



## Recent patents related to muscarinic acetylcholine receptors

Muscarinic acetylcholine receptors are G protein-coupled receptors that regulate a diverse set of physiological functions such as heart rate, smooth muscle contraction, glandular secretions and numerous functions

of the nervous system. On page 549, Kruse *et al.* highlight recent studies that have contributed to our knowledge of how these receptors function, and how this knowledge could be used therapeutically. Here in TABLE 1 we highlight selected patent applications published in the past year related to muscarinic acetylcholine receptors. Data were researched using the [Espacenet](#) database.

Table 1 | Recent patents related to muscarinic acetylcholine receptor inhibitors

Publication numbers	Applicants	Subject
US 2014080861	AbbVie	Heterocyclic compounds that have affinity for mAChRs
US 2014148420	Almirall	The combination of a PDE4 inhibitor and an M <sub>3</sub> receptor antagonist; useful for treating respiratory disease
WO 2014014698	Barry University	Bitopic mAChR antagonists or agonists that are neuromuscular blocking agents; useful for treating Parkinson's disease, schizophrenia, overactive bladder syndrome, COPD or asthma
CN 103242214	Buchang Pharmaceuticals	An indole derivative and its use as a mAChR antagonist. Could be used to treat IBS, dysuria (such as pollakiuria and urinary incontinence) and COPD
WO 2014025569	Chase Pharma	Piperidinium halides that are non-selective mAChR antagonists and act in the periphery but not in the brain
CN 103502213	Chiesi	Alkaloid esters and carbamate derivatives that are mAChR antagonists; useful for treating asthma or COPD
US 2013196978 CN 103221390	Chiesi	Alkaloid aminoester compounds that are mAChR antagonists; useful for the prevention and/or treatment of broncho-obstructive or inflammatory diseases
WO 2013122107	Dainippon Sumitomo Pharma	Novel fused-ring pyrrolidine derivative; useful for treating diseases mediated by mAChRs
US 2014080863	GlaxoSmithKline	mAChR antagonists; useful for treating respiratory tract disorders such as COPD and chronic bronchitis
WO 2014045031	Heptares Therapeutics	Bicyclic aza compounds that are M <sub>1</sub> receptor agonists; useful for treating cognitive or psychotic disorders or for treating or lessening the severity of acute, chronic, neuropathic or inflammatory pain
US 2013225624	IIBR	Bicyclic heterocyclic spiro compounds that are M <sub>1</sub> receptor modulators; useful for treating neurodegenerative diseases, learning and memory processes, or for neuroprotection
US 2013274299	Mithridion	Oxadiazole derivatives and compositions comprising a mAChR agonist for enhancing cognitive function
CN 103393628	Shanghai Jiao Tong University	Application of the M <sub>3</sub> receptor in treating prostate cancer. The M <sub>3</sub> receptor promotes proliferation and migration of prostate tumour cells; its inhibition decreases tumour growth and migration
US 2013172398 US 2013172379	S. Rich	Quaternary ammonium mAChR antagonists in combination with acetylcholinesterase inhibitors to treat either cognitive impairment or acute delirium
WO 2014077401 WO 2013129622	Takeda Pharmaceutical	A nitrogen-containing heterocyclic compound that has M <sub>1</sub> receptor-positive allosteric modulator activity; useful for preventing or treating Alzheimer's disease, schizophrenia or pain
US 2013331364	Theravance	Diamide compounds that have mAChR antagonist and $\beta_2$ -adrenergic receptor agonist activity; these compounds could be used as bronchodilating agents to treat pulmonary disorders
US 2014051864	Theravance	Quaternary ammonium diphenylmethyl compounds that are mAChR antagonists
US 2013267706	Theravance	Guanidine-containing compounds that are mAChR antagonists; useful for treating pulmonary disorders
US 2013157989	Theron Pharmaceuticals	7-azoniabicyclo[2.2.1]heptane derivatives that are mAChR antagonists; useful for treating pulmonary diseases
US 2013267506	University of Manitoba	A mAChR antagonist and a suitable carrier to treat diabetic symmetrical polyneuropathy
WO 2014035829 WO 2013126856	Vanderbilt University	Substituted aminothieno[2,3-c]pyridine-2-carboxamide analogues that modulate the M <sub>4</sub> receptor; useful for treating neurological and psychiatric disorders
WO 2013106795	Vanderbilt University	Substituted 4-(1H-pyrazol-4-yl)-benzyl analogues that modulate the M <sub>1</sub> receptor; useful for treating neurological and psychiatric disorders
WO 2013103931	Vanderbilt University	Substituted 1-benzylindolin-2-one analogues that modulate the M <sub>1</sub> receptor; useful for treating neurological and psychiatric disorders
US 2013281476	Vertex Pharma	Modulators of muscarinic receptors; useful for treating pain, schizophrenia or Parkinson's disease
CN 103265542	X. Zhu	A novel purine derivative that is a selective mAChR antagonist; useful for treating IBS, dysuria and COPD

COPD, chronic obstructive pulmonary disease; IBS, irritable bowel syndrome; IIBR, Israel Institute for Biological Research; mAChR, muscarinic acetylcholine receptor (subtypes M<sub>1</sub> to M<sub>5</sub>); PDE4, phosphodiesterase 4.