Edward A Bayer, J Microb Biochem Technol 2015, 5:4
http://dx.doi.org/10.4172/1948-5948.S1.012

OMICS International
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World Congress and Expo on
Applied Microbiology
August 18-20, 2015 Frankfurt, Germany

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Cellulose, cellulosomes and biofuels

The plant cell wall comprises a collection of natural polymers, which include numerous complex carbohydrates, e.g., cellulose, xylans, mannans, arabinans, etc., and the aromatic polymer lignin, of which cellulose is the most abundant. Cellulose is composed entirely of the simple sugar glucose linked in β(1→4) bonds to form the repeating unit, the disaccharide cellobiose, which is arranged into long linear chains. This arrangement affords near-perfect hydrogen bonding within and between neighboring chains, forming a crystalline-like material, whereby its glucose residues are "locked" in place, virtually inaccessible to the organisms in nature that would otherwise exploit the glucose as an excellent food source. Despite its recalcitrance, an ample corps of microorganisms (bacteria and fungi) can cope with decaying cellulosic matter, by virtue of the cellulolytic enzymes, the cellulases, that they produce. Aerobic fungi and bacteria tend to produce large amounts of cellulases and hemicellulases that together act synergistically in decomposition of the target polysaccharides to their component soluble sugars, as opposed to selected anaerobic bacteria that produce a multi-enzyme complex called the cellulosome. The cellulosome contains numerous cellulases, hemicellulases and related enzymes, attached to the bacterial cell surface, thus enabling efficient degradation of cellulosic substrates. Recent work has been centered on dismantling the cellulosome into its component parts and reassembling them into "designer cellulosomes" of precise content and configuration. This approach reveals insight into the rationale behind its catalytic efficiency, and the knowledge gained enable fabrication of more potent designer cellulosomes for conversion of plant-derived biomass into liquid biofuels.

Biography

Edward A Bayer is a Professor at the Weizmann Institute of Science, Rehovot, Israel. He is Co-Discoverer of the cellulosome concept and has founded, organized and chaired an ongoing Gordon Research Conference on this subject. Since 2008, he has been serving on the Scientific Advisory Board of the US-DOE BioEnergy Science Center (BESC). He is Editor-in-Chief of *Biotechnology Advances,* Section Editor for *Biotechnology for Biofuels,* and serves on the Editorial Board of several other journals, including Environmental Microbiology and *Current Opinion in Biotechnology*. He has authored over 380 articles and reviews, and is a Member of both the American and the European Academies of Microbiology.

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