ABSTRACT

Recent comparative studies have shown that bird brains, although small, have a high processing capacity. The brains of parrots and songbirds have higher neuronal densities than brains of mammals; especially large parrots and corvids compete with or even outnumber primates by the number of telencephalic neurons. However, the processing capacity of the avian brain appears to differ significantly between various phylogenetic lineages. Basal groups such as galliform birds have much lower absolute numbers of neurons and lower neuronal densities than songbirds and parrots. In this Master thesis, I used the isotropic fractionator to determine numbers of neurons and non-neural cells in specific brain regions in 19 species of hornbills (*Bucerotiformes*), woodpeckers (*Piciformes*) and coraciiform birds (*Coraciiformes*). The brains of hornbills and woodpeckers (but not coraciiform birds) have numbers of neurons comparable to that of songbirds and parrots and significantly more neurons than equivalently sized brains of pigeons (*Columbiformes*) and galliform birds (*Galliformes*). In the crown groups, we can observe similar trends such as a higher degree of encephalization, a proportionally larger telencephalon and increasing percentage of telencephalic neurons. On the contrary, in pigeons and galliform birds, we can observe completely opposite trends such as a lower degree of encephalization, a proportionally smaller telencephalon and increasing percentage of cerebellar neurons. Hornbills have significantly higher numbers of non-neuronal cells than any other avian group studied so far. A more detailed analysis of the telencephalon in representative species showed that most telencephalic neurons (40–57 %) are allocated in the nidopallium, which subserve numerous higher cognitive functions. On the contrary, the relative size and percentage of neurons in the hyperpallium, the functional homologue of the mammalian visual cortex, is probably species-specific and reflects the ecology of a given species or taxon.

Keywords: **allometry, brain size, comparative neuroanatomy, number of glial cells, number of neurons, isotropic fractionator.**