

A study of the subcortical anatomy of the brain of the African elephant (*Loxodonta africana*).

Busisiwe Constance MASEKO

Abstract

African elephants are one of the iconic mammalian species of the continent, and are the largest terrestrial mammals on the planet. While being a well-known species, with intensive behavioural studies having been undertaken, studies of the elephant brain are limited. Given that elephants do show a unique and interesting set of behaviours, including infrasonic communication, unique control of the trunk, and that they eat around 500 kg of low quality plant matter each day, the current study aimed to investigate the neural underpinnings of these and many other behaviours exhibited by elephants. While not all aspects of elephant neuroanatomy are covered in the current set of studies, the results have provided a great deal of data for regions of the brain that have not been examined for almost 50 years, and applied modern neuroanatomical methods to this task. This thesis outlines how to obtain elephant brains amenable to modern neuroanatomical study, demonstrates that the ventricles are of a size predictable for a mammal with a 5 kg brain, and that the cerebellum is relatively the largest mammalian cerebellum studied to date. A microscopic examination of the cerebellar cortex revealed that the elephants have a greater amount of a potentially more complexly organized cerebellar cortex. In addition, an architectonic study of the diencephalon and brainstem revealed that elephants, while having a mostly standard mammalian diencephalon and brainstem, do show unique features that correlate to control of specialized behaviours. In summary, the current study shows that the system for motor timing, infrasound production and reception, and the systems for satiety and wakefulness are specialized in the elephant, all of which correlate to the overt behaviours previously studied. In addition, the current studies indicate potential paths to follow for the study of behaviour in these species that will hopefully lead to a better understanding of these animals. There is still much to explore and learn about the elephant brain and it is hoped this thesis creates a platform that provides the impetus for many future studies