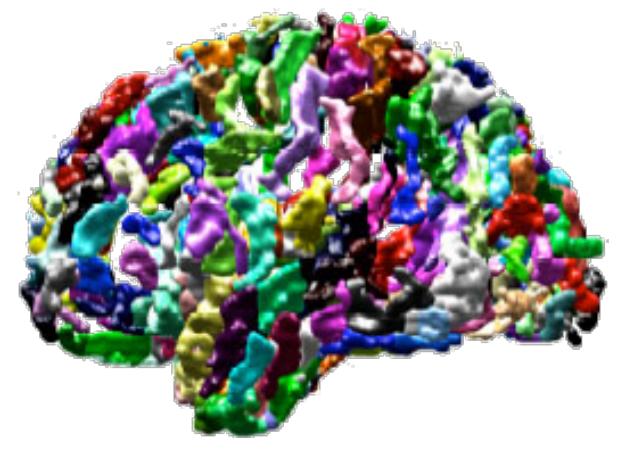


# Open labels: online feedback for a public resource of manually labeled brain images



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## Goal

Create a web application to interactively view manually labeled brain images and submit comments to the labelers and developers of the labeling protocol.

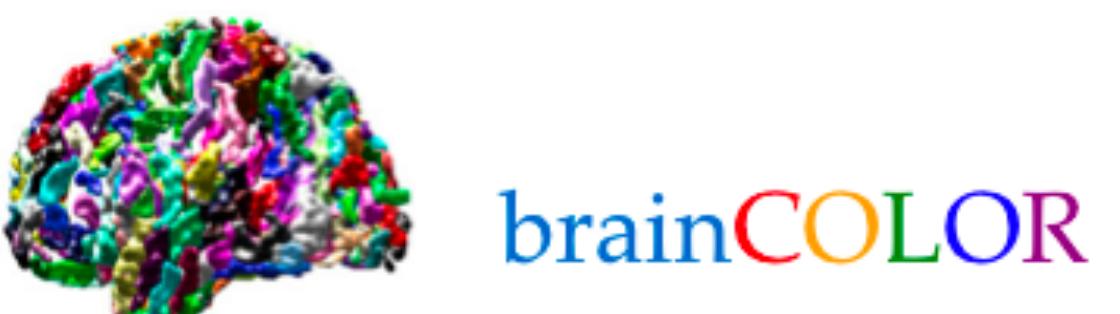
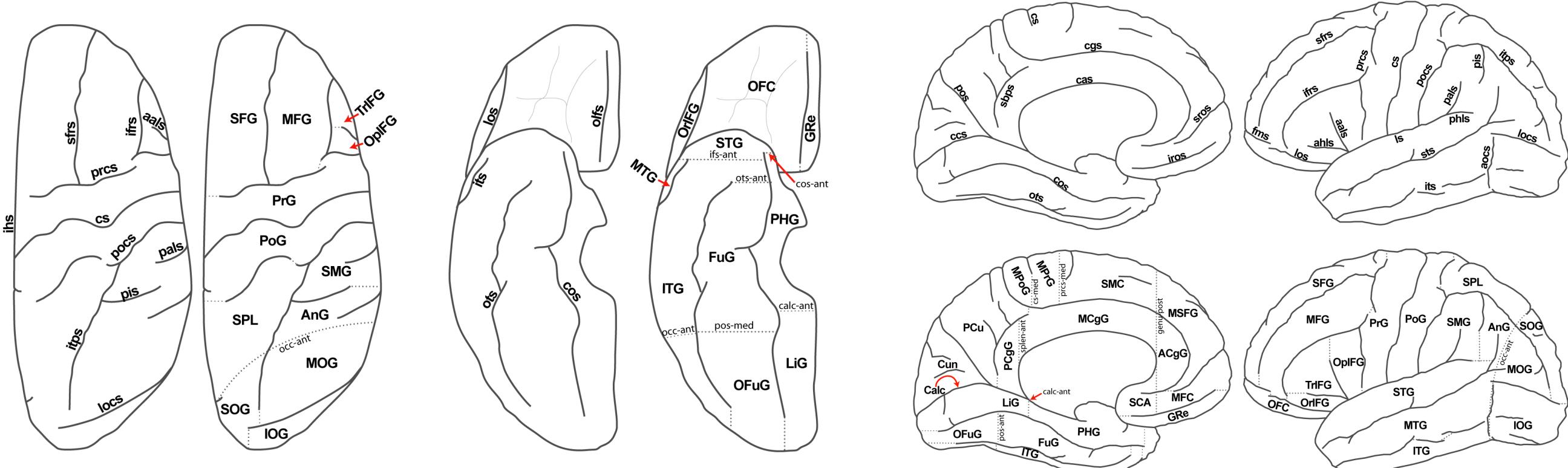
## Background

Neuromorphometrics has developed a brain labeling protocol that will be used by trained personnel to manually label the anatomy in an initial set of at least 800 to 1,000 T1-weighted MRI volumes.

The labeled brain images will be made publicly available online as a free, downloadable resource. In order to ensure that these anatomical labels are meaningful and useful to the neuroscientific community, we gathered feedback about the protocol using online surveys.

## Problem

The schematics used in the survey were not sufficient for users to evaluate the protocol, and we needed to provide a way for users to view the labeled image data to provide feedback. We considered using two different Java applications, WebMILL (<https://brassie.ece.jhu.edu>) and the Internet Image Viewer (<http://james.psych.umn.edu/iiV>), but determined that they would require significant modifications to achieve our goal: iiV had difficulty scaling up to larger images; WebMill has advanced image labeling capabilities, but it does not have the capability of cross-referencing slices or providing text-based user feedback. We therefore decided to design a new online brain image viewer in JavaScript.



brainCOLOR Collaborative Open Labeling Online Resource

## Proposed Cortical Parcellation Protocol: SURVEY 1 SURVEY 2

| Frontal Lobe (FL): Lateral Surface   |  |
|--|--|
| Precentral Gyrus (PrG)   |  |
| Anterior: precentral sulcus --- Posterior: central sulcus --- Superior: superior margin of the interhemispheric fissure --- Inferior: lateral margin of the dorsal bank of the lateral fissure                             |  |
| Superior Frontal Gyrus (SFG)   |  |
| Anterior: frontomarginal sulcus --- Posterior: precentral sulcus / plane prcs-med --- Medial: superior margin of interhemispheric fissure --- Inferior: anterior: lateral orbital sulcus; posterior: middle frontal sulcus |  |
| Middle Frontal Gyrus (MFG)   |  |
| Posterior: precentral sulcus --- Superior: superior frontal sulcus --- Inferior: anterior: lateral orbital sulcus; posterior: inferior frontal sulcus  |  |
| Inferior Frontal Gyrus (IFG)   |  |
| Posterior: precentral sulcus --- Superior: anterior: lateral orbital sulcus; posterior: lateral orbital sulcus / posterior projection from the posterior limit of the lateral orbital sulcus to the lateral sulcus         |  |
| Regions of interest included in the protocol   |  |
| Sulci included in the protocol and their abbreviations   |  |
| Dividing planes included in the protocol and their abbreviations   |  |
| * not included in the NeuroNames database  |  |

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## The Roy G. BIV Image Viewer

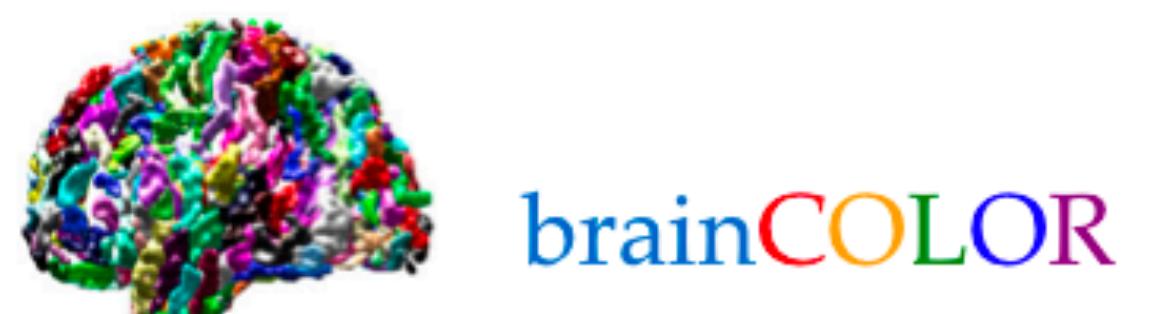
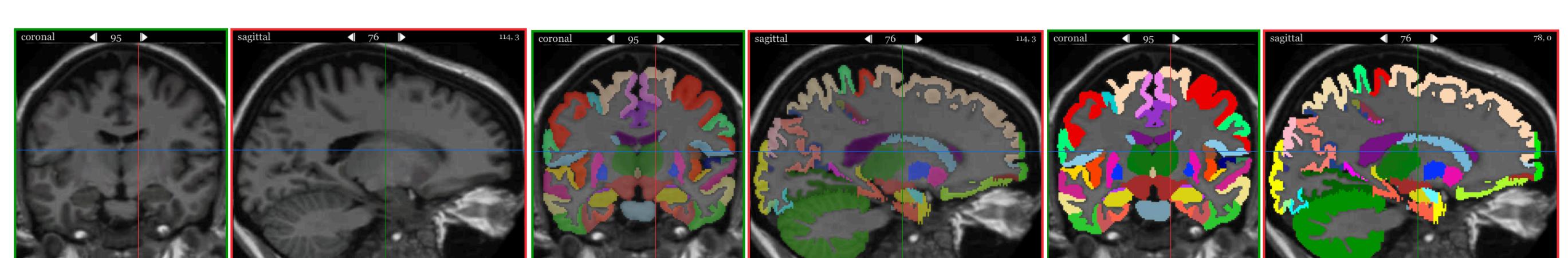
To open the labeling process to easier and more detailed feedback as part of the *Collaborative Open Labeling Online Resource* ([www.brainCOLOR.org](http://www.brainCOLOR.org)), we have created Roy G. BIV, an online brain image viewer with label overlays. A user can change the opacity of the labels, can click on cross-referenced coronal, sagittal, and horizontal slices to move through the images, and can mouse over coronal slices to see label highlights and titles.

We are developing the viewer using the jQuery JavaScript library ([jquery.com](http://jquery.com)) with the Map Hilight and Draw plugins. We faced two challenges: navigation speed and contour data size. To speed up navigation, rather than load individual slices of the image volume and the label volume along each axis, the web browser loads a montage of slices for each axis (generated by server-side Python code). Functions in JavaScript shift the montages in response to mouse events. The (x,y) coordinates for label contours in each coronal slice also exist, but would require a user to upload 15MB of XML data for a single brain. Instead, the viewer remotely loads a few kilobytes at a time of HTML image map data using jQuery AJAX functions.

Next, we will add a navigation panel in the empty quadrant, integrate feedback forms and PHP/SQL database call options for loading image data. We will release the code as open source under the MIT license and extend its functionality as per user requests.

Please visit:

<http://www.braincolor.org/openlabels/roygbiv>



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