Brain Browser: Hypercard Application for the Macintosh

W. D. Willis, Jr., and James A. Koppe

As the number of new findings on the chemical neuroanatomy of the brain escalates, many in the field are experiencing data overload. How can all of this new and pertinent information be organized and made accessible? One solution may be to store neuroanatomical information in a database that is easy to use. A new software package called Brain Browser is such a database.

Brain Browser has been designed by Floyd E. Bloom, Warren G. Young, and Yuag M. Kim (*1*). The purpose of the program is "to assist beginning and advanced neuroscience students as well as neuroscience researchers in their efforts to organize, analyze, and contribute to the growing, detailed knowledge of the brain." It is meant to serve as an "electronic notebook for neuroanatomy" and it has both educational and research functions.

Brain Browser must be run on a Macintosh computer with HyperCard (version 1.2 or later). HyperCard is a Macintosh software tool that creates an information environment in which words, charts, pictures, and digitized photographs can be stored. HyperCard lets users organize the information intuitively by association and context. HyperCard uses graphically generated index cards. One can browse, sort, make notes, draw, type, and cross-reference cards in the same manner as can be done with paper index cards. A group of cards is called a stack, and Brain Browser is a collection of HyperCard stacks. Best results are expected with a Macintosh Plus, SE, or II with 2 megabytes of random access memory (RAM) and a hard disk. A minimum of 1 megabyte of RAM is required (*2*).

The program is subdivided into four main sections supported by several utilities. The main elements are titled **Learner, NeuroNavigator, Linker**, and **DataMaker**. The utilities are the **Dictionary, References**, and **Aliases**. There is also a tutorial to help users new to HyperCard.

Learner (Fig. 1) is a short course in neuroscience. The rodent brain is center stage, but Academic Press promises that future releases of **Brain Browser** will extend the coverage to the brains of monkeys and humans. The topics in **Learner** include many features of the neuroanatomy of the spinal cord and brain, although most of the emphasis is on the brain. There is a survey of the gross features of the central nervous system, and lists are provided of many structures at various levels of the neuraxis. A feature that makes good use of HyperCard is the capability of referring to the **Dictionary** to obtain further details about many structures. This is much more convenient than searching through the index of a textbook and more fun than looking up terms in an ordinary medical dictionary, especially since many of the entries are given a personalized interpretation. The offerings in **Dictionary** are far from complete, but presumably will be expanded in future. In addition to surveying the gross features of the brain, **Learner** introduces the student to neural circuits and neurotransmitters.

NeuroNavigator (Fig. 2) consists of outline drawings of coronal, sagittal, and horizontal sections through the rat brain, based on the atlas of Paxinos and Watson. An attractive feature is that by mouse action it is easy to choose a view of any plane of section through a rostrocaudal level of the brain. A number of brain structures are indicated on the sections, and the abbreviations for these are displayed when the cursor overlies them. These include both nuclei and fiber tracts. A search procedure allows the rapid identification of the planes of section containing a structure of interest (identified either by name or by abbreviation); when a section containing the structure is viewed, the item flashes on and off for easy location. A search can also be made with reference to stereotaxic coordinates. If synonyms are found to be helpful, these can be added to a list called **Aliases**.

DataMaker allows the user to add new information to the database of Brain Browser. Atlas plates from **NeuroNavigator** can be copied into **DataMaker** to serve as templates for maps of neural structures, and text can be added to these. In addition, notes can be stored, and some morphometric measurements can be made and stored. Data can be imported from other applications.

Linker (Fig. 3) is a database in which information about cell types and chemical information related to particular nuclei is stored. There is a list of defined neural locations that can be accessed either from a menu or from a location viewed in **NeuroNavigator** by clicking on a flashing location. A Linker Place Card is displayed that shows a list of afferent pathways to the nucleus and of efferent projections from the nucleus. The card provides spaces for listing the cell type in the nucleus, the neurotransmitter used, receptor subtypes, the system involved, and cell birth date. Much of this information is currently missing from the database, presumably either because it is unavailable or awaits entry by an afficionado of the particular structure. Where the absent information represents a gap in current knowledge, the database serves to provide a research challenge. If the user wishes, the information on a card can be edited, possibly as a result of new data. Additional cards can be called up to display particular circuits through the nucleus. That is, a particular input and a particular output are recorded on a card. Again, space is provided for additional information about the circuit, including the cell type, transmitter, co-transmitter, topography, and collateral pathways on the presynaptic side and the cell type, receptor and co-receptor types, second messenger system, and ion channel on the postsynaptic side. Separate lines can be used to indicate the confidence one has in the data and the methodology used. Again, the user can edit the circuit cards.

There is a **Linker Glossary** that lists all of the places that can be used for Place and Circuit cards. The glossary includes the full names of nuclei in the brain, as well as abbreviations. The list can be edited.

As mentioned earlier, the **Dictionary** includes cards used to define terms. New entries can be made by the user.

Finally, **References** includes a list of literature citations that provide evidence for the relationships listed in the database. **References** can be reached from **Linker, DataMaker**, or **Dictionary**, and new references can be added by the user. References cannot be added from **Learner** or **NeuroNavigator**, which are read-only programs. A reference card includes not only the journal citation, but can also include detailed notes.

The **Brain Browser** is a very attractive software package that should be especially appealing to the new generation of neuroscientists raised in this media-rich era. Future elaborations, perhaps incorporating hu-

Department of Anatomy and Neurosciences and Marine Biomedical Institute, University of Texas Medical Branch, Galveston, TX 77550.

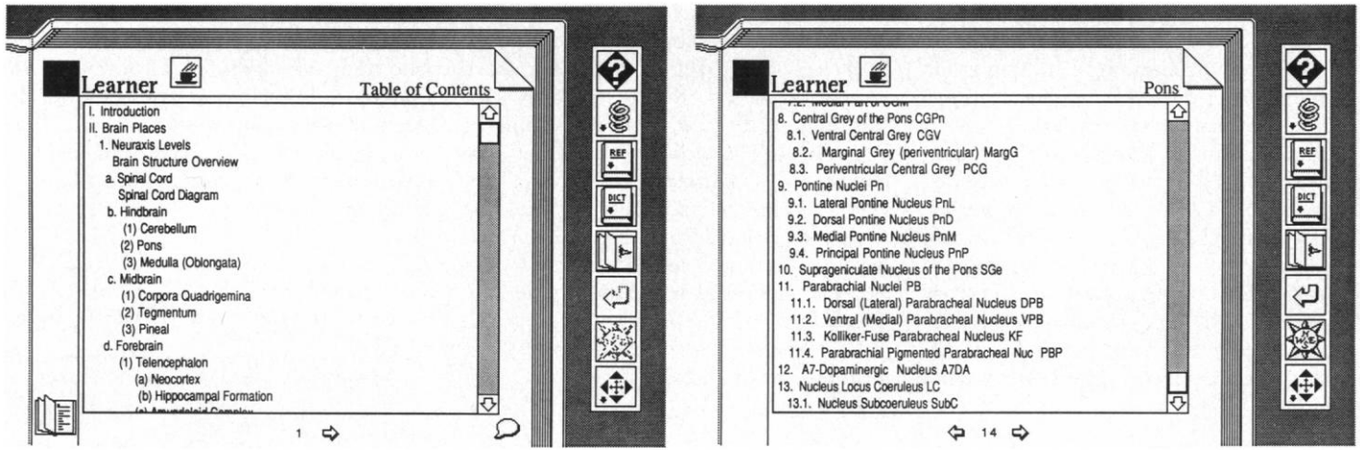


Fig. 1. Outline of some of the topics in **Learner**.

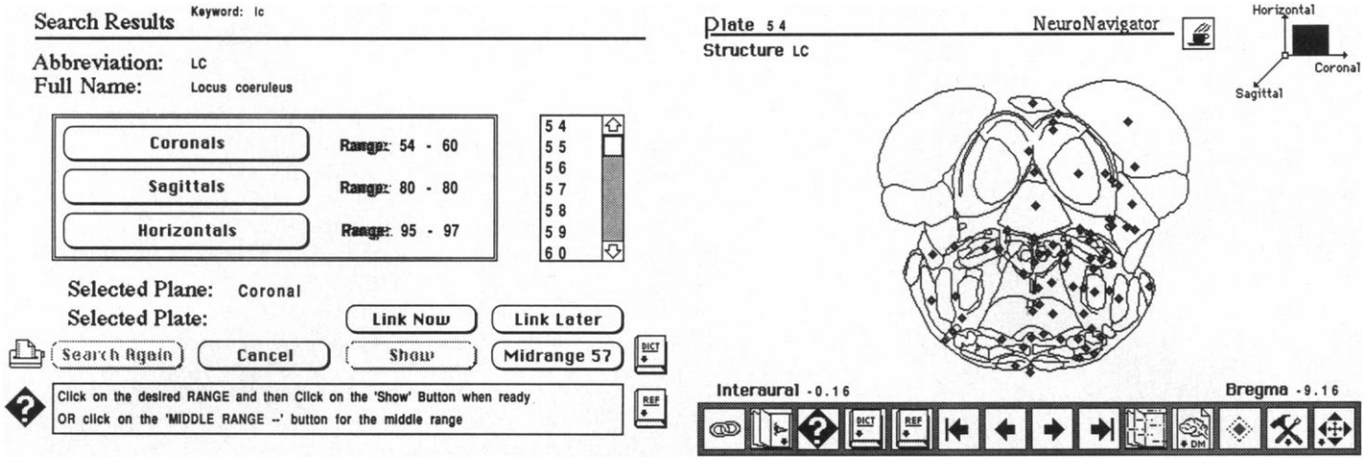


Fig. 2. Finding a structure in the **NeuroNavigator**. (**Left**) A search to find sections that contain a structure of interest, the locus coeruleus (abbreviated LC). The LC can be found on atlas plates 54 to 60 in a coronal plane, on plate 80 in a sagittal plane, or on plates 95 to 97 in a horizontal plane. A coronal plane is selected. (**Right**) One of the options, plate 54. The mark indicating the LC is seen to flash on the screen. By clicking on the coordinate system at the upper right, the plane of section can be changed to horizontal or sagittal.

man neuroanatomy, could become useful in undergraduate medical education, but the current version stressing rat neuroanatomy is already useful for graduate and postgraduate education. The database role has growth potential, especially if a collaborative effort involving many laboratories is developed so that information can be pooled.

Brain Browser is developed around HyperCard, a standard Macintosh utility. Therefore Brain Browser is not dependent on vendor upgrades to match the Macintosh operating system and HyperCard upgrades. There is a great deal of media support for users of Hypercard, and so this application is not solely dependent on the ability of the vendor to produce program documentation and to distribute it to its user base.

This product could be greatly enhanced with dial-in or Internet access to a centralized database to allow collaborative submissions and to load upgrades from a remote database. Because of the ease of writing

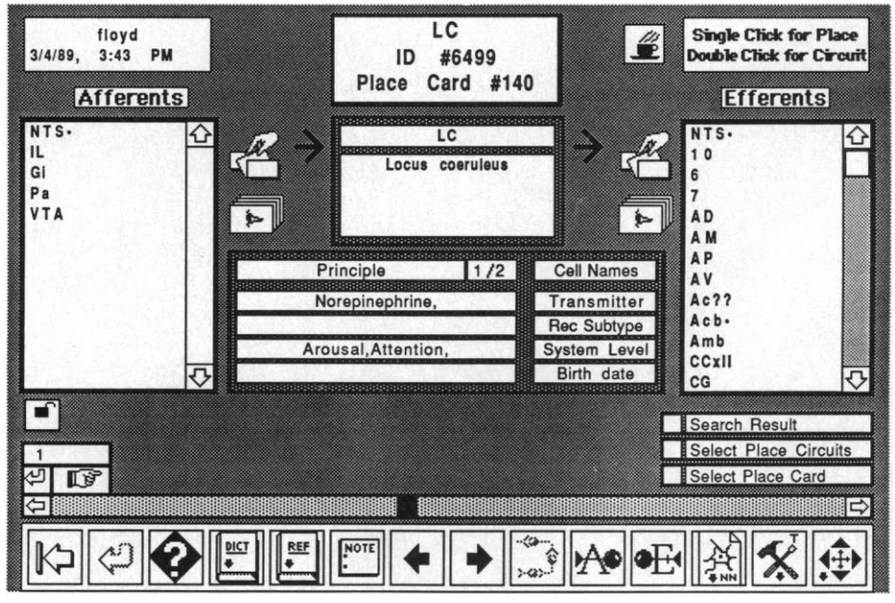


Fig. 3. By clicking on the LC locus in **NeuroNavigator**, there is a jump to the **Linker**. A Place Card is shown for the LC, with data concerning the afferent connections to LC, the efferent connections from LC, and details of the network.

HyperCard scripts, dial-out options could be automated. However, proper quality control and organization of incoming and outgoing material could be a great challenge for the librarian (or the vendor).

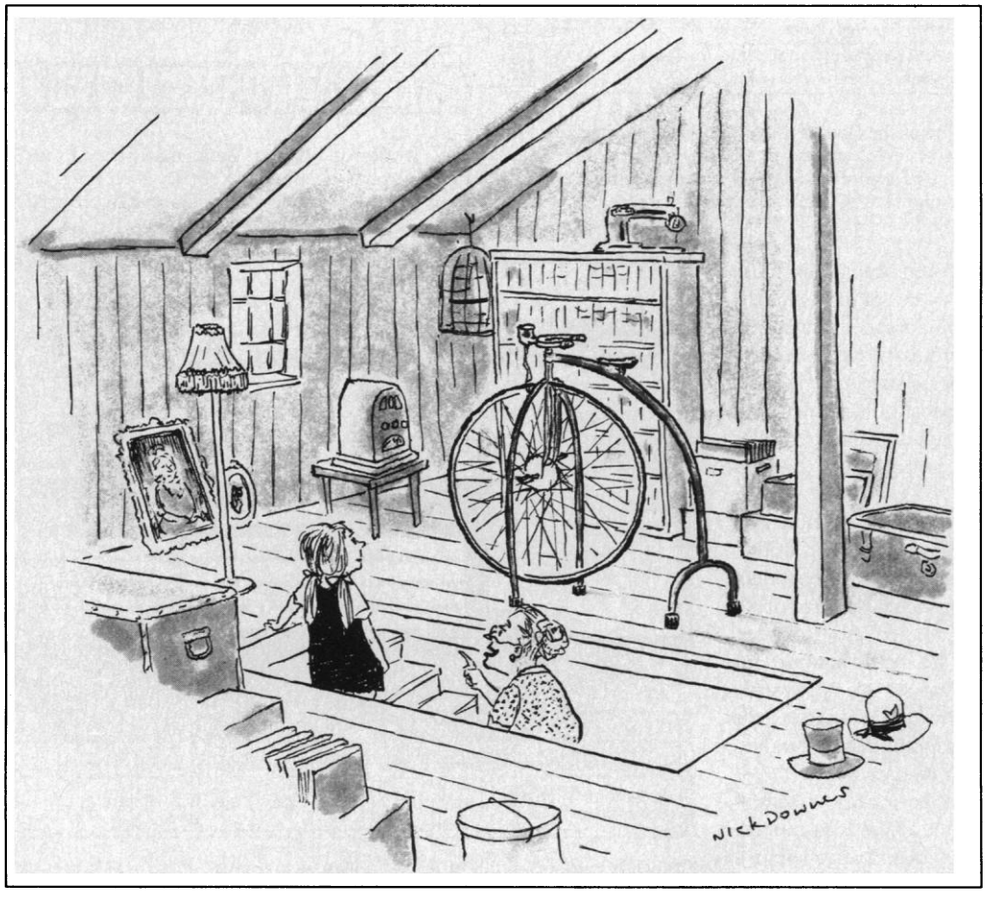
Because this is a HyperCard application, it is highly unlikely that it could be exported to the MS-DOS or UNIX environments. Pathways for sharing data with PC database applications could be made, but the PC application would be specialized and likely to be harder to support. Graphic information can easily be shared between environments. For example, a graphic from Brain Browser could be transferred to a PC and be incorporated into a word processor file.

In an educational environment, the use of central file servers (that is, machines that store and distribute the database) would be a good idea. This would allow a large database to be supported economically. Upgrades could then be simplified and the amount of disk space required on each Macintosh workstation could be reduced. This data-sharing approach could easily be integrated into existing Local Area Network (LAN) environments such as Apple Talk, DECnet, or Novell NetWare.

At the present time, Brain Browser appears to be a unique product. Researchers who study rats will find it a convenient and fun way to organize information about the chemical neuroanatomy of the brain. Those of us who study other parts of the nervous system and other animals look forward to future upgrades.

REFERENCES AND NOTES

1. Brain Browser, Academic Press, 1250 Sixth Avenue, San Diego, CA 92101.
2. MacIntosh and HyperCard, Apple Computer, Inc., 20525 Mariani Avenue, Cupertino, CA 95014.



"Your great-grandmother was a pioneer in the whole aerobics thing."