France-Berkeley Fund

Annual Report 2022

Berkeley
UNIVERSITY OF CALIFORNIA

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Established in 1993 as a partnership with the French Ministry of Foreign Affairs, the France-Berkeley Fund (FBF) promotes and supports scholarly exchange between faculty and research scientists at the University of California and their counterparts in France.

Through its annual grant competition, the France-Berkeley Fund provides seed money for innovative, bi-national collaborations in all disciplines. The Fund's core mission is to advance research of the highest caliber, to foster interdisciplinary inquiry, to encourage new partnerships, and to promote lasting institutional and intellectual cooperation between France and the United States.

FROM THE DIRECTORS

France-Berkeley Fund has had a busy and exciting year! In 2022, we saw the gradual return back to in-person FBF activities, and travel to both Berkeley and France resumed for many of the grantees. Though we successfully pivoted to virtual collaborations, we are delighted to see in-person trans-Atlantic collaborations continue. The FBF was joined by a new Program Manager, Laura Morello, in January. We also welcomed our executive committee back to Berkeley for our annual meeting during which we had many fruitful discussions and made plans for the upcoming year.

We are delighted to support 20 new projects in 2022-23 thanks to the generous sponsorship of the French Ministry of Foreign Affairs, the French Embassy in Washington, the UC Berkeley Office of the Vice Chancellor for Research, as well as the Lawrence Berkeley National Laboratory. This year's cohort showcases the extraordinary diversity of interests and methods that characterizes the FBF: from projects on plant disease, to machine learning for bedsore prevention, to Rococo Art, the evolution of global currencies, the detection of skin tumors and the biosolubilization of phosphate minerals, to mention only a few examples. We look forward to seeing all of the new projects progress over the grant period.

We sincerely thank the many proposal reviewers at Berkeley and in France, together with our Executive Committee, who generously dedicated their time and effort to the evaluation process. We also wish to recognize and thank two outgoing Executive Committee members, Julien Guy, Staff Scientist at Lawrence Berkeley National Laboratory, and Jean-Baptiste Bordes, former Attaché for Science and Technology at the French Consulate in San Francisco, for their contributions and dedication to FBF. Special recognition goes to Mireille Guyet, Counselor for Science and Technology at the French Embassy, for her steadfast service and support. We also would like to thank Frédéric Jung, Consul General of France in San Francisco, and other members of the consulate, whose cooperation we value in advancing the FBF's core mission. Finally, we note with sadness, the passing of Yves Frénot, former Counselor for Science and Technology at the French Embassy, who was particularly dedicated in providing additional support for FBF projects.

We are delighted to wrap up a successful 2022 year of fruitful cooperation between researchers and colleagues on both sides of the Atlantic. We very much look forward to another successful year in 2023!

Larry M. Hyman
Clément Sanchez
Co-Directors

Laura Morello
Program Manager

FBF NEWS

Professor Larry Hyman being awarded the rank of Chevalier in the Ordre des Palmes Académiques (Order of Academic Palms)

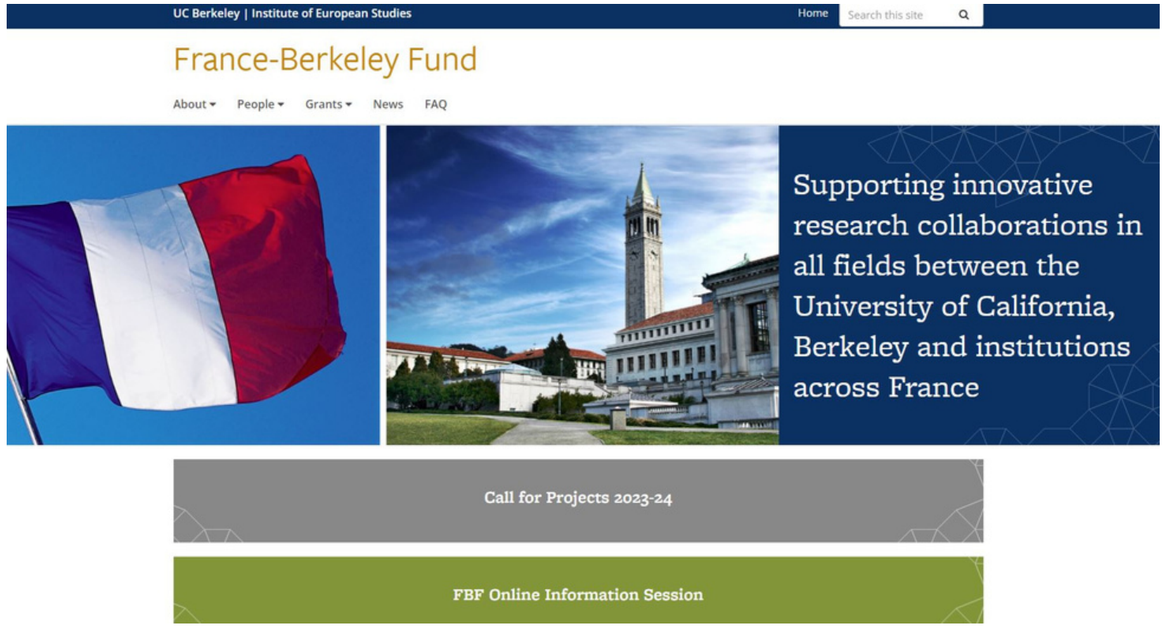
Photography credit: French Consulate of San Francisco

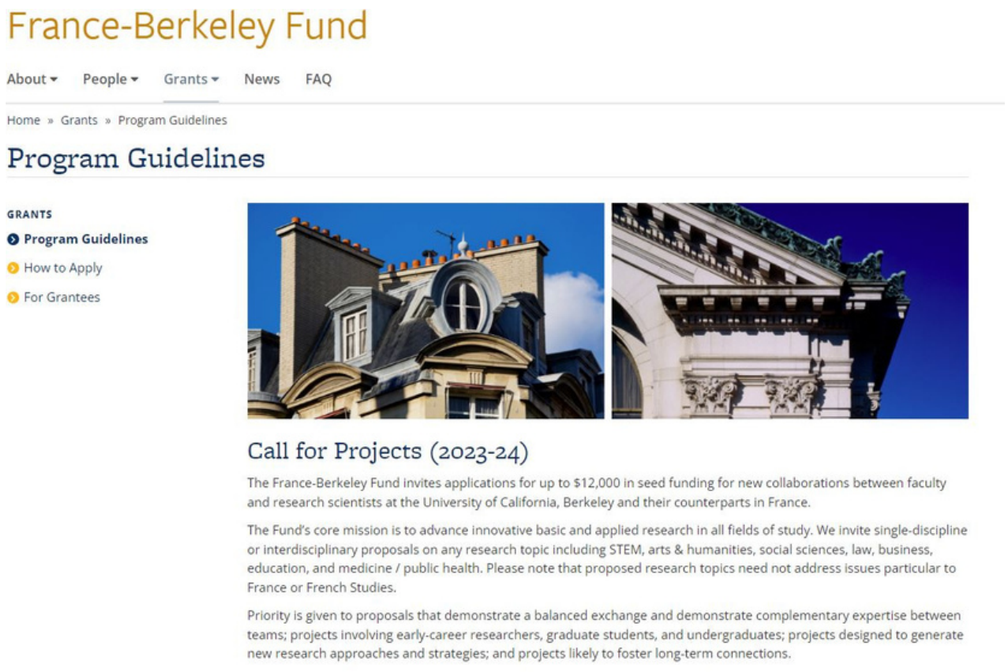
The Order acknowledges distinguished scholars and educators who have actively contributed to the promotion of French culture around the world.

Awarded by the French Government, the Ordre des Palmes Académique recognizes Hyman's extraordinary contributions to strengthening French and U.S. collaboration as longtime Director of the France-Berkeley Fund.

FBF Launches new website in September 2022

Visit fbf.berkeley.edu to browse the new site!



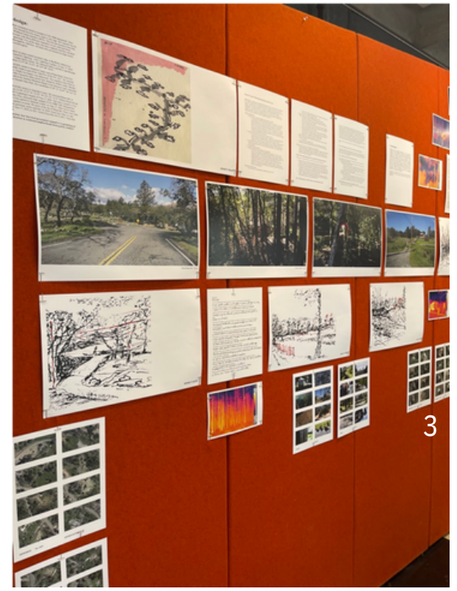


GRANTEE NEWS

FBF Grantees 2021, Prof. Michael Buckland (UC Berkeley) and Olivier Le Deuff (Université Bordeaux Montaigne) hosted a public colloquium in Berkeley, April 2022

Prof. Carla Shapreau (UC Berkeley, FBF Grantee 2017) hosted a conference on “The spoliation of musical instruments in Europe. 1933-1945” in Paris, April 2022, the FBF grant having contributed to this research outcome.

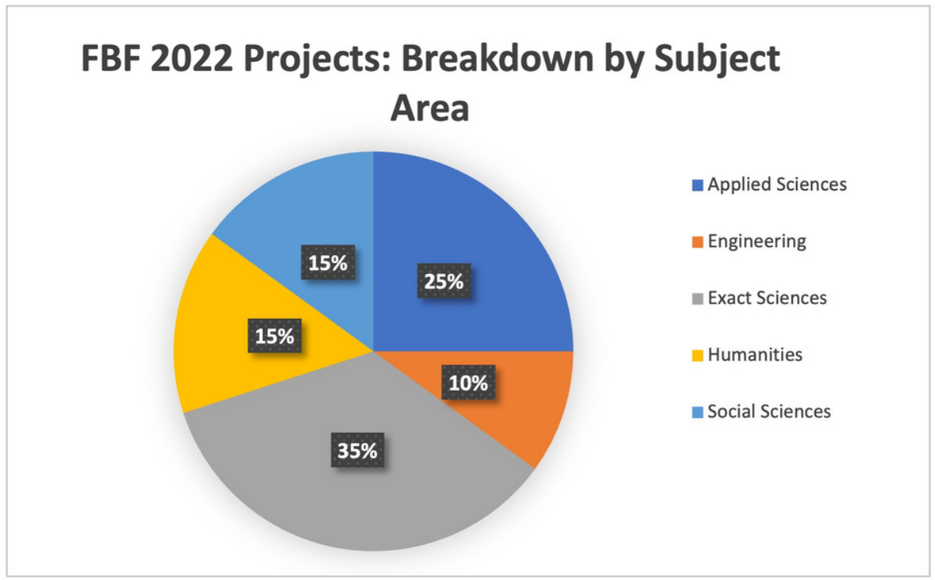
FBF Grantees 2021, Prof. Peter Bosselmann (UC Berkeley) and Prof. Catherine Rannou (Ecole Nationale Supérieure d' Architecture Paris-Val de Seine) hosted an exhibit at Berkeley presenting research project ‘Understand Wildfires’ in February, 2022



Photography credit: Laura Morello

NEW COLLABORATIONS

The FBF is pleased to sponsor 20 outstanding projects in 2022-23, with awards totaling $208,714.



GENOMIC EVALUATION INCLUDING INTERMEDIATE OMICS DATA
Hao Cheng, Animal Science, UC Davis
Andres Legarra, Animal Genetics, INRAE

The discovery of high-density molecular markers (e.g., single-nucleotide polymorphisms, SNPs) in the genome has revolutionized genetic analyses of quantitative traits in human medicine, animal and plant breeding has been widely used to incorporate marker effects from whole-genome data with phenotypic data into genetic evaluation in animal and plant breeding, and this is the primary application that uses whole-genome data in agriculture. To incorporate intermediate omics data (e.g., gene expression levels) between genotypes and phenotypes for genomic evaluation, we will develop a statistical method and software tools.

BIOSOLUBILIZATION OF PHOSPHATE MINERALS
John Coates, Plant and Microbial Biology, UC Berkeley
Karim Benzerara, Institut de Minéralogie, Physique des Matériaux et Cosmochimie, Sorbonne Université

The proposed study will investigate microbial mechanisms for the solubilization of phosphorous minerals to enhance their bioavailability. Due to the intrinsic insolubility of phosphorous, only 20-30% of applied fertilizer is available to cultivated crops with the remaining 70-80% present as insoluble non-bioavailable minerals. Identification of the microbial mechanism for maintaining elevated phosphate solubility is important to improving the efficiency of the agricultural application of this critical nutrient to soils and stretch our limited global reserves beyond the 70-200 years predicted based on current consumption rates.

ARTIFICIAL INTELLIGENCE AND COLD PLASMA FOR REAL-TIME DETECTION OF SKIN TUMORS
Ali Mesbah, Chemical and Biomolecular Engineering, UC Berkeley
Augusto Stancampiano, GREMI UMR7344, Université d'Orléans

The aim of this project is to initiate a collaboration that will enable the development of a novel and timely medical technology for real-time non-invasive detection of skin tumors. The technology will rely on cold plasma (ionized gas) for the generation of spectral and electrical signals and on artificial intelligence for their interpretation.

INTERGROUP SOLIDARITY AND SOCIAL INTEGRATION: MICRO-LEVEL EVIDENCE FROM THE HOLOCAUST IN BELIGUM, FRANCE, THE NETHERLANDS AND POLAND
Robert Braun, Sociology, UC Berkeley
Claire Zalc, History, EHESS/CNRS

Comparative individual level study of Jewish integration and survival chances during the Shoah in Belgium , France, the Netherlands and Poland. Leverage of unique and fine-grained demographic data and its comparative focus make this project the first of its kind.

MULTIMODAL INVESTIGATION OF DYNAMIC INTERFACES (MIDI): CASE STUDY ON 2D/3D HALIDE PEROVSKITES
Carolin Sutter-Fella, Molecular Foundry, Lawrence Berkeley National Laboratory
Philip Schulz, IPVF, UMR9006, CNRS

This project aims at studying halide perovskite materials and in particular unveiling the interface formation dynamics and its evolution under real world operating conditions. The partners will combine state of the art in situ characterization techniques (LBNL) with high-resolution depth profiling techniques to track the interface formation and determine the compositional gradients at the interface (CNRS). The successful demonstration of this approach will be applicable to many optoelectronic devices, which contain critical interfaces responsible for charge transport and device function.

STRUCTURAL FORCES AND NANOLUBRICATION IN POLYMERIZED IONIC LIQUIDS
Joelle Frechette, Chemical and Biomolecular Engineering, UC Berkeley
Frederic Restagno, Physics, Unversité Paris-Saclay

Polymerized ionic liquids (PILs) refer to a special type of polyelectrolyte which monomeric unit is composed of one or different ionic liquid species (IL). These macromolecules have recently drawn the attention since they present a unique combination of the properties of ionic liquid and polymeric materials. An scientifically and technologically interesting properties of ionic liquids is their very low friction coefficient measured on many different surfaces. However, mechanism for the low friction coefficient is poorly understood. The objective of this project is to study the potential lubrication properties (friction) of PILs films as a function of their macromolecular structure and the monomeric interactions involved. This will be possible by gathering the scientific expertise of two groups both in France in University Paris-Saclay (who gain recently an expertise in PIL) and in Berkeley university (expert in surface force measurements) we expect to get unique information on the potential application of PIL as a new class of lubricants by exchanging samples/experimental techniques between the two groups. We will combine the bulk and surface measurement with the Electrochemical Surface Forces Apparatus (e-SFA) to measure equilibrium and lubrication forces created by PIL when confined between two surfaces. Studying high-concentration electrolytes presenting polymeric properties present an exciting opportunity to gain experimental evidence to connect molecular structure, electrostatics, and lubrication.

THE METABOLIC INTERFACE OF GLOBALLY IMPORTANT PLANT DISEASE
Tiffany Lowe-Power, Plant Pathology, UC Davis
Caroline Baroukh, LIPME, INRAE

Plant pathogens threaten global food security by causing significant crop losses. This project will investigate the chemical interface of plant disease to identify sustainable, effective solutions to managing pathogens. We will use advanced genetic, genomic, and modeling approaches to connect pathogen metabolism with pathogenesis

MACHINE LEARNING-BASED DESIGN OF SHAPE-MORPHING STRUCTURES FOR BEDSORE PREVENTION
Grace Gu, Mechanical Engineering, UC Berkeley
Jose Bico, Physique et Mécanique des Milieux Hétérogènes, ESPCI-Paris (École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris)

Bedsores, also known as pressure ulcers, are formed by a long-term compression of blood vessels owing to immobilized patients' limited capacity to shift postures in their hospital beds or wheelchairs, which can result in the degradation of body tissue, or necrosis. In this proposal, we aim to developa shape-morphing structure that changes the patient's body pressure and posture with a single air pump. The Gu Lab at UC Berkeley plans to collaborate with the MecaWet Group, led by Prof. Bico and Prof. Roman at PMMH-ESPCI in Paris, on this project that consists of 1) inverse design of shape-morphing structures using machine learning algorithms (Gu Lab) and 2) validation of the design process via prototypes fabrication and experimentation (MecaWet Group). We foresee broader applications in various forms of medical equipment, such as cushions for wheelchairs and active belts, that could help paraplegic patients with intestinal transit.

HARNESSING NATURAL VARIATION IN REPRODUCTIVE PLASTICITY TO DROUGHT IN SUNFLOWER
Benjamin Blackman, Plant and Microbial Biology, UC Berkeley
Nicolas Langlade, Sunflower Genetics and Genomics, NRAE-CNRS Laboratory of Plant-Microbe-Environment Interactions, Toulouse

A major agricultural concern is the ongoing decline in pollinator services to crops due to climate change, pathogens, and chemical agents, and consequently,a better understanding of plant traits that attract pollinators and their impairment by environmental factors like drought is key to future agronomic improvements and global food security. Through field and genomic studies, our proposed research will assess how the quality and quantity of pollinator rewards (pollen and nectar) and floral morphology are affected by drought and test whether or not genetic variants related to these traits that enhance a plant's success asa pollen donor necessarily also decrease its success as seed bearer. Our results will highlight traits and genes that harbor variation potentially useful for improving pollinator attraction and consequently yield in sunflower and also lay the groundwork for additional studies to evaluate novel hypotheses about the evolution of plant reproduction.

TRANSNATIONAL ARCHIVING OF SEXUALITIES: ENGAGING PLURAL PASTS
Paola Bacchetta, Department of Gender and Women's Studies, UC Berkeley
Sandeep Bakshi, Études Anglophones / LARCA UMR-8225, Université Paris Cité

This project aims to generate novel forms of collective knowledge in the field of archiving. Bringing together academics and practitioners working at the intersection of LGBTQ of color studies and theorization of archiving, it will focus on: (1) how archives, broadly conceived, produce knowledge, (2) how dominant archives resist the creation of other kinds of knowledge and (3) what can be done to produce more equitable archives and archival practices for our times.

CHARACTERIZING MOLECULAR & STRUCTURAL DETERMINANTS OF CYTOSKELETAL HOMEOSTASIS
Eva Nogales, MCB, QB3, UC Berkeley and Lawrence Berkeley National Laboratory
Carsten Janke, Genome integrity, RNA and Cancer (CNRS UMR3348), Institut Curie / CNRS

Microtubules are essential cytoskeletal polymers with critical roles in cell division, cell shape, intracellular transport, and cell motility. To carry out all these biological functions, microtubules interact with numerous associated proteins (MAPs). Here explore how a multitude of different MAPs coordinates microtubules functions to assure cellular homeostasis. Our study has both cell biological and medical importance, as current advances in clinical genetics have resulted in the discovery of increasing numbers of disease-related mutations in MAPs, which most of the time are not mechanistically understood.

FOREIGN RESERVE HOLINGS AND THE EVOLUTION OF GLOBAL CURRENCIES
Barry Eichengreen, Economics and Political Science, UC Berkeley
Eric Monnet, Economie, Ecole des hautes études en sciences sociales

This project explores how countries have held official foreign exchange reserves since the late 19th century and the implications for the current international monetary system. We construct an original dataset that provides for the first time in the long run the distinction between reserves held as foreign deposits and reserves held as purchased foreign securities. We then investigate the political and economic determinants of these two types of foreign reserve holdings, including testing the hypothesis that foreign deposits are less associated with financial openness and a market-based foreign reserve accumulation process. This research has broad implications for understanding how the international monetary system will evolve differently depending on whether foreign reserve holdings are based on market-based financial choices or on factors rooted in bilateral economic and political relations.

LIQUID-PHASE TRANSMISSION ELECTRON MICROSCOPY IMAGING OF 3D STRUCTURE AND DYNAMICS OF HUMAN INNATE IMMUNE PROTEIN INTERACTIONS IN SOLUTION
Gang (Gary) Ren, Molecular Foundry, Lawrence Berkeley National Laboratory
Wai Li Ling, Département de Biologie Structurale et Cellulaire intégrée/Institut de Biologie Structurale, Université Grenoble Alpes

With the complementary expertise of the Berkeley and France teams, we propose to implement liquid-phase transmission electron microscopy (LTEM) and individual-particle electron tomography (IPET) techniques, developed inhouse by the Berkeley team, to study France team long-term focused immune proteins and their interactions.

MAPPING RENAISSANCE MUSICAL NETWORKS: THE CASE OF JOSQUIN DES PREZ (1450-1521)
Emily Zazulia, Music, UC Berkeley
Philippe Vendrix, Centre d'études supérieures de la Renaissance, Université de Tours - CNRS.

We propose to develop a new web-based visualization tool for the study of Renaissance musical culture. Recognizing that central information about musicians and musical institutions is scattered across thousands of volumes, and appreciating the potential for dynamic digital visualization tools to offer up new insights into cultural networks, we seek to map the musical Renaissance. We will prototype this project by exploring the world of the famous composer Josquin des Prez (1450–1521), whose biography and career are so littered with gaps as to make such a tool extremely valuable. To accomplish this goal we will bring together experts at UC Berkeley and the Centre d'Études Supérieures de la Renaissance (CNRS-Tours), whose complementary expertise spans biography, musical institutions, and musical sources, as well as building sustainable, user-friendly, and visually elegant digital tools.

PLASMA PHOTONICS FOR EXTREME OPTICS
Jonathan Wurtele, Physics, UC Berkeley
Caterina Riconda, Physics, Sorbonne

Controlling and manipulating high-intensity laser pulses is crucial for many applications in various areas of basic physics and applications, such as inertial fusion. Traditionally, this control is achieved by using crystals with intrinsic optical properties that can be tuned and controlled to modify the a light pulse. Such properties include the focus, polarization, direction, polarization or length of the pulse. These conventional systems fail when exposed to intense pulses. Plasma photonics uses lasers to shape optical elements in a plasma medium (rather than a solid), thereby allowing an entirely new class of optical elements that in turn may enable a wide range of new science.

QUANTUM COHERENCE IN MOLECULAR HEAVY ELEMENT CLOCK QUBITS
Stefan Minasian, Chemical Sciences Division, Lawrence Berkeley National Laboratory
Grégory Nocton, Laboratoire de Chimie Moléculaire, École Polytechnique

This work will harness the unique electronic structures of heavy elements to create and control quantum coherent properties in atomically precise molecular spin qubits. Nocton is an expert in inorganic synthesis and electronic structure and will supply the novel ligands developed in his labs at École Polytechnique. Minasian will provide access to unique radioisotopes, facilities at Lawrence Berkeley National Laboratory (LBNL) for heavy element research, and characterization including synchrotron radiation, EPR, and magnetometry. We expect this new collaborative effort to afford designer molecular qubits with sustained coherent properties at higher temperatures.

STRUCTURAL DYNAMICS OF OXIDOREDUCTASES CRUCIAL FOR THE SURVIVAL OF HUMAN PATHOGENS

Jan Kern, Molecular Biophysics and Integrated Bioimaging, Lawrence Berkeley National Laboratory
Hugo Lebrette, Laboratoire de Microbiologie et Génétique Moléculaires – Centre de Biologie Intégrative, CNRS / Université Toulouse III - Paul Sabatier

In this project, we aim to study catalytic intermediates in two metal dependent oxidoreductases that both utilize dioxygen (O2) to catalyze reactions essential to various human pathogens. To capture intermediates, we want to employ a novel technique where we perform in situ enzyme activation with O2 gas at room temperature and use time resolved X-ray crystallography coupled with X-ray spectroscopy at an X-ray free electron laser. Using this approach, we will obtain detailed information about changes in the geometry and in the electronic structure of the metal site, and therefore, we will gain further mechanistic understanding of these important enzymes with the long-term goal to open up ways for novel antimicrobial treatments.

ARTIFICIAL INTELLIGENCE APPROACH FOR AEROSOL INDOOR PROPOGATION USING MICRO-LIDAR MEASUREMENTS

Evan Variano, Civil and Environmental Engineering, UC Berkeley
Romain Ceolato, DOTA - Optronics Department, ONERA, The French Aerospace Lab

Many viruses, including SARS-CoV-2, are known to spread via micron-scale aerosol droplets in indoor environments. The goal of this research project is to use novel micro-lidar measurements of aerosols indoors to develop a predictive data driven model for aerosol indoor propagation. Two main tasks will be accomplished through this project: (i) Firstly, experiments will be conducted to collect data about indoor aerosol propagation at the Cal COVID Cube[1] and UC Davis Hospital. (ii) Secondly, the data will be used to develop data-driven models of the aerosol propagation that can be used for aerosol indoor propagation modeling for different indoor configurations. This collaboration will leverage: a state-of the art short-range elastic backscatter micro-lidar named Colibri dedicated to high range resolution aerosol profiling developed by ONERA's Optronics Department, the CAL COVID Cube at UC Berkeley's Civil and Environmental Engineering Department and expertise and hospital experimental facilities at UC Davis Health. The team brings interdisciplinary strength to understand the various aspects of indoor aerosol transmission. The project, if successful, has significant relevance to developing a scientific understanding of both pathogen and pollutant dispersion from expelled aerosol plumes indoors. Specifically in the context of infectious diseases it is important to understand how exhaled particles move through air to an exposed person to better predict the airborne transmission impacts of diseases

A MULTIFACETED ROCOCO

Michael Yonan, Art and Art History, UC Davis
Marlen Schneider, Département d'histoire de l'art et d'archéologie, Université Grenoble Alpes

We propose to host a conference in which we interrogate the relationship between rococo art and geographical setting in order to redefine rococo art as a global phenomenon. When scholars confront rococo art in sites outside of France, it is usually understood in relation to rococo art's Frenchness, either as a straightforward borrowing of French design, or sometimes through modification or adaptation. We suspect that a global approach to rococo art will reveal a much wider range of applications, design and stylistic choices, cultural meanings and practices than have heretofore been recognized, and that this consequently may help to further refine what rococo meant in its "original" version. In other words, our conference seeks to begin a discussion that will create new interpretive frameworks for rococo that account for its full geographical and material diversity.

EVALUATING CURRENT THEORIES IN WORD LEARNING

Mahesh Srinivasan, Psychology, UC Berkeley
Isabelle Dautriche, Laboratoire de Psychologie Cognitive (UMR7290), CNRS/Aix-Marseille University

Words are often associated with more than a single meaning. Surprisingly, despite the widespread prevalence of ambiguity in language, word learning is typically studied within developmental psychology as a problem in which only a single meaning needs to be learned for each new word. This simplification has led to a set of theories that can explain how children learn a single, concrete meaning for a word, like "dog", but fail to illustrate how children develop their vocabulary more generally. The proposed research brings together two investigators with complementary expertise to provide new experimental and computational evidence regarding how ambiguous words are learned.

ACKNOWLEDGEMENTS

The France-Berkeley Fund gratefully acknowledges the partners and collaborators whose efforts and support are crucial to our program. In particular, we thank: Patricia Geltz, Elise Binet Mahé, Corrine Perret, and their colleagues at the French Ministry of Higher Education, Research and Innovation; Vincent Michelot (Attaché for Higher Education, Embassy of France in the United States); Kimberly Carl (Director, IT Systems and Services, UC Berkeley Office of the Vice Chancellor for Research); Zahra Rezapour (Financial Analyst, UC Berkeley Office of the Vice Chancellor for Research); Gia White (Administrative Director, Institute of European Studies, UC Berkeley); Simon Pouly (2022 Undergraduate Research Apprentice)

SUPPORT OUR WORK

"The project has deepened our working relationship and also enhanced or established relationships for all who have participated in it. We are certain that these connections will bear fruit in other contexts in the years ahead."

- TODD HICKEY (Classics, UC Berkeley) and JEAN-LUC FOURNET (Collège de France / EPHE)

"The France-Berkeley Fund has been fantastic support for the initiation of this research trajectory. Without it, this project could not have proceeded in this collaborative fashion. It has advanced the research career of a Berkeley junior faculty member, provided valuable training for a Berkeley PhD, and led to an academic research position for a recent French PhD. These collaborative relationships will be sustained into the future."

- NICHOLAS SWANSON-HYSELL (Earth & Planetary Sciences, UC Berkeley) and YVES GODDÉRIS (Observatoire Midi-Pyrénées, CNRS / Université Toulouse)

"This has been an invaluable experience for the junior researchers involved and it has directly facilitated the establishment of larger-reach projects between Lyon and Berkeley."

- MARY FIRESTONE (Environmental Science, Policy & Management, UC Berkeley) and GRAEME NICOL (Laboratoire Ampère, Université de Lyon)

The France-Berkeley Fund is committed to advancing innovative research and international exchange across the humanities and sciences. Help ampllify our work by making a gift to our grant fund. Gifts to the FBF help sustain cutting-edge collaborations that bring together faculty, researchers, and junior scholars from UC Berkeley and institutions throughout France.

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