Effects of habitat and social complexity on brain size, brain asymmetry and dentate gyrus morphology in two octodontid rodents

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Abstract

Navigational and social challenges due to habitat conditions and sociality are known to influence dentate gyrus (DG) morphology, yet the relative importance of these factors remains unclear. Thus, we studied three natural populations of O. lunatus (Los Molles) and Octodon degus (El Salitre and Rinconada), two caviomorph species that differ in the extent of sociality and with contrasting vegetation cover of habitat used. The brains and DG of male and female breeding degus with simultaneous information on their physical and social environments were examined. The extent of sociality was quantified from total group size and range area overlap. O. degus at El Salitre was more social than at Rinconada and than O. lunatus from Los Molles. The use of transects to quantify cover of vegetation (and other physical objects in the habitat) and measures of the spatial behavior of animals indicated animal navigation based on unique cues or global landmarks is more cognitively challenging to O. lunatus. During lactation, female O. lunatus had larger brains than males. Relative DG volume was similar across sexes and populations. The right hemisphere of male and female O. lunatus had more cells than the left hemisphere, with DG directional asymmetry not found in O. degus. Degu population differences in brain size and DG cell number seemed more responsive to differences in habitat than to differences in sociality. Yet, large-sized O. degus (but not O. lunatus) that ranged over larger areas and were members of larger social groups had more DG cells per hemisphere. Thus, within-population variation in DG cell number by hemisphere was consistent with a joint influence of habitat and sociality in O. degus at El Salitre..