Contribution of neuronal subtypes to the neural representation of social interaction in control versus autistic mice

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Abstract (10 lines)

Behavioral studies have shown that mice can form social memories, i.e., to remember familiar conspecifics. Optogenetic studies have demonstrated that assemblies of neurons in hippocampal ventral CA1 (vCA1) constitute a primary site of social memory. However, vCA1 contains a diversity of neuronal cell types with diverse functions and cellular targets, and the identity(ies) of cell types involved in social interaction remains unresolved. This postdoc project aims at determining which vCA1 cell types encode social interaction and how this encoding is performed. We will combine intersectional genetics and optogenetics with a last-generation miniature microscope to record and manipulate the calcium dynamics — as a proxy for neuronal activity — of different vCA1 cell types in awake mice during a social interaction task. State-of-the-art computational methods will quantitatively correlate mouse behavior and neural activity to disentangle and model

Keywords

Calcium imaging; awake behaving mice; microendoscopy; sensory representation; social memory; quantitative analysis, Constrained Nonnegative Matrix Factorization for microEndoscopic data

Objectives (5 lines)

Aim1: We will record and measure the contribution of different neuronal subtypes to social interactions with novel vs familiar mice.
Aim2: We will test how interfering with the activity of a candidate cell type for autism, the local Pvalb inhibitory neuron subtype, might alter social interaction encoding by other cell types as well as memory of familiar social partners.

Expected profile (5 lines)

We seek a curious and highly motivated person with skills and a keen interest in machine learning/quantitative analyses and/or in the neural bases of cognition and neurodevelopmental disorders. Good knowledge of Python is not mandatory but will be an appreciated asset.

Is this project the continuation of an existing project or an entirely new one?
In the case of an existing project, please explain the links between the two projects (5 lines)

No

2 to 5 references related to the project

1. Okuyama T, Kitamura T, Roy DS, Itohara S, Tonegawa S. Ventral CA1 neurons store social memory. Science. 2016 Sep 30;353(6307):1536-1541. doi: 10.1126/science.aaf7003.

2. Runge K, Mathieu R, Bugeon S [...], de Chevigny A. Disruption of the transcription factor

3 main publications from each PI over the last 5 years

- Antoine de Chevigny

1: Runge K, Mathieu R, Bugeon S, […], de Chevigny A. Disruption of NEUROD2 causes a neurodevelopmental syndrome with autistic features via cell-autonomous defects in forebrain glutamatergic neurons. Mol Psychiatry. 2021 Jun 29.
2: Faure L, Wang Y, Kastriti ME, Fontanet P, Cheung KKY, Petitpré C, Wu H, Sun LL, Runge K, Croci L, Landy MA, Lai HC, Consalez GG, de Chevigny A, Lallemend F, Adameyko I, Hadjab S. Single cell RNA sequencing identifies early diversity of sensory neurons forming via bi-potential intermediates. Nat Commun. 2020 Aug 21;11(1):4175.
3: Bugeon S, de Chevigny A, Boutin C, Coré N, Wild S, Bosio A, Cremer H, Beclin C. Direct and efficient transfection of mouse neural stem cells and mature neurons by in vivo mRNA electroporation. Development. 2017 Nov 1;144(21):3968-3977.

- Léo Guignard

1: Veenvliet JV, Bolondi A, Kretzmer H, Haut L, Scholze-Wittler M, Schifferl D, Koch F, Guignard L, Kumar AS, Pustet M, Heimann S, Buschow R, Wittler L, Timmermann B, Meissner A, Herrmann BG. Mouse embryonic stem cells self-organize into trunk-like structures with neural tube and somites. Science. 2020 Dec 11;370(6522):eaba4937.
2: Guignard L, Fiúza UM, Leggio B, Laussu J, Faure E, Michelin G, Biasuz K, Hufnagel L, Malandain G, Godin C, Lemaire P. Contact area-dependent cell communication and the