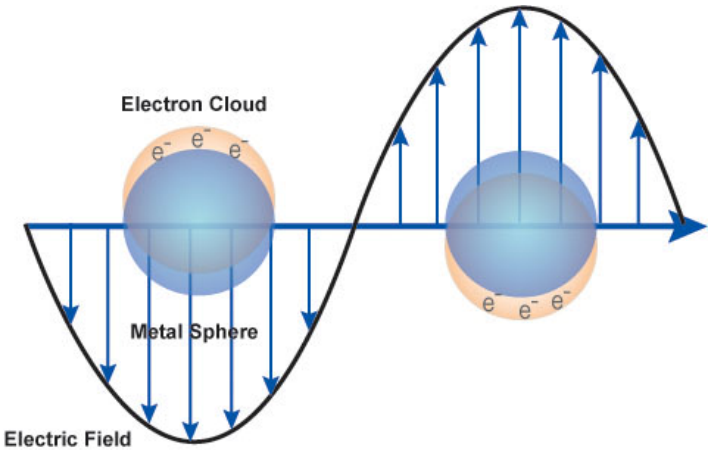
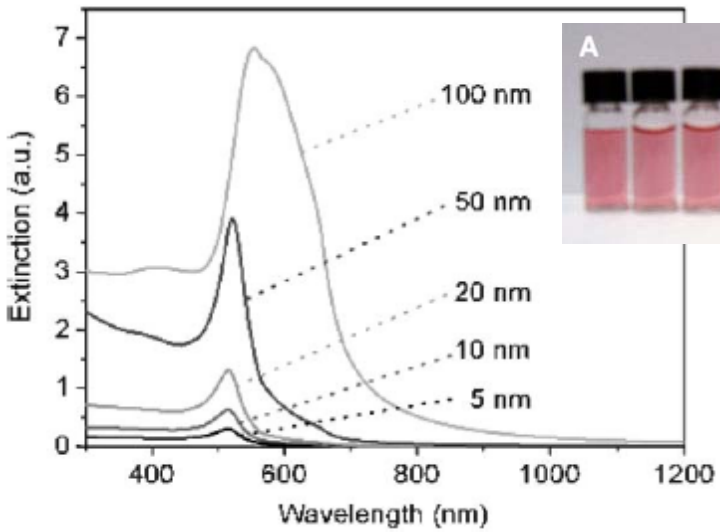
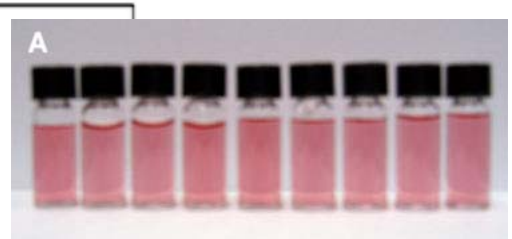
Nanoparticelle d’oro: proprietà

- Assorbimento plasmonico (520 nm per Au)
- Quenching dell’emissione di fluorescenza
- Capacità di assorbire elettroni
- Superficie metallica
- Surface enhanced raman scattering (SERS)
- Superficie funzionalizzabile

Nanoparticelle d'oro: determinazione strutturale

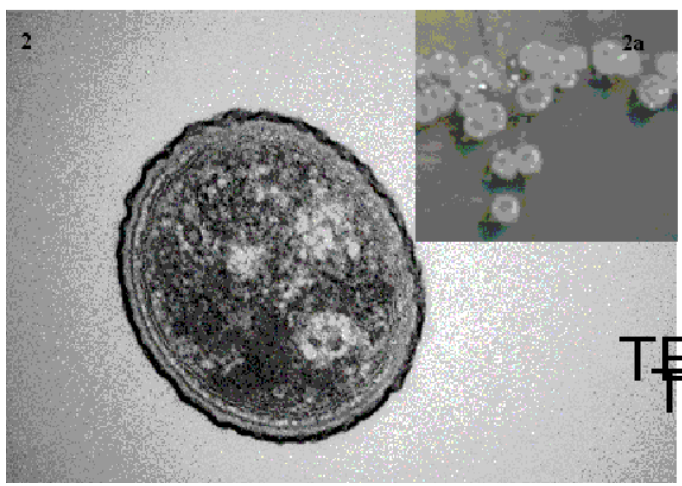






Gold Staining

Microscopia ottica



TEM

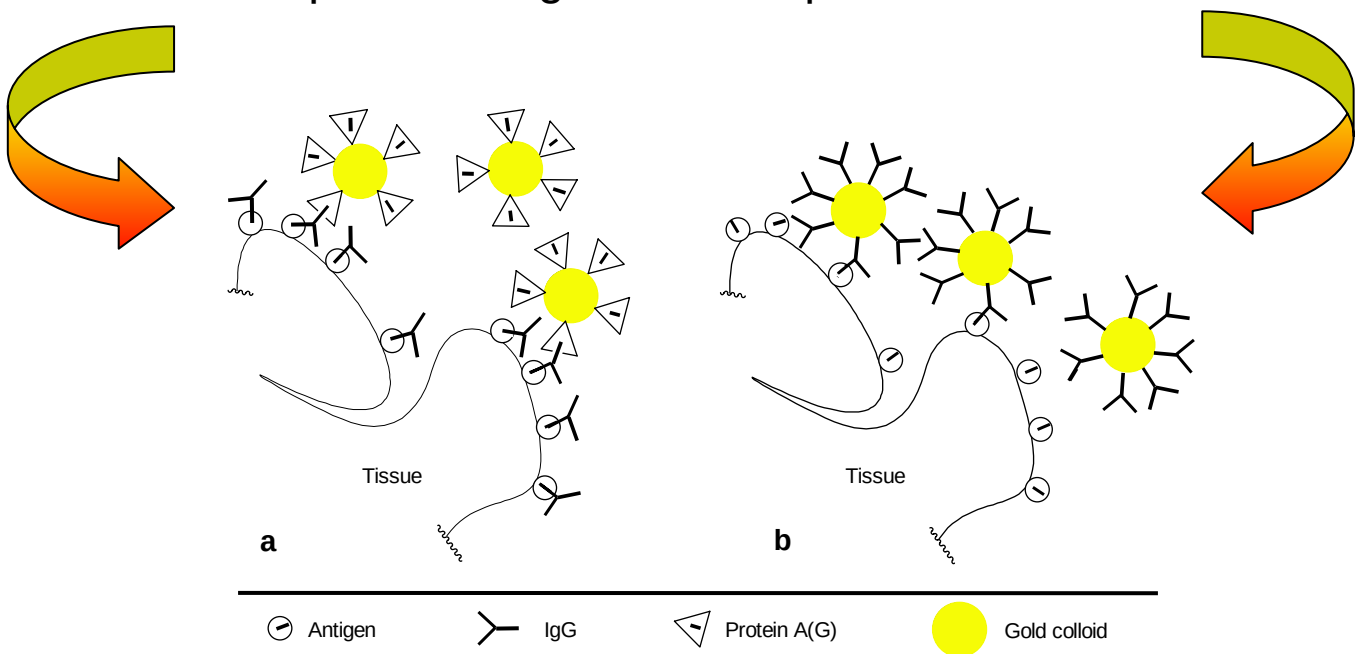
TEM

Nanoparticelle d'oro: applicazioni

Il primo coniugato colloide d'oro/proteina è stato descritto nel 1978

Metodo indiretto:
Individuazione del complesso antigene-anticorpo

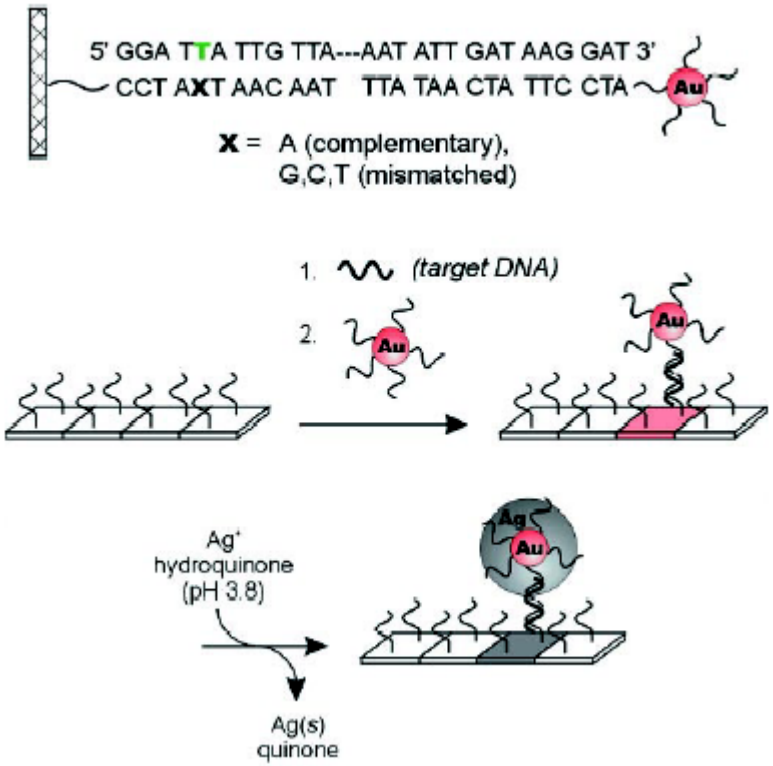
Metodo indiretto:
Individuazione dell' antigene

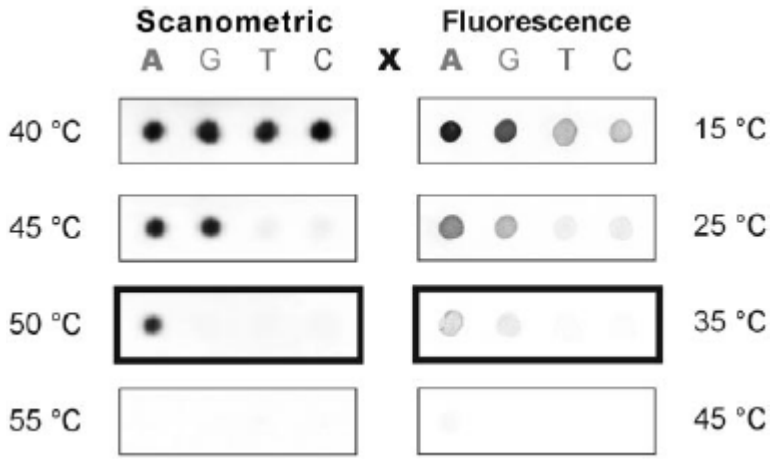


Rivelazione tramite spettroscopia ottica, microscopia ottica, microscopia elettronica, se necessario dopo "silver enhancement"

Nanoparticelle d'oro: determinazione strutturale

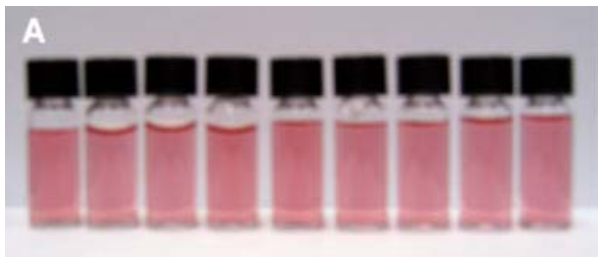
Rivelazione di array di DNA



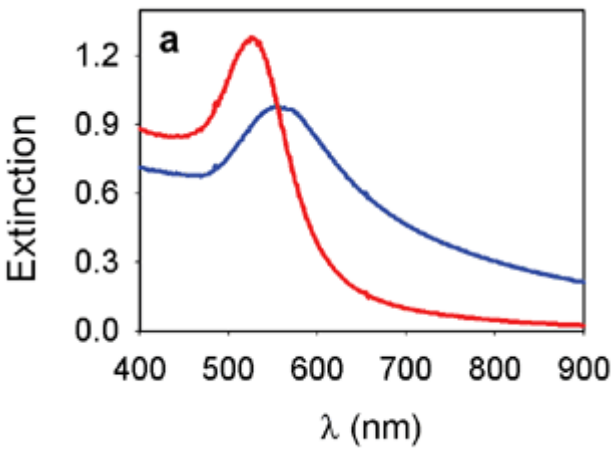


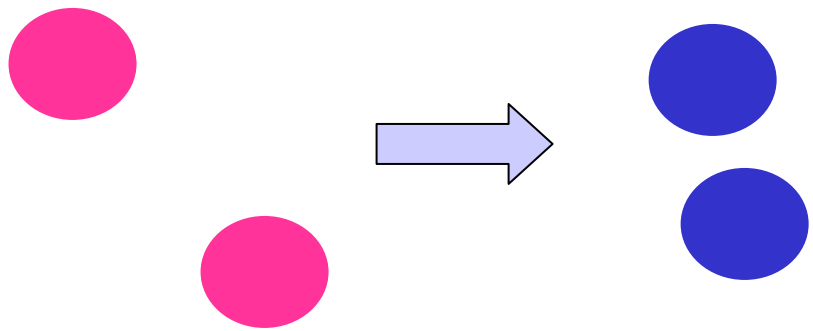
Taton, T. A.; Mirkin, C. A.; Letsinger, R. L. *Science* **2000**, *289*, 1757-1760.

Nanoparticelle d'oro: aggregazione e colore



NaCl

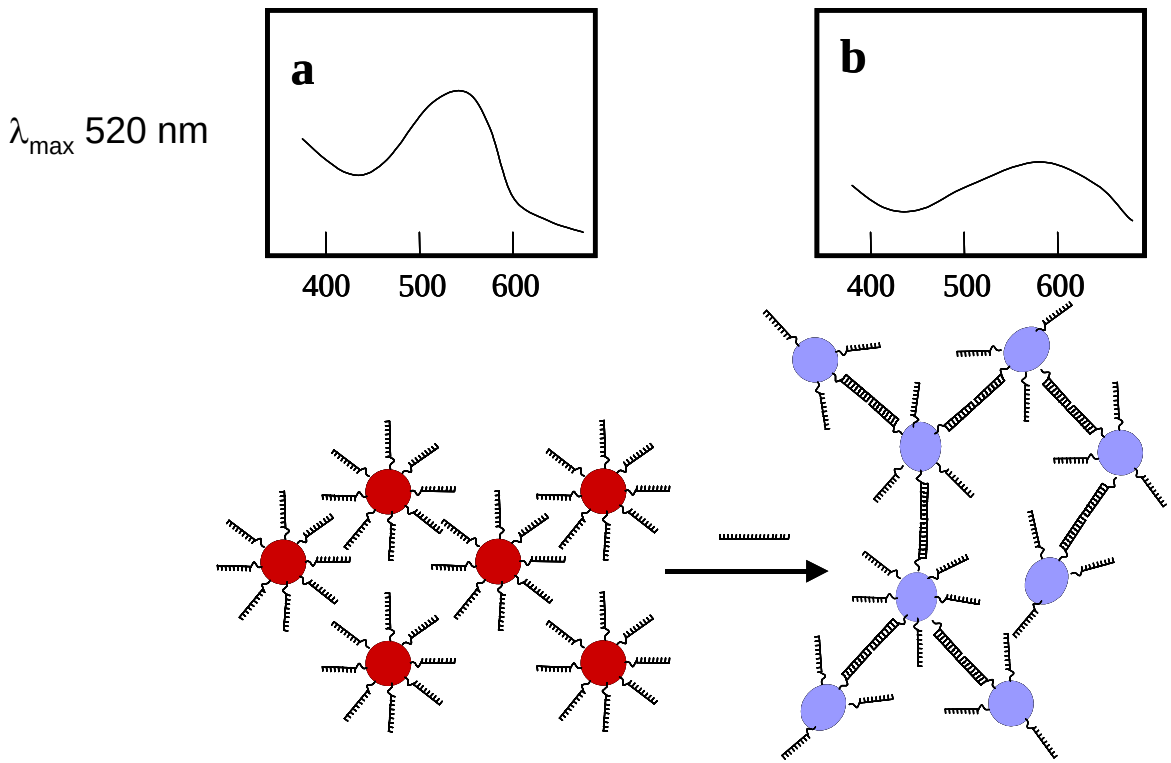




Quando colloidi d'oro si avvicinano ad una distanza inferiore al doppio del diametro lo spettro di assorbimento si sposta verso il blu

Nanoparticelle d'oro: aggregazione e colore

Determinazione colorimetrica selettiva di polinucleotidi

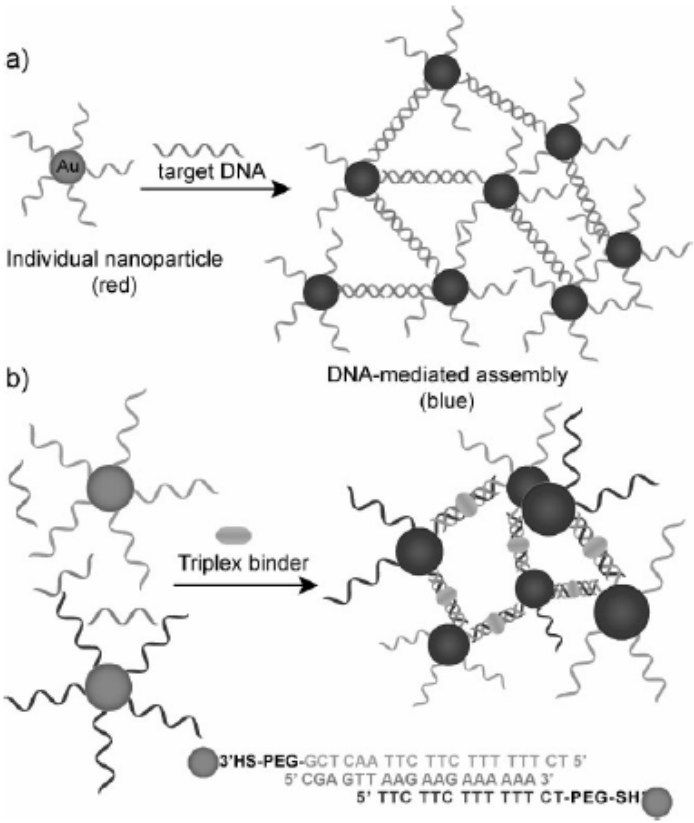


Molto sensibile: si possono misurate fino a 10 femtomoli di polinucleotide

Elganian, R.; Storhoff, J.J.; Mucic, R. C.; Letsinger, R. L.; Mirkin, C. A. *Science* **1997**, *277*, 1078-1081.

Nanoparticelle d'oro: aggregazione e colore

Determinazione colorimetrica selettiva di polinucleotidi

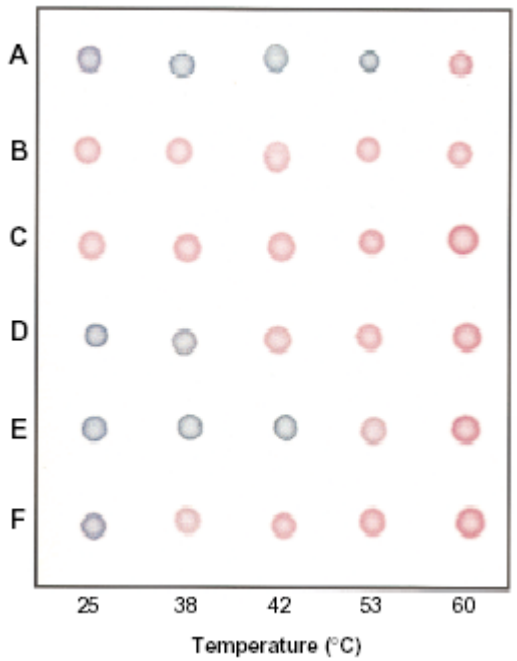


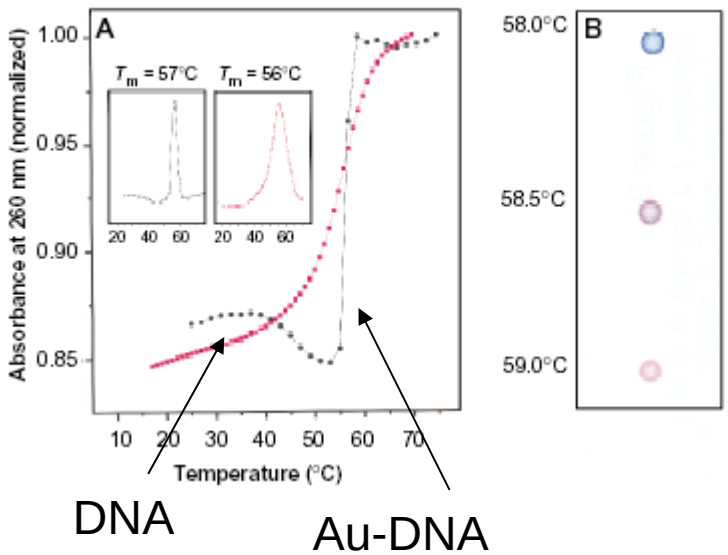
Determinazione di DNA complementare

Determinazione di triplex biders e DNA

Nanoparticelle d'oro: aggregazione e colore

Determinazione colorimetrica selettiva di polinucleotidi



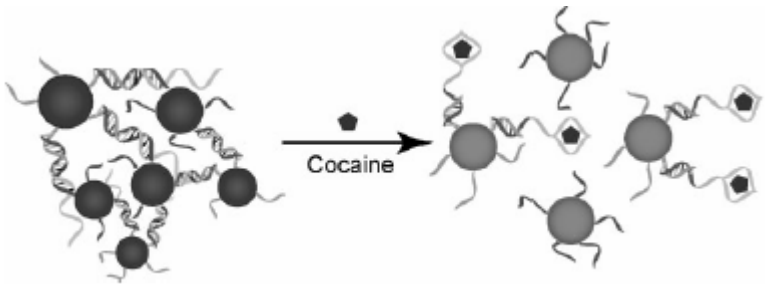


Selective polynucleotide detection for the target probes : (**A**) complementary target; (**B**) no target; (**C**) complementary to one probe; (**D**) a 6-bp deletion; (**E**) a 1-bp mismatch; and (**F**) a 2-bp mismatch. Nanoparticle aggregates were prepared in a 600-μl thin-walled Eppendorf tube by addition of 1 μl of a 6.6μM oligonucleotide target to a mixture containing 50 μl of each probe (0.06 μM final target concentration). The mixture was frozen (5 min) in a bath of dry ice and isopropyl alcohol and allowed to warm to room temperature. Samples were then transferred to a temperature controlled water bath, and 3-μl aliquots were removed at the indicated temperatures and spotted on a C_{18} reverse phase plate.

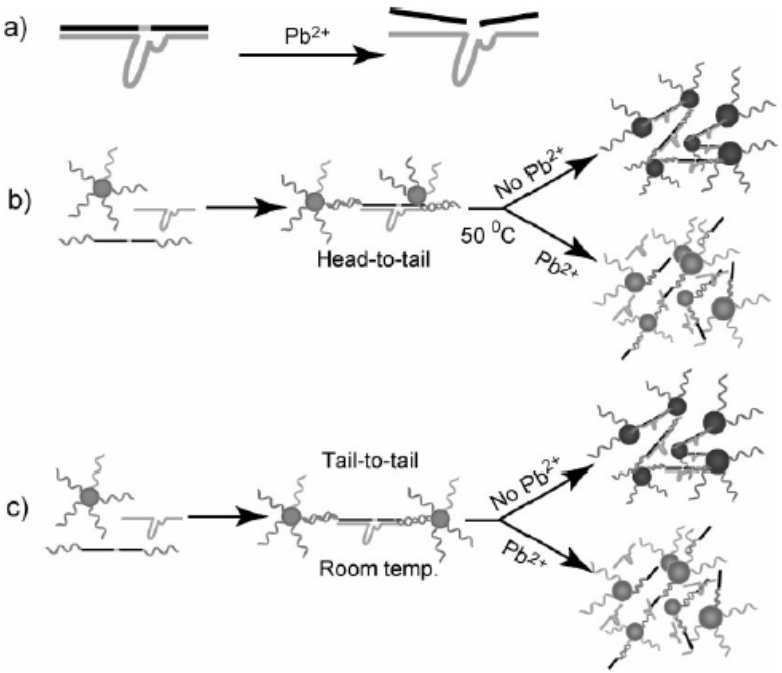
Elganian, R.; Storhoff, J.J.; Mucic, R. C.; Letsinger, R. L.; Mirkin, C. A. *Science* **1997**, *277*, 1078-1081.

Nanoparticelle d'oro: aggregazione e colore

Determinazione colorimetrica di analiti



Determinazione di aptameri



Determinazione di cofattori

Nanoparticelle d'oro: aggregazione e colore

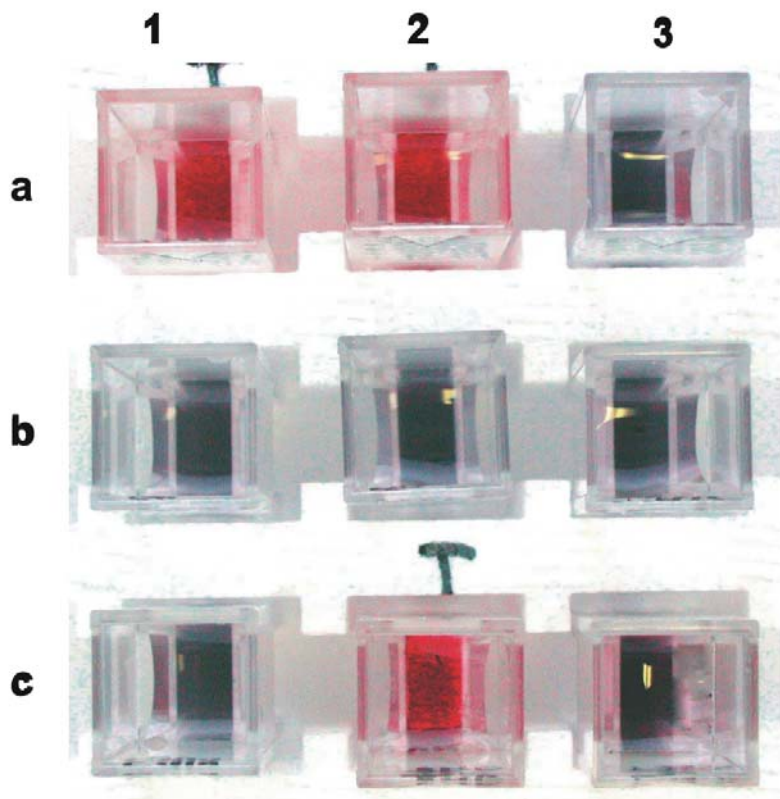
Determinazione colorimetrica di enzimi

AcNHCys(SAc)-peptide-Cys(SAc)OH
sequence specific for a protease

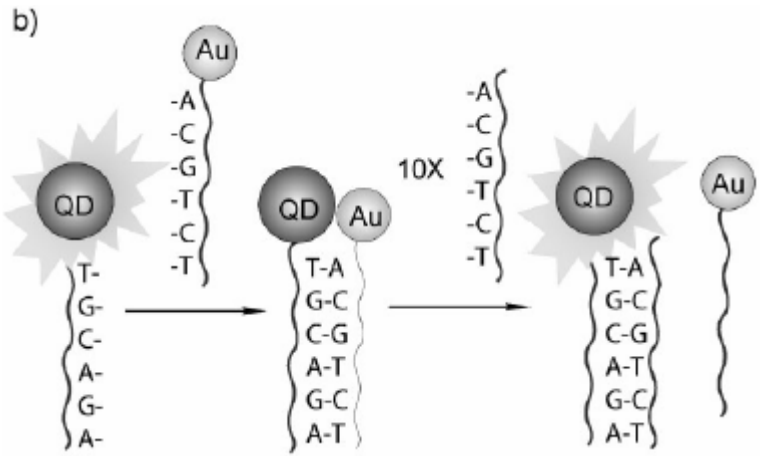
Incubate with protease then add to to > 4 nm pink-red gold nanoparticles

Color does not change: protease is present (cleaved peptide is unable to induce nanoparticle aggregation)

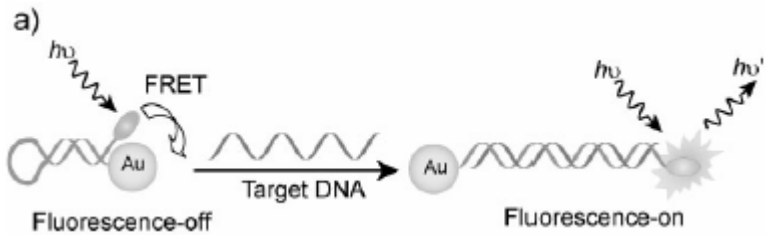
Color turns to blue-violet: protease is absent (uncleaved peptide induces nanoparticle aggregation)



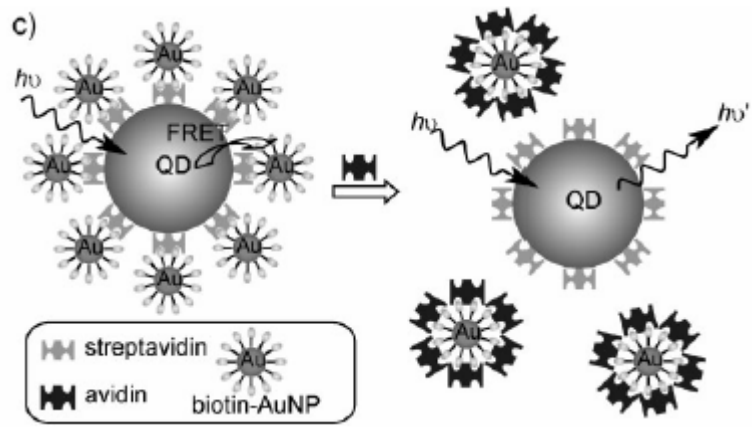
Nanoparticelle d'oro: quenching dell'emissione



Interruzione di queching per scambio



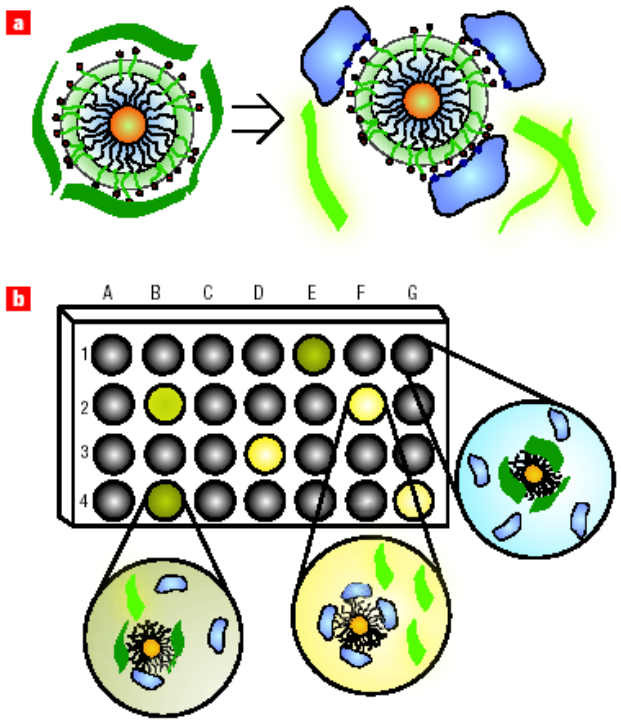
Interruzione di queching per variazione conformazionale

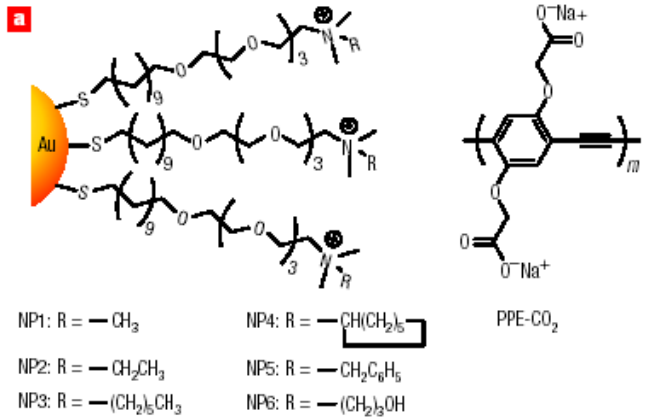


Interruzione di queching per scambio

Nanoparticelle d'oro: aggregazione e colore

Naso elettronico per la determinazione di proteine





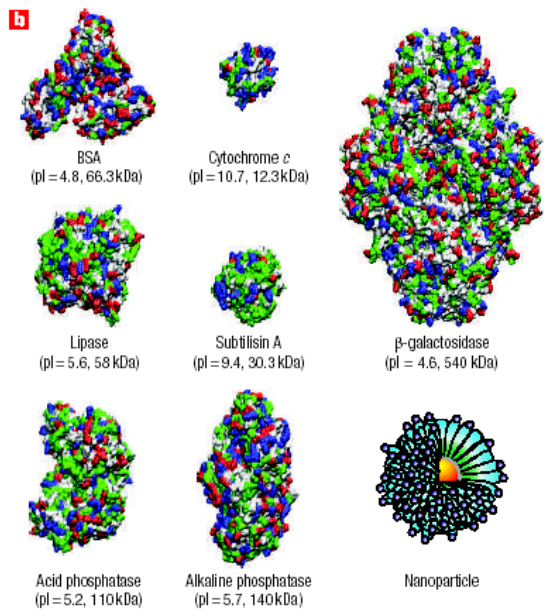


Figure 1 Fluorophore displacement protein sensor array. a, Displacement of quenched fluorescent polymer (dark green strips, fluorescence off; light green strips, fluorescence on) by protein analyte (in blue) with concomitant restoration of fluorescence. The particle monolayers feature a hydrophobic core for stability, an oligo(ethylene glycol) layer for biocompatibility, and surface charged residues for interaction with proteins. **b**, Fluorescence pattern generation through differential release of fluorescent polymers from gold nanoparticles. The wells on the microplate contain different nanoparticle–polymer conjugates, and the addition of protein analytes produces a fingerprint for a given protein.

Nanoparticelle d'oro: aggregazione e colore

Naso elettronico per la determinazione di proteine

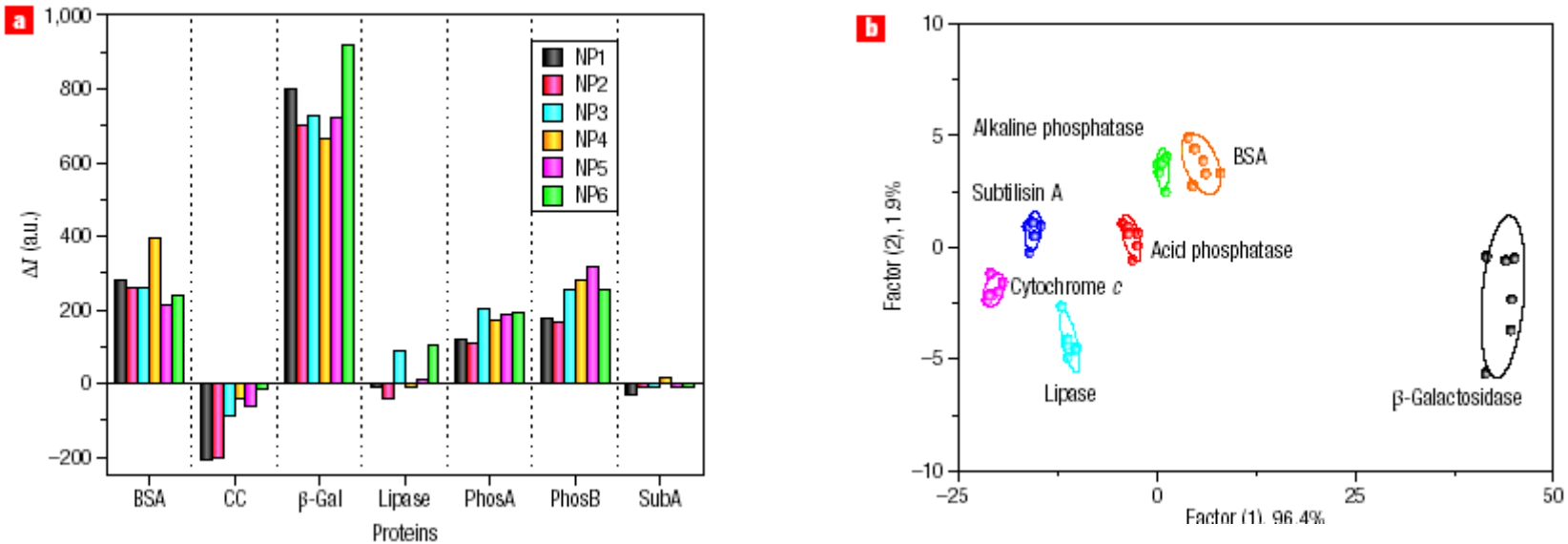
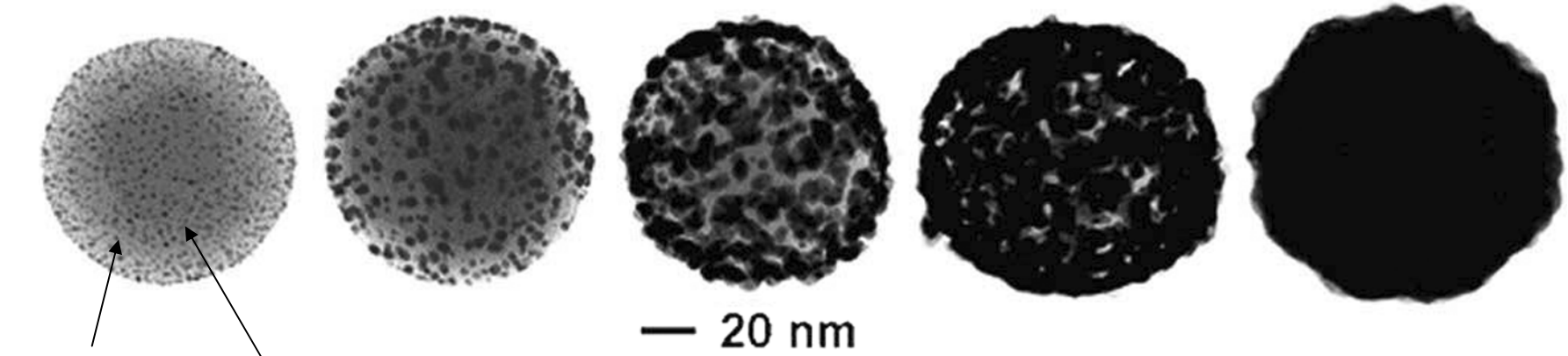
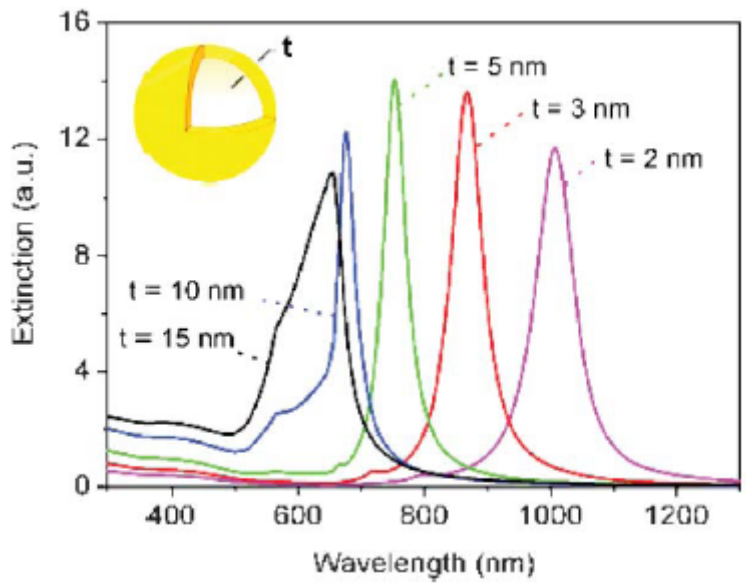


Figure 4 Array-based sensing of protein analytes at 5 μM. a, Fluorescence response (ΔI) patterns of the NP–PPE sensor array (NP1–NP6) against various proteins (CC, cytochrome *c*; β-Gal, β-galactosidase; PhosA, acid phosphatase; PhosB, alkaline phosphatase; SubA, subtilisin A). Each value is an average of six parallel measurements. **b**, Canonical score plot for the first two factors of simplified fluorescence response patterns obtained with NP–PPE assembly arrays against 5 μM proteins. The canonical scores were calculated by LDA for the identification of seven proteins. The 95% confidence ellipses for the individual proteins are also shown.

C.-C. YOU, O. R. MIRANDA, B. GIDER1, P. S. GHOSH, I.-B. KIM, B. ERDOGAN1, S. A. KROVI, U. H. F. BUNZ, VINCENT M. ROTELLO
nature nanotechnology VOL 2 |MAY 2007 , page 318

Gold nanoshell





Gold nanords

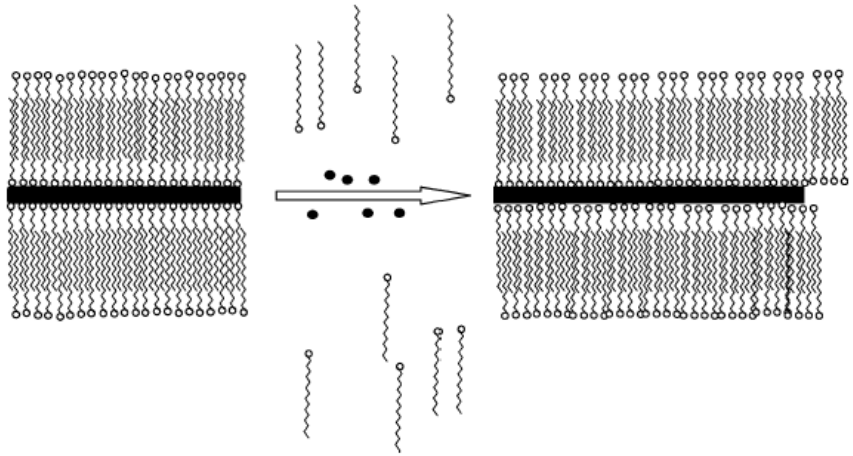
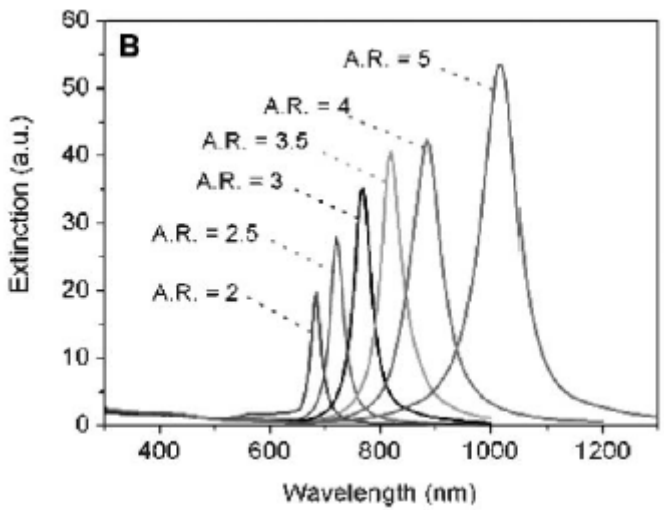
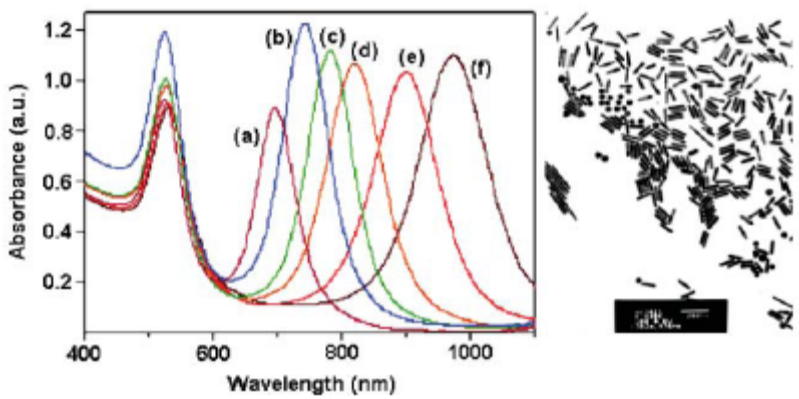


Figure 7. Cartoon illustrating "zipping": the formation of the bilayer of CnTAB (squiggles) on the nanorod (black rectangle) surface may assist nanorod formation as more gold ion (black dots) is introduced. Reproduced from ref 104 with permission.





Terapia fototermica

In vitro

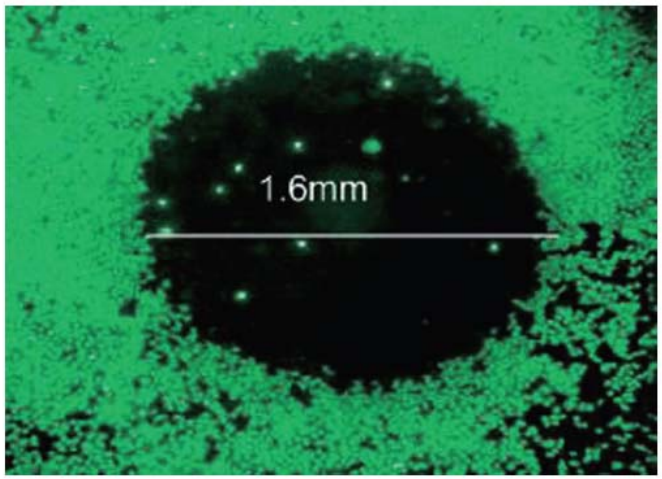


Figure 1.19 PC-3 prostatic cancer cells treated with gold nanoshells and exposed to NIR laser light focused to a spot size of 1.6 mm. Calcein viability staining reveals selective destruction of cells within the laser spot [98].

In vivo

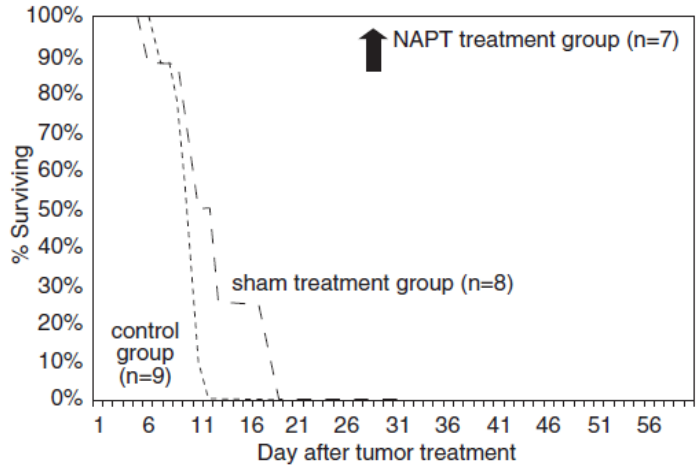


Figure 1.20 Survival rates of control, sham and treatment groups of mice undergoing nanoshell-assisted photothermal therapy (NAPT) of cancer [84]

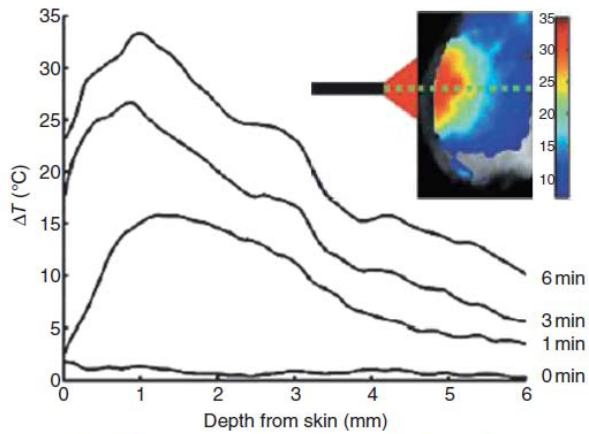


Figure 1.21 Net temperature change (°C) as a function of skin depth for various NIR exposure times [4].

SERS

Nanostrutture metalliche, per motivi ancora da definire, amplificano il segnale di scattering raman di molecole assorbite sulla superficie.

E’ possibile effettuare analisi con elevata sensibilità