Plenary Lecture
57th Annual Convention of Chemists (ACC) - Indian Chemical Society (ICS)
Recent Trends in Chemical Sciences (RTCS 2020)

Halogen Bonding in Thyroid Hormone Action and Membrane Transport

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Abstract

Thyroid hormones regulate almost every process in the body, including body temperature, growth, and heart rate. They influence carbohydrate metabolism, protein synthesis and breakdown, and cardiovascular, renal, and brain function. The deiodination of thyroxine (T4) by iodothyronine deiodinases (DIOs) play a crucial role in thyroid hormone action. These enzymes contain selenocysteine, the 21st amino acid, in their active sites. The phenolic ring (5′) deiodination of T4 by the type 1 and 2 enzymes (DIO1 and DIO2) produces the biologically active hormone, 3,5,3′-triiodothyronine (T3), whereas the tyrosyl ring (5) deiodination of T4 by the type 3 enzyme (DIO3) produces the biologically less active hormone rT3. Therefore, the complex biochemical dehalogenation pathways play an important role not only in human hormone action, but also in the development of drugs for thyroid-related disorders.

In this lecture, the chemical mechanism by which the deiodinases and organoselenium compounds selectively activate and inactivate the thyroid hormones will be discussed. The role of iodine atom, halogen bonding and endosomolytic peptides in the membrane transport of fluorescent molecules will also be discussed.

References and Notes:

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Bio-Sketch of Speaker

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G. Mugesh received his B.Sc. (1990) and M.Sc. (1993) degrees from the University of Madras and Bharathidasan University, respectively. He obtained his Ph.D. (1998) at the Indian Institute of Technology, Bombay, under the supervision of Prof. H. B. Singh. In 2000, he moved to Germany as an Alexander von Humboldt Fellow at the Technical University, Braunschweig. In 2001-2002, he worked with Prof. K. C. Nicolaou at the Scripps Research Institute, as a Skaggs postdoctoral fellow.

Mugesh's work ranges from fundamental chemical synthesis and reaction mechanism at the molecular level to practical biomedical applications. His work on artificial enzymes including nanozymes that modulate the cellular redox signaling has attracted a global attention. The recent discovery from his laboratory that proteins and small molecules can be delivered into mammalian cells by utilizing halogen bonding has direct applications to human health. This novel strategy can be used for the efficient delivery of proteins and small molecules for therapeutic applications.

Mugesh is a recipient of Infosys Prize in Physical Sciences (2019); CRSI Silver Medal (2019); National Prize for Research on Interfaces of Chemistry and Biology (2017); Rajib Goyal Prize in Chemical Science (2017); Bhagyatara Award (2017); ISCB Award for Excellence (2016); J. C. Bose National Fellowship (2015); Shanti Swarup Bhatnagar Prize (2012); AstraZeneca Excellence in Chemistry Award (2012); CDRI Award for Excellence in Drug Research (2010); Swarnajayanti Fellowship (2006-07); Ramanna Fellowship, DST (2006).

He is a fellow of the National Academy of Sciences, India (2012), Indian Academy of Sciences (2012) and Indian National Science Academy (2016). He currently serves as Vice-President and Secretary General of the Chemical Research Society of India (CRSI), President of the Asian Chemical Editorial Society (ACES). He also serves in the Editorial or Editorial Advisory Boards of Chemistry – A European Journal (ChemPubSoc, Europe), Organic and Biomolecular Chemistry (RSC), ACS Omega (ACS); Bioorganic Chemistry (Elsevier) and Biological Chemistry (De Gruyter, Germany).