

ABCC subfamily in GtoPdb v.2025.3

Mary Vore¹

1. University of Kentucky, USA

Abstract

Subfamily ABCC contains thirteen members and nine of these transporters are referred to as the Multidrug Resistance Proteins (MRPs). The MRP proteins are found throughout nature and they mediate many important functions. They are known to be involved in ion transport, toxin secretion, and signal transduction [7, 2].

Contents

This is a citation summary for ABCC subfamily in the [Guide to Pharmacology](#) database (GtoPdb). It exists purely as an adjunct to the database to facilitate the recognition of citations to and from the database by citation analyzers. Readers will almost certainly want to visit the relevant sections of the database which are given here under database links.

[GtoPdb](#) is an expert-driven guide to pharmacological targets and the substances that act on them. GtoPdb is a reference work which is most usefully represented as an on-line database. As in any publication this work should be appropriately cited, and the papers it cites should also be recognized. This document provides a citation for the relevant parts of the database, and also provides a reference list for the research cited by those parts. For further details see [5].

Please note that the database version for the citations given in GtoPdb are to the most recent preceding version in which the family or its subfamilies and targets were substantially changed. The links below are to the current version. If you need to consult the cited version, rather than the most recent version, please contact the GtoPdb curators.

Database links

ABCC subfamily

<https://www.guidetopharmacology.org/GRAC/FamilyDisplayForward?familyId=153>

Transporters

MRP1(ABCC1)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=779>

MRP2, cMOAT(ABCC2)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=780>

MRP3(ABCC3)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=781>

MRP4(ABCC4)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=782>

MRP5(ABCC5)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=783>

MRP6(ABCC6)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=784>

SUR1(ATP-binding cassette, sub-family C (CFTR/MRP), member 8)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=2594>

SUR2(ABCC9)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=2746>

MRP7(ABCC10)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=785>

MRP8(ABCC11)

<https://www.guidetopharmacology.org/GRAC/ObjectDisplayForward?objectId=786>

References

1. Aguilar-Bryan L, Clement JP, Gonzalez G, Kunjilwar K, Babenko A and Bryan J. (1998) Toward understanding the assembly and structure of KATP channels. *Physiol Rev* **78**: 227-45 [PMID:9457174]
2. Alexander SPH, Kelly E, Mathie A, Peters JA, Veale EL, Armstrong JF, Faccenda E, Harding SD, Pawson AJ and Sharman JL *et al.*. (2019) THE CONCISE GUIDE TO PHARMACOLOGY 2019/20: Transporters. *Br J Pharmacol* **176 Suppl 1**: S397-S493 [PMID:31710713]
3. Bakos E and Homolya L. (2007) Portrait of multifaceted transporter, the multidrug resistance-associated protein 1 (MRP1/ABCC1). *Pflugers Arch* **453**: 621-41 [PMID:17187268]
4. Borst P, de Wolf C and van de Wetering K. (2007) Multidrug resistance-associated proteins 3, 4, and 5. *Pflugers Arch* **453**: 661-73 [PMID:16586096]
5. Buneman P, Christie G, Davies JA, Dimitrellou R, Harding SD, Pawson AJ, Sharman JL and Wu Y. (2020) Why data citation isn't working, and what to do about it *Database* **2020** [PMID:32367113]
6. Chen ZS, Kawabe T, Ono M, Aoki S, Sumizawa T, Furukawa T, Uchiumi T, Wada M, Kuwano M and Akiyama SI. (1999) Effect of multidrug resistance-reversing agents on transporting activity of human canalicular multispecific organic anion transporter. *Mol Pharmacol* **56**: 1219-28 [PMID:10570049]
7. Dean M, Hamon Y and Chimini G. (2001) The human ATP-binding cassette (ABC) transporter superfamily. *J Lipid Res* **42**: 1007-17 [PMID:11441126]
8. Isomoto S, Kondo C, Yamada M, Matsumoto S, Higashiguchi O, Horio Y, Matsuzawa Y and Kurachi Y. (1996) A novel sulfonylurea receptor forms with BIR (Kir6.2) a smooth muscle type ATP-sensitive K⁺ channel. *J Biol Chem* **271**: 24321-4 [PMID:8798681]
9. Kalyesubula R and Perazella MA. (2011) Nephrotoxicity of HAART. *AIDS Res Treat* **2011**: 562790 [PMID:21860787]
10. Leier I, Jedlitschky G, Buchholz U, Cole SP, Deeley RG and Keppler D. (1994) The MRP gene encodes an ATP-dependent export pump for leukotriene C4 and structurally related conjugates. *J Biol Chem* **269**: 27807-10 [PMID:7961706]
11. Maltbaek JH, Cambier S, Snyder JM and Stetson DB. (2022) ABCC1 transporter exports the immunostimulatory cyclic dinucleotide cGAMP. *Immunity* **55**: 1799-1812.e4 [PMID:36070769]
12. Pourmal S, Green E, Bajaj R, Chemmama IE, Knudsen GM, Gupta M, Sali A, Cheng Y, Craik CS and Kroetz DL *et al.*. (2024) Structural basis of prostaglandin efflux by MRP4. *Nat Struct Mol Biol* **31**: 621-632 [PMID:38216659]
13. Priebe W, Krawczyk M, Kuo MT, Yamane Y, Savaraj N and Ishikawa T. (1998) Doxorubicin- and daunorubicin-glutathione conjugates, but not unconjugated drugs, competitively inhibit leukotriene C4 transport mediated by MRP/GS-X pump. *Biochem Biophys Res Commun* **247**: 859-63 [PMID:9647783]
14. Ramaen O, Leulliot N, Sizun C, Ulryck N, Pamlard O, Lallemand JY, Tilbeurgh Hv and Jacquet E. (2006) Structure of the human multidrug resistance protein 1 nucleotide binding domain 1 bound to Mg²⁺/ATP reveals a non-productive catalytic site. *J Mol Biol* **359**: 940-9 [PMID:16697012]
15. Rehmann H. (2012) Epac2: a sulfonylurea receptor? *Biochem Soc Trans* **40**: 6-10 [PMID:22260657]
16. Reid G, Wielinga P, Zelcer N, van der Heijden I, Kuil A, de Haas M, Wijnholds J and Borst P. (2003) The human multidrug resistance protein MRP4 functions as a prostaglandin efflux transporter and is inhibited by nonsteroidal antiinflammatory drugs. *Proc Natl Acad Sci USA* **100**: 9244-9 [PMID:12835412]
17. Sager G, Ørvoll EØ, Lysaa RA, Kufareva I, Abagyan R and Ravna AW. (2012) Novel cGMP efflux inhibitors identified by virtual ligand screening (VLS) and confirmed by experimental studies. *J Med Chem* **55**: 3049-57 [PMID:22380603]
18. Shinde O, Boyer JA, Cambier S, VanPortfliet JJ, Sui X, Yadav GP, Viverette EG, Borgnia MJ, West AP and Zhang Q *et al.*. (2025) Structures of ATP-binding cassette transporter ABCC1 reveal the molecular basis of cyclic dinucleotide cGAMP export. *Immunity* **58**: 59-73.e5 [PMID:39765229]
19. Silbermann K, Stefan SM, Elshawadfy R, Namasivayam V and Wiese M. (2019) Identification of Thienopyrimidine Scaffold as an Inhibitor of the ABC Transport Protein ABCC1 (MRP1) and Related Transporters Using a Combined Virtual Screening Approach. *J Med Chem* **62**: 4383-4400 [PMID:30925062]
20. Suzuki H and Sugiyama Y. (1998) Excretion of GSSG and glutathione conjugates mediated by MRP1 and cMOAT/MRP2. *Semin Liver Dis* **18**: 359-76 [PMID:9875554]
21. Wang S, Ryder H, Pretswell I, Depledge P, Milton J, Hancox TC, Dale I, Dangerfield W, Charlton P and Faint R *et al.*. (2002) Studies on quinazolinones as dual inhibitors of Pgp and MRP1 in

- multidrug resistance. *Bioorg Med Chem Lett* **12**: 571-4 [PMID:11844674]
22. Wängler B, Beck C, Shiue CY, Schneider S, Schwanstecher C, Schwanstecher M, Feilen PJ, Alavi A, Rösch F and Schirmacher R. (2004) Synthesis and in vitro evaluation of (S)-2-([11C]methoxy)-4-[3-methyl-1-(2-piperidine-1-yl-phenyl)-butyl-carbamoyl]-benzoic acid ([11C]methoxy-repaglinide): a potential beta-cell imaging agent. *Bioorg Med Chem Lett* **14**: 5205-9 [PMID:15380228]
23. Zelcer N, Reid G, Wielinga P, Kuil A, van der Heijden I, Schuetz JD and Borst P. (2003) Steroid and bile acid conjugates are substrates of human multidrug-resistance protein (MRP) 4 (ATP-binding cassette C4). *Biochem J* **371**: 361-7 [PMID:12523936]
24. Zhang X, Qiu Y, Li X, Bhattacharjee S, Woods M, Kraft P, Lundeen SG and Sui Z. (2009) Discovery and structure-activity relationships of a novel series of benzopyran-based K(ATP) openers for urge urinary incontinence. *Bioorg Med Chem* **17**: 855-66 [PMID:19101153]