Human eyes can distinguish about 10 million different colors but only 100
different grey scales. Therefore, in bioassays or biosensors, a readout system
that is based on different colors rather than different light intensities provides
tremendous advantages. Liquid crystals (LCs) are materials known to give many
different colors depending on their average orientations. Moreover, because
the orientations assumed by LCs near surfaces are very sensitive to molecules
adsorbed on surfaces, LCs can be used to amplify protein-protein binding
events into colorful signals which are readily visible to the naked eye.
Recently, we have successfully demonstrated a variety of LC-based bioassays
and biosensors which have broad applications in environmental monitoring,
clinical diagnosis and defense system.

The bioassays and biosensors to be discussed in this presentation include: (1) A
protein assay which shows clear dark or bright signal when the protein
concentration is above a critical value. (2) An LC based microfluidic
immunoassays suitable for differentiating and quantifying antibody and antigen
concentrations through colors. (3) A highly specific proteases assay which can
report the enzymatic activities of trypsin acting on immobilized oligopeptides.
(4) A real-time pH sensor which can follow the diffusion of H+ near an
aqueous/LC surface, and its application in penicillin detection. These
examples demonstrate the potential utility of LC colors for developing simple,
low-cost and portable bioassays.