Commentary

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Distinct Roles of Alpha/Beta Hydrolase Domain Containing Proteins

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Abstract

Lipid molecules are not only serve as building blocks of biological membranes but are also progressively documented for their role in various biological processes. Alpha/beta hydrolase domain (ABHD) containing proteins are structurally related with diverse catalytic activities. Members in this family include various enzymes with broad substrate specificities. Proteins from these families are having a conserved ABHD region and lipase and acyltransferase motifs. However, little is known about ABHD proteins in plants. This article discusses about the biological roles and the implications of ABHD domain containing proteins in higher eukaryotes.

Keywords: Alpha/Beta; Hydrolase; Lipid; Acyltransferase; Lipase; *Arabidopsis*

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Description

The ABHD family of proteins is rapidly becoming as structurally related enzymes with various biochemical functions in both synthesis and degradation. The proteins have a conserved lipase (GXSXG) and acyltransferase (HXXXXD) motifs, which suggests that they may have a role in lipid biosynthesis and turnover [1]. In recent years, the mammalian ABHD proteins are likely to have regulatory functions of lipid metabolism and signal transduction. To date, eighteen human ABHD hydrolases and their expression in various tissues have been reported, but most need to be characterized [2]. Mutations in ABHD5/CGI58 cause Chanarin–Dorfman syndrome, an autosomal recessive disorder in humans [3-5]. Human CGI-58 has lysophosphatidic acid (LPA) acyltransferase [6] and lysophosphatidyl glycerol acyltransferase [7] activities. In various cancers, high levels of ABHD11 mRNA transcripts have been reported, but the role of this enzyme in cancer metabolism is not known. ABHD11 has been identified as a possible biomarker for lung carcinoma [8]. *In vivo* metabolite profiling disclosed that human ABHD3 overexpressing cells exhibited elevated levels of phospholipase activity [9]. In a similar study, ABHD6 was shown to have an enzymatic activity that hydrolyzed both monoacyl-glycerol (MAG) and lysophospholipid [10]. In a rodent model, ABHD12 was reported to be a major lysophosphatidyl serine and MAG lipase [11]. Similarly, ABHD16A was shown to hydrolyze phosphatidylserine in mammalian systems. Disruption of these two enzymes showed altered phospholipid and lysophospholipid levels and caused neuro-immunological disorders in mice [12].

From the above research, it is clear that ABHD proteins in human are playing the vital roles with respect to lipid metabolism and various disease conditions.

Unlike human ABHD proteins, in plants, very few studies demonstrated the biochemical and physiological functions of these ABHD family proteins. Recombinant *Arabidopsis CGI58* was shown to possess LPA acyltransferase activity [13]. Accumulation of nonpolar lipids in the leaves of *Arabidopsis CGI58* mutants was also demonstrated [14]. Our recent research on ABHD11 of *Arabidopsis* revealed that the heterologously overexpressed ABHD11 had the ability to hydrolyze lysolipids, phospholipids and to some extent monoacylglycerol. The mutant ABHD11 was shown to alter the expression levels of various chloroplast lipid biosynthetic genes and eventually increased the galactolipids in leaves and in addition, it also increased the plant growth as compared to wild-type [15].

Various attempts are upcoming to increase the oil content in plant seeds. Our studies on ABHD family proteins revealed that abolishing the enzyme activity influences the lipid biosynthesis more towards leaf lipids such as galactolipids and less towards

storage lipids. Galactolipids are the abundant lipid found in leaves and are vital for photosynthesis. Hence, in depth knowledge is required on plant ABHD proteins to disclose its physiological roles with respect to lipid metabolism.

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