

Digital Atlas Interest Group

Chairs: Partha Mitra and Kathy Rockland

NIH BRAIN co-organizers: Grace Peng, Jim Gnadt, Susan Wright, Karen David, Christina Fang; Elizabeth Powell

Abstract: Based on presentations from BRAIN TeamBCP U19s in calendar year 2020, an interest group formed in December 2020 to plan an informal ‘collective lab meeting’ of digital atlas efforts across multiple species and scales (EM to LM). The meeting will be primed by short presentations from the TeamBCP site visits and a few invited contributors. The primary goal of the meeting will be to stimulate discussions on common methodologies and challenges, and to deliberate how this Interest Group might confederate efforts and reach out to other international players and atlas-constructing communities.

Proposed structure of session: 3 hours

[60min -- 5min break -- 60min -- 5min break -- 50min]

March 12, 2021, 12:00-15:00 ET

Concrete needs:

- Quasi-isotropic, digitized reference brains at LM resolution (EM, if available)
- Registration algorithms and software to map individual brains onto digitized reference brains
- Outreach/dissemination (second stage)

Speaker list:

Introduction and Overview [10min]

Partha Mitra

Kathy Rockland

Jim Gnadt

Progress in automation (Moderator: Florian Engert) [50min; 7min talks+3min Q&A]

Hongwei Dong - Mouse: from print/manual to digital/semi-automated atlas mapping

Katrin Amunts - Human: evolution of Human brain atlases; current digital atlases.

Daniel Tward - LM [registration methods; atlas segmentation]

Paul Katz - EM Burghia [specifically atlas related – not EM segmentation]

Mike Hawrylycz – Informatics and dissemination

Applications/Challenges/New Tools (Moderator: David Kleinfeld)

[60min; 7min talks+3min Q&A]

Christian Hege - Zebrafish

Yoav Freund - Rodent Brainstem; discussant: Martyn Goulding - Rodent Spinal Cord

Austin Hoag - Rodent brain; discussant: Rui Costa – Rodent brain

Cliff Ragsdale - Birds, Octopi

Michael Dickinson - Fly EM/LM; discussants: Gwyneth Card, Claire McKellar, Greg Jefferis, Steve Plaza
Bingxing Huo - Mouse+Marmoset, across-species atlas reconciliation

Discussion (Moderator: Susan Wright) [35min]

[Moderated forum for all attendees to discuss the issues pertinent to the workshop]

Wrap up and next steps [15min]

Florian Engert
Partha Mitra
Kathy Rockland

Suggestions for speakers + for discussion session:

Please describe the problems you are solving during your research in mapping/registering digital whole-brain imaging data to reference brains and atlases. As appropriate please include **(i)** the tools/algorithms you are using, including visualization tools **(ii)** how you do quality control or proofreading of the maps/registration, **(iii)** applicability across data modalities and across species, **(iv)** applicability to partial image data sets, **(v)** availability/usability of the tools, **(vi)** standardization of data formats, **(vii)** linking to other data sets that can be “pinned” to the atlases and **(viii)** open problems and challenges.

Include computational tools for atlas registration/segmentation + actual reference brains and digital atlases; usage of atlases as data integration platforms [e.g.: single cell and tracer projection data, single cell transcriptome data, etc.].

Focus on LM and EM based atlases. LM: whole reference brains; multimodal - ideally include classical histochemical stains and gender/age balance; EM: from whole, small-brains to regional, large-brain mapping and co-registration to LM atlases.

The meeting is not focused on a single species but provides a forum for discussions across species. Just as comparative genomics has facilitated a broader understanding of genome evolution, Comparative Computational Neuroanatomy could help address questions about brain function by adopting an evolutionary perspective.

Exclude [but mention] debates about atlas boundaries, detailed discussion of MRI, EM image segmentation, cloud services for data storage/management, non-3D approaches (i.e., digital/scanned versions of print atlases that are widely spaced)], cell census/single cell atlases

Items for wrap up/next steps:

1. Reconvene the U19 BRAIN data consortium Atlas Subgroup [co-leads: Florian Engert and Partha Mitra]

2. <https://www.imagwiki.nibib.nih.gov/content/Brain-Atlases-Subgroup>
3. Discussion about more extensive future meeting.
4. Collective white paper publication.

Attendee list (flexible):

1. Partha Mitra & Kathy Rockland, co-Chairs
2. NIH BRAIN Circuits Leadership
3. TeamBCP U19 awards as interested
4. U19 junior scientists
5. U19 data consortium Atlas Subgroup membership
<https://www.imagwiki.nibib.nih.gov/content/Brain-Atlases-Subgroup> (click on Login and select “MSM member” and the BRAIN U19 WG; Helene Gianviti, NIBIB)
6. MSCZ U19 (zebrafish CNS; Florian Engert et al.)
7. BrainCOGS U19 (rodent brain; Carlos Brody et al.)
8. aABC U19 (rodent brainstem; David Kleinfeld et al.)
9. SCC U19 (rodent spinal cord; Goulding et al.)
10. MoC3 U19 (rodent brain; Costa et al.)
11. Paul Katz U01 (burghia)
12. BRAIN BICCN (Hongwei Dong, Pavel Osten, Jim Gee, Yongsoo Kim, Lydia Ng, Mike Hawrylycz, Hanchuan Peng)
13. BICCN POs [Yong Yao, Andrea Beckel-Michener, et.al.]
14. Hongkui Zeng
15. Partha Mitra
16. Kathy Rockland
17. Jeff Lichtman
18. Harvey Karten
19. Yoav Freund
20. Hans-Christian Hege
21. Danial Tward
22. Sam Wang
23. Ashwin Vishwanathan
24. Michael Miller
25. Peter Strick
26. Austin Hoag
27. Katrin Amunts – human; EU brain project
28. Cliff Ragsdale – broad; octopus
29. Janelia fly EM/LM atlas – Gwyneth Card, Steve Plaza
30. Menno Witter
31. Erich Jarvis
32. Claudio Mello
33. Carlos Lois
34. Javier How (MSCZ U19)

- 35. Claire McKellar,
- 36. Greg Jefferis
- 37. Michael Dickinson
- 38. Friedrich Kretschmer