Proceedings of the Iowa Academy of Science

Volume 64 | Annual Issue Article 83

1957

The Mesencephalic Nucleus of the Trigeminal Nerve in Young Snapping Turtles

Jerry J. Kollros
State University of Iowa

Yu-Ying Fu
State University of Iowa

The Mesencephalic Nucleus of the Trigeminal Nerve in Young Snapping Turtles

By Jerry J. Kollros and Yu-Ying Fu

The mesencephalic root of the trigeminal nerve is a constant feature of all gnathostomes. The cells of origin of these root fibers lie mainly within the midbrain. Peripherally the fibers are distributed to the musculature of the jaws, and they constitute the proprioceptive apparatus of that musculature (Corbin and Harrison, '40). Although the large mesencephalic V nucleus cells have been recognized for about 90 years (Meynert, '67), adequate descriptions of their size, numbers and distribution are still not great. Perhaps the most comprehensive study is that of Weinberg ('28) on fifteen different species in five of the classes of vertebrates. Among these was a turtle, *Chrysemys marginata*. The present study was undertaken to compare the mesencephalic V nucleus cells in the snapping turtle with the cells previously described in *Chrysemys*.

Materials and Methods

Hatchling snapping turtles *(Chelydra serpentina)* were collected near Iowa City, Iowa, in the summer of 1953, by Mr. Christopher H. Dodge. They were raised by Mr. Dodge, and grew rapidly, even during winter, when they were kept at room temperature. Thirteen animals were fixed at intervals between December 21, 1953 and March 22, 1954. In general the older the turtle, the greater its weight (Table 1). The entire head was fixed in Bouin's fluid. Later the brain was removed from the skull and the portion containing the midbrain and adjacent levels was embedded in paraffin. Serial sections, 10 μ thick, were obtained of the entire midbrain. They were stained with Ehrlich's acid hematoxylin and light green.

Each section was studied at a magnification of 330X or 550X, and the numer of V nucleus cells was recorded separately for left and right sides, and separately for those in the medial and lateral groups. Cells located in the midline were arbitrarily assigned alternately to either side. Counting was limited to cells whose nuclei showed the characteristic single large nucleolus. It is possible that sectioned nucleoli might occasionally appear in two adjacent sections and be counted twice. Whenever cells in adjacent sections were so located as to make this duplication likely, both sections were restudied to

permit determination of the presence either of a single sectioned cell or of two adjacent cells in tandem.

Sizes of cells and nuclei were determined by drawing 120 cells in each animal at magnifications 1250X, under a camera lucida. In each case 40 cells came from anterior, middle and posterior parts of the cell groupings. To avoid sampling bias, all cells in a given section were drawn. The drawings were then measured with the aid of a polar planimeter, and the figures were converted to values of μ^2.

Table 1

Counts of Mesencephalic V Nucleus Cells in Lateral and Medial Groupings. The young turtles are arranged in order of fixation, and the weight in grams is given.

	Lateral Cells		Medial Cells			
Weight	Left	Right	Left	Right	Total Cells	Ratio lat:med
75	47	66	376	399	888	1: 6.9
54	55	64	523	500	1142	1: 8.6
60	67	70	373	374	884	1: 5.5
48	53	59	483	453	1048	1: 8.4
41	42	62	509	484	1097	1: 9.6
69	27	52	509	509	1097	1:13.9
109	65	50	658	763	1536	1:12.4
130	104	98	632	591	1425	1: 6.1
74	62	80	350	315	807	1: 4.7
65	52	36	503	509	1100	1:11.5
111	59	57	532	528	1176	1: 9.1
245	55	72	394	392	913	1: 6.2
Average	57	64	487	485	1092	1: 8.6

Table 2

Sizes of Mesencephalic V Nucleus Cells, Their Nuclei, and the Average Nucleo-Cytoplasmic Ratio.

All cell and nuclear size values in μ^2. Turtles are arranged in the same sequence as in table 1.

Cell Size		Nuclear Size		Ratio of
Average	Range	Average	Range	N/C (x 100)
374	98- 781	101	27-180	27.0
337	115- 778	78	28-151	23.1
408	87- 745	94	41-196	23.0
403	71- 898	91	41-191	22.6
329	90- 647	82	27-170	24.9
468	156-1181	108	41-188	23.1
292	68- 715	66	22-128	22.6
389	46- 893	89	43-159	22.9
316	79- 721	76	27-123	24.1
404	68- 823	80	19-159	19.8
383	153- 800	86	30-161	22.5
410	109- 756	87	27-188	21.2
Ave. 376		87	-	23.1

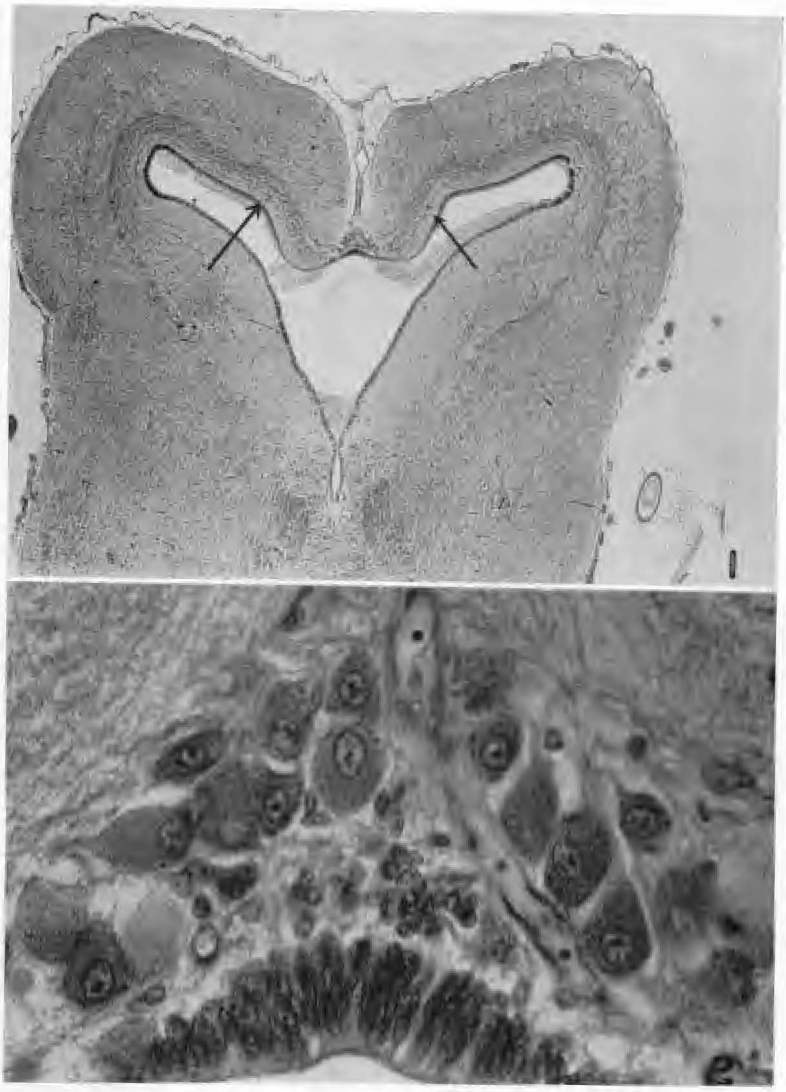

Figure 1. Section showing dorsal four-fifths of the midbrain. Approximately 20 mesencephalic V nucleus cells are shown together in and near the midline, just above the cerebral aqueduct. The arrows identify cells of the lateral group. To either side of the floor of the aqueduct may be seen cells of the oculomotor nucleus. X 17.

Figure 2. The medial cell group of figure 1, more highly magnified. Note that not all cell bodies possess nuclei in this section, and that some nuclei do not display their nucleoli in this section. X 280.

Results and Discussion

Table 1 presents the weights of 12 turtles, their cell counts, and the ratio of lateral to medial cells. One animal is not included in the table because it showed an unusual number of cells on the left side —1303 compared to a count of the right side of 239. Moreover, the large number of cells was concentrated in 27 sections. In one section 75 cells were seen on the left side and only 4 on the right side! With this large excess of cells, forming several continuous rows, it was impossible to distinguish between lateral and medial cell groupings. Ordinarily cell counts seldom exceed 12 mesencephalic V nucleus cells on each side (see figures 1, 2).

If the single count of 537 cells given by Weinberg for *C. marginata* is representative of that species, it is obvious that the snapping turtle has, on the average, more than twice the number of V nucleus cells of the other species. The two species also differ in the fraction of the entire nucleus contributed by the lateral cells. In *Chrysemys* the figure is 36%, while in *Chelydra* the average in only 12%. Despite the larger number of V nucleus cells, overall, in *Chelydra,* it has fewer lateral cells than has *Chrysemys* (ave. of 121 vs. 192). In *Chelydra,* as in *Chrysemys,* an intermediate group of mesencephalic V nucleus cells is not distinguishable.

Cell and nuclear sizes and nucleo-cytoplasmic ratios are presented in table 2. Left and right sides are not presented separately since differences between the two sides were insignificant. Although there is no apparent correlation between body weight and mesencephalic V nucleus cell size, nor between body weight and nucleo-cytoplasmic ratios, there is a fair correlation between average cell and nuclear sizes. Comparisons of cell sizes between *Chrysemys* and *Chelydra* cannot be meaningful. Weinberg does not give the size of his turtles, although presumably they were mature. It is quite clear that our snapping turtles are immature. Certain of the sections show very small mesencephalic V nucleus cells, and many cells, different from adjacent mantle cells, can be seen within the medial group of the V nucleus cells. The smallest of these cells have cross-sectional areas of 46-50 μ^2, with nuclei of 19-27 μ^2, far below the average values given in table 2, and very far below the maximum sizes of 1181 μ^2 for the cells and 196μ^2 for the nuclei. It can be guessed that average cell and nuclear sizes in the mature snapping turtle would be increased well above the figures listed in table 2. If mesencephalic V nucleus cell size and cell number in different species of turtle are correlated with body size, as they are in certain frogs (Payne, '50; Payne and Kollros, unpublished), one would expect mesencephalic V nucleus cell size in adult *Chelydra* to exceed that in adult *Chrysemys*. This relatively late growth of the V nucleus cells in the turtle might further be expected because such late growth postmetamor-

phically has been described in the frog (Kollros and McMurray, 1955), and in the late fetus and even postnatally in man (Pearson, 1949).

Summary

1. The mesencephalic nucleus of the trigeminal nerve of young *Chelydra serpentina* is described, and compared with the same nucleus in *Chrysemys marginata,* as described by Weinberg ('28).

2. Lateral and medial cell groupings, comparable to those in *Chrysemys* were found, but with the lateral cells scarcer than in *Chrysemys. Chelydra* has more than twice as many of these cells as has *Chrysemys* (1092 vs. 537).

3. Cross-sectional areas of the cells and nuclei of this nucleus are also presented.

Literature Cited

Corbin, K. B., and F. Harrison. 1940. Function of mesencephalic root of fifth cranial nerve. J. Neurophysiol., 3:423-435.

Kollros, Jerry J., and Virginia M. McMurray. 1955. The mesencephalic V nucleus in anurans. I. Normal development in Rana pipiens. J. Comp. Neur., 102:47-63.

Meynert, T. 1867. Studien über die Bestandteile der Vierhügel. Zeit. f. Wiss. Zool., 17:655.

Payne, W. 1950. A comparative study of mesencephalic V nucleus cells in anurans. M.S. thesis, Dept. of Zoology, State University of Iowa.

Pearson, A. 1949. Further observations on the mesencephalic root of the trigemenal nerve. J. Comp. Neur., 91:147-194.

Weinberg, E. 1928. The mesencephalic root of the fifth nerve. A comparative anatomical study. J. Comp. Neur., 46:249-405.

Department of Zoology
State University of Iowa
Iowa City, Iowa