Life appeared on Earth four billion years ago, but for most of that time it existed only in the form of microscopic single-celled organisms similar to bacteria and yeast. Only 'recently' have multicellular plants and animals appeared with billions of cells specialized in a variety of functions. The way organisms form their bodies from cells, their body mass and the size of their genomes changed with the Earth's climatic conditions, but we do not fully know why these changes were linked. Now, scientists are slowly beginning to understand how changes in the number and size of cells can affect how organisms are functioning in a changing environment, particularly when we consider aquatic organisms and the thermal and oxygen conditions in water. Having many small cells in the body increases the organism's ability to take up important resources from the environment and use them within the cells. This is due to the large transport surface area that cell membranes produce in organs composed of many small cells. However, maintaining such a large amount of membranes requires increased work and energy expenditure. It is therefore costly, especially when the organism has to conserve energy to stay alive in a demanding environment. Thus, cells of small size will not be optimal in all environments, and the most favourable cell size will be determined by the trade-off between the transport capacity of the organs and the maintenance costs. To find out how cell size and genome size affect the functioning of organisms, we have designed a study of European water frogs in the field in their natural environment and under controlled laboratory conditions. The frogs selected for the study are unique in that their natural populations are composed of two distinct species (*Pelophylax lessonae* and *P. ridibundus*) that readily interbreed (so-called hybridization) and form hybrids (*P. esculentus*). As a result, these frogs come in forms with different genome sizes and different parental gene shares, which we believe also affect cell size, and thus, the functioning of the frogs in different environments. We plan to look closely at a range of water bodies in Poland, which are the breeding sites of the studied frogs. We will record the temperature and oxygen content in these reservoirs and determine the cell sizes and genomes of the tadpoles living there. We anticipate that tadpoles with smaller cells and smaller genomes will be found mainly in warm and less oxygenated ponds. We also intend to breed frogs in the laboratory to obtain tadpoles for our experiments. In the lab, the tadpoles will be developed at two temperatures, which should vary their growth rate, metabolic requirements, and cell size. Examining these tadpoles, we will determine the abundance of each parental genome, measure cell size in different tissues, and quantify the activity of some key physiological processes. We will reveal how fast tadpoles grow, how much oxygen they need, how many energy-releasing sites (known as mitochondria) their muscles have, what capacity their livers have to make new proteins during so-called translation and to create substrates for a range of physiological processes during so-called glycolysis. We will also come closer to understanding the physiological limits by measuring oxygen demand in tadpoles, first at rest and then after they have been provoked to swim, in oxygen-rich and oxygen-poor water. No previous studies of the functional significance of cell size have included such a wealth of information about organisms that vary in genome and cell size. We expect that tadpoles with larger genomes and larger cells will have a physiological advantage in cold and well-oxygenated environments. Such cells are more economical and helpful to the organism when the rate of chemical reactions inside the cells decreases with decreasing temperature. In contrast, tadpoles with smaller genomes and smaller cells should perform better in warm and oxygen-poor environments because such cells facilitate oxygen delivery to mitochondria, even though such cells are costly. Our project proposes a completely new idea for studying the process of species hybridization - an important consequence of gene flow between species (known as introgression) can be the change in cell size, which ultimately affects how organisms cope with their environment. Without studying the significance of these phenomena, we cannot deeply understand the history of life on Earth and, importantly, predict all the changes that life will undergo as a result of global climate change.