frontiers in Molecular Neuroscience

CORRECTION
published: 14 December 2018
doi: 10.3389/fnmol.2018.00444

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

*Nicole M. Fisher*[1†], *Mabel Seto*[1†], *Craig W. Lindsley*[1,2] *and Colleen M. Niswender*[1,3*]

[1] Department of Pharmacology and Vanderbilt Center for Neuroscience Drug Discovery, Vanderbilt University, Nashville, TN, United States, [2] Department of Chemistry, Vanderbilt University, Nashville, TN, United States, [3] Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, United States

**Keywords: Neurodevelopmental disorder, ASD, Rett syndrome, mGlu7, GRM7, allosteric modulator**

OPEN ACCESS

***Edited and reviewed by:***
*Enza Palazzo,*
*Università degli Studi della Campania "Luigi Vanvitelli" Naples, Italy*

****Correspondence:***
*Colleen M. Niswender*
*Colleen.niswender@vanderbilt.edu*

*[†]These authors have contributed equally to this work*

***Received:*** *05 November 2018*
***Accepted:*** *19 November 2018*
***Published:*** *14 December 2018*

***Citation:***
*Fisher NM, Seto M, Lindsley CW and Niswender CM (2018) Corrigendum: Metabotropic Glutamate Receptor 7: A New Therapeutic Target in Neurodevelopmental Disorders. Front. Mol. Neurosci. 11:444. doi: 10.3389/fnmol.2018.00444*

## A Corrigendum on

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

*by Fisher, N. M., Seto, M., Lindsley, C. W., and Niswender, C. M. (2018). Front. Mol. Neurosci. 11:387. doi: 10.3389/fnmol.2018.00387*

In the original article, there was a mistake in **Figure 1** as published. The chirality of L-AP4 and LSP1-2111 was incorrect. $pEC_{50}$ 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.

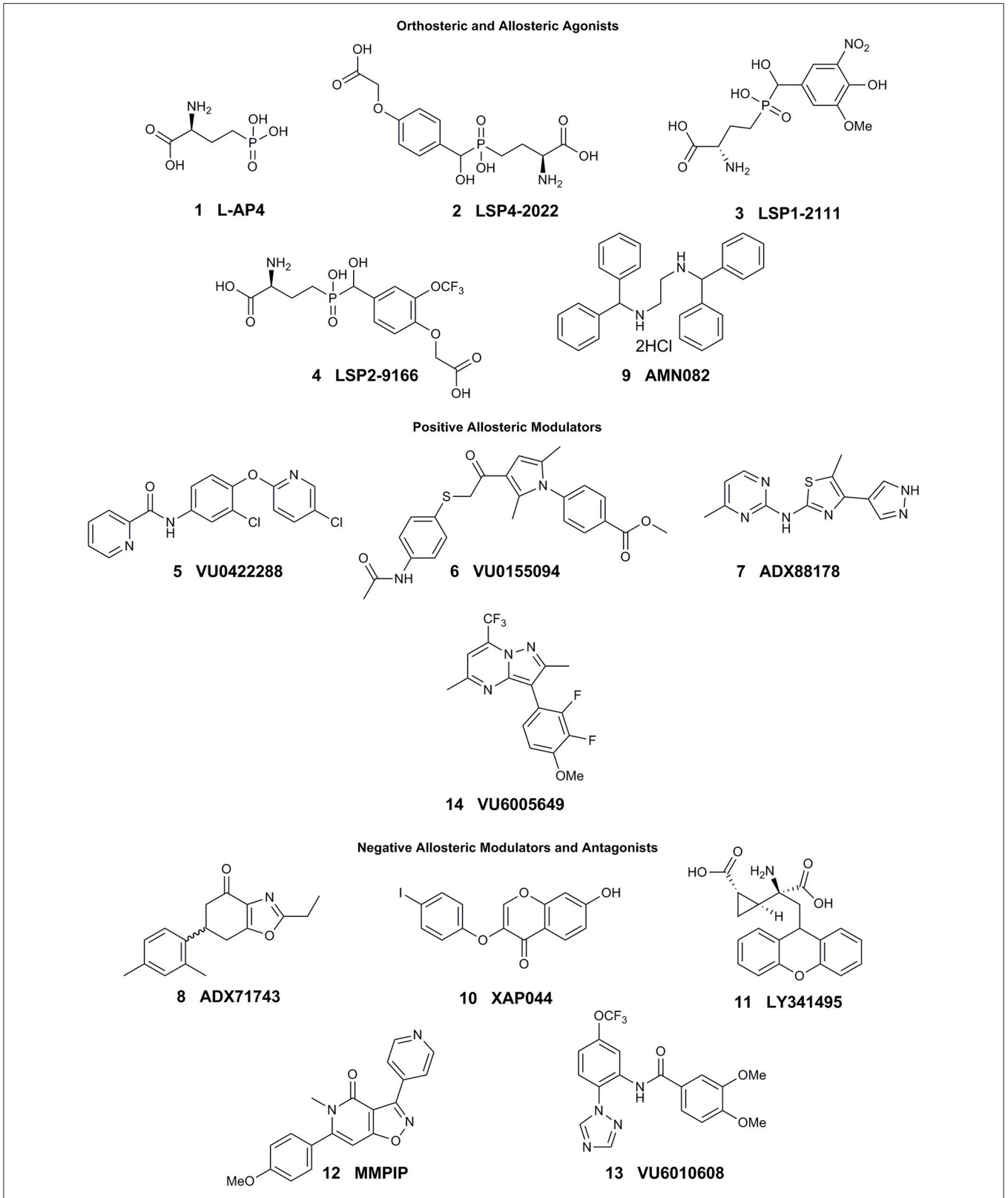


**FIGURE 1 |** Current tool compounds used to study $mGlu_7$.

**TABLE 1 |** Summary of current tool compounds used to study $mGlu_7$.

| Name (#) | Type | $mGlu_7$ $pEC_{50}/pIC_{50}$ | $mGlu_8$ $pEC_{50}/pIC_{50}$ | $mGlu_4$ $pEC_{50}/pIC_{50}$ | $mGlu_6$ $pEC_{50}/pIC_{50}$ | 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)** | $mGlu_7$ 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)** | $mGlu_7$ 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)** | $mGlu_7$ 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; $EC_{50}$, effective concentration 50; $IC_{50}$, inhibitory concentration 50. Assay type is indicated in parentheses: PIH, Phosphatidylinositol hydrolysis; cAMP, cAMP accumulation; $Ca^{2+}$, 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/acsmedchemlett.7b00317

Acher, F., Pin, J.-P., Goudet, C., Eschalier, A., Busserolles, J., Rigault, D., et al. (2012). *Hypophosphorous Acid Derivatives Having Antihyperalgic 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., Roenfanz, 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/acsmedchemlett.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 isoxazolopyridone 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.