Nanoelectronics involves the device development in nanoscale sizes to be used simply and easily. Nanoelectronics includes the use of nanomaterials and nanodevices in order to focus on low consumption of electricity, portability, and high-memory chip generation (Gopinath et al., 2014a,b). Recently, researchers in the field of nanoelectronics have begun focusing more intently on using nanobiosensors to develop the sensing substrate and material-assisted transducers for detecting disease-causing agents. Detecting diseases at early stages is important in treating and preventing them (Lakshmipriya et al., 2013a, b). High-performance detection systems have been developed that have achieved two vital goals; one is generating suitably high-sensitivity electronics, and another one is the material compatibility for the electronic devices.

The biosensor is highly depending on nanoelectronics to detect biomolecules with suitable analytes and ligands, assisted by electronic devices. The electronic device should be portable, easy to use, and capable of improving sensitivity (Kalaiyarasi et al., 2017a,b; Odeh et al., 2017; Ibraheam et al., 2016, 2017; Ranjani et al., 2018). A good biosensor is based on two important characteristics: selectivity and sensitivity. In several cases, sensitivity and selectivity rely on the electronic device, surface conditions, and materials to be used (Gopinath, 2008, 2010; Gopinath et al., 2010a,b, 2011a,b, 2014a,b; Gopinath and Kumar, 2014; Lakshmipriya et al., 2014). The improvement of the biosensor ultimately depends on nanoelectronic-based developments.

Various metal surfaces have been used as the basic substrate in electronic devices for different sensing applications; among them, gold (Au) is more attractive for surface modification because of its positive characteristics such as stability, sensitivity, and ease of use with various surface modifications (Fig. 9.1). Other than Au, silica (especially in a semiconductor)