Probing Cold QCD: Jefferson Lab *eA* program today and its prospects at 20+GeV and EIC

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The Jefferson Lab *eA* program in Hall B, initially carried out with a 5 GeV electron beam and the CLAS detector, is now continuing with beam energies up to 11 GeV using CLAS12. Looking ahead, there are plans to extend the program to higher energies following the CEBAF upgrade to beyond 20 GeV. The primary aim of *eA* program in Hall B is to investigate the underlying mechanisms of medium-induced modifications to quark propagation and hadron formation in semi-inclusive deep-inelastic scattering. These effects are quantified through measurements of hadronic multiplicity ratios and transverse momentum broadening of mesons and baryons, requiring multidimensional analyses over a broad kinematic range. Along with these studies, the program explored a wide range of nuclear medium phenomena, including color transparency, di-hadron and Bose–Einstein correlations, EMC and short-range correlation effects. In this talk, I will summarize key results from Hall B Jefferson Lab *eA* program conducted with 5 GeV and 11 GeV beams, and discuss future prospects for extending these studies to the upgraded 20+ GeV CEBAF and the Electron-Ion Collider (EIC).