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## ACCEPTED MANUSCRIPT

# Gold nanorod-based localized surface plasmon resonance biosensors: a review

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#### Abstract

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14 Noble metal nanoparticle-based localized surface plasmon resonance (LSPR) is an advanced 15 and powerful label-free biosensing technique which is well-known for its high sensitivity to 16 the surrounding refractive index change in the local environment caused by the biomolecular 17 interactions around the sensing area. The characteristics of the LSPR effect in such sensors 18 are highly dependent on the size, shape and nature of the material properties of the metallic 19 nanoparticles considered. Among the various types of metallic nanoparticles used in studies 20 employing the LSPR technique, the use of gold nanorods (GNRs) has attracted particular 21 attention for the development of sensitive LSPR biosensors, this arising from the unique and 22 intriguing optical properties of the material. This paper provides a detailed review of the key 23 underpinning science for such systems and of recent progress in the development of a number 24 of LSPR-based biosensors which use GNR as the active element, including an overview of 25 the sensing principle, the synthesis of GNRs, the fabrication of a number of biosensors, 26 techniques for surface modification of GNRs and finally their performance in several 27 biosensing applications. The review ends with a consideration of key advances in GNR-based 28 LSPR sensing and prospects for future research and advances for the development of the 29 GNR-based LSPR biosensors.

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31 Keywords: localized surface plasmon resonance, LSPR, gold nanorod, label-free, biosensors,

32 nanoparticles, optical fiber sensor.

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