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From biomass to biofuels: Exploiting the cellulosome of *Clostridium clariflavum* for plant cell wall degradation

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As the reservoir of unsustainable fossil fuels, such as coal, petroleum and natural gas, is over-utilized and continues to contribute to environmental pollution and CO[2] emission, the need for appropriate alternative energy sources becomes more crucial. Bioethanol produced from dedicated crops and cellulosic waste can provide a partial answer, yet a cost-effective production method must be developed. The cellulosome system of the anaerobic thermophile, *Clostridium clariflavum*, comprises a large number of cellulolytic and hemicellulolytic enzymes and scaffoldings which self-assemble in a number of different cellulosome architectures for enhanced cellulosic biomass degradation. We determined the cohesin-dockerin interaction pattern of the cellulosomal system of *C. clariflavum* and suggested various possible cellulosome assemblies. Further on, we cultivated *C. clariflavum* on cellobiose-, microcrystalline cellulose- and switchgrass-containing media and isolated cell-free cellulosome complexes from each culture. Gel-filtration separation of the cellulosome samples revealed two major fractions, which were analyzed by label-free LC-MS/MS in order to identify the key players of the cellulosome assemblies therein. In addition, the catalytic activity of each cellulosome was examined on different cellulosic substrates, xylan and switchgrass. The cellulosome isolated from the microcrystalline cellulose-containing medium was the most active of all the cellulosomes that were tested and approaches the degradation capabilities of the cellulosome of the most efficient cellulose-degrading bacterium, *Clostridium thermocellum*. The results suggest that the expression of the cellulosome proteins is regulated by the type of substrate in the growth medium. Identification of the major cellulosomal components expressed during growth of the bacterium and their influence on its catalytic capabilities provide insight into the performance of the remarkable cellulosome of this intriguing bacterium. The findings, together with the thermophilic characteristics of the proteins, render *C. clariflavum* of great interest for future use in industrial cellulose-conversion processes.

Biography

Lior Artzi is a direct-track PhD student at the Weizmann Institute of Science in Rehovot Israel. Her work focuses on the Gram-positive, cellulolytic, thermophilic bacterium, *Clostridium clariflavum*, which produces the most intricate cellulosomal system yet described. This year, she is an invited lecturer at an international conference in the Dead Sea and is scheduled to present her work at a Gordon Research Conference and at World Congress and Expo on Applied Microbiology this summer.

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