The aim of this research proposal is to answer the question (on the example of two Baltic Sea species the three-spined stickleback and European flounder): how does the cutaneous stress response system function in teleost fishes subjected to oxidative stress in the laboratory? Potassium dichromate, a common inorganic chemical reagent, most commonly used as an oxidizing agent in various laboratory and industrial applications, will be added into the aquarium water to induce oxidative stress. The doses of potassium dichromate and exposure time for experiments will be selected on the basis of a study of flounder skin fragments exposed to various concentrations of potassium dichromate performed at the beginning of the project.

The three-spined stickleback and European flounder have been selected for this study, due to, among other things, different structure of their surface (skin+mucus), developed methodology and availability. Flounder was selected due to the size that enables us to do such analyses which are unfeasible in small stickleback. On the basis of our experience and literature, we suppose that melatonin, its derivative AFMK and cortisol, together with other factors protecting cells from oxidative stress in the fish skin and mucus, make a consistent cutaneous stress response system. Carrying out the experiments we will get to know: i) whether the oxidative stress affects melatonin biosynthesis and forming of AFMK in the stickleback and flounder skin, and the release of Mel and AFMK into the mucus in the flounder, ii) is there any relationship between melatonin/AFMK levels in the skin of stickleback and in the skin and mucus of flounder, and level of cortisol (stress hormone), and TBARS and TAC (indicators of oxidative stress).

This project proposal is a continuation of the previous research (project NCN “Stress hormones in fish skin” in years 2012-2017). Then we demonstrated for the first time that there is every chance that a local system of response to stress exists in fish skin. However, at that time we analyzed only flounder skin fragments exposed to cortisol in doses imitating stress conditions, but we did not perform any experiment with fish subjected to stress. We showed that cortisol affects Mel and AFMK release from flounder skin fragments in dose-dependent manner. Moreover, we found that it can be presumed with high probability that melatonin and AFMK are formed in the stickleback skin. Although the research strongly suggested that the cutaneous stress response system is present in fish, one crucial question was left unanswered: how does this system work when fish is subjected to stress?

Now we expect to present a new mechanism of response to oxidative stress in fish and open new perspectives of research (on the cutaneous stress response system) in other vertebrates. The skin of vertebrates which acts on the one hand as a biological barrier defending the organism against harmful environmental factors, and on the other hand mediates in exchange of information between the internal and external environment to maintain the dynamic equilibrium in an organism, is definitely worth studying.