

Polymorphism of *P. vivax* in two Amazonian areas and relation with the G6PD genotype of host populations

PI : Mathieu NACHER

Centre Hospitalier André Rosemon, Equipe Epat, Cayenne

Abstract : *Plasmodium vivax* represents more than 60% of malarial cases in French Guiana. Dispersal and infections depend on geography and the genetic factors of the hosts. We propose to investigate the diversity of *P. vivax* in Amerindian population. Parasitic history and sample collection will be carried out by us (EPMT, Cayenne). Enzymatic states will be defined by molecular analysis in Marseille. Isolates of *P. vivax* will be determined genotyping in Toulouse. The project stands as the first step towards an exhaustive screening of the diversity of *P. vivax* isolates in the French Amazonian context.

Prevailing parasitic diseases in Amazonia: an integrated approach for the rationalization of medicinal plant uses in French Guiana

PI : Emeline Houël

INRA – UMR Ecofog, Kourou

Abstract : The AMAZING project aims at improving the understanding of traditional remedies vivid use in French Guiana by linking plants, people and diseases in a single perspective. We will select renowned remedies based on an in-depth study of existing ethnopharmacological bibliography associated to a statistical approach, and prepare them as indicated by the communities. These remedies will be evaluated as a whole not only for their in vitro activity against the parasites of interest, but also for their anti-inflammatory properties, as these could account for the preparations good reputation by helping to reduce the associated symptoms (fever and pain, or chronicity and severity of the lesion).

Viral biodiversity in rodents communities in French Guiana

PI : Anne LAVERGNE

Institut Pasteur de la Guyane, Cayenne

Abstract : Rodents constitute the most abundant and diversified order of living mammals in the world, representing around 43% of all mammalian species. Numerous species are known to live in close interaction with human and have been described as reservoirs of numerous viruses among which some are pathogenics in human. We will use a metagenomic approach to investigate viral biodiversity in 7 species of rodents from French Guiana. This viral diversity will be studied according to a gradient of ecological requirements of hosts, from species strictly restricted to pristine habitats to opportunist and peridomestic species. This study will allow characterizing virus diversity at both specific and habitat levels.

Short term tropical forest canopy dynamics unveiled by Airborne Lidar Scanning

PI : Grégoire VINCENT

IRD-AMAP, Montpellier

Abstract : We shall operate a coupled high density Laser Scanner and 7cm-resolution optical and infrared imaging system to map the canopy of the Paracou experimental forest site in French Guiana at two seasons. We shall delineate thousands of individual crowns of dominant/emergent trees and evaluate the accuracy of the segmentation algorithm and the correspondence between particular taxa and individual signature. We shall compare spectral and laser based indices of canopy porosity at crown level. Those indices will be cross examined and calibrated against complementary data collected from the ground. Ground work will use Terrestrial Lidar Scan to describe a subset of tree crowns. This project will lay the ground for further work (planned to start in 2014) during which monthly scans of the experimental site will be acquired by unmanned airborne vehicle in order to produce a species specific phenology pattern.

Species delimitation within the neotropical genus *Cecropia* in French Guiana: integrating morphological and molecular techniques

PI : Patrick HEURET

INRA – UMR Ecofog, Kourou

Abstract : *Cecropia* trees are a vital component of Neotropical forests and model study systems for diverse knowledge domains. Morphological traits currently delimit 61 species but strong ontogenetic variation and phenotypic plasticity for these traits within and between species makes circumscription and identification extremely challenging. Putative evidence of gene flow between closely related or recently diverged taxa further complicates the situation. To underpin a broader investigation of *Cecropia* species delimitation, this project will use neutral molecular markers to delimit the seven French Guianese *Cecropia* species and elucidate different sources of morphological variability.

DNA barcoding earthworms in biodiversity hot spots of French Guiana

PI : Virginie ROY

BIOEMCO, Université Paris-Est Créteil

Abstract : Despite the general recognition of the importance of earthworms in key soil processes, efforts to inventory their biodiversity are hampered by a taxonomic impediment which is particularly dramatic in the tropics. Our goals are (1) to build a large reference library for Guyanese earthworms coupling morphology, standard DNA barcodes and another marker; (2) to test the use of this library in a metabarcoding approach for a selection of study sites. Sampling will be carried out in three national natural reserves in French Guiana (Kaw-Roura marshes, Trinité and Nouragues), two

inselbergs (Trinité and Nouragues) and the research station of Paracou (CIRAD) that is devoted to the study of forest ecosystems.

Drought and mortality in Amazonian forests

PI : Damien BONAL and Louis SANTIAGO

INRA – EEF, Nancy and Department of Botany & Plant Sciences University California, USA

Abstract : Tree mortality during drought has been documented in forests worldwide. However, we still do not understand why tropical trees that are large or have low wood density suffer the greatest mortality. This proposal combines measures of hydraulic drought resistance with predawn leaf water potential to estimate the depth of water extraction on 20 tropical tree species to better understand this phenomenon. Wood density databases will be used to further predict drought resistance for species across the forest. The data will be incorporated into a hydraulic model to simulate climate conditions that produce soil water potential low enough to induce widespread drought-induced tropical tree mortality.

Ecological cycling and metal hyperaccumulation in plants of French Guiana

PI : Jérôme CHAVE

EDB, Toulouse

Abstract : The elemental composition of soils results from the erosion of the bedrock and uptake from living organisms, especially plants, and also determines spatial patterns in biodiversity. However, few detailed studies provide a baseline for both the biological and the chemical soil composition in old-growth tropical forests. Here we propose to build upon a unique high-resolution environmental DNA survey over 12 ha at the Nouragues station to study (a) the chemical composition at the same sites, (b) the potential for metal hyperaccumulation for the plant species at this site and more generally in French Guiana.

Aposematic polymorphism in the dyeing poison frog (*Dendrobates tinctorius*): A model vertebrate for the study of selection and speciation

PI : Antoine Fouquet and Brice P. Noonan

CNRS Guyane, Cayenne and University of Mississippi, USA

Abstract : Our goal is to better understand the origin of phenotypic diversity within a species of poison frog (*Dendrobates tinctorius*) and the dynamics of selection on phenotype. Poison frogs are brightly colored, diurnal species from the Neotropics that advertise the distastefulness of their cutaneously sequestered alkaloids, derived from their arthropod prey, to potential predators. As aposematic species, the radical phenotypic polymorphism within and among populations, like that seen in *D. tinctorius*, seems counterintuitive. We will explore the ecology, toxicology and genetics of

this remarkable species to better understand what will surely become a model in the study of evolution.

Mega measure of freshwater biodiversity: Implications in our understanding of infectious disease emergence

PI : Rodolphe Gozlan

MIVEGEC, Montpellier

Abstract : The FRESH project aims at using state of the art technology in terms of metabarcoding to enhance the monitoring of freshwater biodiversity in French Guiana. All around the world, due to their continuum and proximity to urban development, freshwater systems have been under significant environmental pressures including pollution, habitat and flow modification and species introduction, all leading to a serious biodiversity crisis. Here, we set up a new generation of tool that will allow us to better monitor freshwater biodiversity change whilst at the same time enhancing our understanding of infectious water born disease patterns.

Seasonal variations in tree growth and functioning

PI : Damien Bonal

INRA – EEF, Nancy

Abstract : Ce projet s'inscrit dans un programme sur le long terme mené par les UMR Ecofog et EEF portant sur les variations saisonnières de la croissance des arbres de la forêt Amazonienne. Il a pour but d'étudier si les variations saisonnières de croissance sont liées aux différents niveaux de contrainte hydrique rencontrés par le système racinaire et sont associées à des variations du fonctionnement hydrique et carboné des arbres. Ce projet associera des mesures de croissance du tronc, de potentiel hydrique foliaire, et des analyses d'isotopes stables (^{13}C et ^{18}O) dans le bois pour comprendre les liens entre fonctionnement hydrique et carboné et croissance secondaire sous contrainte hydrique.

A first genetic study of the RNA virus associated with *Leishmania guyanensis* and its role on clinical pleiomorphism of human leishmaniasis in French Guiana

PI : Ghislaine PREVOT

Université des Antilles et de la Guyane, Equipe Epat, Cayenne

Abstract : Since its identification in the 80's, Leishmania RNA virus 1 (LRV1) has been identified in different species of Leishmania and 12 different subtypes are known to date. LRV1 has been shown, in a murine model, to subvert the host immune system and to worsen clinical severity of the ulcerative lesions. Our purpose is to determine the prevalence and genetic diversity of LRV1 strains from *L. guyanensis* strains isolated in French Guiana and to correlate these results to the clinical

outcome of patients. The obtained results should allow developing molecular tools for rapid diagnosis and, on a clinical viewpoint, by guiding the choice of treatment, should participate to the better management of leishmaniasis.

Impact des communautés fongiques sur la régénération d'une essence Guyanaise *Vouacapoua americana* (Aublet)

PI : Stéphane TRAISSAC

INRA-UMR Ecofog, Kourou

Abstract : L'objectif principal de cette étude est de mesurer l'impact des communautés de champignons sur les variations du taux de survie des jeunes stades de *Vouacapoua americana*. En effet le recrutement de cette espèce agrégative est quasiment nul lorsque la densité d'adultes est forte. Les communautés fongiques, prélevées suivant plusieurs critères seront caractérisées par typage moléculaire. Après confrontation des séquences aux bases de données de référence et attribution d'un groupe écologique (pathogène, symbiotique, saprophyte), l'impact des communautés fongiques sur la survie des graines et plantules de même que le stade ontogénique critique seront évalués.

Spatial and temporal patterns of species and genetic diversity of Amazonian *Caenorhabditis nematodes*

PI : Christian BRAENDLE

Université de Nice Sophia Antipolis, Nice

Abstract : Understanding the causes and consequences of genetic diversity within and among species represents a key challenge in biodiversity and evolutionary research. Within this context, we study the genetic diversity in different *Caenorhabditis* nematode species (1-7). Our previous research in the Nouragues rain forest has revealed surprisingly high species diversity and population densities, allowing us to characterize patterns of genetic diversity at multiple spatial scales (6,8). We will extend this research by (a) in-depth population sampling in French Guiana and (b) subsequent genomic analyses to assess how variation in ecology and breeding system shape species-specific patterns of genetic diversity.

Do extant plants support past marine incursions in Amazonia?

PI : Christine D. BACON

University of Gothenburg, Sweden

Abstract : Amazonia is one of the world's most biodiverse ecosystems. The evolution of this biodiversity has attracted the interest of naturalists for centuries, but remains a persistent question. Current evidence suggests that Neogene landscape changes in South America, primarily as a result of plate tectonics and the Andean uplift, are tightly correlated to biotic evolution. Despite this, a crucial issue remains to be clarified concerning the existence, nature, and duration of widespread aquatic settings in western Amazonia. We propose to examine the presence of the mega-wetland from the

current distribution of plants, the fossil record, and dated phylogenies of *Acrostichum* ferns and *Manicaria* palms.

Phthalate pollution in an Amazon rainforest

PI : Alain LENOIR

Université François Rabelais, Tours

Abstract : Phthalates are universal contaminants. We recently showed that they are trapped in the cuticles of insects (1), our paper was cited in various media [see for ex (2)]. Ants can be considered particularly good bio-indicators of phthalate pollution. We suggested that the main source of pollutants is the atmosphere. Different ant species collected from various sites showed similar levels of contamination. In some pristine sites, the contamination appeared to be lower, but this needs to be confirmed. We will collect ants from different places in French Guiana and compare urbanized areas versus rainforest sites where there are few or no inhabitants.

Species coexistence and negative density dependence in tropical rain forests

PI : C.E. Timothy Paine

University of Stirling, United Kingdom

Abstract : This project will demographically assess niche differences among tropical trees, and provide an initial estimate of the stability of their coexistence. I will synthesize and augment existing data on seed-fall, seedlings, saplings and adults. I will evaluate the effects of population density on the vital rates of trees, estimates of which will allow me to assess the stability of coexistence. Understanding the importance of niche differences and the stability of species coexistence will improve predictions of community dynamics and thereby bolster the management and conservation of tropical forests.

Introduction to the Teko ethnobotany

PI : Damien DAVY

OHM Oyapock CNRS Guyane, Cayenne

Abstract : Teko Amerindians are mainly living along the Camopi River basin, neighbouring to the Wayãpi Amerindians (settled along the Oyapock River) in southern French Guiana. Their ethnobotany has never been documented. We propose to: a) Draw up the first qualitative and quantitative inventory of the Teko ethnobotany; b) Collect and analyse their folk taxonomy about plants and nature; c) Document the overall utilisation of the species present in the Teko environment, and test the link between diversity of useful plants and local species diversity in historical Amerindian settlements; d) Investigate the relationships between Teko and Wayãpi ethnobotanical datasets.

Tropical rainforest plants as concept generators for biomimetics research

PI : Nick Rowe

AMAP, Montpellier

Abstract : Tropical rainforests contain a potentially vast reservoir of concepts for innovative biomimetic technologies based on plant structure, biomechanics and life history. We will analyse mechanical properties (e.g. friction, adhesion, strength and failure) of attachment syndromes in diverse vines and lianas in French Guiana. Diverse attachment strategies will then be screened for their significance as concept generators where functional traits from biological life histories such as adhesion, strength, reliability, fail-safe mechanisms and economy of design can be integrated and optimized for a wide range of bio-inspired technical applications.

Do patterns of phenotypic variation within species help explain divergence across species in morphology and performance in frogs?

PI : Elodie COURTOIS

CNRS Guyane, Cayenne

Abstract : Can patterns of variation within species influence divergence across species? Such an influence is predicted by the field of evolutionary quantitative genetics yet has generally remained untested. We propose to test this hypothesis through a study of morphology and performance of frog species from French Guiana. We will test whether divergence among species has been neutral (i.e., consistent with genetic variation within species), fully consistent with divergence by natural selection (represented by the relationship between morphology and performance), or a mixture of the two processes.

Biodiversity of the vectors of chagas disease in French Guiana

PI : Jean-Pierre DUJARDIN

MIVEGEC, Montpellier

Abstract : In French Guiana, human dwellings are sporadically “visited” by sylvatic species of Triatominae, half of them infected with *Trypanosoma cruzi*, the agent of Chagas disease (Aznar, pers. comm). As it has been shown in neighbouring countries, the “visiting” behaviour of some Triatominae may be responsible for human infections [23, 3]. This can also turn into a more domestic behaviour of the insect which means a higher risk for humans [21]. At this stage, our main objective is to assess a possible biological basis for the “visiting” behaviour. Are the “visitor” specimens, i. e. the ones attracted to the human dwellings, a random sampling from the sylvatic surrounding foci, or a sub-population with identifiable traits? Focusing on this question, we will apply phenetic and genetic techniques to capture some quantitative aspects of the biodiversity of Triatominae in French Guiana. In case we discover consistent arguments suggesting adapted phenotypes, we would engage in a future project developing the genomics of adaptation approach.

Is the visual fluorescence a relevant signal in the communication between *Mimosa pudica* and *Ministrymon azia*: an interspecific experimental study

PI : Christophe DUPLAIS

INRA-UMR Ecofog, Kourou

Abstract : VisualFACT project aims to elucidate whether biofluorescence influences interspecies communication. The study focuses on the interaction between the butterfly *Ministrymon azia* (Lycaenidae) and its food plant *Mimosa pudica* (Fabaceae) whose anthers are fluorescent. Behavioral tests will be conducted with captive-bred butterflies to determine whether the fluorescent component of anther colour (i) is detectable by and (ii) influences the behavior of *M. azia*. Spectroscopic and chemical analysis will complement this study.