

Curriculum vitae
Makoto KAWAMUKAI
Professor, Shimane University

Educational record

- Mar. 1981 Bachelor's degree, Faculty of Agriculture, Kyoto University
Mar. 1983 Master's degree, Graduate School of Agriculture, Kyoto University
Mar. 1986 Graduated (Ph.D. course), Graduate School of Agriculture, Kyoto University
Sep. 1986 Ph.D. degree, Kyoto University

Employment record

- Jul. 1986~Dec. 1986 Assistant Professor, Faculty of Agriculture, Kyoto University
Jan. 1987~Mar. 1988 Lecturer, Faculty of Agriculture, Shimane University
Apr. 1988~Mar. 1998 Associate Professor, Faculty of Agriculture, Shimane University
Apr. 1998 ~ present Professor, Faculty of Life and Environmental Sciences, Shimane University
Apr. 2015 ~ present Vice dean, Faculty of Life and Environmental Sciences, Shimane University
1989-1991 Visiting Scientist, Cold Spring Harbor Laboratory, NY, USA
2009-2011 Director, Interdisciplinary Center for Science Research, Shimane University

Awards

- Mar. 1999 JSBA young awards (Japan Society for Bioscience, Biotechnology, and Agrochemistry)
Mar, 2018 Most cited review Award (JSPS)

Current research subjects:

Biosynthetic aspect of Coenzyme Q10 in fission yeast

A CoQ-producing organism possesses one type of CoQ as a main product, which is classified according to the length of the isoprenoid side chain. For example, *Schizosaccharomyces pombe* and *Homo sapiens* predominantly produce CoQ₁₀, with ten isoprene units; *Mus musculus* and *Arabidopsis thaliana* produce CoQ₉; *Escherichia coli* produces CoQ₈; and *Saccharomyces cerevisiae* produces CoQ₆ (1). The side chain length of CoQ is defined by a species-specific polyprenyl diphosphate synthase (2). The biosynthetic pathway for the complete conversion of *p*-hydroxybenzoate (PHB) to CoQ consists of at least eight steps. After the polyprenyl diphosphate is synthesized, it is transferred to PHB by Coq2 (PHB-polyprenyl diphosphate transferase). Prenylated PHB is subjected to the following modifications in the six-membered ring: three hydroxylations by Coq6, Coq7, and a

still-unidentified enzyme(s), O-methylations by Coq3, C-methylation by Coq5, and decarboxylation by an unknown enzyme(s) (3). *S. pombe* is an ideal organism for better understanding of the CoQ₁₀ biosynthetic pathway to acquire a general idea how CoQ is synthesized in eukaryote, that strongly helps our understating of human's CoQ₁₀ biosynthetic pathway (4,5). *S. pombe* is also a very good platform to produce CoQ₁₀ because we have a detailed understanding of the metabolic pathways involved in CoQ₁₀ synthesis, as well as tools for genetically modifying this species. We were successful in metabolic engineering of CoQ₁₀ biosynthesis in *S. pombe* (6,7).

(1) Makoto Kawamukai. Biosynthesis and applications of prenylquinones. Biosci. Biotechnol. Biochem. 82:963-977(Jun, 2018)

(2) Kazunori Okada, Kengo Suzuki, Yasuhiro Kamiya, XuFen Zhu, Shingo Fujisakai, Yukinobu Nishimura, Tokuzo Nishino, Tsuyoshi Nakagawa, Makoto Kawamukai, Hideyuki Matsuda. Polyprenyl diphosphate synthase essentially defines the length of the side chain of ubiquinone. Biochim. Biophys. Acta. 1302/3:217-223 (1996)

(3) Makoto Kawamukai. Biosynthesis of coenzyme Q in eukaryotes. Biosci. Biotechnol. Biochem. 80:23-33 (Jan., 2016)

(4) Ryoichi Saiki, Ai Nagata, Tomohiro Kainou, Hideyuki Matsuda and Makoto Kawamukai. Characterization of solanesyl and decaprenyl diphosphate synthases in mice and humans. FEBS J. 56:5606-5622 (2005/11)

(5) Kazuhiro Hayashi, Yuki Ogiyama, Kazumasa Yokomi, Tsuyoshi Nakagawa, Tomohiro Kaino, Makoto Kawamukai. Functional conservation of coenzyme Q biosynthetic genes among yeasts, plants, and humans. PLoS ONE 9(6) e99038 (Jun, 2014)

(6) Daisuke Moriyama, Kouji Hosono, Makoto Fujii, Motohisa Washida, Hirokazu Nanba, Tomohiro Kaino, Makoto Kawamukai. Production of CoQ₁₀ in fission yeast by expression of genes responsible for CoQ₁₀ biosynthesis. Biosci. Biotechnol. Biochem. 79(6):1026-1033 (Jun, 2015)

(7) Daisuke Moriyama, Tomohiro Kaino, Kazuyoshi Yajima, Ryota Yanai, Yasuhiro Ikenaka, Junzo Hasegawa, Motohisa Washida, Hirokazu Nanba, Makoto Kawamukai. Cloning and characterization of decaprenyl dihosphate synthase from three different fungi. Appl. Microbiol. Biotechnol. 101(4):1559-1571 (Feb., 2017)