Spectroscopists have long attempted to summarize what they know about small molecules in terms of a knowledge of potential energy curves or surfaces. For most of the past century, this involved deducing polynomial-expansion force-field coefficients from energy level expressions fitted to experimental data, or for diatomic molecules, by generating tables of many-digit RKR turning points from such expressions. In recent years, however, it has become increasingly common either to use high-level ab initio calculations to compute the desired potentials, or to determine parametrized global analytic potential functions from direct fits to spectroscopic data. In the former case, this invoked a need for robust, flexible, compact, and ‘portable’ analytic potentials for summarizing the information contained in the (sometimes very large numbers of) ab initio points, and making them ‘user friendly’. In the latter case, the same properties are required for potentials used in the least-squares fitting procedure. In both cases, there is also a cardinal need for potential function forms that extrapolate sensibly, beyond the range of the experimental data or ab initio points. This talk will describe some recent developments in this area, and make a case for what is arguably the ‘best’ general-purpose analytic potential function form now available. Applications to both diatomic molecules and simple polyatomic molecules will be discussed.