In 2012, Bio-Psy launched a call for common equipment acquisition, with the aim to strengthen research teams around the development and use of new technological approaches in agreement with Bio-Psy's main scientific axes. Projects had to involve teams with complementary competence and equipment or facilities had to be accessible to all Bio-Psy teams, with shared know-how. Four projects were selected regrouping a total of 14 teams.

- ***Rodent virtual ball (coordinator L. Rondi-Reig, IBPS, 8 teams)***

The ability to make adaptive decisions during goal-directed navigation is a fundamental and highly evolved behavior that requires continual coordination of perception, learning and memory processes, with the planning of behaviors. Impairments in these cognitive functions are thought to underlie the symptoms that define a number of different psychopathologies. The virtual ball is a unique equipment that allows to assess the mechanisms of two complementary processes: 1) how sensori-motor and emotional information is processed in order to build a mental representation of the context in which a given behavior will take place; 2) the ability to properly use and adapt behavior to ongoing changes of the context. The combination of electrophysiological recording with optogenetic control in genetically engineered freely moving mice or rats opened the way of cell-type targeted and temporally precise interventions into mammalian neural circuitry. Virtual reality allows establishing causal effect between behavior and firing pattern of large ensembles of neurons using a cellular resolution. In the context of mental illness, the final objective is to find out which of the identified mechanisms observed in animal models are compromised in pathological conditions. This platform is the first of its kind to be set up in France.

- ***Facility combining electrophysiology with optogenetics in freely moving rodents (Coordinator L. Mallet, ICM, 5 teams)***

The combination of optogenetics and electrophysiology technologies in freely moving rodents allow the establishment of causal relationships between brain activity and normal or pathological behavior. However, while optogenetic tools for perturbing neural circuits on physiologically relevant timescales have recently proliferated, the hardware and software for recording electrophysiological data have remained virtually unchanged; with no commercial system offering readily usable closed-loop functionality, and high-channel-count systems remaining bulky, complex, and expensive. To overcome these limitations, we propose to take advantage of a recent technology, the "open-ephys" system, for acquiring electrophysiological data, analyzing it in real time, and delivering feedback within milliseconds for a very competitive price with better performances than regular recording system. By combining this technology with optogenetics, our hope is to make these cutting-edge approaches available to more investigators and to create a flexible facility which will be applied to animal models of neuropsychiatric disorders.

- ***Mouse behavioral study in complex social/housing environment ("Souris-City") (Coordinator P Faure, Jussieu, 6 teams)***

In order to characterize neuropsychiatric disorders using mouse models, investigators focus on particular aspects of behavior by using a limited number of tests. There is an urgent need to refine such behavioral testing with, in particular, an emphasis on a transition to an automatic testing process. This project aims to develop complex housing environment ("TSE intellicage") to test mice under social conditions or during continuous brain activity recording. In this environment, groups of normal or pathological-model mice have access to specific tasks while their social, circadian and cognitive behaviors are monitored continuously using multiple sensors. This allows portraying a complete phenotype on par with what is available in the human clinics. Such system also counteracts inherent limitations of human assessment and minimizes handling and experimenters' presence that could induce stress or disturb the natural cycle of the animal. It also gives access to a number of data that are not accessible using classical assay and that are essential to model pathological behavior.

- ***Evaluation platform for iPS-derived neurons (coordinators U. Maskos/D Di Gregorio, I Pasteur, 5 teams)***

Human induced pluripotent stem (iPS) cells are becoming the method of choice to study terminally differentiated human neurons in a variety of disease contexts. However, the electrophysiological and electrochemical characterization of these neurons is often lacking, due to insufficient collaboration between

geneticists and electrophysiologists. The proposed platform will allow the detailed analysis of human neurons in vitro, and in vivo. It includes a patch clamp and rapid confocal imaging set-up to handle the high demand for initial characterization of derived neurons. This will allow an initial physiological characterization of human neurons in culture, and, after their transplantation into experimental rodents, in slices obtained from their brains. In vivo imaging will be performed on an existing system already available. For those neurons exhibiting synaptic deficits, more in depth studies will be performed using neurotransmitter photolysis on an existing in vitro system in the department. Neurons in culture or after transplantation will be further analyzed by advanced optical techniques, using uncaging, photoregulation of receptors, and optical detection of neurotransmitter release.