Au-nanoprobe optimization for SNP detection at room temperature by non-cross-linking aggregation

Gonçalo Doria[1,2], Ricardo Franco[2], Pedro Baptista[1]
[1]CIGMH/DCV – FCT/UNL, Campus da Caparica, 2829-516 Caparica, Portugal
[2]REQUIMTE/DQ – FCT/UNL, Campus da Caparica, 2829-516 Caparica, Portugal
doria_go@fct.unl.pt

Gold nanoparticles have been intensively studied and found different applications in several areas, such as chemical and biological sensing, biological imaging and medical diagnostics and therapeutics, mainly due to their unique surface plasmon resonance (SPR) properties[1]. Particularly, the use of gold nanoparticles derivatized with thiol modified oligonucleotides (Au-nanoprobes) has lead to a new era of molecular nanodiagnostics with great potential to clinical diagnostics at point-of-care[2],[3],[4]. Based on the differential non-cross-linking aggregation of these Au-nanoprobes we were able to develop a colorimetric method for the detection of single base mutations/single nucleotide polymorphisms (SNP)[4]. The detection is achieved by colour comparison between solutions containing the Au-nanoprobe with either a complementary or a non-complementary/mismatched target sequence, upon increasing ionic strength. While the presence of a complementary target prevents aggregation upon salt addition and the solution remains red, the non-complementary/mismatched targets do not prevent Au-nanoprobe aggregation, resulting in a visible change of colour from red to blue (see Figure 1).
Here we explore different aspects of the Au-nanoprobe design in order to optimize target hybridization along with increasing specificity towards a better SNP detection at room temperature. Using fluorescent spectroscopy techniques we demonstrate that oligonucleotide density on Au nanoparticle surface and mismatch localization within the Au-nanoprobe's sequence influence target hybridization.

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References:

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Figures:

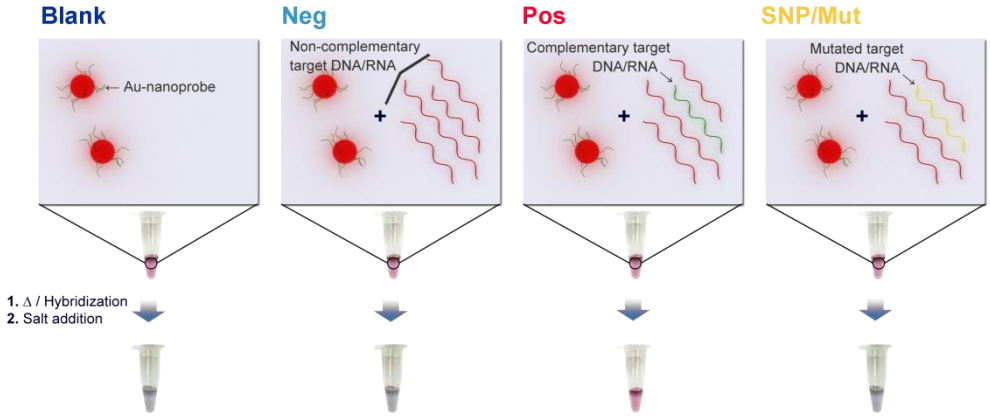

Figure 1 - The Au-nanoprobe assay is based on visual comparison of test solutions before and after salt induced Au-nanoprobe aggregation: i) the Au-nanoprobe alone - Blank; ii) a negative sample – Neg – in presence of non-complementary DNA; iii) a positive sample – Pos – in presence of complementary DNA; and iv) SNP/Mut – in presence of DNA harboring SNP or single point mutation;