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Molecular characterization and structure analysis of a putative tumor suppressor QM homologue from the cabbage butterfly Pieris rapae

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The highly-conserved tumor suppressor, QM-like gene homologues have been cloned and characterized from various organisms including vertebrates such as mammals and fish, invertebrates such as insects (D. melanogaster) and shrimp (P. japonicus), plants, yeast and protozoan parasites. The gene encodes a ribosomal protein L10 and has been implicated to function during cell growth, cell differentiation, apoptosis and immunological defence mechanisms. The study describes the molecular characterization and structure analysis of a putative tumor suppressor, QM-like gene (designated as PrQM) found in a normalized whole tissue cDNA library of the cabbage butterfly, Pieris rapae, considered to be a serious agricultural pest in the world. The sequence comprised of 660-bp open reading frame and encoded a protein of 219 amino acids corresponding to 26 kDa protein with predicted ribosomal protein L10a/L10e domain. PrQM amino acid sequence showed high levels of conservation at their N-terminal regions with putative QM homologues from other insects. The apparent difference in functional modules in insects can therefore be attributed to the less conserved C-terminus. The cDNA corresponding to PrQM was thereafter cloned into pET28 (+) vector and expressed in E.coli BL21 cells, and the recombinant protein purified by His-tag affinity chromatography. The recombinant PrQM was detected as a single band of expected molecular weight of 29 kDa in SDS-PAGE. Polyclonal PrQM antibody was generated in Swiss-albino rats and western blotting studies recognized a polypeptide with a molecular weight of 26 kDa, relating to the endogenous PrQM protein, consistent with the theoretical molecular size. The anti-PrQM antibody was ultimately used to understand sub-cellular localization of the PrQM in infection models of Pieris rapae larvae.

Biography

Bharat Bhusan Patnaik has completed his doctorate from University of Madras in the year 2005 and is the recipient of International Scholar Exchange Fellowship by Korea Foundation for Advanced Studies for the year 2011-12. He has also served as UGC-NRCBS Visiting Fellow to Madurai Kamaraj University, Madurai and received the Indian Academies of Science Fellowship for Teachers to Visva-Bharathi University, Santiniketan. He has published quality papers in International and National journals and is a reviewer to Elsevier and academic journals.

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Biotechnology for industrial sustainability

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Industrial scale application of biotechnology has a tremendous potential as they are often associated with reduced energy consumption, greenhouse gas emissions, and waste generation, and also may enable a paradigm shift from fossil fuel-based to bio-based production of value-added chemicals.

The pivotal factor that contributes to the development and implementation of industrial biotechnology is the market economy, as biotechnology offers a highly efficient process at lower operating and capital expenditures. McKinsey & Company reported that in 2010 the industrial biotechnology contributed to 10 percent of sales within the chemical industry, accounting for $125 billion in value.

Some of the promising avenues of for a sustainable biotechnology are protein engineering, metabolic engineering, system biology, bioprocess engineering, and combinatorial biocatalysis.

The above technologies have significantly contributed to sustainability at the industrial scale. Sustainable industry has been coined to identify and classify those industries that produce goods and services in such a manner as to meet the needs and aspirations of the present without compromising the ability of future generation. Essentially, these industries strive to have a economically viable, environmentally compatible and associate "green social responsibilities" to their business objectives. Role of above technologies in promoting industrial sustainability will be discussed.

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