Chronic periodontitis is the most serious form of a gum disease. In periodontitis, not only soft gingival tissues are affected, but also tissues of the periodontium that keep the tooth in the tooth socket (alveolus), including the bone around the tooth (alveolar bone). Chronic inflammation leads to the degradation of the ligament fibers immobilizing the tooth in the alveolus and dissolution of the alveolar bone, which is manifested by a reduction in the gum line, formation of deep pockets between the gum and tooth, loosening of the tooth and consequent tooth loss. Periodontitis occurs in more than 50% of people over 40 years of age and severely affects about 10% of the population. In addition to the fact that periodontitis can lead to complete loss of teeth, it can cause or exacerbate serious diseases such as: arteriosclerosis, diabetes, chronic lung disease, Alzheimer's disease, some cancers and rheumatoid arthritis. (RA). Despite the difference in the origins of the development of periodontitis, which is caused by pathogenic plaque bacteria below the gum line and RA, which is an autoimmune disease driven by auto-antibodies recognizing modified proteins in the joints, both diseases have many common features. In both cases, chronic inflammation leads to bone tissue damage and both diseases are epidemiologically (in people with periodontitis, RA is more frequent than in people with healthy gums and *vice versa*) and clinically (in patients with RA there are more cases of advanced periodontitis and effective treatment of one disease improves the course of the other). The observed link between periodontitis and RA may result from similarities in the course of both diseases (chronic inflammation), similar mechanisms causing damage to soft tissue and bone, as well as common genetic and environmental (smoking) risk factors. Recently, however, more and more reports point to a causal relationship between periodontitis and RA. In genetically susceptible individuals, the development of RA starts when the confused immune system recognizes modified proteins, in which one of the amino acids (arginine) has been enzymatically changed to citrulline, as foreign and starts the production of antibodies that react with citrullinated proteins (Antibodies to Citrullinated Protein Antigens = ACPAs). In humans, protein citrullination is catalyzed under physiological and inflammatory conditions by enzymes called peptidyl arginine deinminases (PADs). ACPAs appear in the blood up to 10 years before the clinical symptoms of RA and their detection is of great diagnostic importance because ACPAs are only detected in association with RA. In spite of intensive research, it is still unclear where and how the immune tolerance for citrullinated proteins is broken. It is now assumed that ACPAs production is initiated on mucous membranes subjected to chronic inflammation, such as, for example, lungs in tobacco smokers, inflammatory disorders in the digestive system, or gum tissue in people with periodontitis. More and more evidence suggests that *Porphyromonas gingivalis*, the most important pathogen responsible for the development of periodontitis, is responsible for the causative relationship between periodontitis and RA. Among numerous pathogenic factors produced by *P. gingivalis* that disrupt the local anti-bacterial activity of the defense system and perpetuate inflammation, is a unique enzyme (PPAD) converting arginine into citrulline in proteins, thus generating citrullinated proteins similarly to human PADs. In this way, *P. gingivalis* can contribute to the development of RA as confirmed in animal models of RA. In addition, our studies indicated that citrullinated proteins stimulate gingival fibroblasts to synthesize and secrete prostaglandin E2 ($PGE_2$), a pro-inflammatory factor responsible for bone resorption both in periodontitis and RA. In addition, we discovered in some clinical strains of *P. gingivalis* the occurrence of a PPAD form at least twice as active as the one characterized from laboratory strains. Based on these results in this project, we plan to implement the following research goals: (***i***) to study influence of citrullinated *P. gingivalis* proteins as a whole (the so-called citrullinome) and individual modified proteins on $PGE_2$ production by gingival and synovial fibroblasts from healthy and diseased donors; (***ii***) to elucidate the mechanism by which PPAD breaks the immune tolerance acting as a carrier protein for citrullinated peptides (haptens), which are presented to immune cells, producing antibodies to peptides that are not immunogenic under normal conditions; (***iii***) to analyze of the occurrence of *P. gingivalis* strains producing superactive PPAD in the context of the correlation between their occurrence and the severity of periodontitis in association with RA. The results of these studies will shed new light on the mechanisms of periodontal apparatus damage and the overcoming of immunotolerance to citrullinated proteins, which will allow in the future development of new, more effective methods of treatment and prevention of periodontitis and rheumatoid arthritis.