Description for the general public (in English)

Our study is addressed to identify how foraminifera develop their shells. Foraminifera are a group of single-celled organisms, living mostly in marine environment. They are known from forming shells covering their cells. Overall architecture of those shells vary from one species to another: in one species it is formed by one chamber in the others it is multichambered, in that case chambers can have different shapes and arrangements. Thanks to extensive studies of composition and internal structure of fossil foraminiferal shells, we know a lot about changes of climate and environment during the history of the Earth. Foraminifera help us in dating rocks and exploration of petroleum as well. The problem is that there is almost no valuable information about how those tests develop. Our project is going to be the first step to catch up, so we propose studies focused on observations this process alive. As a part of project preparation we established in our laboratory first in Poland culture of foraminifera. This will give us seamless source of them for experiments. We will select calcareous species which have almost transparent shells.

Development of shells was studied using computer modelling. Thanks this original method we identify some factors controlling their growth. We now know that the positon of aperture (a hole or a set of the holes in the shell) is involved in that process. This corresponds to results achieved by methods of molecular biology. The results obtained by both methods was summarized in the film, which can be seen online (see link below). From previous research we know that overall architecture of foraminiferal shell depends on function of protein net called cytoskeleton, which forms 'scaffolding' that shapes the cell and takes part in movement of the cell and its elements. Our hypothesis says that the diversity of the shell shapes reflects different ways of arrangement of cytoskeleton. To reveal this we need to capture stage by stage development of new chamber in living foraminifera. The best way to do that is by using fluorescent microscopy. That technique allows to get high quality images of cells and their internal structures. Moreover, this powerful method enables to make chosen parts of the cell visible. We will get series of images of forams on different stage of development and the we will analyze obtained pictures searching for patterns. The next step is interpretation of those patterns and building an empirical model of development of shells. Additionally, we will check the influence of particular factors such as salinity, concentration of different ions in water etc. on this process. For validation of the our model we are going to perform observation using different techniques, such as confocal microscopy, electron microscopy and micro–computed tomography **(**microCT).

During fossil interpretation scientists always make a lot of assumption on how and why they reflects conditions of the environment in the past. Our understanding of those mechanisms are still insufficient so studies of recent foraminifera can shed new light on the fossil ones. We will check, if those assumptions are justified and thereby improve the interpretation of the fossil material. But possible impact of our research goes further beyond that. If we would learn how to imitate the process of mineralization of forams' shells or control it in nature, we could apply that knowledge in biomedical engineering.

https://www.youtube.com/watch?v=q0WbN34Mh7k