Lysozyme-stabilized bimetallic gold/silver nanoclusters as a turn on fluorescent probe for determination of ascorbic acid and acid phosphatase

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Fig.S1 FT-IR of the free template lysozyme (curve a) and Lys-Au/Ag NCs (curve b) Inset: Zeta potential measurement of Lys-Au/Ag NCs solution.
**Fig. S2** EDX spectrum collected for as-prepared Lys-Au/Ag NCs.

**Fig. S3** The fluorescence emission intensity of Lys-Au/Ag NCs in different pH environments incubated for 30 minutes.
**Fig.S4** The fluorescence emission intensity of Lys-Au/Ag NCs incubated with various NaCl or KCl concentrations for 30 minutes. (10 mmol/L citrate-citric acid buffer solution pH 5.0)

**Fig.S5** The fluorescence emission intensity of Lys-Au/Ag NCs in the presence of various kinds of biomolecules (200 μmol/L Glu, His, Try, Gly, 100 μmol/L AA, 0.4 mg/mL HAS, HB or Pep). (10 mmol/L citrate-citric acid buffer solution pH 5.0)
Fig.S6 The UV-Vis absorption spectra of Lys-Au/Ag NCs respectively incubated with 0 μmol/L (curve a), 50 μmol/L (curve b), 100 μmol/L (curve c) or 200 μmol/L AA (curve d) for 10 minutes.

Fig.S7 The temporal evolution of fluorescence emission intensity of Lys-Au/Ag NCs incubated with of 500 μmol/L PAA and 10 μg/mL ACP.
<table>
<thead>
<tr>
<th>Fluorophore</th>
<th>Sensing system</th>
<th>Dynamic range</th>
<th>Detection limit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon quantum dot</td>
<td>Turn off-on/ Cr(VI)ions-AA</td>
<td>5-200 μmol/L</td>
<td>1.35 μmol/L</td>
<td>33</td>
</tr>
<tr>
<td>Carbon dots</td>
<td>Turn off/ Cu^{2+} ions-AA</td>
<td>0.057-4.0 μmol/L</td>
<td>18 nmol/L</td>
<td>34</td>
</tr>
<tr>
<td>Graphitic carbon nitride nanosheets</td>
<td>Turn off-on/ Cr(VI)ions-AA</td>
<td>0.6-300 μmol/L</td>
<td>0.15 μmol/L</td>
<td>35</td>
</tr>
<tr>
<td>Carbon dots</td>
<td>Turn off/ Fe^{3+} ions-AA</td>
<td>24-40 μg/mL</td>
<td>–</td>
<td>36</td>
</tr>
<tr>
<td>Carbon quantum dots/AuNCS nanohybrid</td>
<td>Turn off-on/ Cd^{2+} ions-AA</td>
<td>0.15-15 μmol/L</td>
<td>0.105 μmol/L</td>
<td>37</td>
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<tr>
<td>Silver/carbon nanohybrid</td>
<td>Turn off-on/ Fe^{3+} ions-AA</td>
<td>0.2-60 μmol/L</td>
<td>25 nmol/L</td>
<td>38</td>
</tr>
<tr>
<td>Gold nanoclusters</td>
<td>Turn off-on/ I ions-AA</td>
<td>0.1-10 μmol/L</td>
<td>22 nmol/L</td>
<td>39</td>
</tr>
<tr>
<td>Au nanoclusters-PbS quantum dot</td>
<td>Turn off/ AA-quenching</td>
<td>3-40 μmol/L</td>
<td>1.5 μmol/L</td>
<td>40</td>
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<tr>
<td>CdTe quantum dot</td>
<td>Turn off-on/ 4-AP-AA</td>
<td>0.022-0.44mmol/L</td>
<td>4.33 μmol/L</td>
<td>41</td>
</tr>
<tr>
<td>Lyz-Au nanoclusters</td>
<td>Turn-on/ AA-enhancing</td>
<td>0.2-200 μmol/L</td>
<td>0.12 μmol/L</td>
<td>This method</td>
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</tbody>
</table>

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<tr>
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<th>Dynamic range</th>
<th>Detection limit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuInS₂ quantum dots</td>
<td>Turn-off-on-off/ Cu^{2+}-ATP-ACP</td>
<td>6.4-192 nU/mL</td>
<td>3.1nU/mL</td>
<td>24</td>
</tr>
<tr>
<td>Carbon quantum dots</td>
<td>Turn-off-on-off/ Ni^{2+}-pyrophosphate-ACP</td>
<td>18.2-1300 U/L</td>
<td>5.5 U/L</td>
<td>25</td>
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<tr>
<td>Gold nanoclusters</td>
<td>Turn-off-on-off/ Fe^{3+}-pyrophosphate-ACP</td>
<td>1-30 nmol/L</td>
<td>1 nmol/L</td>
<td>26</td>
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<tr>
<td>Copper nanoclusters</td>
<td>Turn-on-off/ pH-Fe(III) pyrophosphate (FePPi₂) complex-ACP</td>
<td>3.1-100 U/L</td>
<td>0.8 U/L</td>
<td>27</td>
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<tr>
<td>Anionic polymer</td>
<td>Turn-off-on-off/ Fe^{3+}-pyrophosphate-ACP</td>
<td>4-28 nmol/L</td>
<td>–</td>
<td>28</td>
</tr>
<tr>
<td>Lyz-Au/Ag NCs</td>
<td>Turn-on/ PAA-ACP</td>
<td>100-12500ng/mL</td>
<td>53ng/mL</td>
<td>This method</td>
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</table>
Table S3 Determination of ACP in fetal bovine serum samples according to equation (2)

<table>
<thead>
<tr>
<th>Serum samples</th>
<th>Added ACP (ng/mL)</th>
<th>Detected ACP (ng/mL)</th>
<th>Recovery (%)</th>
<th>RSD (n=3, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>94</td>
<td>94</td>
<td>4.8</td>
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<tr>
<td>2</td>
<td>500</td>
<td>532</td>
<td>106</td>
<td>3.9</td>
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