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[Disclaimer](#)

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I.

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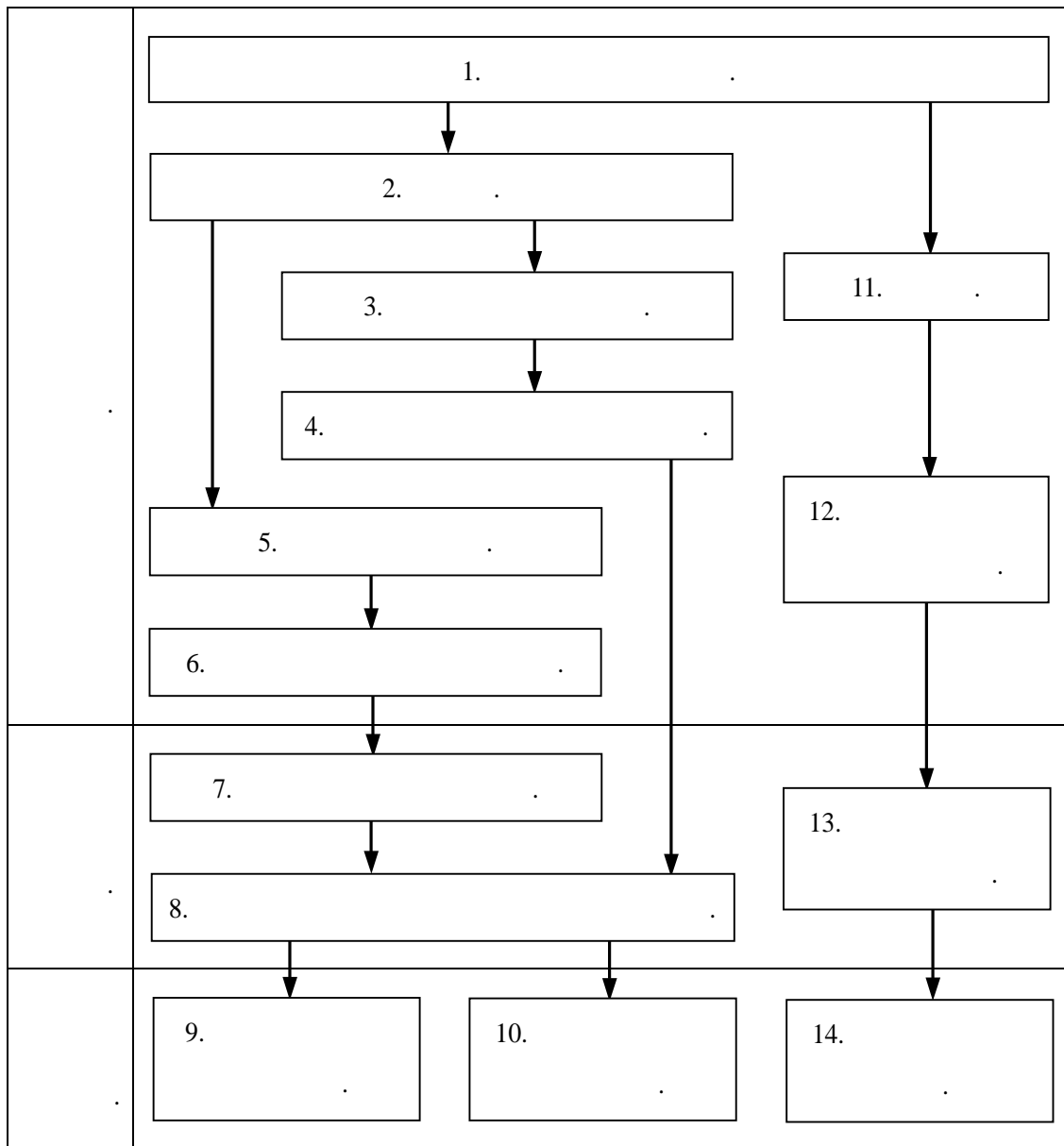
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1.

Fig. 1. The process of making computer programs for horizontally-sectioned and free angle-sectioned as well as conventionally dissected images of brain.

1. 가
3 3 .
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2

2. .
1 gelatin (14 gm%) .
silicon 200 mm × 300 mm × 400 mm ,
gelatin (14 gm%) . 가
(-20) 24
formalin 24 가

3. .
(G.E. Signa Horizon 1.0 Tesla MRI System)
(proton weighted image). ,
1.4 mm가 . 122 .

4. DICOM
bmp pi-view(Mediface™) .
300 × 360, 16 bit gray scale,
15 Mbytes .

5.

(HFS-330L, Fuzee™)

,
, 1.4 mm가 . 122
122 .

6.

(Scanjet 4c, Hewlett Packard™)

. (bmp) 496 × 582,
2²⁴, 15 Mbytes .

7.

8.

10 (, , ,)
, , , , , ,)
, 가 2
(, , ,)
83 가

11.

9.

2 (, , ,)
) Director(version
7.0, Macromedia™)

10. 2 (, ,) 3
3
Visual C++(version 6.0, Microsoft™)

11. 1 , 1 가
 , 가
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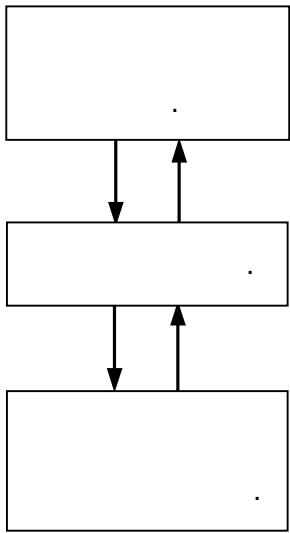
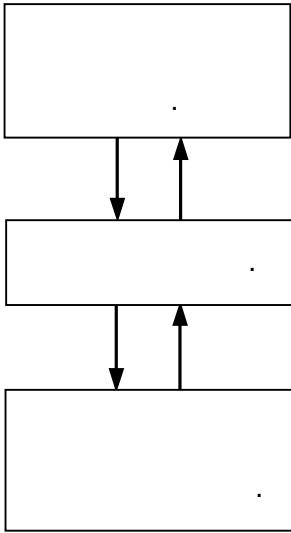
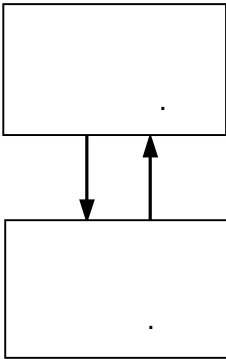
12. 27
Nikon FM-2 , Macro (55 mm), SB-16 ,
(ASA 100) , .
(Scanjet 4c, Hewlett Packard™)
(bmp) 460 × 500, 2²⁴,
5 Mbytes .

13. 102 가
11.

14. Director(version 7.0, Macromedia™)

III.

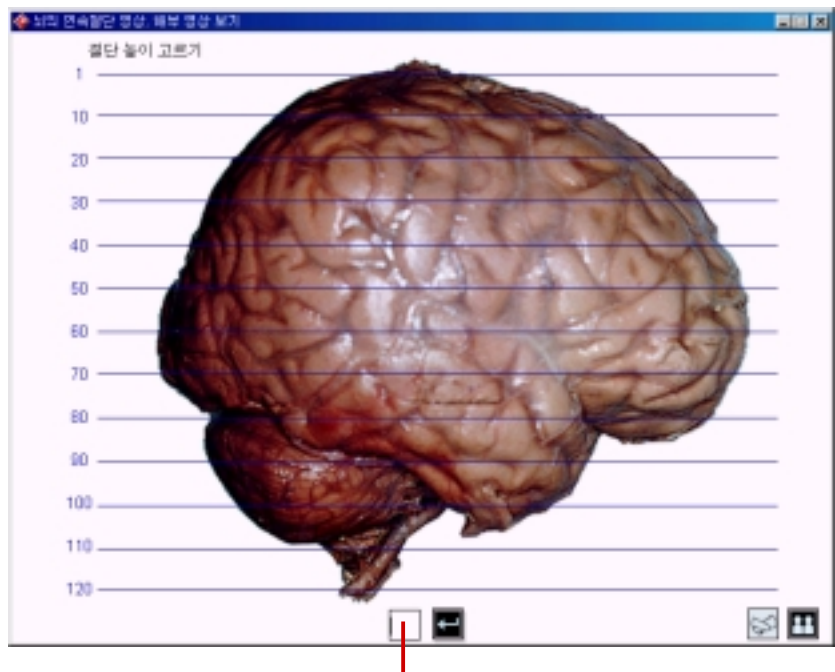
2 .
, , , 가 64 Mbytes
가
37 Mbytes ,
150 Mbytes 가
127 Mbytes .

		64 Mbytes	37 Mbytes	
		.	.	
		20 Mbytes	150 Mbytes	
		32 Mbytes	64 Mbytes	
		800 × 600	1024 × 768	
		2^8	2^{16}	
				

2.

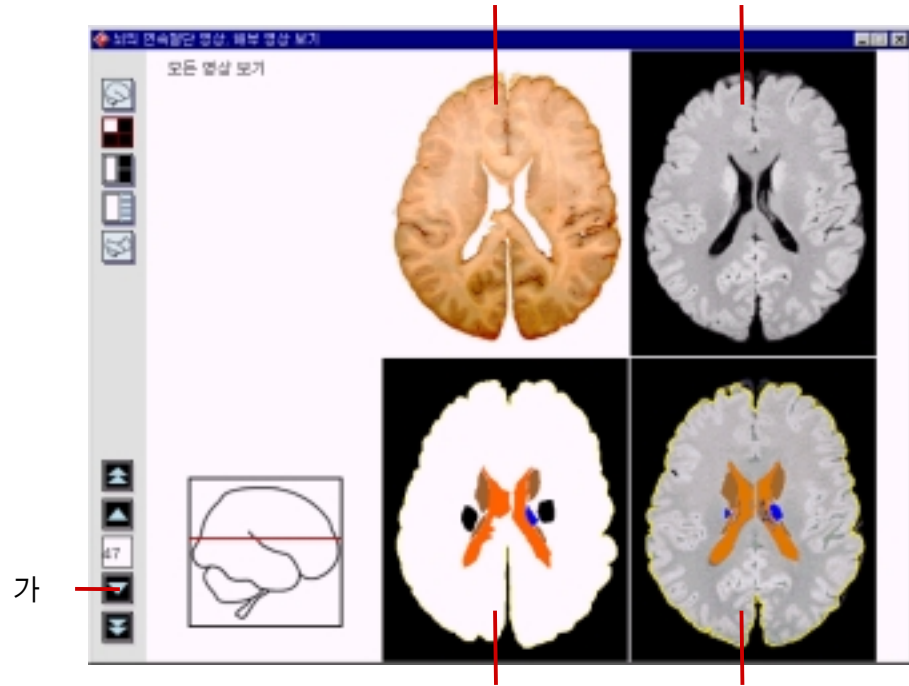
Fig. 2. The specifications and functions of the computer programs for horizontally-sectioned and free angle-sectioned as well as conventionally dissected images of brain.

가 가 1 가 가 122 . 47
 ‘ ’ 47 (3) 47
 가 (, , ,
) . ‘ 가 ’ (4) 50
 . ‘ , , ’ (5) 가 (,
 , , ,) . ‘
 , , ’ (6)
 (7).



3.

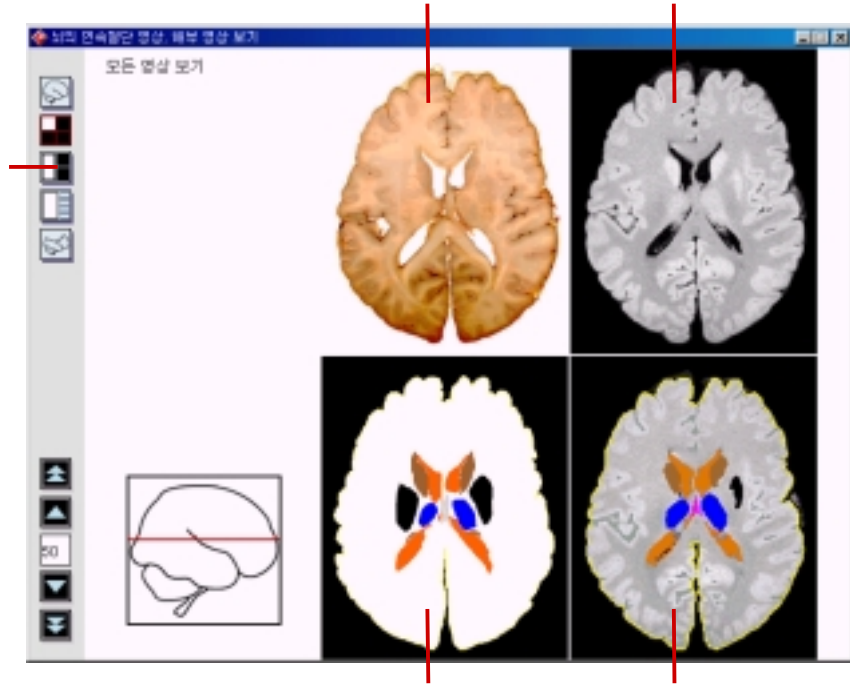
Fig. 3. The computer program for horizontally-sectioned images of brain. The window indicates that several levels of horizontally-sectioning can be selected.



4. . 3

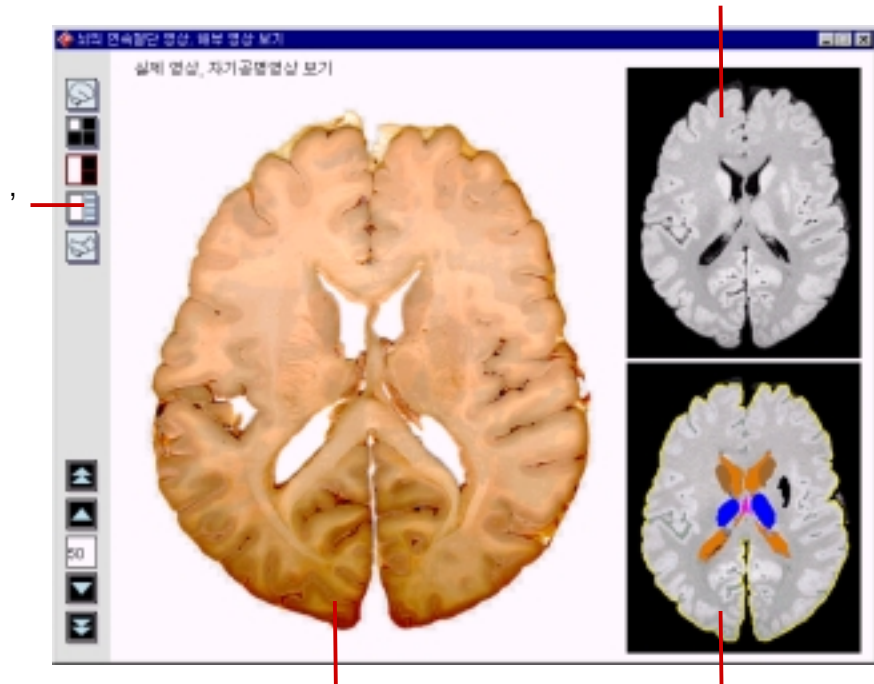
가 .

Fig. 4. The computer program for horizontally-sectioned images of brain. The corresponding images of the horizontally-sectioned, magnetic resonance, segmented, and segmented magnetic resonance images at the level 47 are shown by selecting in Fig. 3.



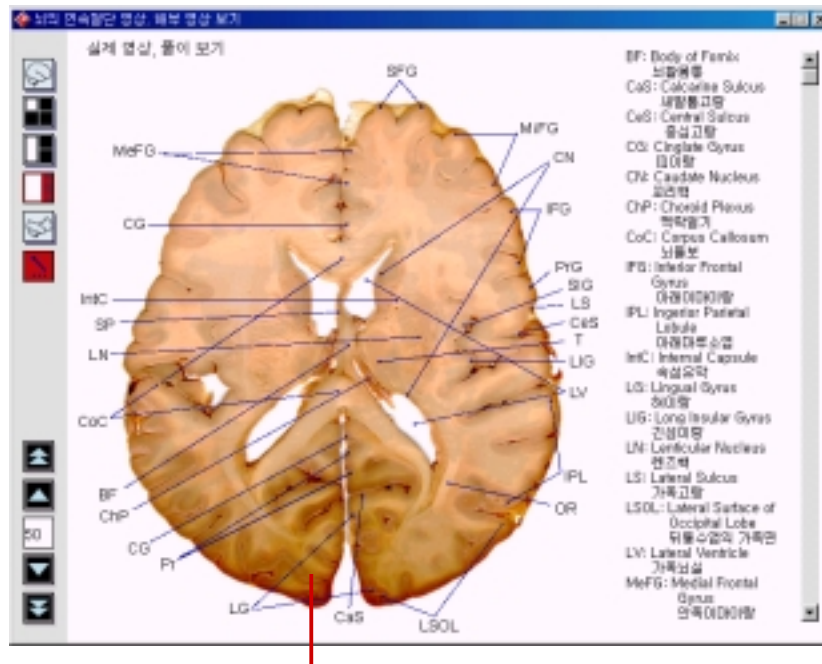
5. 가 . 4 ‘ 가 ’
가 .

Fig. 5. The computer program for horizontally-sectioned images of brain. The corresponding images of the horizontally-sectioned, magnetic resonance, segmented, and segmented magnetic resonance images at the level 50 can be seen by pressing the 'downward' button three times in Fig. 4.



6. . 5 ‘ , ,
가 .

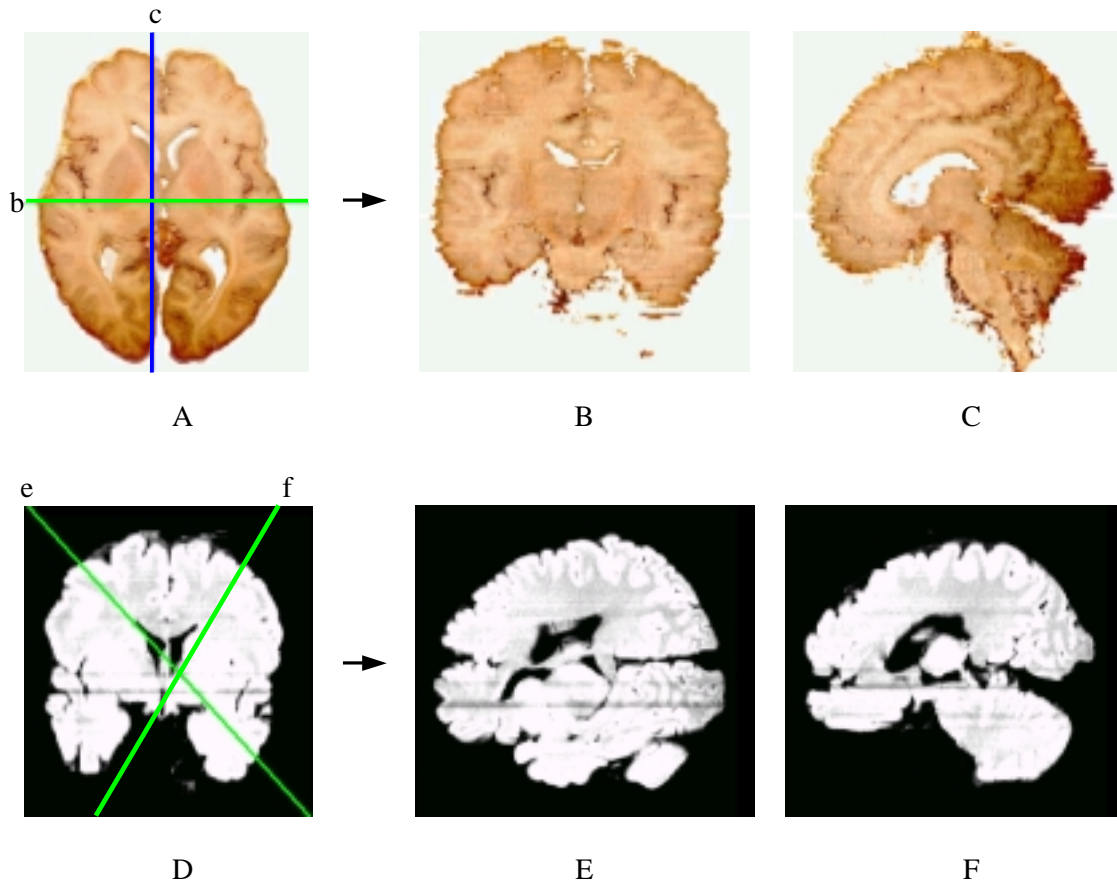
Fig. 6. The computer program for horizontally-sectioned images of brain. The corresponding images of the horizontally-sectioned, magnetic resonance, and segmented magnetic resonance images can be seen by pressing the icon for the 'horizontally-sectioned and magnetic resonance images' in Fig. 5.



7. . 6 ‘ , , ’

Fig. 7. The computer program for horizontally-sectioned images of brain. The names of detailed structures can be shown in the horizontally-sectioned image by pressing the icon for the 'detailed structures' in Fig. 6.

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(8). 가 (
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) 가 (9).



8. (A) (b) (D)
 (c) (B) (C) (D)
 (e, f) (E, F).

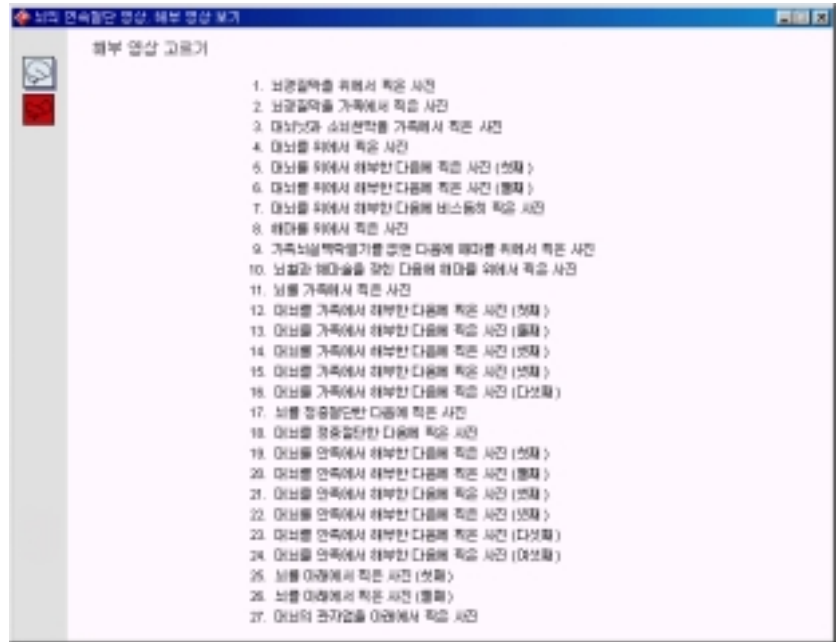
Fig. 8. The computer program for free angle-sectioned images of brain. The coronal (B) and sagittal (C) images can be visualized by selecting coronal (b) and sagittal (c) planes in the horizontally-sectioned image (A). The oblique images (E, F) can be visualized by selecting oblique planes (e, f) of free angle in the coronal plane (D).



9. . 8 (C) 가

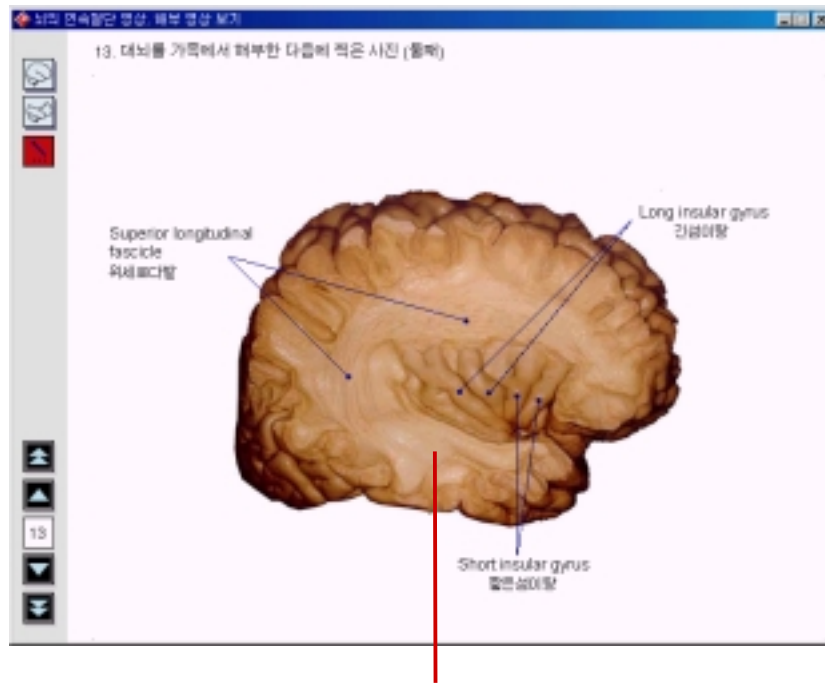
Fig. 9. The computer program for free angle-sectioned images of brain. The sectioned, segmented sectioned, magnetic resonance, and segmented magnetic resonance images are shown by the sagittal image (C) in Fig. 8.

(11).



10.

Fig. 10. The computer program for conventionally dissected images of brain. The window indicates that several images obtained by conventional dissection can be selected.



11. . 10

Fig. 11. The computer program for conventionally dissected images of brain. The conventionally dissected images with the names of detailed structures are shown by selecting in Fig. 10.

IV.

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. 가 (1)

1. 가

Table 1. Comparison of the present computer-aided program with other conventional educational tools in understanding brain morphology and magnetic resonance image.

	-	++	++
	++	-	+
	++	++	-
	++	++	++

-: , +: , ++: .

가 ,

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,
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. 1 cm

¹². 1.4 mm

cryomacrotome

가 ^{13,14}

celloidin

polycut

^{15,16}

gelatin

^{17,18},

가

가 .

7,8,19 .

3

가

가

가 ⁵.

가

가 ²⁰.

21

가

13,14

cryomacrotome

가

22,23,24

가

가

VI.

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- Abstract -

A Computer Program for Understanding Brain Morphology and Magnetic Resonance Image

Yi Suk Kim

Department of Medical Sciences
The Graduate School, Ajou University
(Directed by Assistant Professor Min Suk Chung)

Understanding of brain morphology and magnetic resonance image (MRI) is essential for accurate diagnosis and treatment of the brain diseases. As education tools, the cadaver dissection, plastic models, and neuroanatomy books have been used for understanding brain morphology; and the MRI films and radiology books have been used for understanding brain MRI. Recently, due to the popularization of powerful personal computers, computer programs compensating the conventional education tools have been used. But these computer programs have a disadvantage that it is not possible to visualize the details of brain morphology or to compare the corresponding sectioned specimens and MRI. Therefore, we attempted to make a computer program which could visualize not only the details of brain morphology but also the corresponding sectioned specimens and MRI by using the brains removed from Korean cadavers.

Three brains were removed from Korean cadavers. With a brain, 122 MRI and 122 serially-sectioned specimens with a 1.4 mm interval were acquired and inputted into the computer. Ten brain structures were segmented, and 83 fine structures were designated on the images. With two brains, 27 dissected specimens were acquired and inputted into the computer. One-hundred two fine structures were designated on the images. Based on these images, a computer program for understanding brain morphology and MRI was made.

The computer program, which was made in this study, visualized the corresponding sectioned specimens, MRI, and segmented images after sectioning a brain horizontally or at any angles. In addition, the computer program visualized the images of dissected brain.

This computer program is helpful to understand brain morphology and MRI. This computer program is expected to be used through CD-title or Internet as an educational tool for medical students and doctors.

Key Words: Computer program, Brain, Morphology, Magnetic resonance image