The objective of near-infrared (NIR) spectroscopy is to obtain spectra from which quantitative or qualitative calibrations for an analyte of interest can be developed. A near-infrared instrument can deliver incorrect or inaccurate results for one of two reasons: (i) the calibration failed, or (ii) the instrument failed. Other chapters will cover the former; this chapter covers instrument performance. We will discuss the various tests that are performed on a routine basis to assure consistent instrument performance. These routine diagnostic tests encompass spectrometer, sampling attachment, and operational performance.

While one-time calibrations may be possible with a poorly performing instrument, it is unlikely that such calibrations will work well with new samples in the future. For example, if the wavelengths at which data are collected shift due to poor instrument alignment from the time the initial calibration was developed, then analysis of samples scanned at a later date will not likely give accurate analyte values using the original calibration. The purpose of instrument validation is to determine if a near-infrared instrument is performing according to specifications and to provide the means to correct any instrument misalignment or malfunction if within the domain of the user.

There are two general areas within which such tests can be classified: (i) those based strictly on physical measurements of instrument performance and (ii) those based on the utilization of test samples and calibrations previously developed for the instrument in question.