

Ion dynamics in the brain during metabolic stress

Description and aims

Brain function critically depends on the availability of ATP. During metabolic stress, energy-dependent processes will fail affected, ranging from failure of synaptic transmission (seconds) to changes in ion gradients (seconds to minutes) and cell swelling (minutes to days) with time scales from seconds to days. The aim of the workshop was to bring together neurobiologists, mathematicians, physicists and clinicians to bridge to gap between neurobiological experiments, computational modelling and clinical observations, define “important questions” in the field and to explore possibilities for further collaboration.

Outcomes

While all disciplines have made contributions to the body of knowledge on metabolic stress, it became clear that primary motivation, terminology, knowledge base and scientific approach are vastly different. Further integration into a meaningful overview of the processes leading to metabolic stress and how to treat this in patients will require significant ongoing effort, where it was noted that clinical utility is not the primary motivation for many neurobiologists. Also, in the same vein, to which extent fundamental processes need to be understood to improve clinical treatment is an open question, too. For example, there is a huge discrepancy of reported treatment effects in animal models of stroke and clinical impact: while in the first very promising results have been reported, clinically efficacy is essentially absent.

Although during this workshop it was not possible to fully bridge the gap between neurobiology, computational modelling and the clinic, it became clear that progress in the modelling of neurobiological processes at the level of synapses is to be expected in the near future. The workshop contributed substantially in the interaction between neurobiologists and modelers from the mathematical and physical community. It is most challenging to pinpoint the right questions that will advance the field.

Format of the workshop

In the program we had scheduled three planar breakout sessions. It turned out that discussions in smaller groups replaced some those session, with lively and very useful discussions. Having top experts in several but different fields paid off to raise the quality of these breakouts in smaller groups. However, we should have paid much more attention to bring the neurobiological PhD-students to the level where they could profit much more from the discussions on modelling.

Comments

First, a follow up effort would require a tutorial section in which each specialty is cross-trained to a level where interaction across disciplines is facilitated. Second, a session where gaps in the research approach between the disciplines are summarized and discussed has the potential to lead to a set of recommendations on how to proceed. Third, as a follow up on the second step we need to create an inventory of realistic translational opportunities for future work.

In conclusion, we have enjoyed an inspiring week in the always beautiful environment of the Lorentz institute, with excellent support staff.