Contribution ID: **11** Type: **Poster**

High-resolution 3D mapping of the amygdala - piriform region in the BigBrain

Thursday 5 October 2023 16:30 (45 minutes)

The amygdala –piriform region plays a central role in olfaction (Buchanan et al., 2003; Gottfried, 2010). The allocortex (amygdala and piriform cortex) and related piriform periallocortex receive projections from the olfactory bulb (Sakamoto, 1999). Deep amygdala nuclei seem to be involved in emotional processing of olfactory stimuli (Anderson et al., 2003). The region is cytoarchitectonically heterogeneous and includes small areas with a complex geometry, which cannot be studied in detail using structural in vivo neuroimaging. Previously, based on 10 postmortem brains, we have introduced probabilistic maps of 10 areas and nuclei of the amygdala (Kedo et al., 2018). Here we build on this research, and generate high-resolution maps of four areas of the mesial piriform region and new subdivisions of the amygdala in the BigBrain template, to study the extent and topography of cortical and subcortical structures, as well as their neighborhood relationships.
Cytoarchitectonic mapping in serial histological sections and a Deep-Learning workflow were applied to 3D-reconstruct the structures in the BigBrain. Firstly, we identified and delineated 19 structures of the amygdala in 57 sections in the right hemisphere and in 59 sections in the left hemisphere (Kedo et al., 2022). Secondly, the piriform region was analyzed, resulting in reference delineations in 57 sections in the right hemisphere and 42 sections in the left hemisphere. All delineations were performed using the web-based annotation tool (MicroDraw) at 1-micron resolution in-plane, in each 3rd to 18th section. Convolutional Neural Networks (CNNs) were applied for image segmentation in the unmapped sections in-between (Schiffer et al., 2021), separately for each data set. The annotations of both regions (Fig. 1A-B) were non-linearly transformed to the sections of the 3D reconstructed BigBrain space at 20-micron isotropic resolution (Amunts et al., 2013). The amygdala –piriform region was visualized using the Neuroglancer (Figs. 1A-C).
We have identified allocortical areas PirTBd, PirTBv and periallocortical areas PirTit, PirTu. The PirTB areas are located ventromedially to the Claustrum (Figs. 1A,C). Their spatial relationship to the caudally adjacent amygdala is shown in Figs. 1C-D. PirTit and PirTu rostrally replace the amygdalopiriform transition area (APir) on the temporal brain surface. PirTBv lies dorsally to both APir and PirTit. The dorsal areas PirTBd and anterior amygdaloid area (AAA) show a bumpy surface. Both areas medially extend on the basal brain surface. The shape of PirTit is influenced by the macroanatomy of the temporal pole. Lateral nucleus (invisible) reveals recesses in places of contact with granular parts of the paralaminar nucleus.
These maps will be openly available on EBRAINS platform of the HBP and integrated with the BigBrain model (https://go.fzj.de/bigbrain/) to serve as a histological reference data.
Amunts el al. (2013), Science 340:1472-1475.
Anderson el al. (2003), Nat Neurosci 6:196-202.
Buchanan el al. (2003), Learn Mem 10:319-325.
Gottfried JA (2010), Nat Rev Neurosci 11:628-641.
Kedo et al. (2022), 6th BigBrain Workshop, 25.-27. Okt 2022 In. Zadar.
Kedo et al. (2018), Brain Struct Funct 223:1637-1666.
Sakamoto et al. (1999) In: Handbook of Chemical Neuroanatomy (Bloom et al., eds).
Schiffer et al. (2021), Neuroimage 240:118327.

Primary author: KEDO, Olga (INM-1 Forschungszentrum Jülich)

Co-authors: SCHIFFER, Christian (INM-1 Forschungszentrum Jülich; Helmholz AI, Forschungszentrum Jülich, Jülich, Germany); DICKSCHEID, Timo (INM-1 Forschungszentrum Jülich; Helmholz AI, Forschungszentrum Jülich, Jülich, Germany; Institute for Computer Science, Heinrich-Heine Universtity, Düsseldorf, Germany); AMUNTS, Katrin (INM-1 Forschungszentrum Jülich; C.& O.Vogt Institute for Brain Research, Medical Faculty, University Hospital Düsseldorf, Heinrich-Heine-University, Düsseldorf, Germany)

Presenter: KEDO, Olga (INM-1 Forschungszentrum Jülich)

Session Classification: Poster Session