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Toluidine blue-stained chromatin exhibits different textural properties in thymus cortical and medullar lymphocytes

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Texture analysis is a novel, exact and affordable computational biology technique, today commonly used for evaluation of digital micrographs in light and electron microscopy. In this study, on a mouse experimental model, we demonstrate that there is a significant difference between lymphocytes in thymus cortex and medulla regarding textural features of their toluidine blue-stained chromatin.

The study was performed on 56 male albino mice. Thymus tissue was stained with DNA-binding toluidine blue dye (Figure 1). A total of 1120 nuclear structures (560 cortical and 560 medullar lymphocytes; 20 nuclei per animal) were analyzed using Grey level co-occurrence matrix (GLCM) method as previously described [1, 2]. The algorithm based on MATLAB code (MathWorks, Natick, Massachusetts, USA) was performed on 8-bit segmented nuclei micrographs using ImageJ software (National Institutes of Health, USA). For each animal, the average values of chromatin angular second moment, GLCM contrast, entropy, and inverse difference moment, were determined.

The results indicate that the cortical lymphocytes have significantly higher values of inverse difference moment ($p<0.001$), and significantly lower values of entropy ($p<0.001$) and GLCM contrast ($p<0.001$), when compared to medullar lymphocytes. There was no significant difference in chromatin angular second moment between the two cell populations ($p>0.05$). These findings further suggest that textural analysis may become a valuable addition to conventional morphometric methods in evaluation of structural changes that take place in cell genetic material during lymphocyte migration and maturation in thymus.

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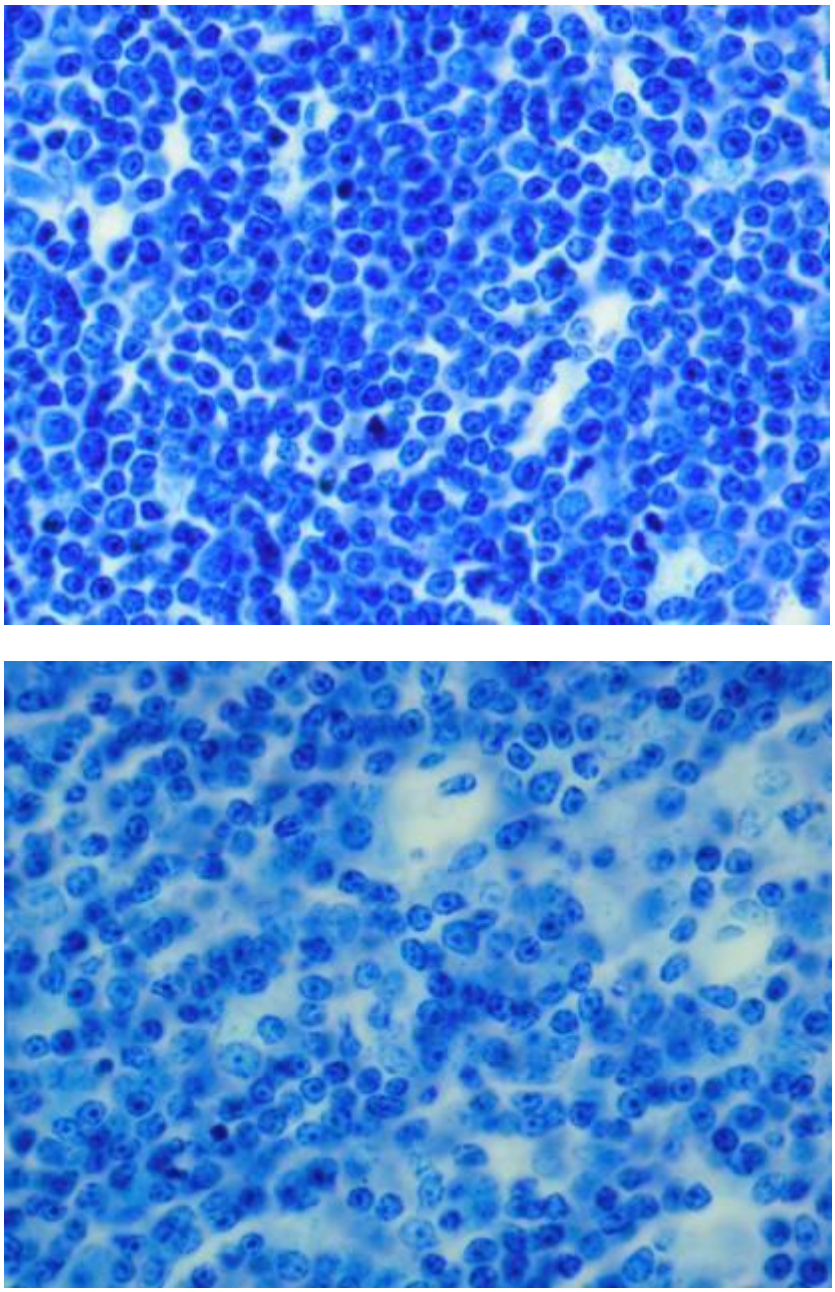

Figure 1. Digital micrographs (magnification 1000x) of the thymus t cortex (A) and medulla (B) stained with DNA-binding toluidine blue dye