# SCIENCESPRINGDAY

FACULDADE DE CIÊNCIAS E TECNOLOGIA UNIVERSIDADE NOVA DE LISBOA

**Life Sciences Department / Chemistry Department**

## Gold Nanoparticles for Surface-Assisted Laser Desorption/Ionisation of DNA – Application to DNA Adduct identification


Nanotheranostics Group, CIGMH

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**Research grants**
Development of colloidal gold nanoprobes for specific DNA/RNA sequence detection

Development of gold-silver alloy nanoprobes for specific DNA/RNA sequence detection

## Objectives

The main objective of this project is to develop an easy-to-perform laser/desorption ionisation (LDI) based technique, suitable for application to DNA adduct identification. Gold nanoparticles (AuNPs) will be used as surface to optimise a AuNPs-surface-assisted LDI (SALDI) - Fig.1 - approach capable of circumventing the ionisation issues related to analysis involving high molecular weight DNA. Optimisation of a sample preparation procedure will be also attempted. To achieve this goal, several intermediate objectives need to be addressed:

Evaluation of gold AuNPs as a surface for LDI; optimisation of analytical conditions for DNA analysis and characterization of DNA adducts; development of methodologies for sample preparation in medium-throughput analysis; utilisation of AuNPs-SALDI for DNA adducts identification in exposed cell lines.

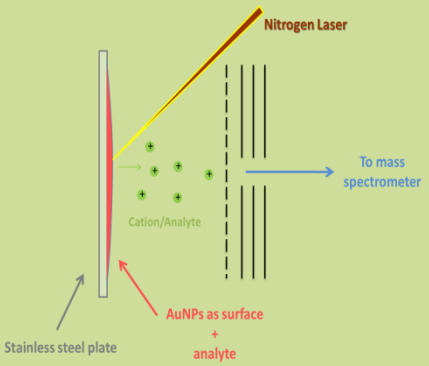


**Fig.1 - SALDI schematics**

## Methodology

Synthesis, characterisation and functionalisation of AuNPs following the citrate reduction method. UV-Vis spectrophotometry, transmission electron microscopy and dynamic light scattering will be used for AuNP characterisation. Synthesised AuNPs are to be used as a surface for LDI of DNA standard solutions (oligonucleotides, nucleotides and modified nucleobases), using different additives, to optimise detection conditions. Adequate organic matrices (Fig. 2) will be used for comparison purposes. Sample preparation techniques such as ultrasound, enzymatic digestion and chromatography will be assessed to improve analyte purification. Finally, a chosen cell line will be treated with different concentrations of an alkylating carcinogen compound as to produce DNA adducts (Fig. 3). A possible toxicological assessment and the identification of DNA adducts using the proposed AuNP-SALDI strategy will be in order.

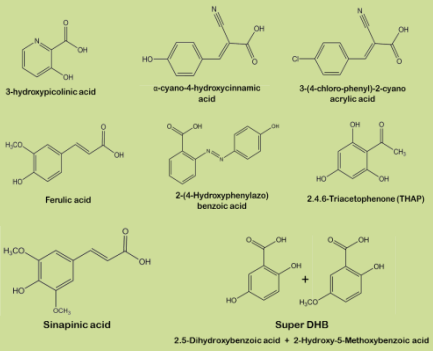


**Fig.2 - Some organic matrices commonly used in MALDI**

## Expected Results

A comparison amongst different organic matrices commonly used in matrix-assisted laser desorption/ionisation (MALDI) and AuNPs will reveal the most suitable surface, whether organic or inorganic, for nucleotide analysis.

DNA adduct identification will be achieved by assessing differences between the mass spectra signals corresponding to nucleotides and modified nucleotides (DNA adducts).

Carcinogen agents used to treat cell lines are expected to induce metabolic alterations and possibly, genotoxicity. Toxicity studies will be performed and these alterations will be correlated with the formation of DNA adducts.

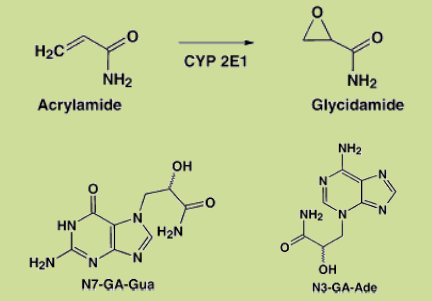


**Fig.3 - Acrylamide as a carcinogen agent, its biotransformation to glycidamide (alkylating agent) and formation of DNA adducts.**


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