Signal amplification for bioanalysis

To detect biomolecules with low abundance and extract the ultra weak biological signals, our group brings nanotechnology and biotechnology into the development of analytical methodologies, and has designed a series of novel signal amplification strategies for sensitive detection of biomolecules. Nanotechnologies for signal amplification include 6 ways: 1) accelerating the electron transfer or obtaining sensitized optical signal, 2) realizing optical, electrical or visual analysis by applying the catalytic and enzyme mimetic functions of the nanomaterials, 3) using nanomaterials as tag molecules, 4) using nanomaterials as the carriers of signaling molecules, 5) using nanomaterials to realize electrochemiluminescent or photoelectrochemical signal amplification, and 6) selectively concentration of biomolecules using biofunctionalized nanomaterials. The molecular biological technologies for signal amplification are to use PCR, rolling circle amplification, target-induced repeated primer extension, hybridization chain reaction, loop-mediated amplification and target DNA recycling amplification including endonuclease-, exonuclease- and polymerase-based circular strand-replacement polymerization to amplify the electrochemical, optical and visual signals. These novel signal amplification strategies have been used for electrochemical detections, optical detections such as chemiluminescent analysis, fluorescent analysis and infrared, ultraviolet and Raman analysis; mass spectrometric analysis and the development of imaging technologies such as grayscale scanning imaging, scanning electrochemical microscopy imaging, chemiluminescence imaging, fluorescence imaging, Raman spectral imaging and mass spectral imaging. The established methods can conveniently be used in the detections of small biomolecules, DNA, proteins, cells, the carbohydrate sites on cell surfaces intracellular microRNA as well as pre-microRNA, intracellular telomerase and sialyltransferase activity. Some methods can even realize quasi-single-molecule detection.

Biography

Huangxian Ju received BS, MS and PhD from Nanjing University during 1982-1992 and was a postdoc in Montreal University from 1996-1997. He became a professor of Nanjing University in 1999, won the Funds for National Distinguished Young Scholars in 2003 and National Creative Research Groups in 2006. He is a Changjiang Professor, Chief Scientist of National Basic Research Program of China and the Director of State Key Laboratory of Analytical Chemistry for Life Science. He focuses on analytical biochemistry and molecular diagnosis and has published 476 papers with an h-index of 63 and SCI citation of 13186, authored 30 patents, 2 English books, 6 Chinese books, and 6 Chinese and 8 English chapters.

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