



Corrigendum: Metabotropic Glutamate Receptor 7: A New Therapeutic Target in Neurodevelopmental Disorders

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A Corrigendum on

Metabotropic Glutamate Receptor 7: A New Therapeutic Target in Neurodevelopmental Disorders

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In the original article, there was a mistake in **Figure 1** as published. The chirality of L-AP4 and LSP1-2111 was incorrect. pEC₅₀ values have also been corrected for LSP1-2111 in **Table 1**. The authors apologize for these errors and state that they do not change the scientific conclusions of the article in any way. The original article has been updated.

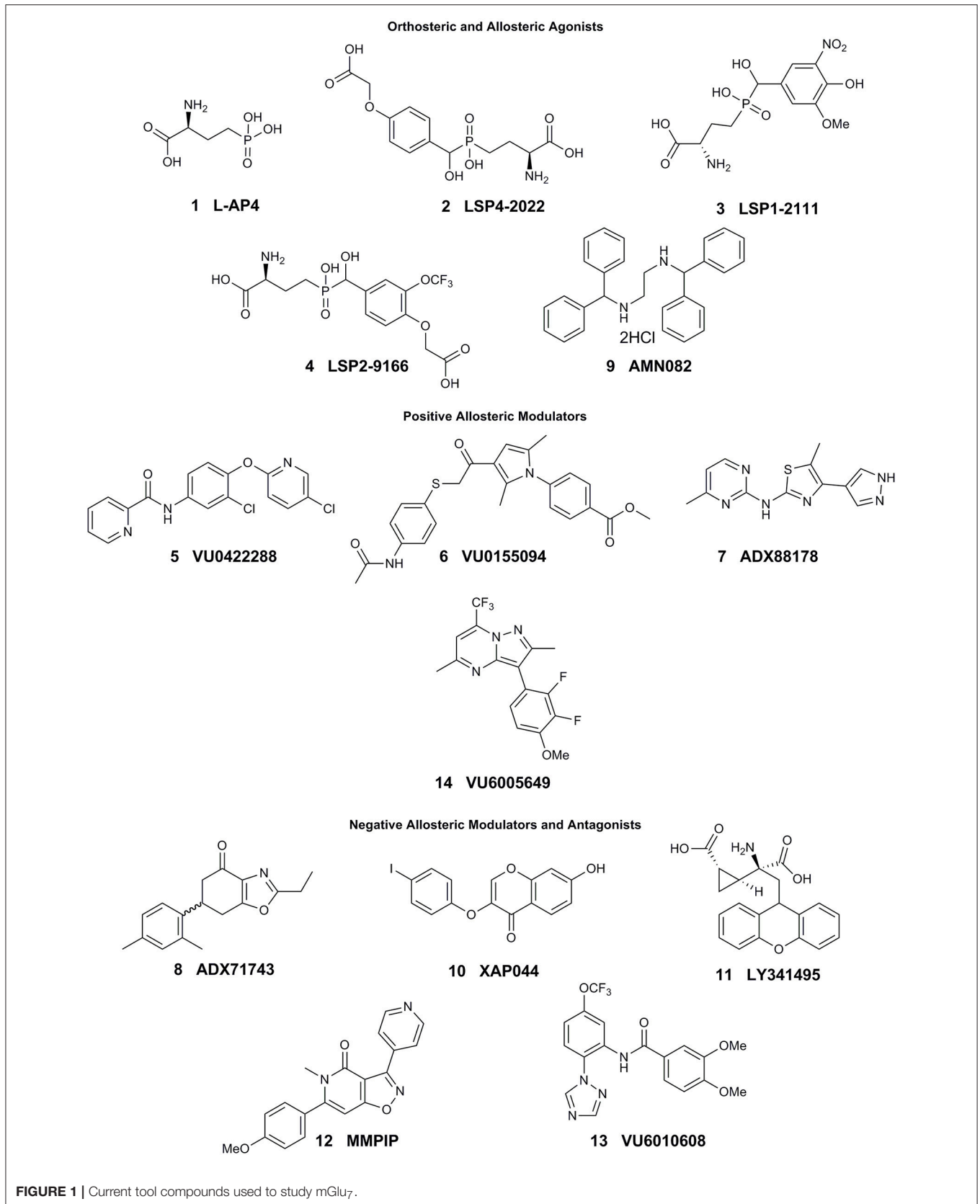


TABLE 1 | Summary of current tool compounds used to study mGlu7.

Name (#)	Type	mGlu7 pEC ₅₀ /pIC ₅₀	mGlu8 pEC ₅₀ /pIC ₅₀	mGlu4 pEC ₅₀ /pIC ₅₀	mGlu6 pEC ₅₀ /pIC ₅₀	Source
L-AP4 (1)	Orthosteric agonist	3.47 (PIH)	6.53 (PIH)	7.00 (PIH)	5.62 (PIH)	Acher et al., 2012; Selvam et al., 2018
		3.61 (Ca ²⁺)	6.53 (Ca ²⁺)	6.89 (Ca ²⁺)	6.00 (Ca ²⁺)	
LSP4-2022 (2)	Orthosteric agonist	4.34 (Ca ²⁺)	4.54 (Ca ²⁺)	6.96 (Ca ²⁺)	5.36 (Ca ²⁺)	Acher et al., 2012; Goudet et al., 2012; Selvam et al., 2018
LSP1-2111 (3)	Orthosteric agonist	4.28 (PIH)	4.18 (PIH)	5.66 (PIH)	5.77 (PIH)	Selvam et al., 2018
		4.00 (Ca ²⁺)	4.71 (Ca ²⁺)	6.05 (Ca ²⁺)	5.49 (Ca ²⁺)	
LSP2-9166 (4)	Orthosteric agonist	5.71 (Ca ²⁺)	4.25 (Ca ²⁺)	7.22 (Ca ²⁺)	not reported	Acher et al., 2012
VU0422288 (5)	Group III PAM	6.85 (Ca ²⁺)	6.93 (Ca ²⁺)	6.98 (Ca ²⁺)	not reported	Jalan-Sakrikar et al., 2014
VU0155094 (6)	Group III PAM	5.80 (Ca ²⁺)	6.07 (Ca ²⁺)	5.48 (Ca ²⁺)	not reported	Jalan-Sakrikar et al., 2014
ADX88178 (7)	mGlu _{4/8} PAM	>4.52 (Ca ²⁺)	5.66 (Ca ²⁺)	8.46 (Ca ²⁺)	>5	Le Poul et al., 2012
ADX71743 (8)	mGlu7 NAM	7.20 (human, Ca ²⁺)	inactive	inactive	inactive	Kalinichev et al., 2014
		7.06 (rat, Ca ²⁺)	inactive	inactive	inactive	
AMN082 (9)	Allosteric agonist	6.59 (GTPγS)	>5 (GTPγS)	>5 (GTPγS)	>5 (GTPγS)	Mitsukawa et al., 2005
XAP044 (10)	Antagonist	5.26 (cAMP)	4.48 (cAMP)	inactive	inactive	Gee et al., 2014
		5.55 to 5.46 (GTPγS)				
LY341495 (11)	Orthosteric antagonist	6.00 (cAMP)	6.76 (cAMP)	4.66 (cAMP)	not reported	Kingston et al., 1998
MMPIP (12)	mGlu7 NAM	6.66 (cAMP)	>5 (cAMP)	>5 (cAMP)	not reported	Suzuki et al., 2007
		7.15 (Ca ²⁺)				Niswender et al., 2010
		6.14 (Thallium)				Niswender et al., 2010
VU6010608 (13)	mGlu7 NAM	6.12 (Ca ²⁺)	>5 (Ca ²⁺)	>5 (Ca ²⁺)	inactive (>5)	Reed et al., 2017
VU6005649 (14)	mGlu _{7/8} PAM	6.19 (Ca ²⁺)	5.59 (Ca ²⁺)	>5 (Ca ²⁺)	inactive	Abe et al., 2017

NAM, negative allosteric modulator; PAM, positive allosteric modulator; EC₅₀, effective concentration 50; IC₅₀, inhibitory concentration 50. Assay type is indicated in parentheses: PIH, Phosphatidylinositol hydrolysis; cAMP, cAMP accumulation; Ca²⁺, Calcium mobilization; GTPγS, GTPγS binding.

REFERENCES

- Abe, M., Seto, M., Gogliotti, R. G., Loch, M. T., Bollinger, K. A., Chang, S., et al. (2017). Discovery of VU6005649, a CNS penetrant mGlu7/8 receptor PAM derived from a series of Pyrazolo[1,5-a]pyrimidines. *ACS Med. Chem. Lett.* 8, 1110–1115. doi: 10.1021/acsmchemlett.7b00317
- Acher, F., Pin, J.-P., Goudet, C., Eschalier, A., Busserolles, J., Rigault, D., et al. (2012). *Hypophosphorous Acid Derivatives Having Antihyperalgesic Activity and Biological Applications Thereof*. US Patent 9212196B2. Paris: Universite Paris Descartes.
- Gee, C. E., Peterlik, D., Neuhäuser, C., Bouhelal, R., Kaupmann, K., Laue, G., et al. (2014). Blocking metabotropic glutamate receptor subtype 7 (mGlu7) via the Venus flytrap domain (VFTD) inhibits amygdala plasticity, stress, and anxiety-related behavior. *J. Biol. Chem.* 289, 10975–10987. doi: 10.1074/jbc.M113.542654
- Goudet, C., Vilar, B., Courtiol, T., Deltheil, T., Bessiron, T., Brabet, I., et al. (2012). A novel selective metabotropic glutamate receptor 4 agonist reveals new possibilities for developing subtype selective ligands with therapeutic potential. *FASEB J.* 26, 1682–1693. doi: 10.1096/fj.11-195941
- Jalan-Sakrikar, N., Field, J. R., Klar, R., Mattmann, M. E., Gregory, K. J., Zamorano, R., et al. (2014). Identification of positive allosteric modulators VU0155094 (ML397) and VU0422288 (ML396) reveals new insights into the biology of metabotropic glutamate receptor 7. *ACS Chem. Neurosci.* 5, 1221–1237. doi: 10.1021/cn500153z
- Kalinichev, M., Le Poul, E., Boléa, C., Girard, F., Campo, B., Fonsi, M., et al. (2014). Characterization of the novel positive allosteric modulator of the metabotropic glutamate receptor 4 ADX88178 in rodent models of neuropsychiatric disorders. *J. Pharmacol. Exp. Ther.* 350, 495–505. doi: 10.1124/jpet.114.214437
- Kingston, A. E., Ornstein, P. L., Wright, R. A., Johnson, B. G., Mayne, N. G., Burnett, J. P., et al. (1998). LY341495 is a nanomolar potent and selective antagonist of group II metabotropic glutamate receptors. *Neuropharmacology* 37, 1–12. doi: 10.1016/S0028-3908(97)00191-3
- Le Poul, E., Boléa, C., Girard, F., Poli, S., Charvin, D., Campo, B., et al. (2012). A potent and selective metabotropic glutamate receptor 4 positive allosteric modulator improves movement in rodent models of Parkinson's disease. *J. Pharmacol. Exp. Ther.* 343, 167–177. doi: 10.1124/jpet.112.196063
- Mitsukawa, K., Yamamoto, R., Ofner, S., Nozulak, J., Pescott, O., Lukic, S., et al. (2005). A selective metabotropic glutamate receptor 7 agonist: activation of receptor signaling via an allosteric site modulates stress parameters *in vivo*. *Proc. Natl. Acad. Sci. U.S.A.* 102, 18712–18717. doi: 10.1073/pnas.0508063102
- Niswender, C. M., Johnson, K. A., Miller, N. R., Ayala, J. E., Luo, Q., Williams, R., et al. (2010). Context-dependent pharmacology exhibited by negative allosteric modulators of metabotropic glutamate receptor 7. *Mol. Pharmacol.* 77, 459–468. doi: 10.1124/mol.109.058768
- Reed, C. W., McGowan, K. M., Spearing, P. K., Stansley, B. J., Roenfan, H. F., Engers, D. W., et al. (2017). VU6010608, a novel mGlu7 NAM from a series of N-(2-(1H-1,2,4-Triazol-1-yl)-5-(trifluoromethoxy)phenyl)benzamides. *ACS Med. Chem. Lett.* 8, 1326–1330. doi: 10.1021/acsmchemlett.7b00429
- Selvam, C., Lemasson, I. A., Brabet, I., Oueslati, N., Karaman, B., Cabaye, A., et al. (2018). Increased potency and selectivity for group III metabotropic glutamate receptor agonists binding at dual sites. *J. Med. Chem.* 61, 1969–1989. doi: 10.1021/acs.jmedchem.7b01438
- Suzuki, G., Tsukamoto, N., Fushiki, H., Kawagishi, A., Nakamura, M., Kurihara, H., et al. (2007). In Vitro pharmacological characterization of novel isoxazopyridone derivatives as allosteric metabotropic glutamate receptor 7 antagonists. *J. Pharmacol. Exp. Ther.* 323, 147–156. doi: 10.1124/jpet.107.124701

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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