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“Spatial Analysis of Cortex–Medulla Interactions in the Mouse Adrenal Gland”

The adrenal gland consists of two functionally distinct regions: the cortex, which produces steroid hormones including cortisol, and the medulla, which contains neuroendocrine chromaffin cells that release catecholamines such as norepinephrine. Although these regions produce different hormones, both contribute to the physiological response to stress on different timescales, suggesting that communication between the cortex and medulla may help coordinate adrenal function. However, the structural relationship between these regions throughout the adrenal gland remains poorly understood.

The goal of this study was to examine the spatial organization of the adrenal cortex and medulla in mouse adrenal tissue and determine whether consistent patterns of interaction are present across different regions of the gland. Serial tissue sections spanning from the peripheral tip of the adrenal gland, where the medulla is absent, to the central sections containing the largest medullary area were analyzed to assess how the cortex and medulla are organized relative to one another.

Mouse adrenal tissue was stained immunohistochemically using an antibody against tyrosine hydroxylase (DAB), the fluorescent dye LipidSpot 488, and 4',6-diamidino-2-phenylindole (DAPI) to distinguish the medulla and cortex while searching for unusual tissue architecture. TH staining was used to label chromaffin cells (mainly located in the medulla), LipidSpot 488 labeled the lipid-rich cortex, and DAPI was used to visualize cell nuclei. Images from serial sections were compared to examine changes in cortical and medullary organization throughout the gland. Initial findings indicate there are regions where the inner cortex and the medulla interdigitate providing a potential anatomical site for zonal communication.

Characterizing the spatial relationship between the adrenal cortex and medulla provides a foundation for understanding how these functionally distinct regions may interact. Identifying consistent organizational patterns across serial sections may offer insight into mechanisms that coordinate rapid catecholamine release from the medulla with slower steroid hormone signaling from the cortex and may guide future studies investigating functional communication within the adrenal gland.