# Low-Voltage Electron Microscopy for Pathology Applications: Accessibility and High-Quality Data Acquisition

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## Abstract

Transmission electron microscopy (TEM) is widely used for ultrastructural analysis in diagnostic pathology, particularly in renal diseases 1,2. The gold standard system, high-voltage TEM (HV-TEM), operates at accelerating voltages above 80 kV and provides near atomic-level resolution; however, it is costly and requires complex operation and maintenance 3,4. In the current context of limited staffing and financial resources, alternative systems are needed to provide pathologists with high-quality ultrastructural information 5. Low-voltage electron microscopy (LVEM) offers a cost-effective solution for pathological analysis. Operating at accelerating voltages below 25 kV, LVEM provides sufficient resolution for the identification of key diagnostic features across diverse tissue types 6,7. In addition, LVEM offers up to 20-fold higher contrast for biological specimens compared with HV-TEM 8. In this study, we evaluated LVEM as an alternative diagnostic tool for pathological assessment, including renal, muscle, optic, and respiratory samples. Low-voltage TEM images were acquired using an LVEM 25E system (Delong Instruments), operating at an accelerating voltage of 25 kV in TEM mode and 15 kV in STEM mode. LVEM imaging provided comprehensive ultrastructural cellular details, including podocytes, dense deposits, amyloid fibrils, myofilament organization, and ciliary structures. The images demonstrated high contrast and well-defined ultrastructural features. With a resolution of 1.0 nm, compact design, simplified operation, and reduced maintenance requirements, LVEM represents a practical and reliablealternative that maintains diagnostic accuracy while addressing the financial and operational limitations associated with conventional HV-TEM systems.

## References

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