

# Interview with Matthias Merkel (CPT, Marseille, France)

## - Could you briefly describe your academic background and experience ?

I have studied physics at the Technical University Dresden, Germany, before doing my Ph.D. in theoretical biophysics with Frank Jülicher in the same city. During that time, I have been working on physical aspects of epithelial deformation and mechanics, as well as planar cell polarity. There was a very active and fruitful collaboration with the group Suzanne Eaton, who is interested in the wing development of the fruit fly, *Drosophila melanogaster*.

Afterwards, I did a post-doc with the group of Lisa Manning in Syracuse, NY, USA. With her, I have studied a class of models for biological tissues called vertex models. Biological tissues can behave as solid or as a fluid, depending on the conditions and on what kind of tissue one looks at. Together with Lisa, I have studied in detail a solid-fluid transition that appears in vertex models. Moreover, I realized that this transition very generally applies to a broad class of physical systems.

## - What led you to interdisciplinary research ?

During my Ph.D. and later on during my post-doc, I have continuously been collaborating with experimentalists, who were most of the time biologists. I found this very exciting and inspiring. For example, I am amazed by one of the fundamental questions in developmental biology: How do trillions of cells coordinate their behavior in order to create the complex adult organism out of a single egg cell? Interdisciplinary collaborations with biologists allow me to combine my fascination for biological questions with my interest and excitement about physical and mathematical approaches.

I have realized that interdisciplinary collaborations are extremely beneficial for both sides- both theory and experiment can mutually benefit and fuel each other's research.

In particular, both sides gain an additional, and not seldomly, completely different perspective. Often, a forth-and back between experiment and theoretical ideas and hypothesis-testing leads to a deeper understanding of the system.

## - What led you to CENTURI ?

I have heard of the establishment of this new center at a conference in Germany, and then talked in person to some of its members. I quickly got the impression that this would be a great opportunity for me to build my own group, in particular due to the possibility to collaborate with high-level experimentalists.

## - Could you describe us your research projects and perspectives within CENTURI ?

Very broadly, I am interested in how in living systems, the behavior of a whole arises from the interplay of the individual parts. For instance, most multi-cellular organisms develop out of just a single egg cell. During this process, a large number of cells need to coordinate to create the complex patterns that constitute the adult. One important kind of process here is the self-organized deformation of biological tissues. I want to understand under which conditions tissues can robustly and autonomously deform in an oriented manner, and in particular how this can arise from the collective behavior of the constituent cells.

Moreover, I am interested in understanding the behavior of disordered materials.

For example, an important ingredient of many biological tissues is collagen, which consists of a network of flexible fibers. However, these fibers are randomly arranged within these networks and this makes the whole-network behavior harder to understand. I am developing new mathematical approaches to predict the mechanical behavior of such networks despite the randomness.

Besides these theoretical projects, I am collaborating with several CENTURI researchers on projects where I can apply these theories.

**- What are your first impressions about CENTURI ?**

I like that CENTURI has a very collaborative and interdisciplinary work atmosphere with open and friendly people, such that the integration into the center is relatively quick for me. Another positive point is the proximity to potential collaborators, which are mostly even in the same building. From what I have experienced so far, the center shows a great diversity of high-level research.