1 Supporting Information for

2 Practical immune-barometer sensor for trivalent Chromium Ions
detection using gold core platinum shell nanoparticles Probes

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11 1. The amount of mAb-MBs added optimization

12 The procedures of optimized the amount of anti-Cr(III)-EDTA mAb - MBs were as
follows: For positive control, 1 \textmu{}L, 2 \textmu{}L, 4 \textmu{}L, 6 \textmu{}L and 8 \textmu{}L anti-Cr(III)-EDTA mAb
- MBs were mixed with 100 \textmu{}L 20 ng. mL\textsuperscript{-1}Cr(III) solution in 0.5 mM EDTA reagent
diluent. Then, 5 \textmu{}L Cr(III)-EDTA-BSA-Au@PtNPs were added into the solution. For
negative control, 1 \textmu{}L, 2 \textmu{}L, 4 \textmu{}L, 6 \textmu{}L and 8 \textmu{}L anti-Cr(III)-EDTA mAb - MBs were
mixed with 100 \textmu{}L PBS buffer and 5 \textmu{}L Cr(III)-EDTA-BSA-Au@PtNPs were added.
After washing, 200 \textmu{}L of 30\% H\textsubscript{2}O\textsubscript{2} were added and measured the pressure change by
barometer. The ratio of negative and positive values with different amount of anti-
Cr(III)-EDTA mAb - MBs was calculated.
2. Au@PtNPs labeled Cr(III)-EDTA-BSA optimization

1 μL, 2 μL, 3 μL, 4 μL, 5 μL and 6 μL 1mg/mL Cr(III)-EDTA -BSA were used to label 1 mL Au@PtNPs respectively. For positive control, 4 μL anti-Cr(III)-EDTA mAb - MBs were mixed with 100 μL 20 ng. mL-1 Cr(III) solution in 0.5 mM EDTA reagent diluent. Then, 5 μL Cr(III)-EDTA-BSA-Au@PtNPs were added into the solution. Cr(III)-EDTA-BSA-Au@PtNPs were added into the solution. For negative control, 4 μL anti-Cr(III)-EDTA mAb - MBs were mixed with 100 μL PBS buffer and 5 μL Cr(III)-EDTA-BSA-Au@PtNPs were added. After washing, 200 μL of 30% H2O2 were added and measured the pressure change by barometer. The ratio of negative and positive values with different amount of mAb labeled Au@PtNPs was calculated.

3. enzyme-linked immunosorbent assay (ELISA) for Cr(III) detection

In a typical experimental procedure, 100 μL of 10 μg/mL Cr(III) antibody was first bound to a 96-well microplate well and incubated overnight at 4℃. Then, each well was washed three times with 300 μL Wash Buffer (0.05% Tween20 in PBS) and the remaining wash buffer was removed by inverting 96-well microplate well to blot it against clean paper towels each time. After that, 300 μL 1% BSA in PBS was added to block each well, incubated for 1 h at room temperature, and washed three times. A 100-μL aliquot of Cr (III) solution (0, 0.5, 1, 2, 4, 8, 16, 32, 64, 128 and 256 ng/mL) in 0.5 mM EDTA Reagent Diluent was added to the well. Subsequently, 100 μL of 0.2 μg/mL Cr(III)-EDTA-BSA -HRP was added and incubated for 1 h at room temperature. After repeated washing three times, 100 μL TMB substrate was add each well, incubated for 10 min in the dark at room temperature, and then 50 μL of 2 M H2SO4 were added to stop the reaction. The result was analyzed by ultraviolet–visible spectrophotometer.
**Result**

Fig. S1. a). The size distribution of Au@PtNPs by DLS. b). The zeta potential of Au@PtNPs.

Fig. S2. a). Optimized the amount of added mAb-MBs optimization. b) Optimized the amount of Au@PtNPs labeled Cr(III)-EDTA-BSA.
Fig. S3). The dynamic range and calibration curve of ELISA for Cr(III) detection ($R^2=0.996$). Each value presents the mean from 3 independent experiments ($n=3$).

Table S1. Intra-Assay and Inter-Assay Precision.

<table>
<thead>
<tr>
<th>Spiked concentrations (ng. mL$^{-1}$)</th>
<th>Measured Value (Mean, ng. mL$^{-1}$)</th>
<th>SD</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-Assay Precision 2.5</td>
<td>2.536</td>
<td>0.091</td>
<td>3.6</td>
</tr>
<tr>
<td>Inter-Assay Precision 2.5</td>
<td>2.452</td>
<td>0.213</td>
<td>8.7</td>
</tr>
<tr>
<td>Intra-Assay Precision 10</td>
<td>10.397</td>
<td>0.551</td>
<td>5.3</td>
</tr>
<tr>
<td>Inter-Assay Precision 10</td>
<td>9.762</td>
<td>1.093</td>
<td>11.2</td>
</tr>
<tr>
<td>Intra-Assay Precision 20</td>
<td>19.51</td>
<td>0.936</td>
<td>4.8</td>
</tr>
<tr>
<td>Inter-Assay Precision 20</td>
<td>19.14</td>
<td>1.971</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Notes: CV (%) is calculated from SD /Mean. ($n=3$). SD: Standard deviation. CV: Coefficient of variation