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**Cancer Biomarker Detection in Serum Samples using Surface  
Plasmon Resonance and Quartz Crystal Microbalance Sensors  
with Nanoparticle Signal Amplification**

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## TABLES

**Supplementary Table 1.** The summary of the PSA detection assay results obtained using Biacore 3000 biosensor.

		<b>Direct assay</b>	<b>Sandwich assay with PSA antibody</b>	<b>Sandwich assay with PSA antibody modified 20 nm Au nanoparticles</b>	<b>Sandwich assay with PSA antibody modified 40 nm Au nanoparticles</b>
PSA in buffer	LOD (ng ml <sup>-1</sup> )	18.8	9.4	0.5	-
	Equation	$y = 0.72x + 0.34$ (R <sup>2</sup> = 97)*	$y = 0.80x + 0.65$ (R <sup>2</sup> = 0.99)*	$y = 0.59x + 1.58$ (R <sup>2</sup> = 0.99)*	-
PSA spiked in 75% human serum	LOD (ng ml <sup>-1</sup> )	n/a	18.8	2.3	0.29
	Equation	n/a	$y = 1.04x + 0.03$ (R <sup>2</sup> = 0.98)* CV = 5 to 14 %	$y = 0.73x + 1.00$ (R <sup>2</sup> = 0.99)* CV = 7 to 22 %	$y = 1,391.12\ln(x) + 1,173.16$ (R <sup>2</sup> = 0.96) CV = 1 to 8 %

\* y = log (response)    x = log (concentration)

**Supplementary Table 2.** Examples of PSA assay in the literature performed using SPR biosensors.

Sensor surface format and/or amplification method	LOD for direct assay in buffer	LOD in buffer	LOD in serum	Assay reaction time	References
40 nm Au nanoparticle amplification, planar surface	-	-	0.29 ng mL <sup>-1</sup> 75% serum	6 min	Uludag & Tothill
20 nm Au nanoparticle amplification, planar surface	18.8 ng mL <sup>-1</sup>	0.5 ng mL <sup>-1</sup>	2.3 ng mL <sup>-1</sup> 75% serum	6 min	Uludag & Tothill
planar surface	20.7 ng mL <sup>-1</sup>	10.2 ng mL <sup>-1</sup>	18.1 ng mL <sup>-1</sup> 10% serum	10 min	(Cao et al., 2006)
HRP-labelled polyclonal antibody-functionalized ca. 20nm Au nanoparticle amplification, planar surface	56.9 ng mL <sup>-1</sup>	0.027 ng mL <sup>-1</sup>	-	10 min	(Cao and Sim, 2007)
planar surface	-	3.5 ng mL <sup>-1</sup>	-	12 min	(Saerens et al., 2005)
CM5 surface	-	0.19 ng mL <sup>-1</sup>	-	12 min	(Saerens et al., 2005)
20nm Au nanoparticle amplification, planar surface	10 ng mL <sup>-1</sup>	1 ng mL <sup>-1</sup>	-	19 min	(Huang et al., 2005)
10nm Au nanoparticle amplification, planar surface	60 ng mL <sup>-1</sup>	0.15 ng mL <sup>-1</sup>	-	30 min	(Besselink et al., 2004)
20nm Au nanoparticle amplification, planar surface	-	0.01 ng mL <sup>-1</sup>	-	8 hrs	(Choi et al., 2008)

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**Supplementary Table 3.** The summary of the PSA detection limit and detection ranges for some of the commercial ELISA kits and the developed assay.

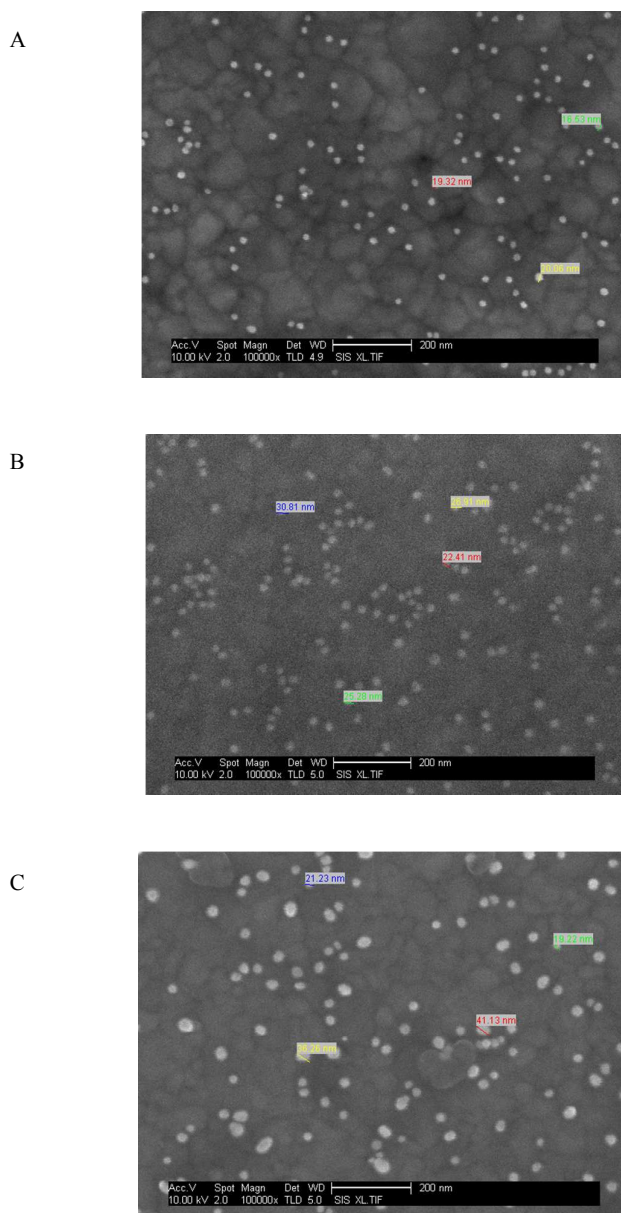
	<b>Detection range (ng mL<sup>-1</sup>)</b>	<b>Limit of detection (ng mL<sup>-1</sup>)</b>
The developed assay*	0.39 – 200	0.39
Abazyme PSA ELISA kit	1 - 80	1
MP Biomedicals PSA ELISA kit	2 - 120	1
Alpco Diagnostics PSA ELISA kit	2 - 120	1
Calbiotech PSA ELISA kit	0.585 - 50	0.585
Alpha Diagnostic PSA ELISA kit	0.3-60	0.30

\*Both detection range and limit is given based on 100% serum.

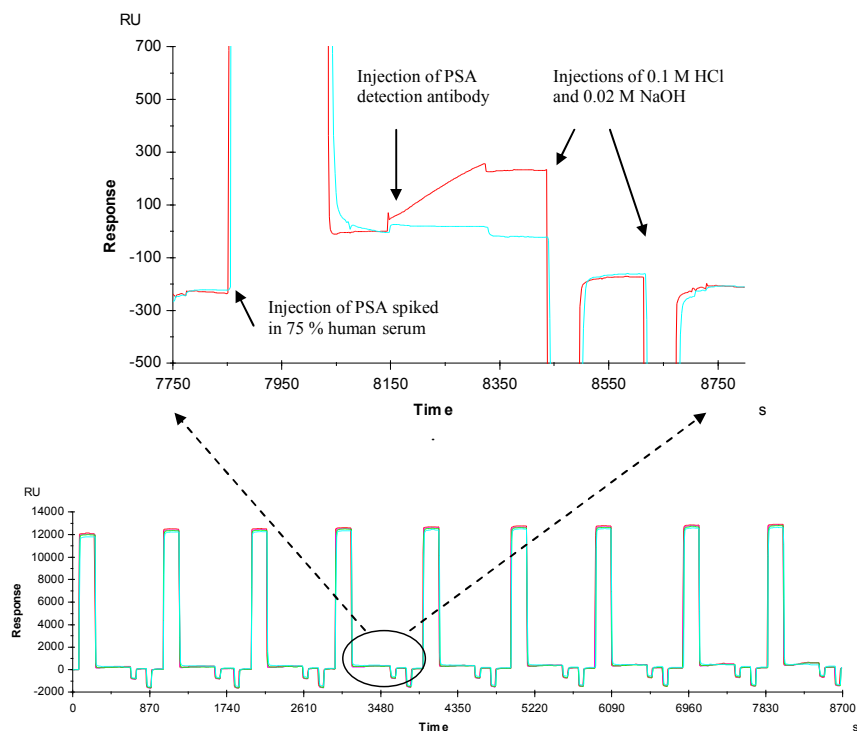
**Supplementary Table 4.** The kinetic data for PSA direct assay and detection limits using SPR and QCM biosensors.

	<b>SPR</b>	<b>QCM</b>
$K_D$	$9.46 \times 10^{-10} \text{ M}$	$5.56 \times 10^{-10} \text{ M}$
$k_a$	$2.08 \times 10^{+06} \text{ M}^{-1} \text{ s}^{-1}$	$1.23 \times 10^{+06} \text{ M}^{-1} \text{ s}^{-1}$
$k_d$	$1.97 \times 10^{-03} \text{ s}^{-1}$	$6.83 \times 10^{-04} \text{ s}^{-1}$
$R_{\text{max}}$	110 RU	108 Hz

## FIGURE



**Supplementary Figure 1.** SEM images of Au nanoparticles. The sizes of the 20 nm nanoparticles were measured as 16 to 20 nm before modification (A) and after antibody modification the sizes were measured between 22 to 31 nm (B). SEM image of 40 nm Au nanoparticles showed that the size of nanoparticles have a larger size variation that was between 20 to 41 nm (C), and this made it difficult to compare uncoated and antibody modified nanoparticles.



**Supplementary Figure 2.** Sensorgram of the detection of tPSA spiked in 75 % human serum at varying concentrations of PSA ( $2.3$  to  $150 \text{ ng mL}^{-1}$ ). After each binding assay the surface was regenerated with consecutive 60s injections of 100 mM HCl and 20 mM NaOH.