Nucleic acid extraction is a key step in many molecular laboratories. Obtaining DNA and RNA of sufficient quality and quantity is critical for the next-generation sequencing assays performed at our facility. To improve efficiency of our lab process, we implemented automated nucleic acid extraction with the QIAcube (Qiagen, Germantown, MD). Introducing automation into the clinical laboratory to replace manual processes requires validation of the automated method. Here we present a validation study that compares our manual nucleic acid extraction processes with the QIAcube for varying extraction materials: frozen tissue, peripheral blood, and formalin-fixed paraffin-embedded tissue. For this study, a total of 30 frozen tissue or cell pellets were processed, including replicates for intermediate precision and reproducibility. A total of 15 peripheral blood samples from 3 unique donors were processed, including replicates for intermediate precision and reproducibility. A total of 30 formalin-fixed paraffin-embedded tissues were processed, including for intermediate precision and for reproducibility. Resulting DNA and RNA were assayed for quantity and quality with a Nanodrop spectrometer (ThermoFisher, Waltham, MA). For all samples, the same reagents were used for both manual and automated extractions. Material processed by the QIAcube was shown to be of equivalent quality and quantity to material processed by the manual protocol. Future studies will confirm whether this automation improves consistency of results as expected.