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Metabolic Roles of the M₃ Muscarinic Acetylcholine Receptor Studied with M₃ Receptor Mutant Mice: A Review

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Abstract

The M₃ muscarinic acetylcholine (ACh) receptor (M₃ mAChR) is expressed in many central and peripheral tissues. It is a prototypic member of the superfamily of G protein-coupled receptors and preferentially activates G proteins of the G_q family. Recent studies involving the use of newly generated mAChR mutant mice have revealed that the M₃ mAChR plays a key role in regulating many important metabolic functions. Phenotypic analyses of mutant mice that either selectively lacked or overexpressed M₃ receptors in pancreatic β -cells indicated that β -cell M₃ mAChRs are essential for maintaining proper insulin release and glucose homeostasis. The experimental data also suggested that strategies aimed at enhancing signaling through

β -cell M_3 mAChRs might be beneficial for the treatment of type 2 diabetes. Recent studies with whole body M_3 mAChR knockout mice showed that the absence of M_3 receptors protected mice against various forms of experimentally or genetically induced obesity and obesity-associated metabolic deficits. Under all experimental conditions tested, M_3 receptor-deficient mice showed greatly ameliorated impairments in glucose homeostasis and insulin sensitivity, reduced food intake, and a significant elevation in basal and total energy expenditure, most likely due to increased central sympathetic outflow and increased rate of fatty acid oxidation. These findings are of potential interest for the development of novel therapeutic approaches for the treatment of obesity and associated metabolic disorders.

Key Words: :

Glucose homeostasis

Insulin

Knockout mice

Muscarinic receptor

Transgenic mice

Related Research Data

[Plasma Membrane Localization and Functional Rescue of Truncated Forms of a G Protein-coupled Receptor](#)

Source: Journal of Biological Chemistry

[Ringing the dinner bell for insulin: Muscarinic \$M_3\$ receptor activity in the control of pancreatic \$\beta\$ cell function](#)

Source: Cell Metabolism

[Dual Roles for Glucokinase in Glucose Homeostasis as Determined by Liver and Pancreatic \$\beta\$ Cell-specific Gene Knock-outs Using Cre Recombinase](#)

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[Uncoupling Protein-3 Is a Mediator of Thermogenesis Regulated by Thyroid Hormone, \$\beta_3\$ -Adrenergic Agonists, and Leptin](#)

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