Comparative morphometry of corticocortical and callosal axon terminals from the primary somatosensory area (S1) of rats

De SÁ, AL.[1], Correa, V.[1], Dias, I.[1], Bahia, C.[2] and Pereira, A.[2]

[1]Universidade Federal do Pará
[2]Universidade Federal do Rio de Janeiro

Somatosensory information is processed in the cortex along a combination of hierarchical and parallel pathways connecting different ipsilateral and contralateral somatosensory areas. Objectives: To evaluate quantitatively the morphology of axon terminals projecting from the primary somatosensory area (S1) to both ipsilateral and contralateral secondary somatosensory areas in the cortex of rats. Axon fragments from S1 were labeled anterogradely with biotinilated dextran amine (BDA) (10kD Molecular Probes) injected iontophoreticly. We performed the morphometric analysis of axon fragments using the software Neurolucida (Microbrightfield, Inc.). We evaluated comparatively the reconstructed axon terminal fragments in the secondary somatosensory area (S2) (n = 21), the parietal ventral area (PV) (n = 4), the parietal rhinal area (PR) (n = 19) ipsilateraly, and S1, contralaterally (S1)c (n = 13) using the following parameters: density of bouton terminaux (BTd) (nr. of boutons/ μm), bouton en passant (BPd), density of boutons (TBd = BTd + BPd) and density of segments (Sd) (nr. of segments/ μm). The results (expressed as MEAN ± S.E.) are, respectively for S2/PV/PR/S1c: BTd = 0.01 ± 0.002/0.01 ± 0.003/0 .01 ± 0.002/0.006 ± 0.002; BPd = 0.06 ± 0.009/0.06 ± 0.013/0.05 ± 0.008/0.07 ± 0.01; BTd = 0.07 ± 0.009/0.07 ± 0.015/0.06 ± 0.008/0.08 ± 0.01 and Sd = 0.01 ± 0.001/0.01 ± 0.002/0.01 ± 0.001/0.01 ± 0.001. Discriminant analysis showed that areas S2, PV, PR and S1c cannot be discriminated based only on the morphometry of axon terminals (p > 0.05). The ANOVA (with Tukey post hoc) based on morphometric characteristics of axon terminals in each area showed that BTd is significantly higher than BPd (p < 0.05) in all of them. Also, cluster analysis ofthe morphometry of axon fragments in each area showed that there are two well-defined morphological groups and the variables that most favored the distinction between them was BTd, with a coefficient of variation of 64.72; 119.10, 70.82 and 85.83% for S2, PV, PR and S1c, respectively. Axon projections from S1 to S2, PV, PR and S1c are morphologically similar, suggesting there is no difference between corticocortical and interhemispheric projections. Each projection pathway, hoverer, is individually composed by two terminal subpopulations, differentiated mostly by the number of bouton terminaux.