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Short Communication

Enzyme Promiscuity and Molecular Mechanism; Mystery Remain Unsolved

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Enzymes/proteins are the most versatile bio-molecules in the living system. In the living system, the enzyme catalyzes biochemical reactions in varying magnitude. The nature of the enzyme can be defined as robust and effective. It is believed enzymes are highly specific towards its substrate. At the same enzyme do catalyze multiple biochemical reactions at varying pace. There is growing research evidence suggests enzymes are highly promiscuous and capable of multiple binding substrates. Promiscuity is a phenomenon where enzymes do develop an affinity for various substrates and catalyze numerous biochemical reactions. Further, promiscuity is a natural phenomenon that can be at the substrate level and or at the catalytic level. However, recent studies have established artificial promiscuity called induced promiscuity. Induced promiscuity is entirely different from protein engineering, where a specific amino acid/s modified for the desired property. Over the last decade, growing research work was carried out to understand the nature and mechanism of enzyme promiscuity along with its commercial implication. Despite extensive research work on enzyme promiscuity still, we are unable to comprehend molecular insights of enzyme promiscuity. As a core area of green chemistry, enzyme promiscuity is crucial not only for the extended use of such unique molecules but also for sustainable development as well. The wide range of applications of enzymes, including healthcare, agriculture, industry, and food industry, the enzyme promiscuity had shown tremendous scope in the future.

Considering past and current research findings, the phenomenon of enzyme promiscuity seems more common in lower organisms where bio-molecules play a diverse role in physiology. The lower organism, including animals and microbes, do possess unique enzymes to exist in isoforms and catalyze multiple biochemical reactions. During 2015 - 2018, we have isolated several enzymes from earthworm contains a wide range of enzyme capable of exerting antibacterial, antiviral, clot-dissolving properties. Proteomics studies have shown that these enzymes possess a highly dynamic catalytic active site (catalytic amino acid triad) capable of multiple binding substrates and hence catalytic diverse biochemical reactions. Such a phenomenon is an advantage for an animal not only to habitat but also to an average growth and defense mechanism. Similarly, many plants and humans as well possess enzymes with a promiscuous phenomenon. In the case of plant and human lipoxygenase enzyme (LOX) exist several isoforms such as LOX1, LOX2, LOX3, LOX5, LOX12 and LOX15. These LOX isoforms in plants involved in several physiological processes and development as well. However, in the case of human LOX, isoforms are essential for lipid metabolism, i.e. polyunsaturated fatty acid. One of the grown area in lipidomics in humans involves an in-depth insight of LOX, resulting in a series of bioactive compounds, including specialized pro-resolving mediators (SPM).

Similarly, the microbial world exhibits a unique feature to survive in a hearse environment. Microbes possess several mechanisms to support their habitat, where the presence of diverse bioactive molecules, mainly proteins, and enzymes, are crucial ones. It has been reported during molecular evolution microbial enzymes are derived from a common ancestor opted for a divergent evolution resulting in a series of such proteins/enzymes. Like plants and humans, microbes itself contains isoforms of LOX vital for physiology and defense system. However, a little is known about the molecular insight of these unique molecules. Not only microbes but also other organisms, including plants and animals, require an adaptation with biotic and abiotic components, including temperature, nutrients availability, salinity, or the interaction with other organisms

for their survival. Research findings have suggested organisms capable of possessing such dynamic and promiscuous molecules find ease in habitat. Additionally, looking into a commercial perspective, these molecules (enzymes/proteins) certainly have scope for the future, i.e. green chemistry. To explore the potential of these amazing molecules and their extended applications, it is essential to understand molecular insights of promiscuous nature. Further, how these groups of enzymes arrange amino acids in their catalytic site in three-dimensional spaces will be useful to explore the nature of promiscuity [1-10].

Bibliography

1. Martínez-Núñez MA., *et al.* "Tracing the Repertoire of Promiscuous Enzymes along the Metabolic Pathways in Archaeal Organisms". *Life* 7.3 (2017): 30.

2. Gupta R. "Recent advances in enzyme promiscuity". *Sustainable Chemical Process* 4 (2016): 2.

3. Hult K and Berglund P. "Enzyme promiscuity: Mechanism and applications". *Trends in Biotechnology* 25 (2007): 231-238.

4. Peregrin-Alvarez J.M., *et al.* "The phylogenetic extent of metabolic enzymes and pathways". *Genome Research* 13 (2003): 422-427.

5. Arora B., *et al.* "Enzyme promiscuity: Using the dark side of enzyme specificity in white biotechnology". *Sustainable Chemistry and Pharmacy* 2 (2014): 25.

6. Lamble HJ., *et al.* "Metabolic pathway promiscuity in the archaeon *Sulfolobus solfataricus* revealed by studies on glucose dehydrogenase and 2-keto-3-deoxygluconate aldolase". *Journal of Biological Chemistry* 278 (2003): 34066-34072.

7. Verma MK and Pulicherla KK. "Broad substrate affinity and catalytic diversity of fibrinolytic enzyme from *Pheretima posthumous*-Purification and molecular characterization study". *International Journal of Biological Macromolecules* 95 (2017): 1011-1021.

8. Verma MK and Pulicherla KK. "Enzyme promiscuity in Earthworm serine protease- Substrate versatility and therapeutic potential". *Amino Acid* 48.4 (2016): 941-948.

9. Jia B., *et al.* "Multifunctional enzymes in archaea: promiscuity and moonlight". *Extremophiles* 17.2 (2013): 193-203.

10. Khersonsky O and Tawfik DS. "Enzyme promiscuity: a mechanistic and evolutionary perspective". *Annual Review of Biochemistry* 79 (2010): 471-505.