

DISTRIBUTION OF OXYTOCIN AND VASOPRESSIN IN THE RAT SUPRAOPTIC AND PARAVENTRICULAR NUCLEUS

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The 'classical' view on the distribution of oxytocin and vasopressin producing cells suggests that the paraventricular nucleus (PVN) is predominantly or entirely responsible for oxytocin production and the supraoptic nucleus (SON) synthesizes mainly vasopressin. However, recent hormone assays and electrophysiological studies indicate the presence of each hormone in both nuclei (for references see Burford, Dyball, Moss & Pickering, 1974). We report an immunofluorescence study in the SON and the magnocellular part of the PVN (Bodian & Maren, 1951) using antibodies to oxytocin (produced in our laboratory) and to vasopressin (produced by Drs Hollemans, Schellekens and Toubert), purified by absorption with arginine-vasopressin and oxytocin respectively (Swaab & Pool, 1975).

Frontal cryostat serial sections of glyoxal-prefixed hypothalami from five male Wistar rats weighing 200 g were studied. Out of each group of six sections, the first was incubated with vasopressin antibody, the second with oxytocin antibody, and the other four sections were skipped. The sections were counterstained with ethidium bromide to visualize the cells without hormone (Swaab & Pool, 1975; Swaab, Pool & Nijveldt, 1975). The total number of cells (n) in each nucleus was calculated from the amount of cells (p) that were counted in the serial sections using the formula $n = p \times 2 \times 6 \times 6 / 20$ (cf. Bandaranayake, 1971). Explanation of the factors: 2 was used because counts were done on one side only, 6 was used because only one section from each group of six sections was counted, 6/20 is a correction factor for section thickness (6 μm) and cell diameter (20 μm) assuming that 6 μm of the cell had to be situated in a section before it was recognized as being a cell.

There were 6430 ± 287 (S.E.M.) cells in the SON and 2100 ± 95 cells in the magnocellular part of the PVN.

For each antibody, 176 sections through the SON and 91 sections through the PVN were examined for immunofluorescence. The data were grouped into 13 and 10 classes for each area respectively from the rostral to caudal part. In both nuclei, oxytocin-containing cells were found to be localized more in the rostral part and vasopressin cells more in the caudal part (Fig. 1).

Whether vasopressin and oxytocin are synthesized in separate cells cannot be proved by the present data, although this possibility is supported (see also Swaab *et al.* 1975). If a part of the same cell could be recognized in two adjacent sections, it did not stain with both antibodies. In addition, staining with a non-purified anti-vasopressin that stained both hormones (no. 125) revealed a similar percentage (81%) of stained cells as the sum of the vasopressin- and oxytocin-containing cells (84%).

The present data show that the two hormones are found in both nuclei in similar percentages (Fig. 1). Because of its size, the SON contains 2.5 times more oxytocin-containing cells than the PVN. These data seem to contradict the classical view of a functional division between the SON and PVN and support recent hormone assays and electrophysiological data. A new finding is the topographical differentiation between oxytocin- and vasopressin-containing cells. Within the SON and PVN, oxytocin-containing cells were mainly localized in the frontal part and vasopressin cells more in the caudal part.

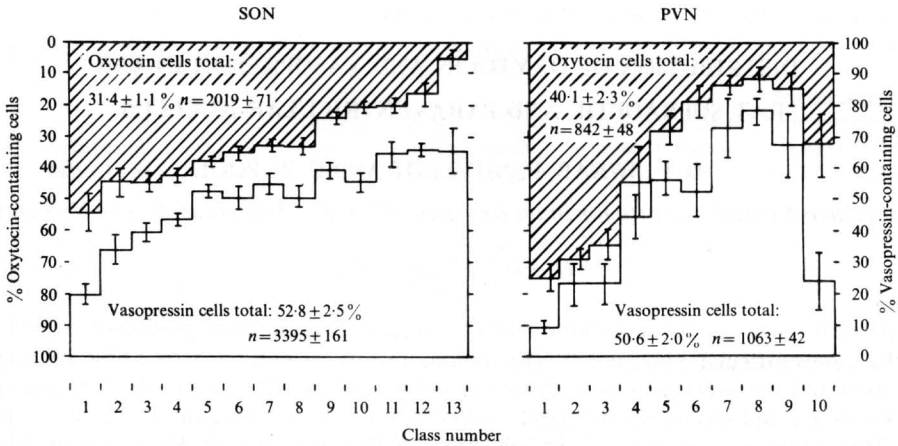


Fig. 1. Percentages of vasopressin- and oxytocin-containing cells in the supraoptic nucleus (SON) and paraventricular nucleus (PVN) from the rostral (left) to caudal (right) part, and the percentage and total number (n) of these cells per nucleus.

Values given on the figure are means \pm S.E.M. (calculated from 5 mean values). The percentages of cells without hormone are represented by the blank areas between the oxytocin and vasopressin cells in this figure. The data are minimal values that will exist if each hormone is synthesized in a separate cell. For the SON this figure is $15.8 \pm 1.8\%$ ($n = 1016$) and for the PVN, $9.3 \pm 1.1\%$ ($n = 195$). The number of cells that do not contain hormone was obtained by subtracting the vasopressin- and oxytocin-containing cells from the total number. Note that the SON contains about 2.5 times more oxytocin-containing cells than the PVN.

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