

Nov 14, 2023

## Regional Mouse Brain Analysis (Modified QUINT)

DOI

[dx.doi.org/10.17504/protocols.io.kqdg3xbkzg25/v1](https://dx.doi.org/10.17504/protocols.io.kqdg3xbkzg25/v1)

Michael X. Henderson<sup>1</sup>

<sup>1</sup>Van Andel Institute

Michael X. Henderson: ORCID: 0000-0001-9710-0726



**Michael Henderson**

Van Andel Research Institute

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**Collection Citation:** Michael X. Henderson 2023. Regional Mouse Brain Analysis (Modified QUINT). **protocols.io**  
<https://dx.doi.org/10.17504/protocols.io.kqdg3xbkzg25/v1>

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**Protocol status:** Working

We use this collection and it's working



**Created:** August 18, 2023

**Last Modified:** May 31, 2024

**Collection Integer ID:** 90668

**Keywords:** QUINT, Segmentation, Registration, non-linear warp transformation, ASAPCRN, regional mouse brain analysis, serial microscopic brain image, histological images from rodent brain, rodent brain, frontiers in neuroinformatics, neuroinformatics, histological image, spatial analysis of feature, quint workflow, original quint workflow, quicknii tool, spatial analysis, quint, qupath, mouse, modified quint, select aba mouse edition

**Funders Acknowledgements:**

**Aligning Science Across Parkinson's**

Grant ID: ASAP-020616

**National Institute on Aging**

Grant ID: R01-AG077573

## Disclaimer

This collection of protocols was written in the Henderson lab, but all software and original protocols were developed and are available through the NeuroImaging Tools and Resources Collaboratory (NITRC).

## Abstract

This is series of protocols that has been adapted from published and unpublished protocols broadly referred to as the QUINT workflow. Note that the original QUINT workflow was generated by Yates and colleagues, and all credit for development of these programs goes to that team. References for each software is listed below.

Yates, S. C. et al. QUINT: Workflow for Quantification and Spatial Analysis of Features in Histological Images From Rodent Brain. *Frontiers in neuroinformatics* 13, 75, doi:10.3389/fninf.2019.00075 (2019).

Puchades, M. A., Csucs, G., Ledergerber, D., Leergaard, T. B. & Bjaalie, J. G. Spatial registration of serial microscopic brain images to three-dimensional reference atlases with the QuickNII tool. *PloS one* 14, e0216796, doi:10.1371/journal.pone.0216796 (2019).

VisuAlign, RRID:SCR\_017978

1. QuPath: <https://qupath.github.io/>
2. QuickNII: <https://www.nitrc.org/projects/quicknii> (SELECT ABA Mouse Edition)
3. Visualign: <https://www.nitrc.org/projects/visualign/>
4. Qmask: \\pn.vai.org\projects\_secondary\henderson\NOAH\QMask-Standalone
5. Nutil: <https://www.nitrc.org/projects/nutil/>

## Attachments



812-2118.pdf

4.6MB



## Guidelines

### Purpose

The purpose of this workflow is to enable mouse brain segmentation, registration and quantification of regional signal. The simplest segmentation is done in QuPath because this program handles whole slide images and has good segmentation algorithms. Registration is done using 3 programs: QuickNII (aligns to a 3D atlas, typically the 2017 CCFv3 Allen Brain Atlas), Visualign (allows for non-linear warp transformation of the atlas to match sections), QMask (masks each side of the brain to allow for bilateral assessment of brain regions). Segmentations and registrations are then brought together in Nutil, enabling the generation of quantitative measures for every region of the brain.

### Necessary Programs and Locations

1. QuPath: <https://qupath.github.io/>
2. QuickNII: <https://www.nitrc.org/projects/quicknii> (SELECT ABA Mouse Edition)
3. Visualign: <https://www.nitrc.org/projects/visualign/>
4. Qmask: \\pn.vai.org\projects\_secondary\henderson\NOAH\QMask-Standalone
5. Nutil: <https://www.nitrc.org/projects/nutil/>

### Folder Organization

The programs for registration and quantification rely on having exact file paths from which to call the data. Therefore, it is easiest to set these folders up from the beginning. We have the following typical layout for folders:

1. Project (e.g. Tau-MLi-2)
  - a. Figure (e.g. Figure 23)
    - i. Repeat (e.g. 1 or 2)
      1. Cohort/Block (e.g. TM1)
        - a. QuPath (place for qupath project and exported
        - b. QVN (for QuickNII, Visualign, Nutil)
          - i. Atlas
          - ii. Input
          - iii. Mask
          - iv. Output\_Left
          - v. Output\_Right
      - b. Figure (next one, same internal folder organization)...

## Troubleshooting

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## Files

 SEARCH

### Protocol

NAME

QuPath Visualization/Segmentation

VERSION 1

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### Protocol

NAME

QuickNII Brain Atlas Registration

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### Protocol

NAME

QMask Hemispheric Separation

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### Protocol

NAME

Visualign Transformation

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## Protocol

NAME

**Nutil Data Integration**

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## Protocol

NAME

**QUINT Workflow Appendix**

VERSION 1

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## Protocol

NAME

**QUINT Workflow for Fluorescence**

VERSION 1

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## Protocol references

Yates SC, Groeneboom NE, Coello C, Lichtenthaler SF, Kuhn PH, Demuth HU, Hartlage-Rübsamen M, Roßner S, Leergaard T, Kreshuk A, Puchades MA, Bjaalie JG. QUINT: Workflow for Quantification and Spatial Analysis of Features in Histological Images From Rodent Brain. *Front Neuroinform.* 2019 Dec 3;13:75. doi: 10.3389/fninf.2019.00075. PMID: 31849633; PMCID: PMC6901597.

Groeneboom NE, Yates SC, Puchades MA, Bjaalie JG. Nutil: A Pre- and Post-processing Toolbox for Histological Rodent Brain Section Images. *Front Neuroinform.* 2020 Aug 21;14:37. doi: 10.3389/fninf.2020.00037. PMID: 32973479; PMCID: PMC7472695.

Puchades MA, Csucs G, Ledergerber D, Leergaard TB, Bjaalie JG. Spatial registration of serial microscopic brain images to three-dimensional reference atlases with the QuickNII tool. *PLoS One.* 2019 May 29;14(5):e0216796. doi: 10.1371/journal.pone.0216796.