Behavioural lateralization and its benefits to cognitive flexibility in domestic pigs

Brains of all mammals show morphological division into two hemispheres, left and right. This feature is linked to the brain's ability to perform tasks in each of the hemispheres independently, which thereby increases cognitive efficiency. This phenomenon is called cerebral lateralization. Cerebral lateralization is expressed through a side bias (right or left) in behaviour and motor functions. An example is "handedness" in humans, which is a preference to use the right or the left hand over the other. Studying lateralization can give insight in the development and functioning of the brain, including in neurodevelopmental disorders that are associated with lateralization, such as autism and schizophrenia. Studies on how lateralization develops in early life, and how it relates to later life cognitive flexibility are scarce and involve very few species. This project aims to investigate the phenomenon of brain lateralization in an animal species that is biologically very similar to humans - the domestic pig (Sus scrofa). Pigs are often used as a model for humans and therefore studying lateralization in pigs will increase our understanding of pigs as well as our understanding of human neurobiology. This 2-year project addresses three main research questions related to lateralization. It will first look at the early development of motor function lateralization (Objective 1). This will be based on the direction of the curl, which is a strong indicator of motor function lateralization in pigs. This will be studied in 48 piglets from birth until the side preference has become stabilised. The same pigs will be studied at later age for their cognitive flexibility in several tasks, thereby answering the question how lateralization relates to cognitive flexibility (Objective 2). Cognitive flexibility, such as the ability to adjust to a sudden change in circumstances and switch between tasks, is increasingly of importance due to the rapid change in the environment, partly due to climate change. Being able to adapt quickly may determine whether animals survive in changing conditions. Cognitive flexibility will be studied during spatial tasks related to remembering food locations, and during a problem-solving task in which the animal can shift from individual problem-solving to a social strategy, thereby reflecting social cognition. The cognitive outcomes will be related to lateralization of the tail, snout and eye. These research objectives are studied at the individual level. Lateralization can also be present at the population level, when more than half of the population has the same side preference. Population-level lateralization provides information about the influence of social behaviour on the evolution of a species. Not all species show population-level lateralization and therefore the third question is whether pigs, as social species, show a population-level bias (Objective 3). This will be studied in a large number of pigs (ca. 2,400 piglets), while taking into account the effect of genetics and non-genetic factors such as body weight and sex differences. The project is built upon the pioneering studies of the project's mentor and the practical experience of the principal investigator in the field of animal behaviour. It is designed to fill in some of the gaps in the current literature relating to the emerging and increasingly relevant topic of lateralization in non-human animals. The results are expected to increase the understanding of the development and expression of individual and population-level lateralization, and thereby contribute to various areas of research including neuroscience, biology and animal physiology and behaviour.