DNA is one of the most important cell molecules. It contains all information about body structure and functions performed by its organs. Since the discovery of structure in 1950's by Watson and Crick and later confirmed by other scientists, DNA is known to be the central molecule of life. Therefore, any damage to DNA affect the whole cell and sometimes even the whole organism. Some damages can cause cell death, while other may lead to cancer. DNA molecules are prone to various damaging factor such as chemical agents, UV light, high energy radiation (X-ray). Luckily, the DNA is composed of two complimentary copies (strands). If one of the copies is damaged, the other one is used as a template for repairing. Therefore, the most harmful situations occur when both DNA strands are damaged simultaneously – these types of damages are called double strand breaks. A number of natural mechanisms of human DNA repair have been discovered, which prevent changes of DNA structure. When double strand break occurs, the first line of defense is to identify the damaged fragment and link the loose fragment together. In most cases, this mechanism results in finding the proper way to match the damaged DNA. However, it is not perfect and sometimes it fails. Then the last line of defense for human cells to prevent significant changes of DNA structure is the so called “popping-out” mechanism. DNA is constructed as a sequence of repeating fragments. Therefore, if a repeat is damaged beyond repair, the whole block is excised from the structure. In this project, we will study the last line of cell defense against DNA damage, which thus prevents the cells to become the potential cancer seeds. Before studying how the excision of the whole block occurs, it has to be analyzed what happens when the DNA is damaged. As it is extremely difficult to investigate this mechanism in detail by using experimental methods, a computer-simulation approach will be pursued within the proposed project. In the begging we will investigate what happens when both strands are damaged. As there are many reactions occurring these system will be simulated with extremely high precision. Once the reaction ends, which happens very quickly, we will then study how the damaged DNA behave. Is it stable or is it moving around, are the most basic question we want to answer. Answering what reactions are occurring and what is happening next will help to understand how the cancer cells are born. The understanding of this mechanism will help for better design of drugs preventing this process. In the next step we will investigate how poping out protein find the damaged DNA. How the protein recognize it should bind to the damaged fragment? Finally, we will investigate how the protein drives away the whole block.