SURFACE FRICTION AND BULK PROPERTIES OF CORTICAL GRAY AND WHITE MATTER IN LE/BLU GILL RATS

BY

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THESIS

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ABSTRACT

This study addresses the importance, procedures and results of experimental measurement of surface properties of brain tissues under normal and frictional contact. Load and friction response is studied in coronal slices of LE/Blu Gill rats; the scope of this study encompasses the white and gray matter found in the cortex area of the brain. Tests including indentation and sliding are used to quantify the stiffness and friction response on fixed and unfixed samples. In order to apply the needed loads and retrieve data with precision, a portable custom microtribometer is employed to take the measurements. In this analysis a thin film approximation to Hertzian mechanics is implemented since the slices in question are thin cortical samples and measurements can be affected by substrate effects. Indentation to increasing depths is used to evaluate the stiffness of gray matter as well as any permanent deformation. The reciprocating sliding experiments are performed in three locations: over gray matter, parallel to a region of white matter fiber direction, and crossing from gray matter to white matter. A data analysis method is implemented for spatially-resolved friction coefficient able to detect features and interfaces in the samples surface. Experimental results confirm the presence of a highly compliant tissue with moderate friction coefficient that is distinct according to the specific tissue in the interface, with gray matter in the fixed and unfixed states showing μ=0.102-0.105 and μ=0.159-0.182, respectively. White matter showed μ=0.13-0.3 along the fiber and spatially-varying friction perpendicular to the fiber μ=0.19-0.36 in fixed samples and, μ=0.17-0.24 and μ=0.23-0.34 respectively on unfixed samples.