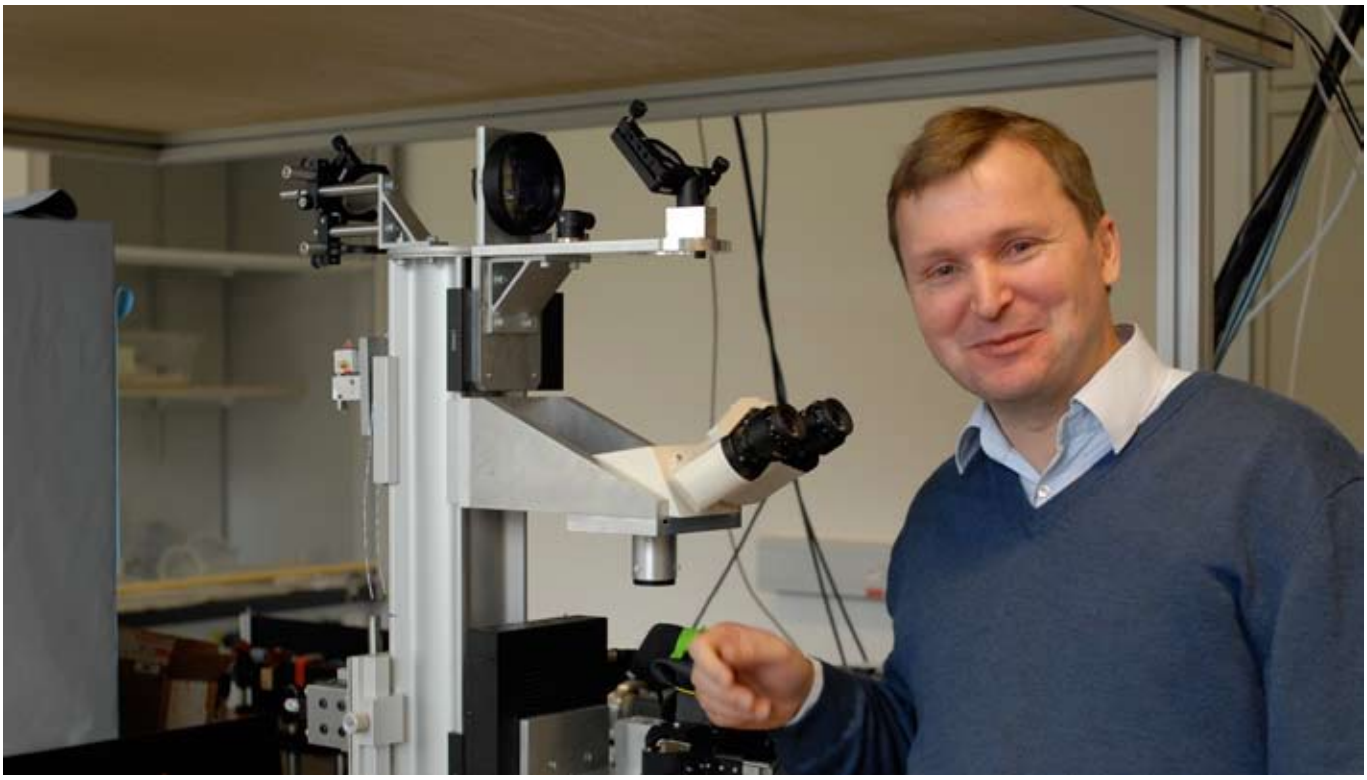
Humans and Brains decide collectively.

The project «Neurochoice» searches for decision patterns all the way from synapses to financial experts.



Project leader Fritjof Helmchen is building a laboratory with microscopes capable of showing decision-making processes in mice brains. Photo thm

Thomas Müller

Zurich. The current financial crisis was, and continues to be, the consequence of a collective shortcoming of brokers and managers positioned at different stages in a commercialization chain and who repeatedly took the same decisions. Most likely, the financial crisis will continue to keep economists busy for years, if not decades. However, they are not alone this time. In SystemsX.ch, biologists, economists, physicians and mathematicians work together to find the neuronal correlates responsible for collective decision-making. «Neurochoice» is the title of the ambitious research project launched last fall by nine research groups at five Universities.

«Yes, one can expect to find evidence that the decision-making pattern leading to a financial crisis is represented in the brain.», says Professor Fritjof Helmchen from the Brain Research Institute of the University of Zurich. Physicist and physician Helmchen heads «Neurochoice» and – months before the financial crisis erupted – joined forces with Professor Ernst Fehr, Director of the University's Institute for Empirical Research in Economics. Fehr is a co-founder of the discipline neuroeconomics and has been studying the neurobiological fundamentals of individual decision-making and social behavior for over ten years.

Are humans overtaxed?

It is known that humans use the same brain areas to assess expected reward as to rely on sensorial perception and to gauge potential risk. From an evolutionary point of view, new financial risks differ gravely from the traditional perception-risks, therefore it is questionable if humans are well equipped to judge financial risks properly, or if they are fundamentally overtaxed.

«To answer questions like this, we plan to do experiments with mice and men, which we can compare to each other.», says Helmchen. Behind this idea lingers the hypothesis that, although mice and men make very different decisions, those decisions take place in the same or at least similar brain structures.

Typically, various brain areas work together to make a decision and take an act of volition. A network of thousands of neurons clarifies each aspect of the decision – for example, the risk calculation. Neurons are, to some extend, network processors connected with thousands of other neurons. These connection junctions, called synapses, represent the elementary layer of the brain structure and function. What stands out on closer examination of the decision-making layers: the work is always done collectively.

The origin of addiction

The synaptic clefts at a specific region of the middle brain is the scope of an additional part of the socially relevant project «Neurochoice». In order to gain a short-term reward, drug

addicts hazard the consequences of long-term damages. Christian Lüscher, Professor at the Department of Basic Neurosciences of the University of Geneva wants to discover how does «addiction» manifest itself in the brain. Among other things, he wants to examine the behavior of mice under the effect of cocaine when weighing between a small, short-term reward and a large, long-term reward. The same mechanism applies for various other drugs, such as nicotine, alcohol, marihuana, amphetamine and opium.

The group of Walter Senn, Professor for Computational Neuroscience at the University of Bern, will try to describe the biochemistry of substance abusing behavior through mathematical models. Thus, addiction can either be an exaggerated valuation of a small, short-term kick, or a suppression of a larger, long-term damage. Which mechanism is at stake, from a brain physiology point of view, is still controversial. Nevertheless, Senn's mathematical models could determine which brain signals need to be observed during experiments to differentiate between the alternative decisions. As for the remaining decision-making layers, Senn's group will try to find respective models. It would be interesting to know if such patterns also appear in decisions which are commonly not considered to be related to addiction – such as, for example, society's «indulgence» in fossil fuels consumption in the view of the global climate problem.

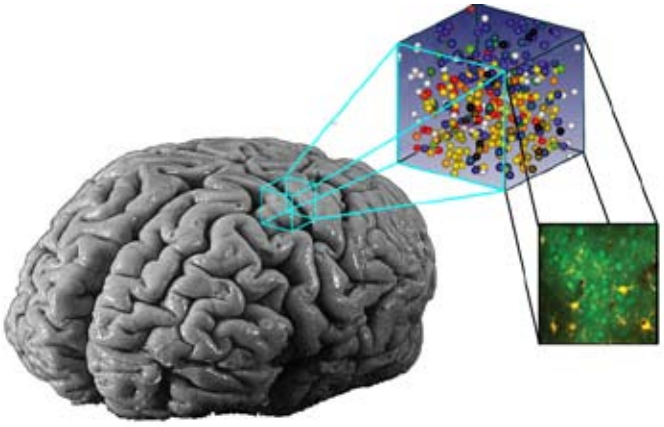
This line of reasoning is, no doubt, a long stretch; nevertheless it is a realistic stretch. The researches of «Neurochoice» are convinced that similar decision-making principles exist in the various layers – from the synapses to the social groups. Helmchen: «We want to discover these principles.»

Filming the brain during decision making

Brain researchers use functional magnetic resonance imaging (fMRI) to observe the brain during activity. Depending on the task, a specific brain area lights up, allowing a map to be drawn of the activated brain regions.

Through the use of fMRI, the neuroeconomists of «Neurochoice» will examine the interaction between different brain areas during decision-making processes. However, the neuronal networks located inside a single brain area are more difficult to observe.

In this regard, «Neurochoice» will do pioneering work. By using electrophysiological and optical methods, they will uncover the activity patterns of networks in networks of mice and rats during decision-making.



Cube: the network activity of some hundreds of brain cells is measured in the rate of 10 times per second with the help Square: Dyed neurons and astrocytes Graphic art NET

A combination of a laser sampling procedure and a sophisticated dyeing technique is applied to differentiate neurons from other brain cells. In doing so, the group of Fritjof Helmchen will succeed, for the first time worldwide, in depicting the activity of hundreds of neurons in a three dimensional and real-time manner (10 images per second).

During the «Neurochoice» term, the amount of observed neurons will increase, and the image rate will raise to 100 images per second.

Furthermore, an endoscopic miniature microscope, which allows animals to move freely while carrying it on their heads, will be adopted. thm

«Neurochoice» – Neuronal Correlates of Collective Decision Making» at a glance

Neurochoice
Neural Correlates of
Collective Decision Making

Head	Prof. Fritjof Helmchen, Brain Research Institute, University of Zurich
Involved research groups	Institute for Empirical Research in Economics, University of Zurich; Institute of Pharmacology and Toxicology, University of Zurich; Department of Physiology, University of Bern; Swiss Finance Institute; Brain Mind Institute, EPF Lausanne; Department Basic Neurosciences, University of Geneva.
Number of research groups	18
Researchers : Administration	30:2
Biologist : Non-biologists	3:1
Overall Budget (2008-2011)	14'778'900 Fr., from which SystemsX.ch 5'395'900 Fr.