Autism spectrum disorder (ASD) is one of the psychiatric diseases of the developing age, with greater incidence in the population. It is characterized by the concomitant presence of deficits in social interaction and social communication associated with behavioural stereotypies. It has recently been hypothesized that the endocannabinoid system may play an important role in the pathogenesis of ASD, especially for disorders of the social sphere. In this context, in the last few years, the use of devices dedicated to imaging on laboratory animals has grown exponentially, integrating different techniques to investigate the correlations between pharmacological effects and neurological reactions. Behavioural neuroimaging is an emerging discipline that merges neuroscience behavioural and functional neuroimaging. To provide a deep, circuit-level understanding of social brain functioning it is necessary to perform in vivo animal analysis. The Single Photon Emission Computed Tomography (SPECT), provides a quantitative, real-time measure of drugs biodistribution. It is able to image biochemical processes and as a highly sensitive technique, it requires very small amounts of radiolabels, which minimizes the disruption of cell function and surrounding tissue. This study has been devoted to the design of a new class of SPECT detectors with high performance suitable for preclinical imaging. In particular, the imaging on awake animals has many advantages, in fact actually: (a) animals need to be anaesthetized during SPECT imaging due to their inability to lie motionless in the scanner; (b) anaesthesia can greatly depress brain functions and affect the neurochemistry which is the object of the study; (c) simultaneous images acquisition is precluded; (d) the immobilization may cause stress to the experimental subject and alter the measurements; (e) there is an ethical problem associated with the animal immobilization. To overcome all these issues, we carried out several computer simulations to understand the best geometry and performance to apply. A preliminary experimental study with rodents has been performed with good results, opening a new and wide field of research in the knowledge in deep brain structure and drugs bio-distribution. Study and design of a miniaturized, lightweight system that allows reasonable freedom of movement. We expect, in the nearest future, to miniaturize a SPECT system to apply it to behavioural studies. For this reason, we will develop a new detector based on silicon photomultipliers (SiPMs) that could reach 1.2 mm of spatial resolution. Our aim will be the identification of the brain regions and neurotransmitters involved in social behaviour to better understand the neural underpinnings of autism.

Brain regions in which neurotransmitters are involved in social behavior. Uniform and striatum activation.

**Keywords**: Autism spectrum, social behaviour, Small Animal SPECT, lightweight scintigraphic devices.


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