tion with Rad18 or Rad51. Probably these independent functions act with one or more other proteins out of Rad18 and Rad51. Thus we expect that Rad5 has a more complex protein interaction network than it was previously known.

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Heterologous protein expression and *in vitro* analysis of *Drosophila melanogaster* proteins involved in telomere maintenance

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Our laboratory is particularly interested in the maintenance of genome integrity and telomere structure in *Drosophila melanogaster*. In eukaryotic cells, telomere prevents the chromosome ends from being detected as DNA double strand breaks and protects the coding regions from degradation. Telomere "capping" by the multi-subunit complex Shelterin, expressed in higher eukaryotes, averts the triggering of the DNA damage signaling pathways. In *Drosophila* this capping process is performed by a putative complex called Terminin, which is believed to have HOAP, HipHop, Ver and DTL (or Moi) proteins as subunits and it binds to the DNA in a sequence-independent manner. HP1 is generally regarded as the fifth subunit of the putative complex, thought it is not a strictly terminin-specific protein. HP1 is evolutionary highly conserved and plays a role also at non-telomeric regions while Terminin proteins manifest an accelerated rate of evolution and localize only at chromosome ends. Deletion of any of these genes results in telomere fusions. The physical interactions among Terminin proteins have been demonstrated *in vitro*. All these data support the existence of the Terminin complex.

The aim of my research was to study in details the putative Terminin complex and its suggested components by bioinformatics and molecular biological methods.

In silico analysis on the proportion of synonym and non-synonym codon substitutions confirmed that the full length HOAP, HipHop, DTL and Ver molecules have accelerated evolution compared to HP1. Interestingly, specific protein domains showed different rates of evolution and some of the hyper-variable domains have a role in protein-protein interactions.

The cDNA of each protein was cloned and expressed both in bacterial and in baculoviral expression systems. Our results indicated that DTL and Ver proteins form inclusion bodies in bacteria. Co-expression with at least two interacting partners resulted in soluble DTL and Ver proteins. A polycistronic construct containing all the five cDNA was engineered, and the purification of the complex is in progress. Early data suggest the formation of several sub-complexes rather than the assembly of a holo-complex in bacteria. The DTL protein produced in baculovirus system was applied in far-western experiments and although we were unable to detect interactions with Terminin proteins by this method, an interaction with a nuclear protein has been revealed.

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Biological control of plant pathogenic fungi by use of a *Bacillus amyloliquefaciens* strain

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The damage in agricultural production and storage by phytopathogenic fungi is a serious problem in agriculture. Biological control is an alternative method against phytopathogenic microbes. An organism, which can interfere with pests or pathogen species, is referred to as a biological control agent. A biological control agent can compete for niche and nutrients in the rhizosphere, inhibit the growth of plant pathogens by the production of antibiotics and extracellular lytic enzymes and act indirectly, promoting plant growth and triggering defensive systems of plants against pathogens. It is beneficial if antagonistic strains used for protection against pathogenic microorganisms are resistant to metals present in the soil. The antagonistic microorganisms have to grow and reproduce as well as produce antibiotics and extracellular enzymes in the presence of different metals. The use of biological control may not always be sufficient against pathogenic species. In this case, we need to use combined methods such as use biological control agents with pesticides and appropriate cultivation methods. The biocontrol agent needs to tolerate against the pesticides used in combined treatments.

The *Bacillus* genus contains various species with potential biocontrol capabilities. *Bacillus amyloliquefaciens* SZMC 22206 has been isolated and studied as a potential biocontrol agent in our laboratory. Our aims were to investigate the effect of metals and pesticides on the growth, the extracellular chymotrypsin-like enzymes and the antibiotics produced by *B. amyloliquefaciens* SZMC 22206 strain and to

perform antagonisms test against plant pathogenic fungi.

Using chromogenic substrates we investigated the secretion of protease, chitinase, cellulase and lipase enzyme systems of the *B. amyloliquefaciens* SZMC 22206 strain. The chymotrypsin-like protease activity was significantly high, so in our further studies we analysed this enzyme activity. The effects of metals and pesticides on the growth and chymotrypsin-like protease activity were also investigated. The effects of metals were analyzed with 0,1 mM, 0,5 mM and 1 mM concentration of copper, manganese, nickel, iron and zinc. The manganese did not inhibit the growth and chymotrypsin-like protease activity in the analysed concentrations. The other metals inhibited the growth and enzyme activity at 0,5 mM concentration. We analysed the effects of four pesticides (2,4-dicholorophenoxyacetic acid, carbendazim, linuron and chlortoluron) on the growth and the extracellular chymotrypsin-like enzymes of *B. amyloliquefaciens* SZMC 22206. These results indicated that both bacterial growth and the tested exoenzyme activities were significantly reduced in the presence of these pesticides. These findings suggest that the presence of chemical pesticides (e.g. in agricultural soils) can strongly affect the behavior and effectiveness of the non-target biocontrol bacterial species. *B. amyloliquefaciens* SZMC 22206 strain can produce fengycin, that is a cyclic lipopeptide antibiotic. The production of fengycin is increased if glicerol was used as carbon source, and if aspartic acid, ornithin or alanine were used as nitrogen sources. During in vitro tests the strain inhibited the growth of plant pathogen fungi like *Fusarium solani*, *Phoma cucurbitacearum*, *Phytophtora infestans*, *Alternaria solani* and *Botrytis cinerea*. On the basis of our results *B. amyloliquefaciens* SZMC 22206 shows the potential of being a promising biological control agent against plant pathogenic fungi.

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