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MicroRNAs (miRNAs) are a class of small non-coding RNAs that are involved in nearly all developmental processes and human pathologies. MiRNAs are considered to be promising biomarkers, since their dysregulation correlates with the development and progress of many diseases. Short length, sequence homology among family members, susceptibility to degradation, and low abundance in total RNA samples make miRNA analysis a challenging task. Photoluminescent semiconductor nanoparticles (quantum dots, QDs) possess unique properties such as bright photoluminescence, photostability and narrow emission peaks, wide possibilities for surface modification and bioconjugation, which serve as the basis for the development of different analytical methods for variety of analytes. Relatively small size of QDs' and their narrow distribution are especially important for miRNA assay. The combination of QD-based biosensors with amplification techniques makes it possible to identify the target miRNA at a single-particle level with the detection limit at the attomolar scale. This review describes the principles of signal generation: direct intensity measurements, different "signal on" and "signal off" mechanisms as well as electro-chemiluminescence. Special attention is paid to the FRET-based techniques. According to our knowledge this is the first review related to QDs application for miRNA detection.