SUPPLEMENTARY INFORMATION

A Label-Free Electrochemical Impedance Cytosensor Based on Specific Peptide-Fused Phage Selected from Landscape Phage Library

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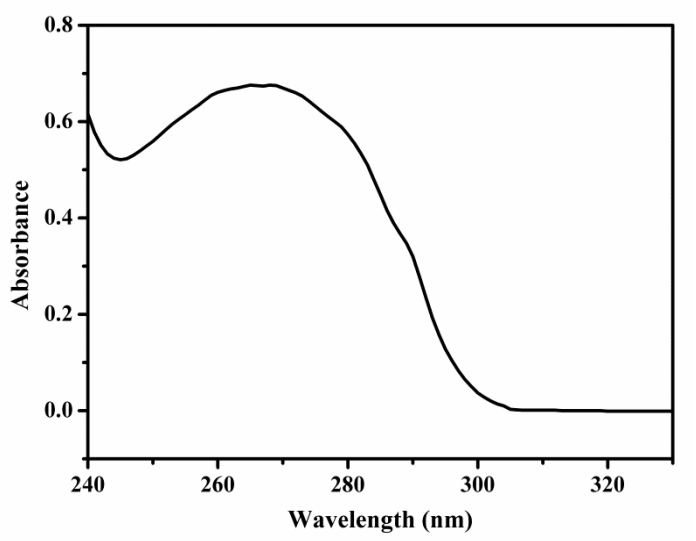

Figure S1. The typical UV spectrum of purified phage.

Table S1. Comparison of various cytosensors for detection of human cells

Cytosensor	Cell	Linear range (cells ml^{-1})	LOD (cells ml^{-1})	Reference
Aptamer/PTCA/CRGO/GCE impedance sensor	Hela	$1.0 \times 10^3 – 1.0 \times 10^6$	794	1
Enzyme-linked Con A/ 3D-architecture interface sensor	Hela	$8.0 \times 10^2 – 2.0 \times 10^7$	500	2
FA/PAMAM/AuNPs/GCPE cytosensor	Hela	$1.0 \times 10^2 – 1.0 \times 10^6$	100	3
VTA@MWCNTs impedance cytosensor	HL-60	$2.7 \times 10^2 – 2.7 \times 10^7$	90	4
FA/PEI/CMC-G impedance sensor	HL-60	$5.0 \times 10^2 – 5.0 \times 10^6$	500	5
SWCNTs-AuNPs-gelatin impedance sensor	HL-60	$1.0 \times 10^4 – 1.0 \times 10^7$	5.0×10^3	6
Enzyme-linked -peptide-SWNTs/GCE sensor	BGC-823	$1.0 \times 10^3 – 1.0 \times 10^7$	620	7
PLL/GCE impedance sensor	Jurkat	$5.0 \times 10^4 – 1.0 \times 10^7$	1.8×10^4	8
Au-cage/$Ru(bpy)_3^{2+}$-Con A electrochemiluminescence sensor	K562	$5.0 \times 10^2 – 5.0 \times 10^6$	500	9
APBA-MWCNTs/GCE impedance sensor	K562	$1.0 \times 10^3 – 1.0 \times 10^7$	1.0×10^3	10
CNF/CS/GCE impedance sensor	K562	$5.0 \times 10^3 – 1.0 \times 10^7$	1.0×10^3	11
Aptamer-nanoparticle strip biosensor	Ramos	$4.0 \times 10^3 – 2.0 \times 10^5$	800	12
Aptamer-CdSe NPs-PDDA photoelectrochemical cytosensor	CEM	$1.6 \times 10^2 – 1.6 \times 10^3$	80	13
Phage-based impedance sensor	SW620	$2.0 \times 10^2 – 2.0 \times 10^8$	79	this work

PTCA, 3,4,9,10-perylene tetracarboxylic acid;
CRGO, chemically reduced graphene oxide;
FA, folic acid;
PAMAM, poly(amidoamine);
GCPE, glassy carbon paste electrode;
VTA, 2-p-aminophenyl-1, 3, 2-dithiarsenolane;
MWCNTs, multi-walled carbon nanotubes;
PEI, polyethyleneimine;
CMC-G, carboxymethyl chitosan-functionalized graphene;
SWCNTs, single walled carbon nanotube;
AuNPs, gold nanoparticles;
PLL, poly-lysine;
APBA, 3-aminophenylboronic acid;

CNF, carbon nanofiber;

CS, chitosan;

PDDA, poly(dimethyldiallylammonium chloride).

References:

1. Feng L, Chen Y, Ren J, Qu X. A graphene functionalized electrochemical aptasensor for selective label-free detection of cancer cells. *Biomaterials* **32**, 2930-2937 (2011).
2. Zhang J-J, Cheng F-F, Zheng T-T, Zhu J-J. Design and implementation of electrochemical cytosensor for evaluation of cell surface carbohydrate and glycoprotein. *Anal. Chem.* **82**, 3547-3555 (2010).
3. Tepeli Y, Demir B, Timur S, Anik U. An electrochemical cytosensor based on a PAMAM modified glassy carbon paste electrode. *RSC Advances* **5**, 53973-53978 (2015).
4. Xu Y, *et al*. Sensitive detection of tumor cells by a new cytosensor with 3D-MWCNTs array based on vicinal-dithiol-containing proteins (VDPs). *Biosens. Bioelectron.* **66**, 321-326 (2015).
5. Yang G, Cao J, Li L, Rana RK, Zhu J-J. Carboxymethyl chitosan-functionalized graphene for label-free electrochemical cytosensing. *Carbon* **51**, 124-133 (2013).
6. Zhang J-J, Gu M-M, Zheng T-T, Zhu J-J. Synthesis of Gelatin-Stabilized Gold Nanoparticles and Assembly of Carboxylic Single-Walled Carbon Nanotubes/Au Composites for Cytosensing and Drug Uptake. *Anal. Chem.* **81**, 6641-6648 (2009).
7. Cheng W, Ding L, Lei J, Ding S, Ju H. Effective cell capture with tetrapeptide-functionalized carbon nanotubes and dual signal amplification for cytosensing and evaluation of cell surface carbohydrate. *Anal. Chem.* **80**, 3867-3872 (2008).
8. Huang B, Jia N, Chen L, Tan L, Yao S. Electrochemical impedance spectroscopy study on polymerization of L-lysine on electrode surface and its application for immobilization and detection of suspension cells. *Anal. Chem.* **86**, 6940-6947 (2014).
9. Ge L, Su M, Gao C, Tao X, Ge S. Application of Au cage/$Ru(bpy)_3^{2+}$ nanostructures for the electrochemiluminescence detection of K562 cancer cells based on aptamer. *Sensors Actuators B: Chem.* **214**, 144-151 (2015).
10. Zhong X, Bai H-J, Xu J-J, Chen H-Y, Zhu Y-H. A Reusable Interface Constructed by 3-Aminophenylboronic Acid-Functionalized Multiwalled Carbon Nanotubes for Cell Capture, Release, and Cytosensing. *Adv. Funct. Mater.* **20**, 992-999 (2010).
11. Hao C, Ding L, Zhang X, Ju H. Biocompatible Conductive Architecture of Carbon Nanofiber-Doped Chitosan Prepared with Controllable Electrodeposition for Cytosensing. *Anal. Chem.* **79**, 4442-4447 (2007).
12. Liu G, Mao X, Phillips JA, Xu H, Tan W, Zeng L. Aptamer−Nanoparticle Strip Biosensor for Sensitive Detection of Cancer Cells. *Anal. Chem.* **81**, 10013-10018 (2009).
13. Zhang X, Li S, Jin X, Li X. Aptamer Based Photoelectrochemical Cytosensor with layer-by-layer assembly of CdSe semiconductor nanoparticles as photoelectrochemically active species. *Biosens. Bioelectron.* **26**, 3674-3678 (2011).