DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

(state the objective of the project, describe the research to be carried out, and present reasons for choosing the research topic – max. 1 standard type-written page)

The nineteenth century naturalists were disappointed when they found familiar microbes instead of exotic species that they were expecting in samples from newly explored regions of the Earth. The conclusion seemed obvious – there are no microbe counterparts to kangaroos limited to Australasia or penguins to the southern hemisphere. This led scientists to formulate the "everything is everywhere, but environment selects" hypothesis ('EiE'). In short, the hypothesis states that microorganisms are free to disperse around the globe and they can thrive wherever environmental conditions are favourable. The hypothesis was later extended to protists and multicellular organisms that produce microscopic propagules or are themselves microscopic, *i.e.* no more than around 2 mm in size. The 'EiE' hypothesis bears important consequences for evolution and biodiversity of microfauna as the way the organisms are distributed is likely to influence the number of species, the rates at which they evolve and how likely they are to go extinct. Yet, the 'EiE' hypothesis has been tested on animals only once and the test was limited to showing that some rotifer species exhibit cosmopolitan distributions, whereas other do not. This suggests that body size – in contrast to the predictions of the 'EiE' hypothesis – is not the only factor that affects the dispersal of microscopic animals. Thus, it seems that traits other than body size have to be taken into consideration in order to explain geographic ranges of the microfauna. Both, the *type of reproduction* (*i.e.* sexual and asexual) as well as the ability to enter *cryptobiosis* (a dormant state in which an organism can survive through unfavourable conditions) are hypothesised to be important determinants of dispersal potential and could, therefore, influence geographic ranges of small organisms. In other words, the interplay between these two factors could be crucial for understanding the mechanisms behind the distributions of microscopic animals.

The project I propose will be the first test of the 'EiE' hypothesis that takes into account the reproductive mode and cryptobiotic abilities. As a model, I will utilise tardigrades, microscopic animals that can reproduce both sexually and asexually, and are famous for their cryptobiotic abilities. In order to achieve this, tardigrades will be collected from nine distinct regions on three continents: Europe, South America and Australasia. The regions will differ not only in their geographic locations, but also in the type of climate. This way both geographic distance and environmental conditions will be taken into account. In order to obtain a required number of individuals for all planned analyses, tardigrades will be reared in the lab. Animals of each found species will be split into several groups. Some will be photographed and measured in light and scanning electron microscopes – this will provide detailed data on the morphology of investigated species which will be needed for their identification. Other animals will be processed for genetic studies – the knowledge of DNA sequences will verify species identifications but it will also be used to reconstruct phylogenies, *i.e.* genealogical trees that show evolutionary relationships between different species. Another group of animals will be used to establish how they reproduce, *i.e.* whether both sexes are present or whether they are parthenogenetic (*i.e.* females can reproduce by themselves). This will be achieved by tracking lifecycles from egg to egg, looking for spermatozoa, and by establishing the number of chromosome sets in cells. The accurate diagnosis of the reproductive mode is important because it is suspected that parthenogenetic species are more likely to colonise new habitats than sexually reproducing counterparts. This is so, because only a single egg can start a new parthenogenetic population whereas mature individuals of two sexes are needed to start a sexual population. The last group of tardigrades will be tested for cryptobiotic survival. They will be first dried and then rehydrated a month later. The percentage of animals that woke up and are active will tell how tough they are and knowing this will let us know how likely they are to travel long distances, *e.g.* by wind (the tougher the species, the better coloniser it should make). Thus, combining the data on geographic ranges of the species with information on their reproduction and cryptobiosis will not only tell us whether tardigrades can be cosmopolitan, but will also tell us if species distributions at different geographic scales are influenced by these two factors. Interestingly, using these data in other combinations can also answer some additional fascinating questions. For example, how reproductive mode and dispersal potential affect how fast species are evolving into new ones and how likely they are to go extinct. Last but not least, tardigrade species collected and described during the study will enrich our knowledge on the biodiversity of poorly explored regions of the Earth.