Yves Achdou (Université Paris Diderot)
Title: Some recent contributions on mean field games
Abstract: In 2007, J-M. Lasry and P.-L. Lions proposed mean field-type models to study differential games with a large number of players. We will discuss several variants of these models, in particular stochastic optimal control problems with mean-field effects and applications to pedestrian crowds and macroeconomics.

Nicolas Champagnat (INRIA Nancy)
Title: Genealogical processes associated to general branching processes; applications to the size of large families
Abstract: This is joint work with Amaury Lambert (UPMC and Collège de France).
We consider general branching processes where life lengths are i.i.d. with arbitrary distribution and births occur in a Poissonian manner. The corresponding genealogical trees are called splitting trees and can be characterized by a contour process with jumps, which a Levy process without negative jumps. This contour process allows to describe the genealogy of a population at a given time with a so-called coalescent point process. In this talk, we consider a supercritical population with Poissonian mutations within the infinite allele framework. The population at time t is partitioned into several "families" woth different alleles. We study the size of the largest families when t goes to infinity, depending whether the clonal process is subcritical, critical or supercritical. In particular, we are able to prove the convergence of the conveniently scaled point process of largest families.

François Delarue (Université de Nice)
Title: Stochastic control for large population driven by correlated noises
Abstract: I will discuss recent advances in large population stochastic control, in the spirit of the pioneering by Lasry and Lions and by Caines and Malhamé in 2006. The basic point is to seek approximate equilibria over families of interacting players when the number of players tends to the infinity, by taking benefit of some underlying propagation of chaos. The framework I will consider is twofold: the first one is the standard mean-field game problem, for which equilibria are investigated as Nash equilibria, and the second one is the control of McKean-Vlasov diffusion processes, for which equilibria are investigated as cooperative equilibria. In both cases, I will assume that players are driven by correlated noises. In this setting, I will discuss a probabilistic approach for proving the existence of equilibria. I will also investigate the connection with an infinite dimensional partial differential equation, set on the space of probability measures, that describes the equilibria in an analytic way.
Joint work with R. Carmona and D. Lacker (Princeton).

Sylvie Méléard (Ecole Polytechnique)
Title: Stochastic modeling of Darwinian evolution in a chemostat
Abstract: We consider a stochastic model describing the Darwinian evolution of a polymorphic population with mutation and selection in a multi-resource chemostat. The interactions between individuals occur by way of competition for resources whose concentrations depend on the current state of the population. Our aim is to model the successive fixations of successful mutants in the population and further its diversification on an evolutionary time scale.
We prove, starting from a birth and death process coupled with a piecewise deterministic Markov process, that, when advantageous mutations are rare and the population size large enough, the population process behaves on the mutation time scale as a jump process moving between successive equilibria. The main idea is a time scale separation. The model explains a possible diversification into species well adapted specialized to consume some specific resources.
Essential technical ingredients are the study of a generalized system of ODE's modeling a finite number of biological populations in a competitive interaction due to multi-resources and a fine description of the invasion and fixation of mutants using branching processes.

Huyên Pham (Université Paris Diderot)
Title: Randomization approach for stochastic control problems
Abstract: We study optimal stochastic control problem for non-Markovian stochastic differential equations (SDEs) where the drift, diffusion coefficients, and gain functionals are path-dependent, and importantly we do not make any ellipticity assumption on the SDE. We present a randomization approach of the control, and prove that the value function can be characterized by a backward SDE with nonpositive jumps under a single probability measure, which can be viewed as a path-dependent version of the Hamilton-Jacobi-Bellman (HJB) equation, and an extension to G-expectation. This includes in particular equations in finance arising from model uncertainty. In the Markovian case, our BSDE representation provides a Feynman-Kac type formula to fully nonlinear HJB equation, and leads to a new probabilistic numerical scheme for solving this equation, taking advantage of high dimensional features of Monte-Carlo methods.

Gilles Wainrib (Université Paris 13)
Title: Information processing in random neural networks
Abstract: Motivated by the modeling of neuronal networks and by the emerging field of reservoir computing in machine learning, we will discuss in this talk recent results concerning the dynamics and phase transitions of random neural networks. In particular, the question of signal representation with input=driven random neural network and its appplication for information processing will be developed in this talk.