

Prof. Marek Cieplak directs activities of the Institute of Physics group within a research project funded through the ERA-NET Scheme of the 7th European Union Framework and through the National Centre for Research and Development (NCBiR)

FiberFuel ERA-NET-IB/06/2013

Improved cellulosomes to enhance saccharification of industrially-suitable lignocellulosic biomass residues

The project runs from 7/03/2013 till 30/09/2016. Funds allocated: 150 000 EUR, or 617 280 PLN.

FiberFuel targets the rational design of optimized designer cellulosomes (DCs: cellulolytic enzyme systems based on a scaffolding protein) to overcome the major bottleneck in biomass industrial processing, namely saccharification (the conversion of cellulosic biomass to fermentable sugars). The goal is to improve the efficiency of the saccharification process from low-value raw biomass materials (all of them renewable, sustainable and inexpensive) to produce industrial-value chemicals. Our cross-disciplinary approach includes bio-nanotechnology, structural biology, lab-on-a-chip and modeling.

Partners of the consortium:

Consejo Superior de Investigaciones Cientificas (CSIC), Spain
Weizmann Institute, Department of Biological Chemistry, Israel
Ludwig Maximilian Universitat, Physik und Center for NanoScience
Institute of Physics Polish Academy of Sciences, Poland
Centre National de la Recherche Scientifique, Station Biologique de Roscoff, France
University of Limerick, Ireland – subcontractor to Institute of Physics
Designer Energy (a company involved in production of sugar from biomass), Israel – subcontractor of the Weizmann Institute
Abengoa Bioenergia (a company involved in production of bioethanol), Spain

Papers written in Prof. Cieplak's group at the Institute of Physics till March 21, 2016

1. M. Chwastyk, A. Galera, M. Sikora, A. Gomez-Sicilia, M. Carrion-Vazquez, M. Cieplak, Theoretical tests of the mechanical protection strategy in protein nanomechanics, *Proteins: Struct., Funct., Bioinf.* 82, 717-726 (2014)
2. M. Chwastyk, M. Jaskólski, M. Cieplak, Structure-based thermodynamic and mechanical stability of plant PR-10 proteins with cavities, *FEBS J.* 281, 416-429 (2014)
3. B. Różycki, Ł. Mioduszewski, M. Cieplak, Unbinding and unfolding of adhesion protein complexes through stretching: interplay between shear and tensile mechanical clamps, *Proteins: Structure, Function, and Bioinformatics*, 82, 3144-3153 (2014)

4. M. Chwastyk, M. Cieplak, Knotted proteins under tension, *Israel J. Chem.* 54, 1241-1249 (2014)
5. B. Różycki, M. Cieplak, Citrate synthase proteins in extremophilic organisms – studies within a structure-based model, *J. Chem. Phys.* 141, 235102 (2014)
6. M. Wojciechowski, D. Thompson, M. Cieplak, Mechanostability of cohesin-dockerin complexes in a structure-based model: Anisotropy and lack of universality in the force profiles, *J. Chem. Phys.* 141, 245103 (2014)
7. M. Chwastyk, A. B. Poma, M. Cieplak, Statistical radii associated with amino acids to determine the contact map: fixing the structure of a type I cohesin domain in the *Clostridium thermocellum* cellulosome, *Phys. Biol.* 12, 046002 (2015)
8. M. Chwastyk, M. Cieplak, Cotranslational folding of deeply knotted proteins, *J. Phys.: Cond. Matter* 27, 354105 (2015)
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11. K. Wołek, A. Gomez-Sicilia, M. Cieplak, Determination of contact maps in proteins: a combination of structural and chemical approaches, *J. Chem. Phys.* 143, 243105 (2015)
12. G. Nawrocki, P. –A. Cazade, D. Thompson, M. Cieplak, Peptide recognition capabilities of cellulose in molecular dynamics simulations, *J. Phys. Chem. C* 119, 24402-24416 (2015)
13. A. B. Poma, M. Chwastyk, M. Cieplak, Coarse-grained model of the native cellulose and the transformation pathways to the I β allomorph, *Cellulose* 23, 1573-1591 (2016) [grant number added as a correction in 23, 2247-2247 (2016)]
14. B. Różycki, M. Cieplak, Stiffness of the C-terminal disordered linker affects the geometry of the active site in endoglucanase Cel8A, *Mol. Biosyst.* (2016), published on-line, DOI: 10.1039/c6mb00606j
15. M. Gunnoo, P-A. Cazade, A. Galera-Prat, M. A. Nash, M. Czjzek, M. Cieplak, B. Alvarez, M. Aguilar, A. Karpol, H. Gaub, M. Carrion-Vazquez, E. A. Bayer, D. Thompson, Nano-scale engineering of designer cellulosomes, *Adv. Mat.* 28, 5619-5647 (2016)