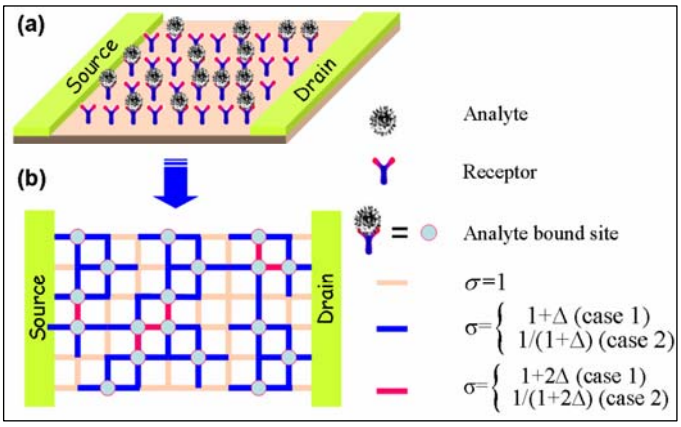
Ultrahigh Sensitivity Biosensors Based on Nanoscale Field-Effect Transistors

Conventional field-effect transistors (FETs) control the flow of charge carriers by applying an electrical field. Recently, the same kind of field effect has been created at the nanoscale by adsorption of different molecules onto chemically or biologically functionalized nanowires or nanotubes. These devices are known as nanoscale field-effect transistors (nano-FETs).

Dr. Wu Lu of the Ohio State University and Dr. Qi-Huo Wei of Kent State University are collaborating on a project involving nano-FETs that has potential for modeling and developing nanoscale chemical and biological sensors. The approach is to investigate how the performance of nano-FET biosensors varies as a function of their geometrical size and physical conditions. The sensitivity of such devices can be as small as 10^{-15}, equivalent to the ability to pick up one apple out of a trillion oranges. This research promises to enable the development of ultrasensitive, highly miniaturized devices that can sense and detect a variety of chemical and biological agents.



The flow of charge carriers changes when a chemical or biological material (known as the analyte) is adsorbed onto the nano-FET.

Q.–H. Wei, and W. Lu, "Scaling of Nanoscale Chemical/Biological Biosensors" (in preparation).

Patents or other steps toward commercialization:

Contributing Agency: NSF