BRAIN MAPS

Computer

Graphics Files
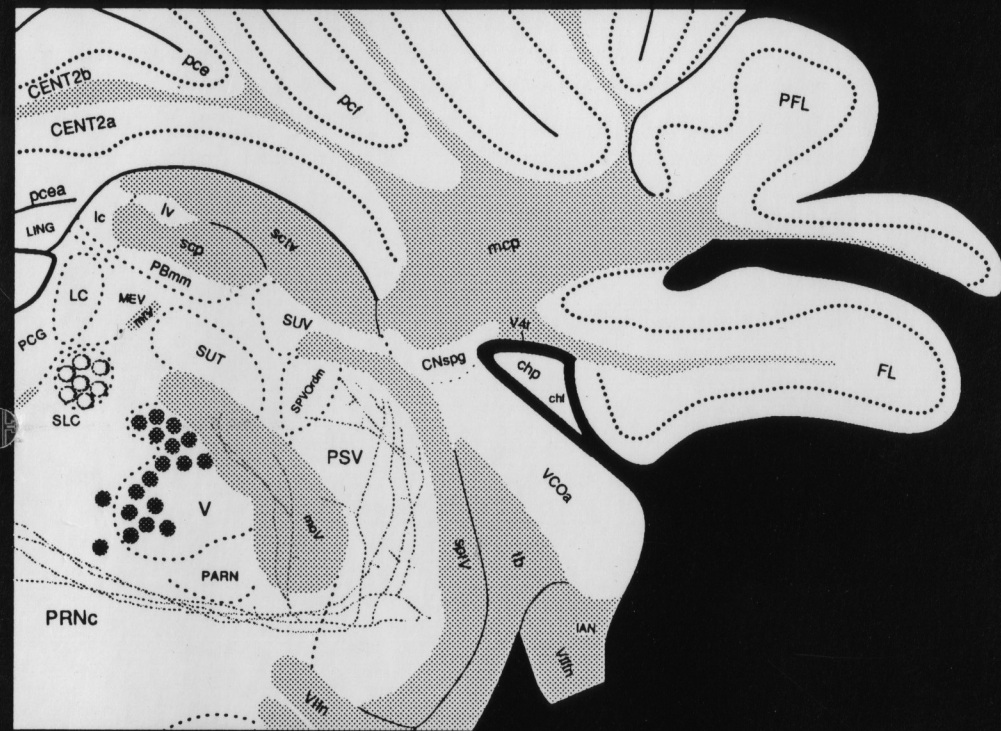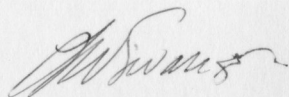
L.W. Swanson

Manual Design by Dave Warren.

1993

CONTENTS

These drawings have been created in Adobe Illustrator® 3.2 (Mac), but can be used with any later version of the program (4.0 for PC; 5.0 for Mac). The hardware and software system requirements will vary depending on which system you have and which version of the program you use. Most of this information is detailed in the *Illustrator User Guide,* but in summary:

Please Note: The disks provided have been formatted for PC use; they can be easily read and used by any Macintosh machine using a software package such as Access PC (Insignia Solutions Inc., 526 Clyde Avenue, Mountain View, CA 94043, USA).

Illustrator 3.2 (Mac)

Essential: a Macintosh Plus or above, with at least 2 Mb of random-access memory (RAM); Apple® System software version 6.0.3 or later.

Recommended: a Macintosh LC or above, with 8 Mb or more of RAM; System 7.0 software or later; a 12-inch or bigger color monitor.

Illustrator 4.0 (PC)

Essential: an IBM® PC AT® or Personal System/2 or 100%-compatible personal computer using a 386™ or above processor, with at least 4 Mb RAM; Microsoft® MS-DOS® 3.3 or above with Windows™ 3.0 or later; a VGA (640 x 480) or better display adapter and a 12-inch or bigger monitor.

Recommended: an IBM® PC AT® or Personal System/2 or 100%-compatible personal computer using a 486™ or above processor, with at least 8 Mb RAM; Microsoft® MS-DOS® 5.0 or above with Windows™ 3.1 or later; a SuperVGA (800 x 600) or better display adapter and a 19-inch or bigger monitor.

Illustrator 5.0 (Mac)

Essential: a Macintosh Plus or above, with at least 3.1 Mb of RAM; Apple® System software version 6.0.7 or later.

Recommended: a Macintosh LC or above, with 8 Mb or more of RAM; System 7.0 software or later; a 19-inch or bigger color monitor.

For All Versions of Illustrator

You will also need Adobe Type Manager 2.0 or later (Adobe Systems Inc., 1585 Charleston Road, PO Box 7900, Mountain View, CA 94039-7900, USA), and a PostScript® printer (or other laser printer with a PostScript® interpreter). Any printer may be used for draft printing, but the use of a 300 or 600 dots-per-inch (dpi) printer for showing the fine differences between gray levels is recommended. Output by a 1250 or better line printer (such as Linotronic) is essential for publication-quality printing, and prints may be obtained from commercial electronic publishing centers (see your local computer newspapers or magazines, or check your telephone directory under *Desktop Publishing and Service Bureaus*).

Other Graphics Packages

The procedures described in this manual focus on the Adobe Illustrator program, but are written with a general drawing package in mind. While it is not the goal of this manual to provide detailed procedures used in other packages, it is possible to use the drawings with software programs that support the widely accepted Illustrator format such as CorelDRAW! 3.0 (PC). Commands may differ slightly between packages, but equivalent functions exist in most illustration programs, and can be translated with common sense. In most cases an Import (or *Open as...*) command accesses Adobe Illustrator files. To aid in recognition by other programs, all files have been named with an ".AI" extension.

Earlier versions of these files were used to illustrate a series of frontal sections through the rat brain in *Brain Maps: Structure of the Rat Brain* (Swanson, '92). These rather complex drawings are provided here with minimal accompanying instructions for use by professional neuroanatomists and other workers thoroughly familiar with Adobe Illustrator® 3.2 (or later versions), a sophisticated computer graphics program with very broad applications. *The **Adobe Illustrator® tutorial** is an essential and enjoyable prerequisite for those not comfortable with the program.*

This guide is designed to suggest applications for the 73 Atlas Levels through the rat brain. Obviously they may be used as templates for plotting data, and Adobe Illustrator® provides a wide range of options for this, as well as for modifying the drawings themselves. However, because the drawings are so flexible, they are also complex. Thus, a major part of the Guide is devoted to explaining design principles used in their creation.

Adobe Illustrator® 3.2 itself has two features that are particularly important for understanding the construction of these templates. First, it uses **groups** rather than **layers** for items with some common feature like fiber tracts or labels. This is convenient because (a) all groups can be visible and available for manipulation at the same time, and (b) individual features within a group may be selected with the **direct-selection tool** (open arrow) without having to ungroup. And

second, very smooth vector-based outlines (Bezier curves) may be drawn with the **pen tool**, while irregular lines such as axons may be drawn quickly with the **freehand tool** (bitmapped lines). Adobe Illustrator® 4.0 (PC) allows one to work in Preview mode, while 5.0 (Mac) introduces the use of layers.

The drawings are all at the same scale, are in register, and are designed to fit on a piece of US letter size (8.5 x 11 in.) paper when printed. They are 66.67% as large as those in *Brain Maps: Structure of the Rat Brain*.

Be sure to make back-up copies of the diskettes provided.

While these files have broad applications, their use in published figures should acknowledge that they are based on *Brain Maps: Structure of the Rat Brain* (Swanson, 1992).

ATLAS LEVELS

LEVEL NUMBER
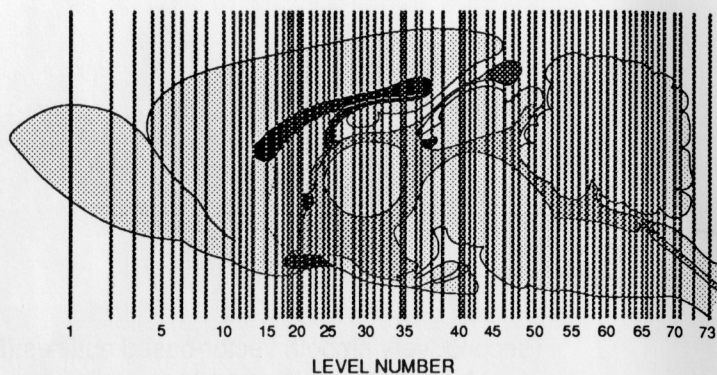
COMPOSIT.AI
This drawing illustrates the relative position of 73 frontal sections through the rat brain (named *Level_01.AI - Level_73.AI*). Locations are projected onto a schematic midsagittal view of the brain, and distances between sections can be obtained from *Brain Maps* (Swanson, '92).

On a color monitor the section lines are red (**Preview Illustration**); to manipulate the drawing (as well as atlas levels), **unlock** and (if necessary) **ungroup**.

PLOTTING DATA
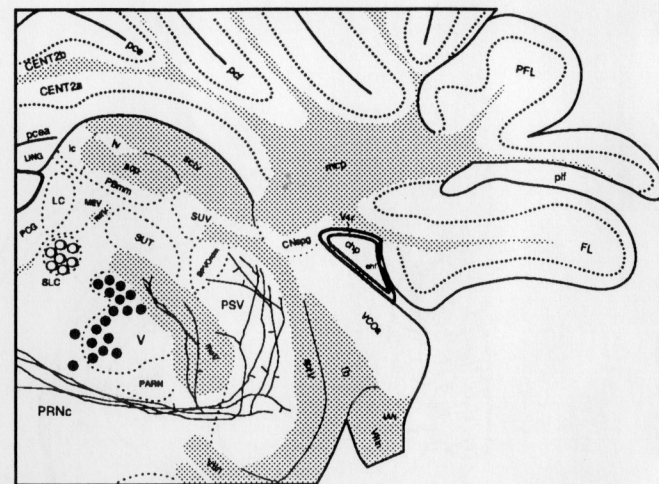
There are many ways to plot information on the templates. For example, it is convenient to draw irregular features like axons with the **freehand tool**, and the font *Zapf Dingbats* provides a number of useful symbols for different cell types. A method for cropping drawings is described elsewhere (*Cropping*).

It is usually convenient to plot data while the drawing is **locked** (as it is when the file is opened); before **unlocking**, **group** the data so that individual items do not need to be selected from other parts of the drawing.

STACKING DRAWINGS
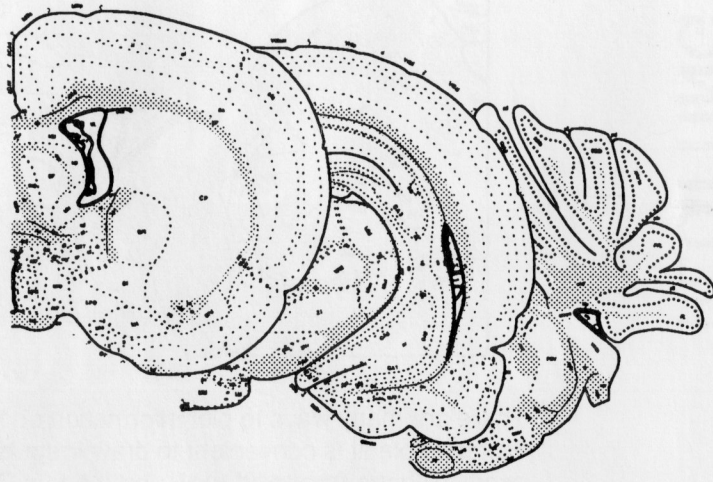
This figure shows that the drawings are opaque (because of group 6), and may thus be stacked in a way that hides parts of one drawing that are in back of another drawing. The next Chapter explains how this is accomplished.

DESIGN OF AN ATLAS DRAWING

Various components of a drawing are **grouped** so that they can be changed or manipulated together. For example, all of the tracts are **grouped**, so **fill** and **stroke** characteristics may be manipulated together. Fiber tracts are normally **filled** with 10% black and have no **stroke**. For clear tracts, **select** tracts and under **Paint**, **Style** choose fill: *none* and **stroke**: *black* (with an appropriate line thickness).

As shown in the following illustrations, groups are arranged from *front* to *back*, with items in front blocking any items in back of them. Thus, the group of lines indicating *tract divisions* is placed in front of the group of *tracts* itself because division lines would be hidden in the reverse order.

The drawings as a whole are opaque and may thus be stacked because the last group (layer 6, behind) is a white mask. In addition, the ventricles are transparent because they form a **compound path** with the section outline.

The **direct-selection tool** is very useful in selecting one feature of a group when multiple groups are **unlocked**, and in cropping.

Some groups are more complex than others because they have subgroups:

Group 1 (*Labels*). When **ungrouped**, it contains several groups – text (*Helvetica*), leaders for some abbreviations, arrowheads to indicate approximate boundaries between cortical areas, and fiduciary marks (*no stroke, no fill*) indicating the midline and the position of coordinate grids.

Group 5 (*Cell groups*). Contains a number of different line types for cell group borders, and outlines of choroid plexus. To select a whole line, use the **direct-selection tool**, and Option+Click.
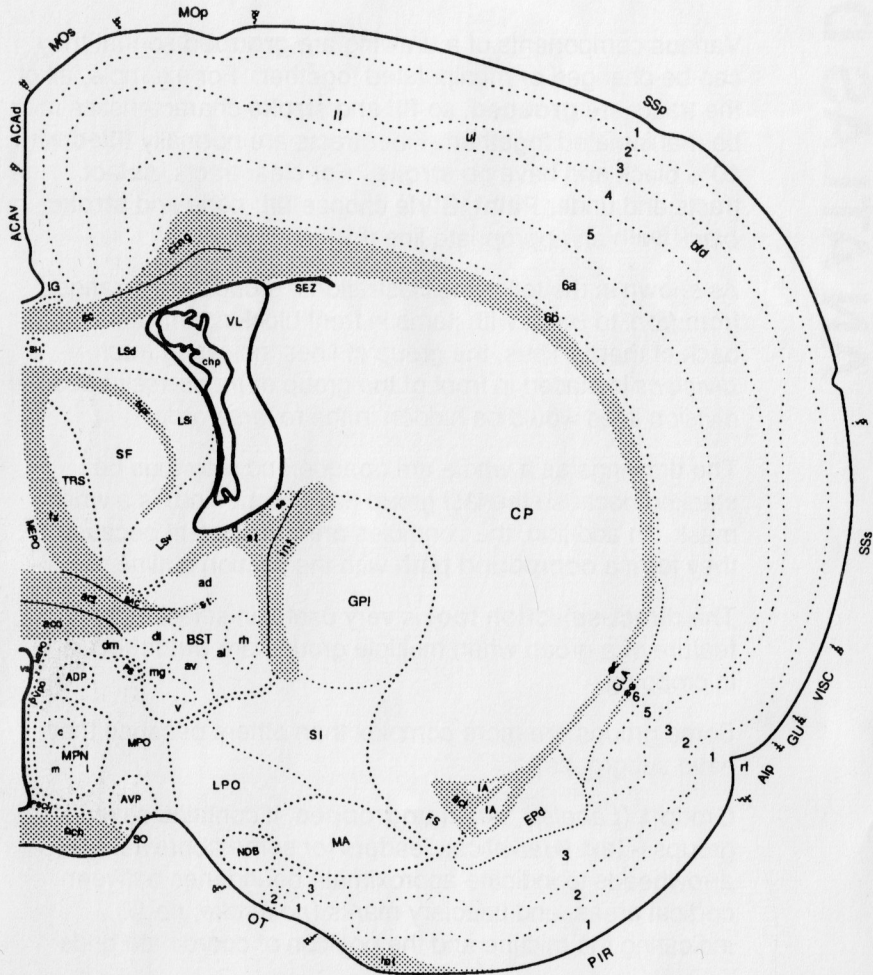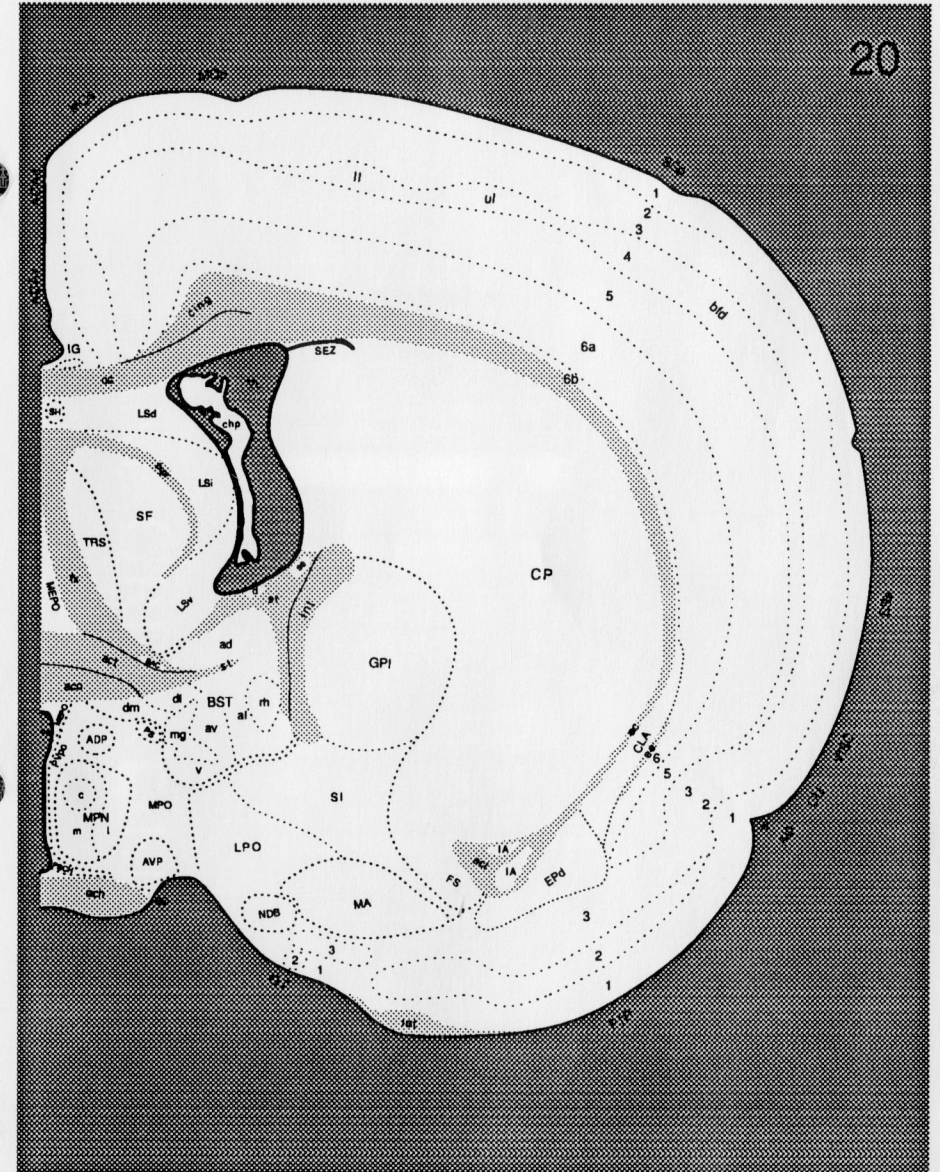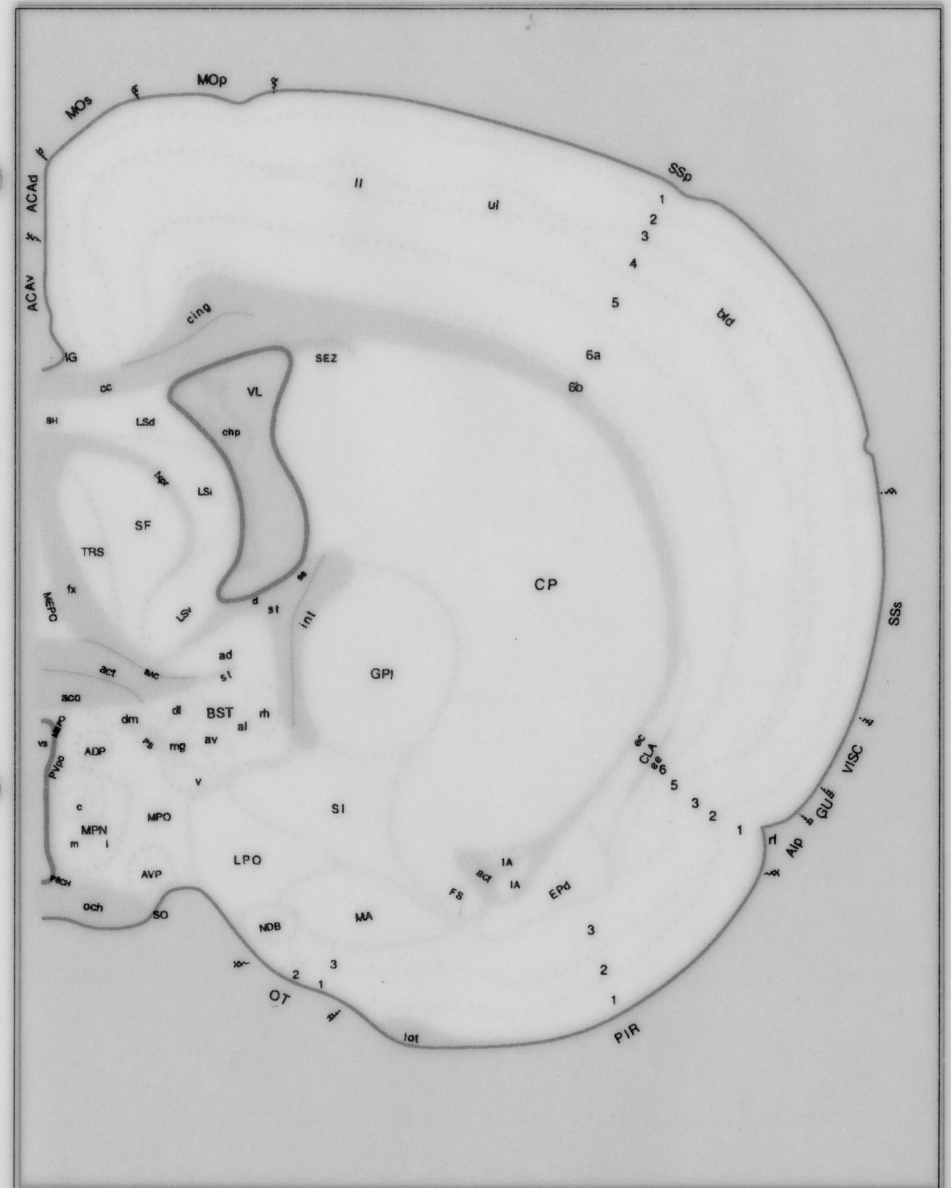
Group 1: Labels (front)
Group 2: Outline
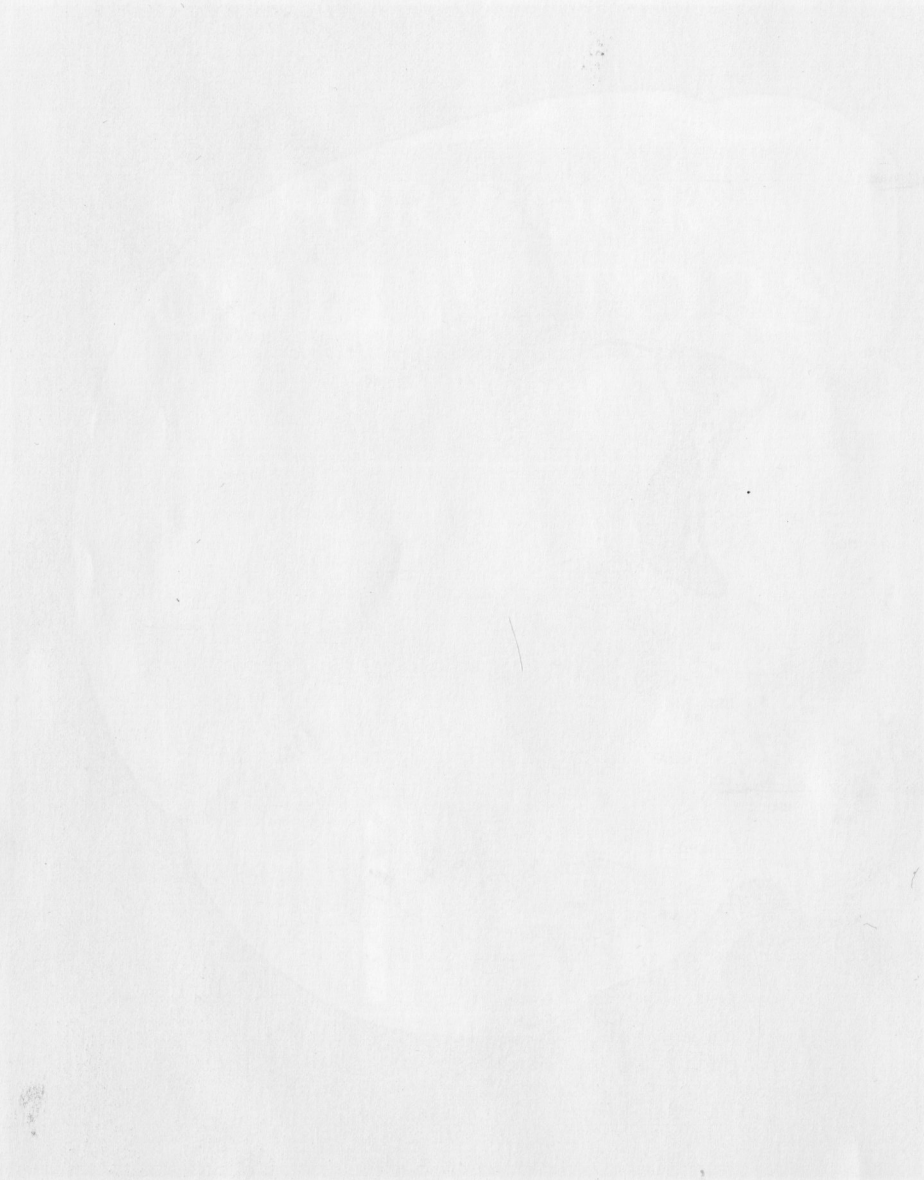Group 3: Tract divisions
Group 4: Tracts
Group 5: Cell groups

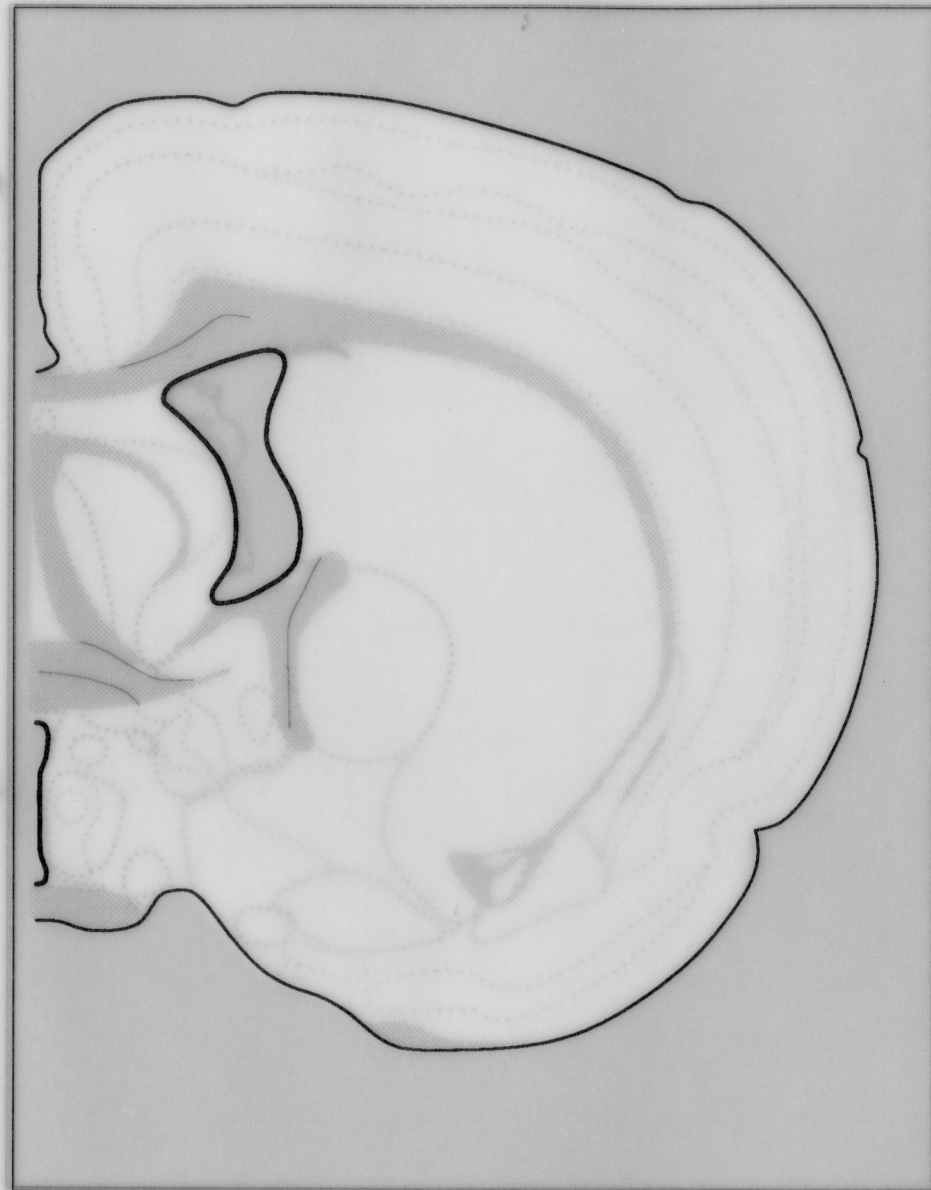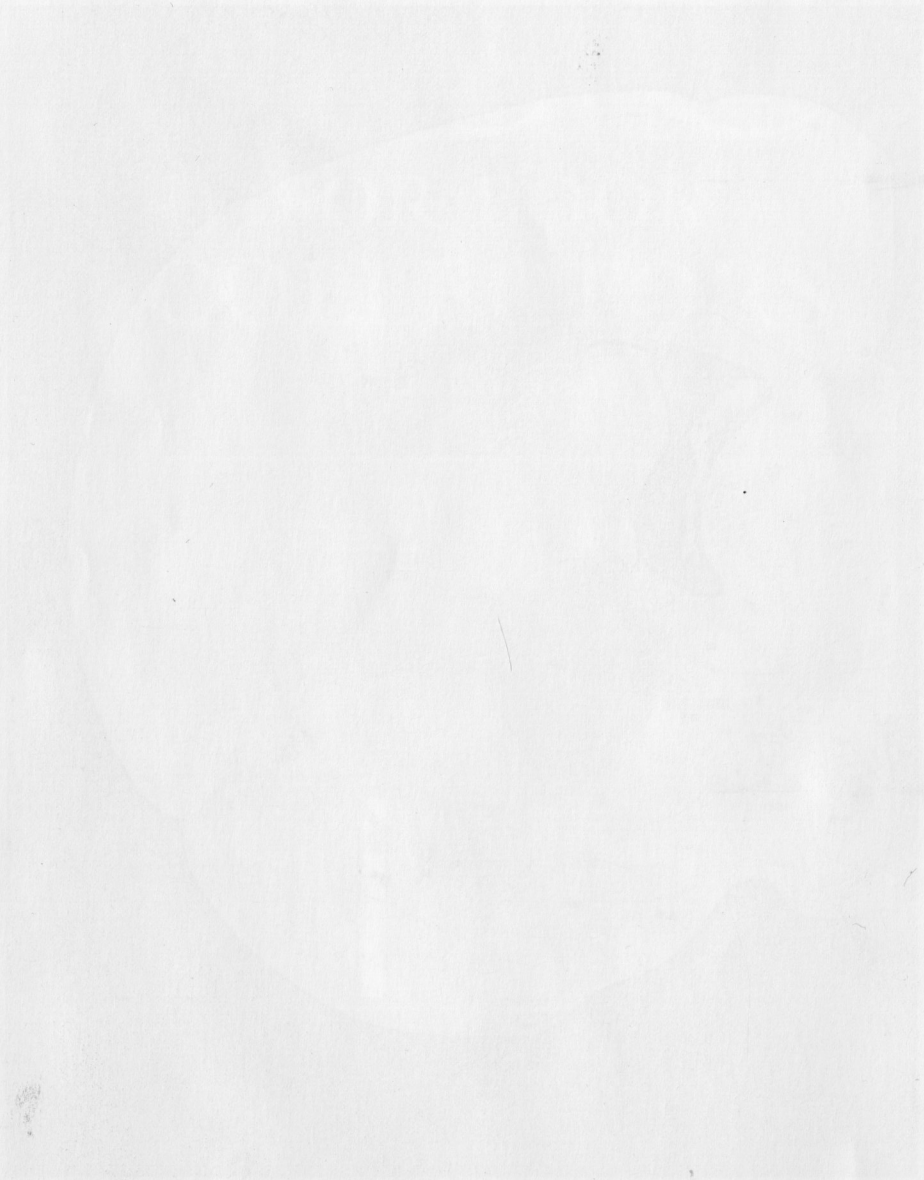Group 2: Outline
Group 3: Tract divisions
Group 4: Tracts
Group 5: Cell groups

17

Group 3: Tract divisions
Group 4: Tracts
Group 5: Cell groups
Group 6: Mask (back)

19
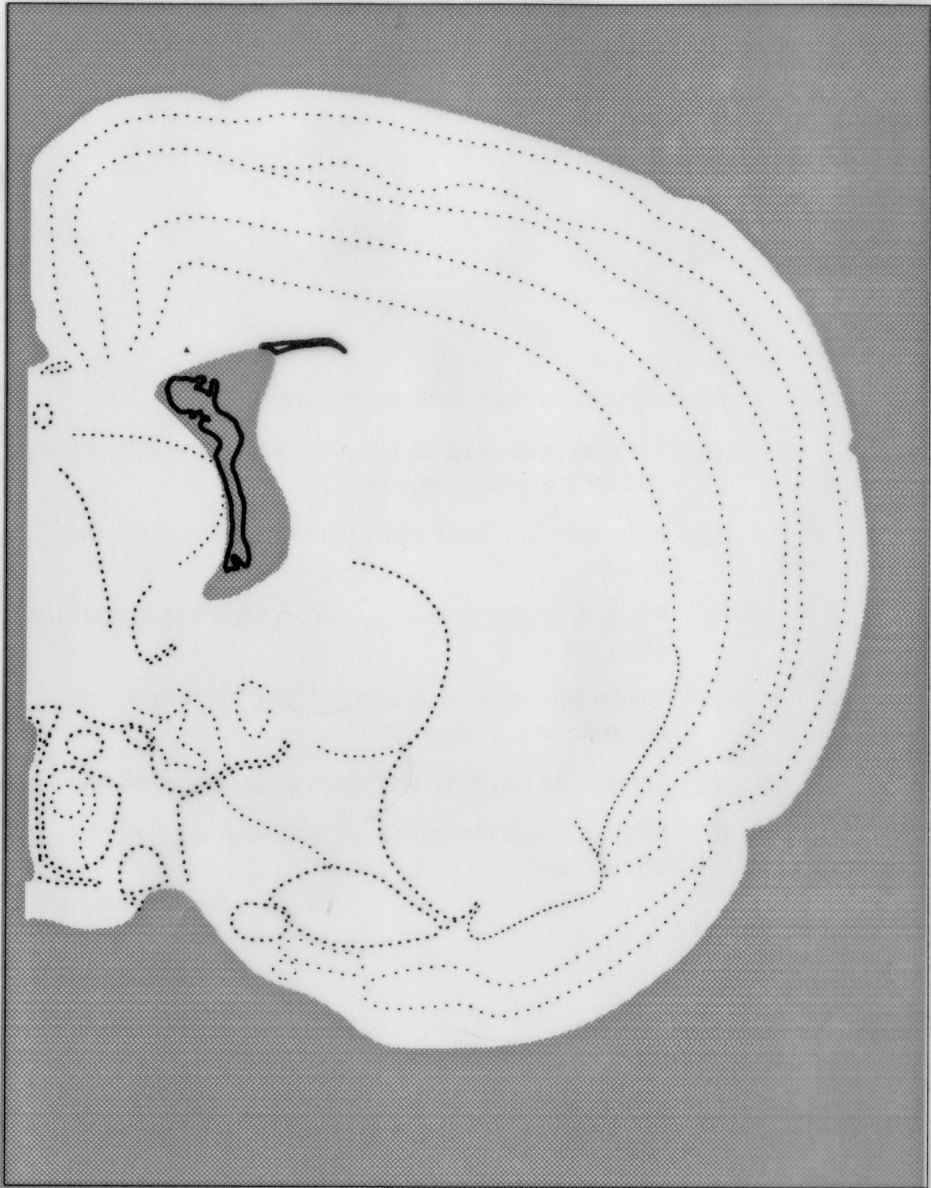
Group 4: Tracts
Group 5: Cell groups
Group 6: Mask (back)

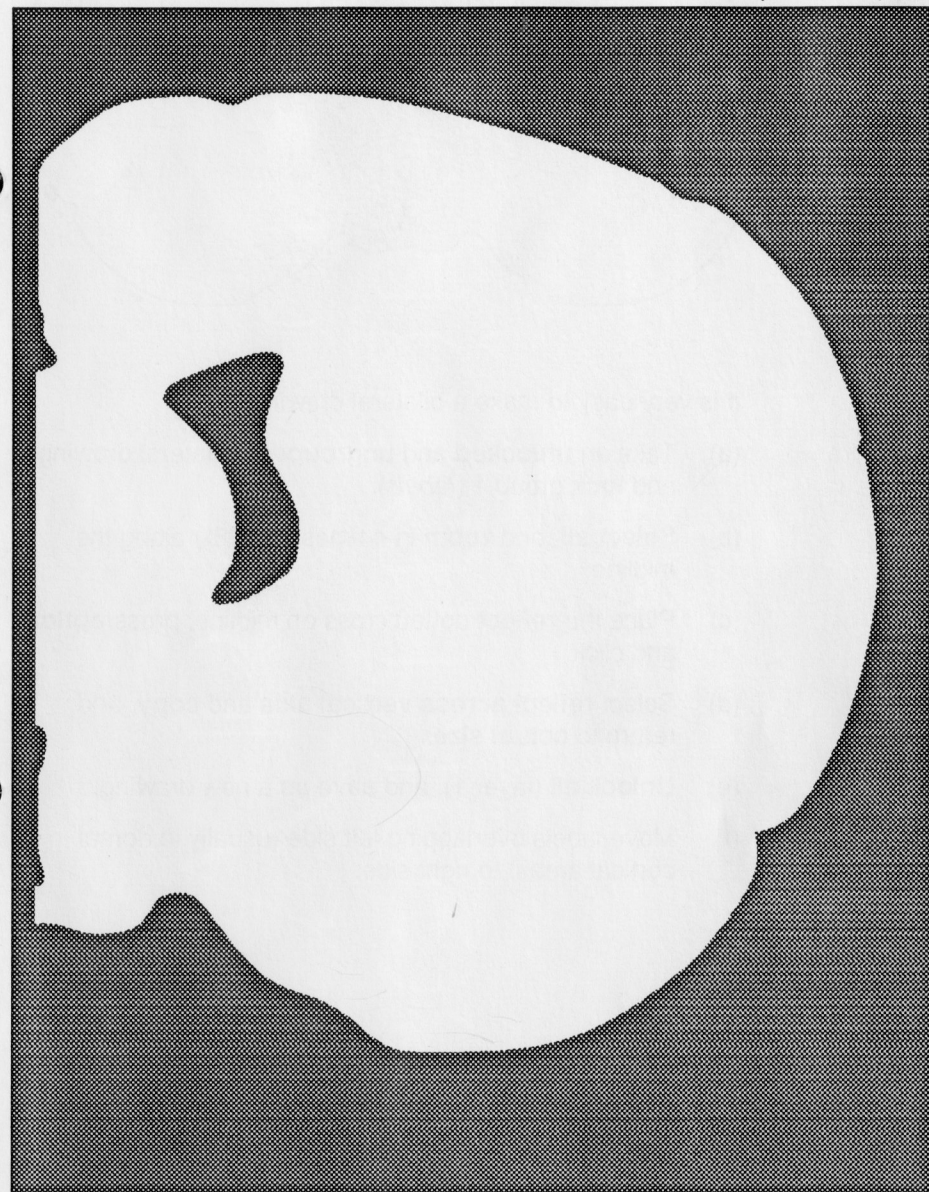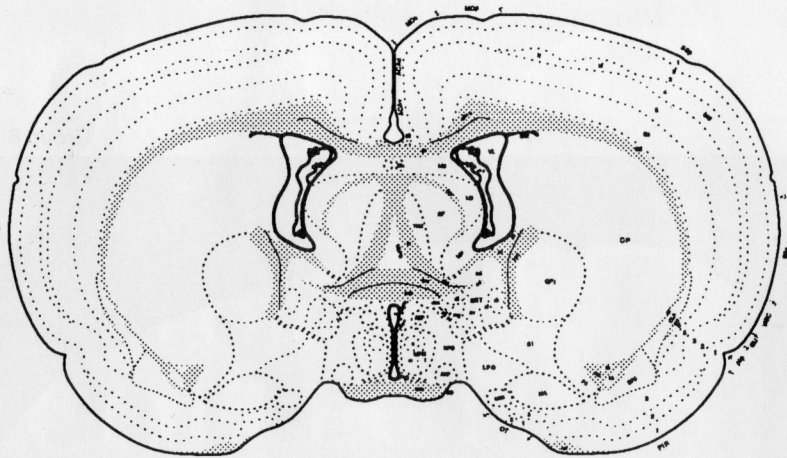Group 5: Cell groups
Group 6: Mask (back)

It is very easy to make a bilateral drawing:

(a) Take an **unlocked** and **ungrouped** unilateral drawing and **lock** group 1 (*labels*).

(b) **Select all**, and **zoom** in 4 times (1600%) along the midline.

(c) Place the **reflect** dotted cross on midline, press **option**, and click.

(d) Select **reflect across vertical axis** and **copy**, and return to **actual size**.

(e) **Unlock all** (layer 1), and **save as** a new drawing.

(f) Move labels overlapping left side (usually in dorsal cortical areas) to right side.
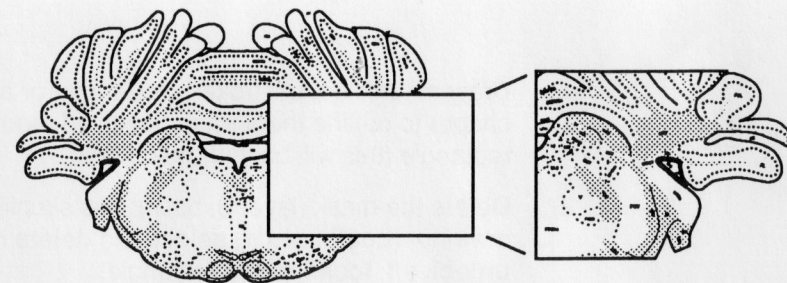
Unfortunately, there is no simple, one-step way to crop the more complicated drawings when one wishes to place several cropped drawings next to one another in a montage. In principle, the desired area is outlined with a rectangle that is locked. Then all lines in the drawing that cross the rectangle are **cut** with the **scissors tool**, and all lines outside the rectangle are **deleted**.

Two features complicate this process. First, several lines from different groups commonly overlap, complicating use of the **scissors tool** and requiring use of the **lock/unlock** feature. And second, when filled objects are **cut**, fill patterns extend between the cut ends, so that remaining parts of the object must be closed in an appropriate way with the pen tool (see below).
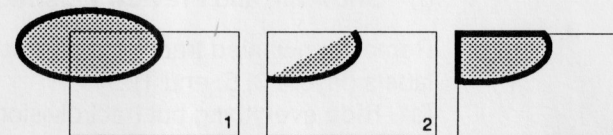
A systematic cropping method for the most complicated drawings is presented on the next page.
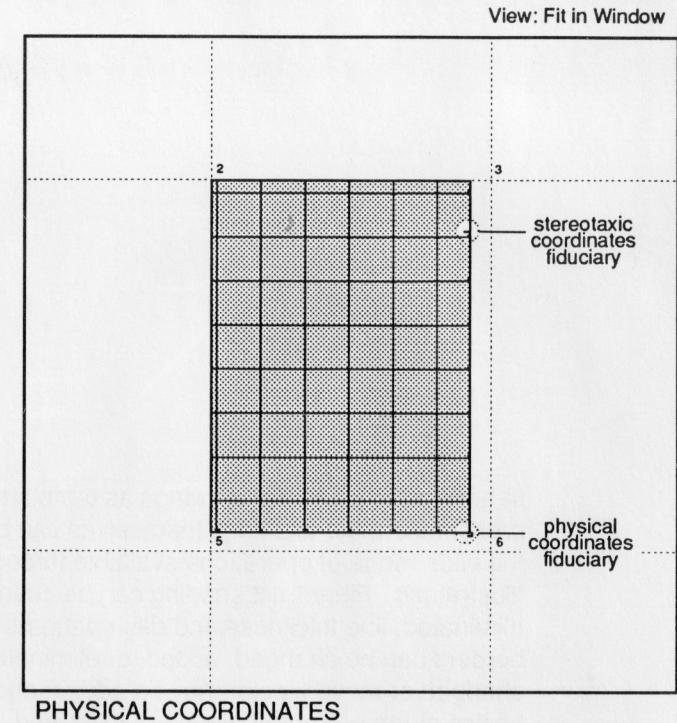
A SYSTEMATIC METHOD
F0R CROPPING ATLAS DRAWINGS

1. Draw an unfilled, unstroked rectangle (or any other shape) to outline the area to be saved, and **lock** the rectangle (this will be your guide box).

2. **Delete** the mask (layer 6, back); this simplifies the drawing (**Lock** layer 1, **select** and **delete** layer 6, **unlock all**, **lock** just the rectangle).

3. Remove unwanted outlines (layer 2).
    (a) **Hide** everything but outlines (**select all, deselect** outlines, **hide**).
    (b) **Ungroup** outlines.
    (c) **Cut** lines crossing guide box. **Delete** all lines outside the guide box.
    (d) **Group** remaining outlines (inside guide box).
    (e) **Show all**, and **Preview Illustration**.

4. Remove unwanted tracts (layer 4).
    (a) **Hide** everything but tracts.
    (b) **Ungroup** tracts.
    (c) **Cut** lines crossing guide box. **Delete** all lines outside the guide box.
    (d) Draw line with **pen tool** between cut ends of filled tracts (use shift key to end points for vertical and horizontal lines to maintain straight lines; see lower illustration on previous page).
    (e) **Group** remaining tracts.
    (f) **Show all**, and **Preview Illustration**.

5. Remove unwanted tract divisions, cell groups, and labels (layers 3, 5, and 1).
    (a) **Hide** everything but tract divisions, cell groups, and labels.
    (b) **Cut** lines crossing guide box. **Delete** all lines outside the guide box (use **direct select tool**).
    (c) **Show all, unlock all**, and **Preview Illustration**.

Voilá!

COORDINATE GRIDS

View: Fit in Window

stereotaxic coordinates fiduciary

physical coordinates fiduciary

PHYSICAL COORDINATES

Two coordinate systems were provided and explained in *Brain Maps: Structure of the Rat Brain* (Swanson, '92). One is called *Physical Coordinates* (Physical.AI) and the other *Stereotaxic Coordinates* (Stereotx.AI). The former refers to actual dimensions of the brain used for the drawings, while the latter was adjusted to correspond to the stereotaxic coordinates in Paxinos and Watson ('86).

Copy either grid and **paste in back** of the desired level. The upper left corner of the grid should fit exactly into the upper left corner of page 5. This placement is accurate for the physical coordinates; the dorsoventral (vertical) position of the stereotaxic coordinate grid must be adjusted by a distance indicated in Swanson ('92).

For convenience, an unstroked, unfilled fiduciary mark is included for the lower right corner of the physical coordinates grid, and for the upper right corner of the stereotaxic coordinates grid (the corner of the grid should be placed at the right end of the fiduciary line).

MODIFYING A DRAWING

In addition to using the drawings as templates for data presentation, the drawings themselves can be modified with the wide range of operations available through Adobe Illustrator®. Fiber tract shading can be changed or eliminated; line thickness and dash patterns can be modified; borders can be changed, added, or eliminated; labeling changed or moved; color may be added; and so on. After the basics of the program have been mastered, useful advanced ideas can be gleaned from a number books, including *Illustrator Illuminated* by Andres ('92) and *Adobe Illustrator 3.0: The Official Handbook for Designers* by Bove et al. ('91).

BIBLIOGRAPHY

Andres, C. (1992) *Illustrator Illuminated,* Berkeley: Peachpit Press.

Bove, T., F. Davis & C. Rhodes (1991) *Adobe Illustrator 3.0: The Official Handbook for Designers,* 3rd Ed., New York: Bantam Books.

Canteras, N.S., R.B. Simerly & L.W. Swanson (1992) Connections of the posterior nucleus of the amygdala. *J. Comp. Neurol.,* **324**:143-179.

Paxinos, G. & Watson, C. (1986) The Rat Brain in Stereotaxic coordinates, 2nd edn., Sydney: Academic Press.

Swanson, L.W. (1992) *Brain Maps: Structure of the Rat Brain,* New York: Elsevier.

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