
- Lledo Cora
- Loisel Ayala
- Lorel Claire
- Lorenzo Antonio Ii
- Lucas Cathy

M

- Majchrzyk Aleksander
- Majewska Adrianna
- Maldanis Lara
- Mallet Christophe
- Massiot Elodie
- Mauran Guilhem
- Mermer Janusz
- Miamoun Mounia
- Mieszkowicz Patryk
- Mihailova Līga
- Mina Rúben
- Minaoui Farah
- Missant Thomas
- Monnens Marlies
- Moreau Gwénaëlle
- Morel Séverin
- Morin Aïssa
- Moutaouakil Soumia
- Mpakairi Kudzai
- Müller Christian

N

- Niyongabo Eric
- Noroozitayola Fereshteh

O

- Oufquir Sara
- Ougadire Mohamed
- Oumarou Danni Saadou
- Ousbih Mehdi

P

- Pagès Fanny
- Pannetier Théo
- Parrot Arnaud
- Parrot Elsa
- Peckre Louise
- Percel Gwendoline
- Pereira Luiz Gustavo
- Petit Cathleen
- Petzold Alice
- Pieńkowska Aleksandra
- Pili Arman
- Pinna Charline
- Pintore Romain
- Piquet Bérénice
- PrevotEAU Jocerand
- Prosnier Loïc

R

- Rabińska Justyna
- Rachid Choukri
- Rachida Ouaabou
- Rafai Aida
- Rahmouni Mouna
- Ratz Tom
- Razanatsoa Estelle
- Ribes Charlotte
- Ringot Gabrielle
- Robin Ninon
- Rollin J'er'emy
- Romain Duez
- Rosumek Felix
- Rozen-Rechels David

S

- S'khifa Abderrahim
- Salaka Latifa
- Samlali Mohamed Amine
- Sanders Malcolm
- Schneider-Maunoury Laure
- Sculfort Ombeline
- Seudre Océane
- Shukla Ushma
- Sibille Loic
- Siedlecki Igor
- Simões Sandra
- Soualah Alila Hana

- Souchet Jeremie
- Souleymane Boni
- Sow Abdoulaye Diouma
- Suire Alexandre
- Sutton Matthew

T

- Taboubi Maha
- Taverne Maxime
- Thaler Caroline
- Thomas-Bulle Camille
- Thuong Linh-Thao
- Tillier Sylvie
- Tischer Marta
- Tissot Tazzio
- Tomczyk Przemyslaw
- Touhami Feirouz
- Truong Minh-Xuan
- Tumung Laxmi

V

- Vallée Gillette Nathan
- Varón González Ceferino
- Vignes Constance
- Villain Avelyne
- Vincent Florian
- Vrana Jakub
- Vuillot Carole

W

- Walczynska Katarzyna
- Weinbach Avril
- Weissgerber Magali

Y

- Yang Liyuan

Z

- Zakeri Zakieh
- Zamudio Sarah Grace
- Zango Palau Anna
- Zineb Amane

Scientific committee

Adrienne Gastineau, Alice Petzold, Anaïs MARRAST, Baptiste Carton, Cédric Del Rio, Charles Thévenin, Chloe OLIVIER, Cindy Lim, Claire Lorel, Clément Jauvion, Constance Bronnert, David ROZEN-RECHELS, Delphine VETTESE, Donald Davesne, Elie Gaget, Fanny Pagès, Hugo Harbers, Isabelle De Regnacourt, Laura Bento Da Costa, Laure Schneider-Maunoury, Léa DeBrito, Louise LE MEILLOUR, Malcolm SANDERS, Margaux ALARCON, Marine DUROCHER, Marine Fau, Marine Levé, Martial Plasse, Maxime Lasseron, Minh-Xuan Trong, Morgane BONADE, Myriam Agnel, Myriam Boivin, Nelida Padilla, Nicolas LAZZERINI, Nicolas MORAND, Pauline Conversy, Pierre Gueriau, Romain Sabroux, Simon Veron, Tannina Alloul, Thibault Josselin, Thomas Arbez, Typhaine Rousteau, Valentin Seizilles de Mazancourt, Victor Saito, Yoan Paillet

Jury members

Humanities and Natural Sciences

Antoine Zazzo, Jean-Bernard Huchet, Laurie Bouffandeau, Michael Ilett

Systematics, Evolution and Comparative Anatomy

Agnès Dettai, Erin Saupe, Guillaume Lecointre, Samuel Ginot

Biodiversity Dynamics and Conservation

Anne-Caroline Prévot, Aurélien Besnard, Emmanuelle Porcher, Yoan Paillet

Earth and Planetary Sciences

Anneleen Foubert, Constance Bronnert, Laurent Rémusat, Thibault Josselin

Evolutionary Ecology

AFIE member, Benjamin Yguel, Celine Teplitsky, Philippe Grandcolas

Methods in Natural sciences

Esther Lopez-Montalvo, Laetitia Carrive, Patricia Wils, Yves Desdevises