

BrainGraph Editor

Software User Reference Manual

Version 1.0 Beta

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1 Overview

Many research scientists work with taxonomies or hierarchies to classify and organize information such as ontologies, anatomy, and developmental stages (Figure 1). Other tools, such as the Mouse BIRN Atlas ToolKit (MBAT, <http://cms.loni.ucla.edu/MBAT>) (Figure 2) and SHIVA (<http://www.loni.ucla.edu/twiki/bin/view/SHIVA/WebHome>), can visualize and navigate through this information. Based on the needs of researchers participating in the Mouse Biomedical Informatics Research Network (BIRN), the Brain Graph Editor was developed in conjunction with the Mouse BIRN Atlas ToolKit to help scientists create and edit these hierarchies.

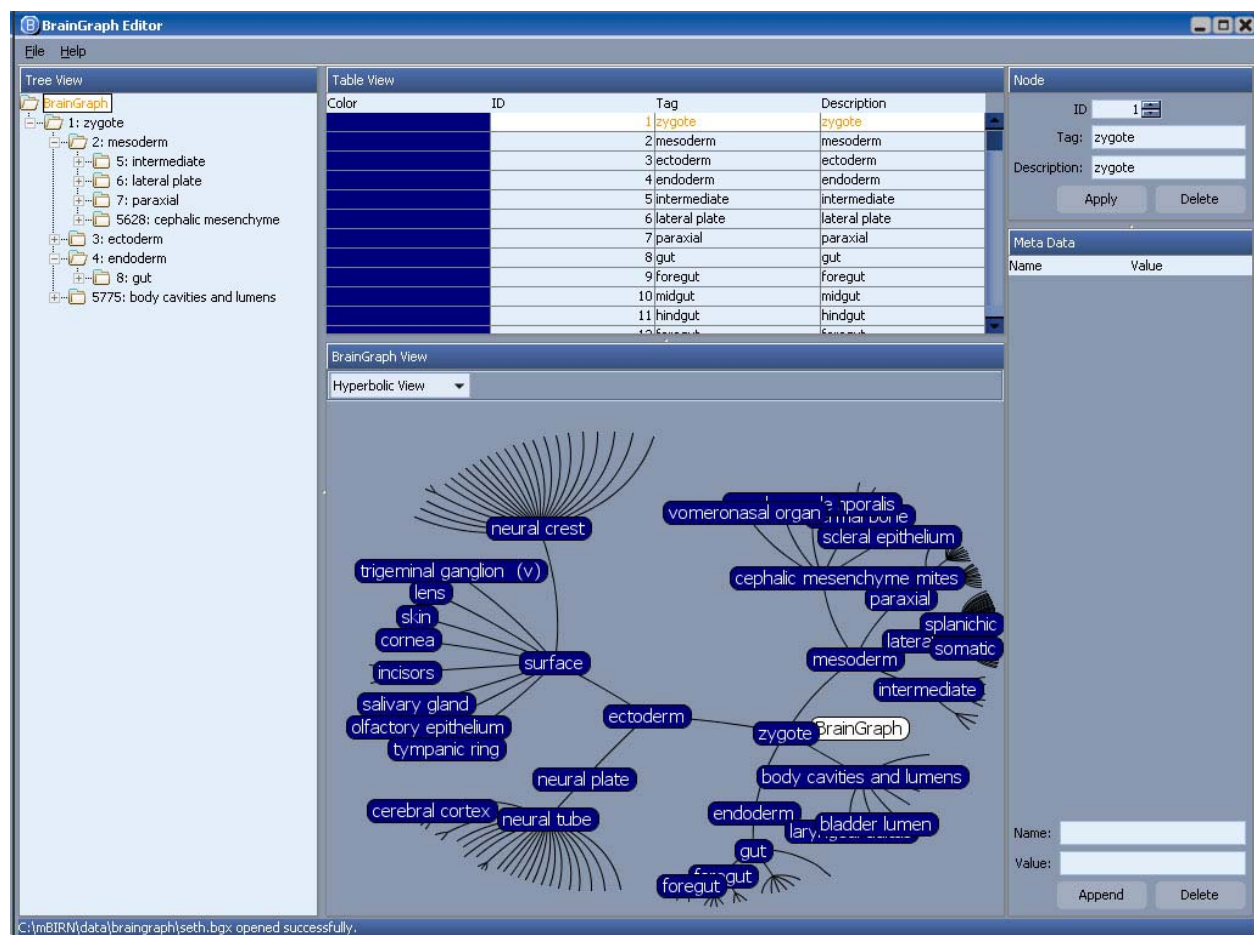


Figure 1. A BrainGraph Editor display of the mouse anatomical development hierarchy provided by Seth Ruffins, MRI Center in the Biological Imaging Center (BIC) at the California Institute of Technology (CIT).

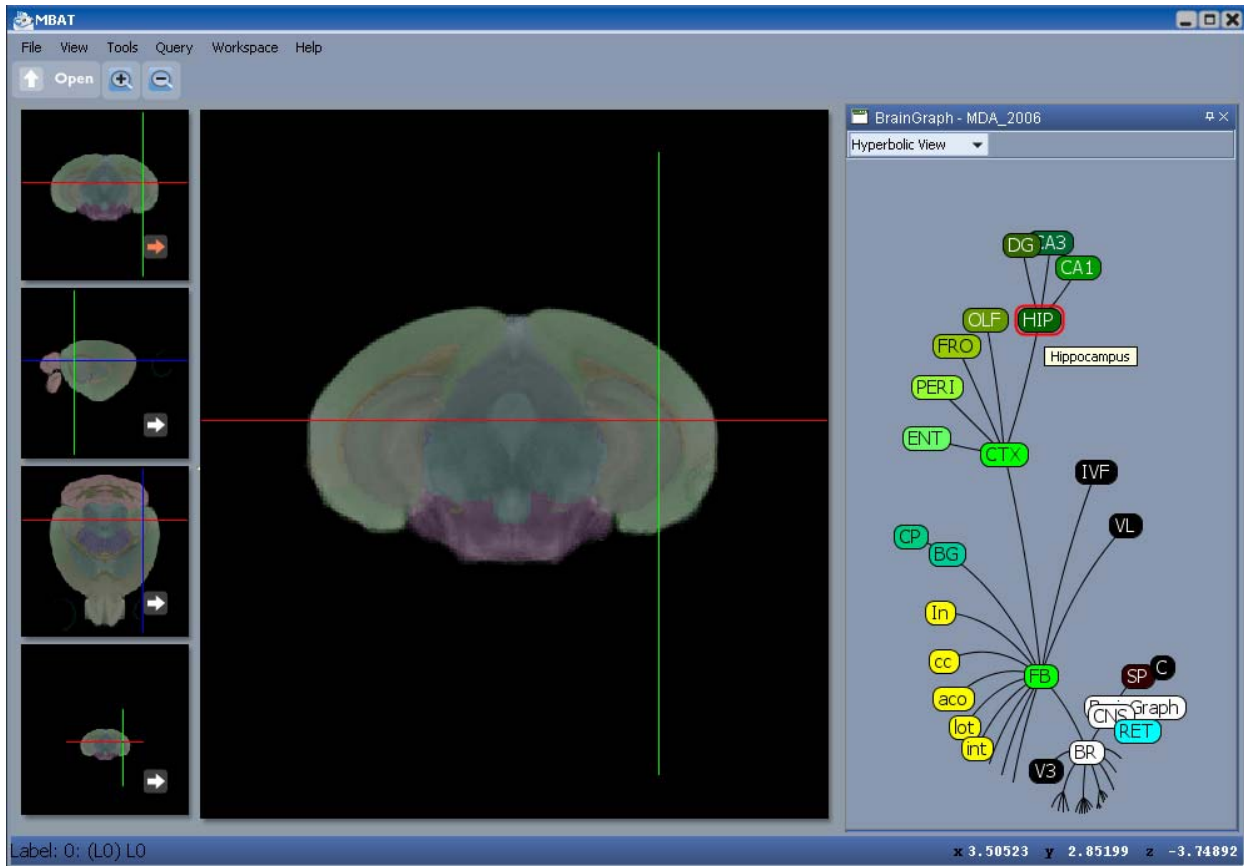


Figure 2. Example of a BrainGraph file used to navigate an atlas structure hierarchy within the Mouse BIRN Atlas Tool (MBAT). The color-coded structures are synchronized between the BrainGraph and the atlas.

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1.2 Acknowledgements

The BrainGraph Editor is developed primarily by Heng Yuan at the UCLA Laboratory of NeuroImaging (LONI) in consultation with Seth Ruffins at Caltech Biological Imaging Center (BIC) and Allan MacKenzie-Graham at UCLA LONI.

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1.3 Release Version and Date

BrainGraph Editor version 1.0 Beta, January 2008

2 Application Introduction

The BrainGraph Editor represents hierarchies as nodes in a graph. A user can easily add, edit, or delete nodes, node properties, and metadata. Node properties include color, tags, and descriptions. Metadata may be any user defined name-value pair. The BrainGraph Editor also allows the user to edit and manipulate an existing hierarchy of nodes through an intuitive drag-and-drop interface.

Hierarchies may be displayed with either a hyperbolic or tree view (Figure 3). The hierarchical information is contained in an XML-based file that may be also be read by MBAT or SHIVA. The hierarchy may also be associated with an atlas volume so that the BrainGraph viewer can be used to navigate an atlas volume within MBAT (Figure 2).

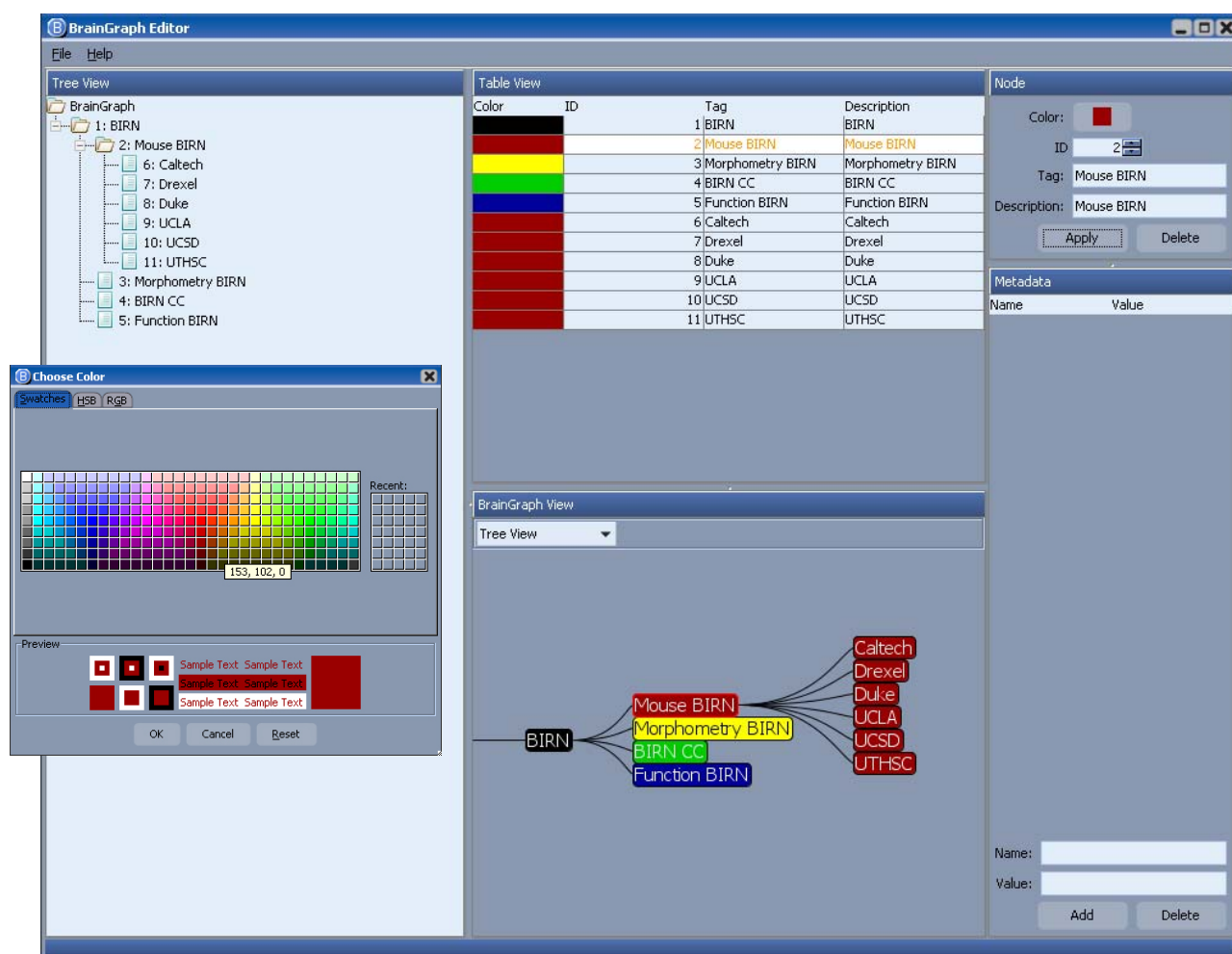


Figure 3. Example of the BrainGraph Editor used to illustrate an organizational hierarchy. The simple label color editor is used to add color information to help visualize the classifications.

2.1 Platform

The BrainGraph Editor is written in Java and platform independent.

2.2 Compatibility and Requirements

2.2.1 Java

The BrainGraph Editor requires installation of the Java Runtime Environment (JRE) 1.5. Download and install the appropriate version at <http://java.com/en/download/index.jsp>.

2.3 Installation

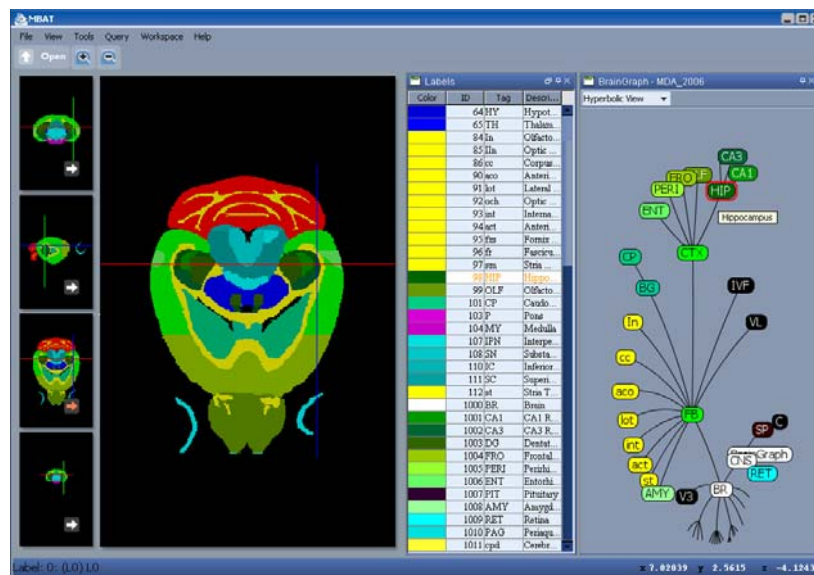
Since the BrainGraph Editor is a Java program, it may be copied to any location on the user's hard drive.

2.4 Launching BrainGraph Editor

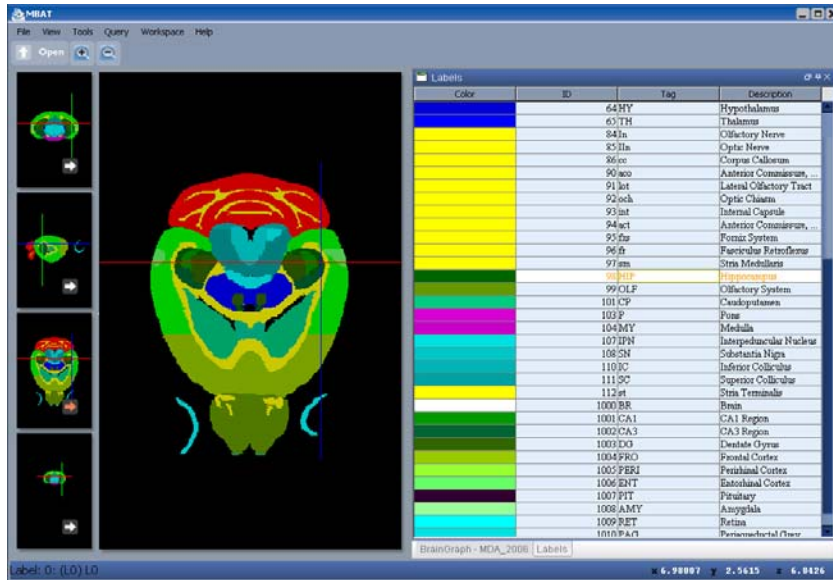
Double-click the BrainGraphEditor.jar file to launch the program.

3 File Formats

The BrainGraph Editor supports several different file formats for specifying hierarchical and label information. The primary and preferred file format is the Integrated Label File (.ilf) format. However, the BrainGraph Editor also supports BrainGraph (.bgx) and older brain label index (.lbl) files as described below.



(a)



(b)

Figure 4: Information in (a) an integrated label file (.ilf) and (b) a Label Index file (.lbl) visualized in MBAT.

3.1 Integrated Label Files (.ilf)

The Integrated Label File (ILF) contains a list of unique indexes and their tags, descriptions, and color that have been placed into a hierarchy. In addition, it allows for the association of this information with delineations in a labeled volume. These files can be displayed separately or can be used in conjunction with a labeled volume, which inherits the information associated with the node (see Figure 4).

An example ILF file showing the XML syntax is listed below:

```
<ilf atlas="example">
  <meta>
    <creator>amg</creator>
    <date>2007-05-130 14:21:53</date>
  </meta>
  <structure>
    <label id="1" color="#ffffff" abbreviation="CNS" name="Central Nervous System">
      <label id="34" color="#330000" abbreviation="SP" name="Spinal Cord">
        <label id="21" color="#0" abbreviation="C" name="Central Canal, Spinal Cord/Medulla">
        </label>
      </label>
      <label id="1000" color="#ffffff" abbreviation="BR" name="Brain">
      </label>
      <label id="1009" color="#ffff" abbreviation="RET" name="Retina">
      </label>
    </label>
  </structure>
</ilf>
```

3.2 Brain Label Index (.lbl)

A Brain Label Index file is an XML file that contains a list of unique indices for each node, along with tags, descriptions, and color. Unlike .ilf files, .lbl file types do not contain hierarchical information. When associated with label volumes, the .lbl file typically contains information about what the labels represent. MBAT can be used to view label index files using the Label Tool (see Figure 4b).

3.3 BrainGraph Files (.bgx)

A BrainGraph file is similar to a .ilf file, but it is independent of a label volume. This older file format also does not support metadata.

This format is still supported but the Integrated Label Format (.ilf) is the preferred file format for this kind of information.

4 Usage

The Brain Graph Editor, shown in Figure 5, has 5 main windows:

- 1) The **Tree View** (left side of main frame) allows the user to move nodes and edit the hierarchy through a drag-and-drop interface.
- 2) The **Table View** (top center) lists the nodes and their properties (color, ID, tag, and description) and allows the user to edit these properties.
- 3) The **BrainGraph View** (bottom center) displays the current hierarchy in a hyperbolic or tree view.
- 4) The **Node** display (top right) allows the user to add, edit, or delete a node and its properties.
- 5) The **Metadata** table (bottom right) allows the user to add, edit, or delete metadata for the current node.

The Tree View, Table View, and BrainGraph View are synchronized so that the current node is always displayed. To select a node in:

- the **Tree View**, left-click on the node name
- the **Table View**, left-click anywhere in the node's table row
- the **BrainGraph View**, left-click on the node icon

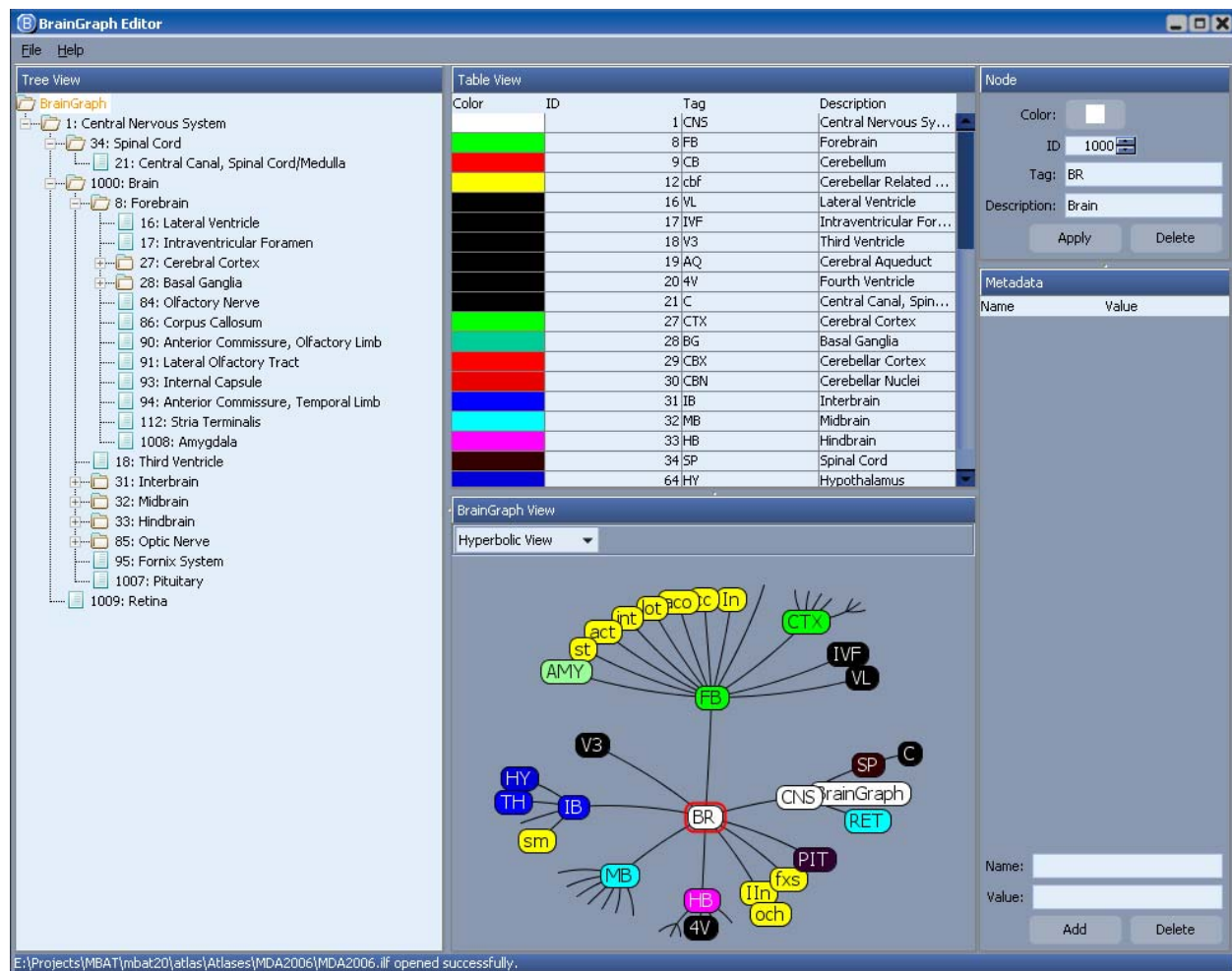


Figure 5: Brain Graph Editor Layout: Tree View (left), Table View (top center), BrainGraph View (bottom center), Node (top right), and Metadata (bottom right).

4.1 File operations

4.1.1 Create File

To create a file, click on the "File" menu and select "New". Begin by entering values in the ID, color, tag, and description fields of the Node window. Each entry will automatically appear under the Tree View, Table View, and Brain Graph View windows. A default set of metadata values will automatically appear in the Metadata window.

4.1.2 Open File

To open a file, click on the "File" menu and select "Open". Click on the desired file and click "Open".

4.1.3 Save File

To save an existing file in the current file format, click on the "File" menu and select "Save". To save a file in a different file format, click on the "File" menu and select "Save As". Enter a filename, select the desired file format, and click "Save".

4.2 Nodes

4.2.1 Add Nodes

To add a node, enter the ID, color, tag, and description fields in the Node window.

- Enter a unique ID number by either using the selection buttons or entering a number manually.
- Enter a tag by typing in the textbox. The tag is a name used to identify the node and is a required field.
- Enter a description by typing in the textbox. Adding a description is optional. The description will be shown in a tooltip for the corresponding tag. If you do not add a description, the tag will be used for the description.
- Enter a color by clicking the color button to pop up a color chooser window.
- Click “Add” or hit the Enter key to create a new node.

Repeat these steps until all of the desired nodes are created.

4.2.2 Edit Nodes

Either the Node or Table View can be used to edit nodes.

- Select a node using the Tree View, Table View, or BrainGraph View. Once selected, the selected node’s properties will be visible in the Node and Tree View windows.
- To edit the node using the Node window, change the desired properties in the Node Window and click “Apply” to commit the changes.
- To edit the node using the Table View, double-click on the desired property in the table and edit directly. Hit the Enter key to commit the changes.

4.2.3 Delete Nodes

To delete a node, select the node using the Tree View, Table View, or BrainGraph View and click on “Delete” in the Node window.

4.3 Metadata

Additional metadata may be added to any node to attach extra information. When the node is selected, this metadata information is visible in the Metadata View. However, neither MBAT nor SHIVA currently supports viewing metadata.

To add, edit, or delete metadata for a particular node, select that node using the Tree View, Table View, or BrainGraph View.

Only the ILF file format supports the inclusion of metadata.

4.3.1 Add Metadata

To add metadata, enter the name and value fields in the Metadata window. Click on “Add” or hit the Enter key to create the new metadata. For the metadata:

- 1) The name field should be a single word (not beginning with a digit) or multiple words separated by a single space.
- 2) Multiple metadata values can exist for the same name. This allows multiple references, creators, etc.

4.3.2 Edit Metadata

To edit metadata, double-click on the desired field and edit the Metadata table directly. Hit the Enter key to commit the changes.

4.3.3 Delete Metadata

To delete metadata, select a field in the Metadata table and click on “Delete” to remove the metadata from the node.

4.4 Hierarchies

4.4.1 Move Nodes

To move nodes, use the Tree View window to drag-and-drop nodes to the desired position in the hierarchy. Note that dragging a parent node will move all child nodes too.