Supplementary Material

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S-1. UV-Vis spectra of gold reduced by (HRE)-SubE virus over 4 hours sampled every 30 seconds in a septum sealed 1.5 mL quartz cuvette in water.

S-2. Time plots of absorbance at 550 nm for reduction of $AuCl_4^-$ with (HRE)-SubE, Wild type virus, and SubE virus expressed in yeast in water.

S-3. Time plots of absorbance at 550 nm for $AuCl_4^-$ with HRE peptide, YHRE peptide, Y_4HRE peptide, and the tripeptide of YYY in water.

S-4. Time plots of fluorescence over four hours of (HRE)-SubE with $AuCl_4^-$ in water. Excited at 270 nm and 295 nm, while fluorescence was monitored at 352 nm. Excitation slit set at 10 nm, emission slit at 5 nm, 30 second cycles, average time 1 second, PMT voltage 800 V.

S-5. Spatial relationship between tyrosine and tryptophan residues within CCMV subunit.

S-6. Time plot of fluorescence for $AuCl_4^-$/YYY tripeptide in water with same parameters as S-4.

S-7. Gold titration plot of (HRE)-SubE virus. 20 μL of purified (HRE)-SubE (stock concentration 0.2 μg/μl) was added to 750 μL of a 50 mM HEPES buffer pH 7.5 in a septum sealed 1.00 mL quartz cuvette. A 5 μL aliquot of a 1 mM stock solution of $HAuCl_4$ (Strem) was added to (HRE)-SubE and incubated at room temperature for 1 hour at which time the UV-Visible spectrum was obtained on a Hewlett Packard Agilent 8453 photodiode array spectrophotometer. Subsequent 5 μL additions followed with 1 hour incubation period between additions and monitored until the absorbance at 550 nm became constant.

S-8. Time plots of absorbance for the metal precursors of Ag^{+}, $PtCl_6^{2-}$, and $PdCl_6^{2-}$ with (HRE)-SubE virus. Absorbance monitored at 300 nm for $PdCl_6^{2-}$/SubE, at 410 nm for Ag^{+}, and at 600 nm for $PtCl_6^{2-}$.

S-9. Time plots of absorbance at 550 nm of (HRE)-SubE/$AuCl_4^{-}$ buffered over the pH range of 4.0 – 9.0 with acetate, phosphate, borate, and Tris buffers prepared at 50 mM and adjusted with HCl or NaOH to desired pH.

S-10. pH profile of (HRE)-SubE reduction of gold vs absorbance at 550 nm at 4 hours from time plots.

S-11. TEM micrographs of native viral capsids negatively stained with 2 % uranyl acetate. (A) (HRE)-SubE capsid. (B) Wild type capsid. (C) SubE capsid expressed in yeast.

S-12. TEM histograms of gold reduced by virus in water. (A) (HRE)-SubE/Au^0. (B) Wild type/Au^0. (C) SubE (yeast)/Au^0.

S-13. EDS spectra of viral/Au^0 nanoparticle structure (negatively stained with 2 % uranyl acetate). Copper peaks are from TEM grid.

S-14. TEM image of $AuCl_4^{-}$ reduced by YYY tripeptide in water.

S-15. TEM micrographs of Au^0/virus structures from borohydride reduction of virus saturated with $AuClP(CH_3)_3$. (A) SubE (yeast)/Au^0. (B) Wild type virus/Au^0.

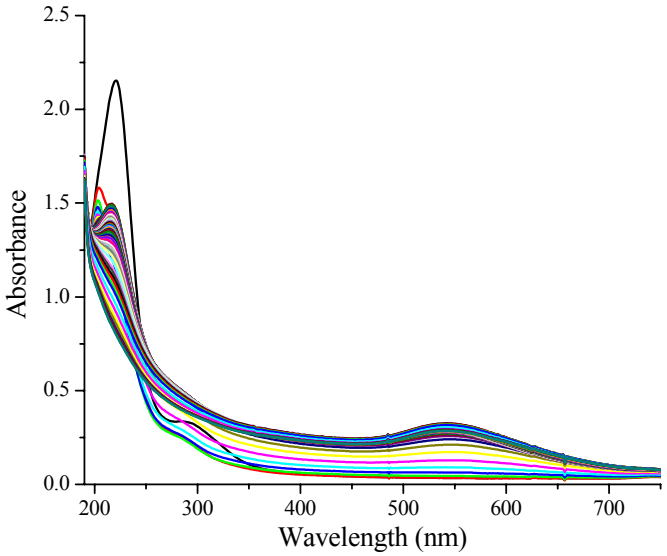
S-16. TEM histograms of Au^0 from S-15. (A) Au^0/(HRE)-SubE. (B) Au^0/Wild type. (C) Au^0/SubE (yeast).

S-17. TEM images of Au^0/SubE (yeast) from borohydride reduction of $AuClP(CH_3)_3$ tilt at -40°, -20°, 0°, +20°, and +40° with respect to image plane.

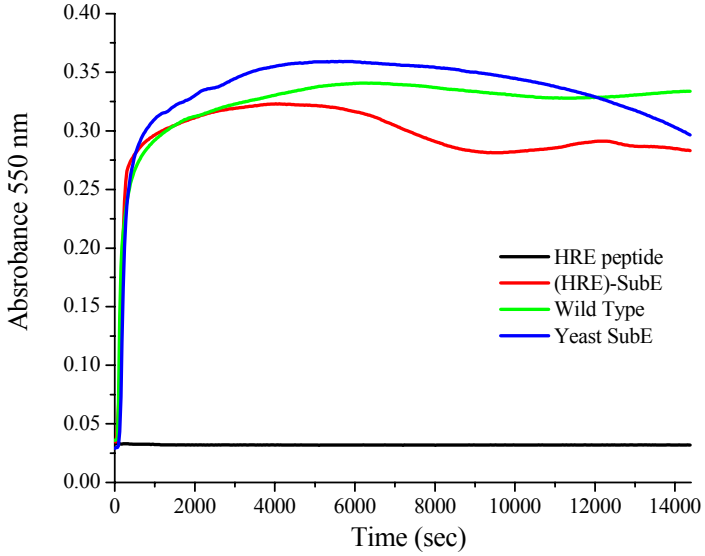
S-18. TEM of Au^0/SubE (yeast) diluted 10 fold from concentrated sample.

S-19. UV-Vis absorbance spectra of Au^0/SubE (yeast) from $AuClP(CH_3)_3$ (diluted 10 fold) and Au^0 from virus modified with diethylpyrocarbonate (undiluted).

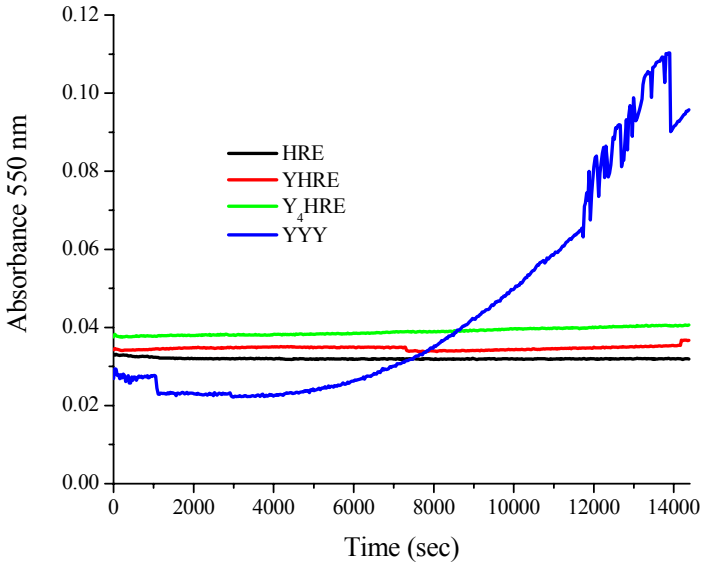
S-1.


Absorbance
Wavelength (nm)
2.5
2.0
1.5
1.0
0.5
0.0
200
300
400
500
600
700

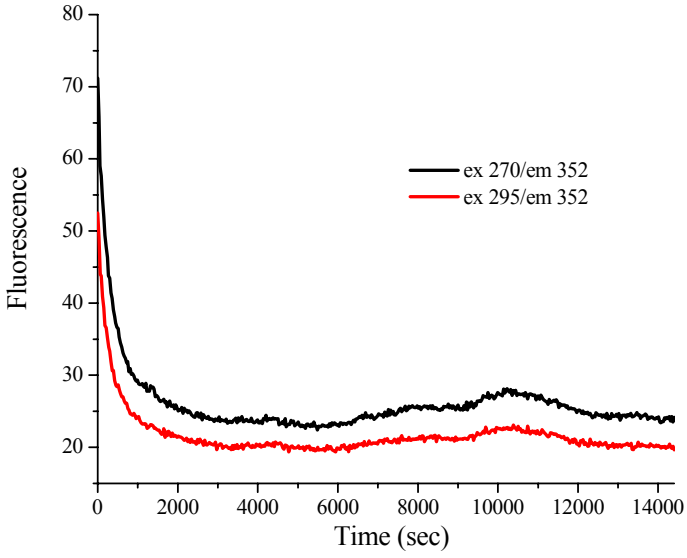
S-2.


Absrobance 550 nm
Time (sec)
HRE peptide
(HRE)-SubE
Wild Type
Yeast SubE
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000
12000
14000

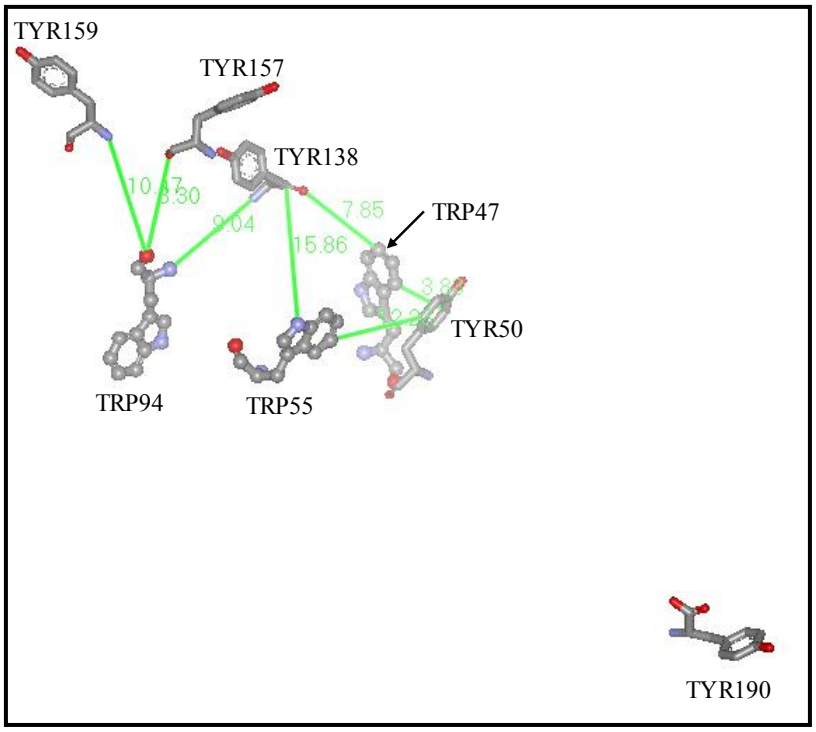
S-3.


Absorbance 550 nm
Time (sec)
HRE
YHRE
Y4HRE
YYY
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
2000
4000
6000
8000
10000
12000
14000

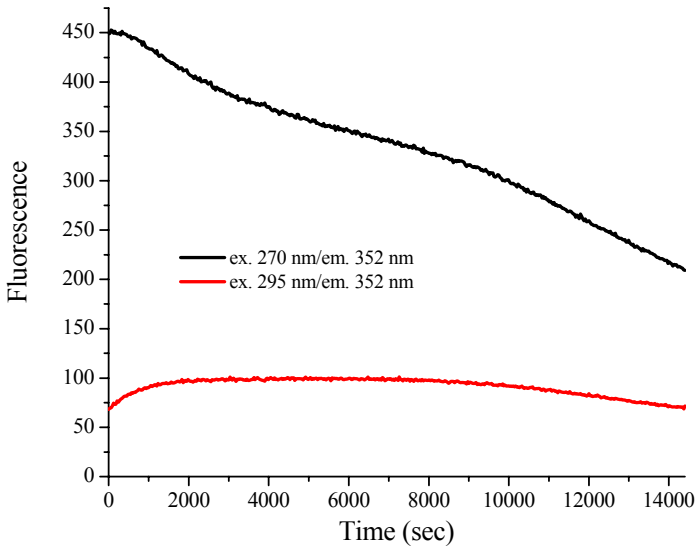
S-4.


Fluorescence
Time (sec)
ex 270/em 352
ex 295/em 352
80
70
60
50
40
30
20
0
2000
4000
6000
8000
10000
12000
14000

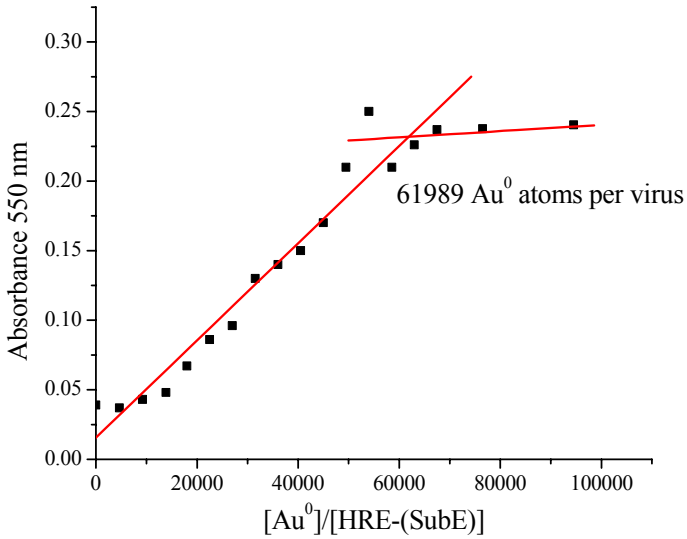
S-5.


TYR159
TYR157
TYR138
10.47
3.30
9.04
7.85
15.86
TRP47
TYR50
TRP94
TRP55
TYR190

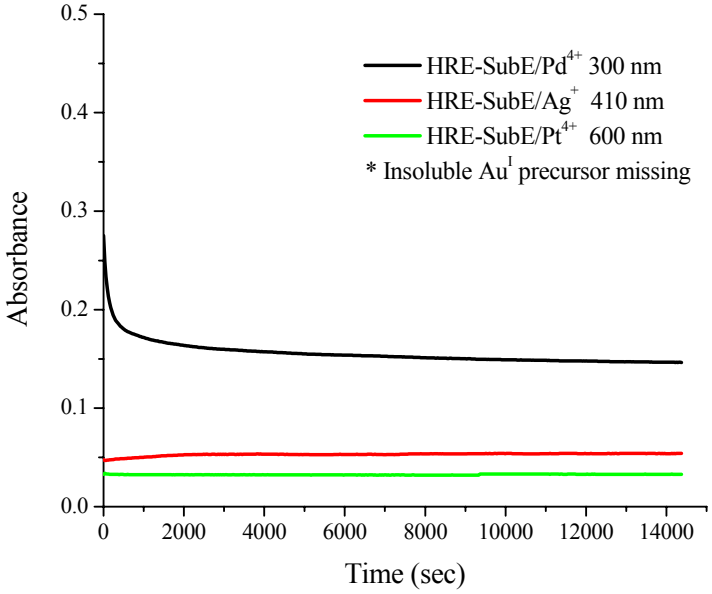
S-6.


Fluorescence
Time (sec)
ex. 270 nm/em. 352 nm
ex. 295 nm/em. 352 nm
0
50
100
150
200
250
300
350
400
450
0
2000
4000
6000
8000
10000
12000
14000

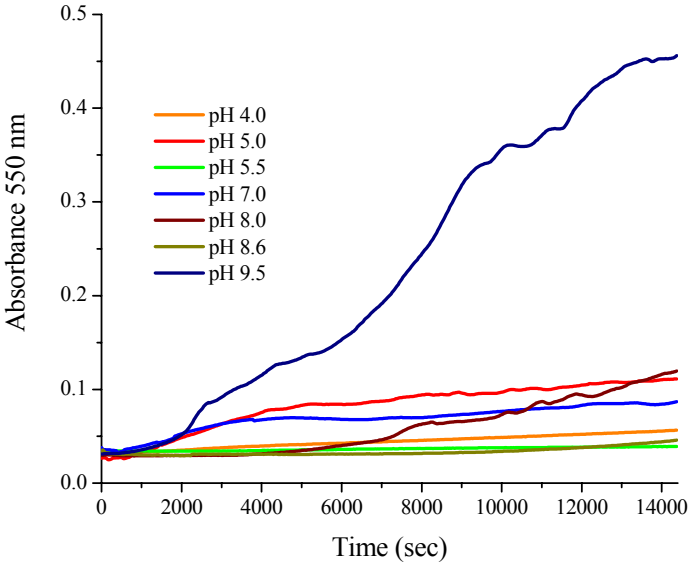
S-7.


Absorbance 550 nm
[Au0]/[HRE-(SubE)]
61989 Au0 atoms per virus
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
20000
40000
60000
80000
100000

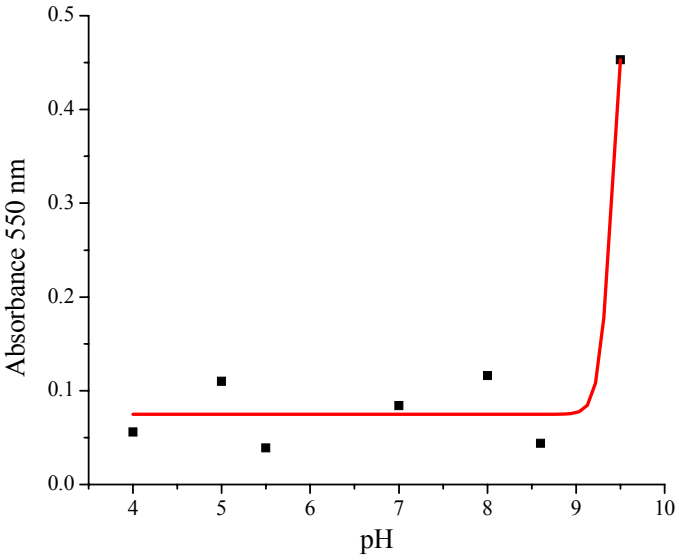
S-8.


Absorbance
Time (sec)
HRE-SubE/Pd4+ 300 nm
HRE-SubE/Ag+ 410 nm
HRE-SubE/Pt4+ 600 nm
* Insoluble AuI precursor missing

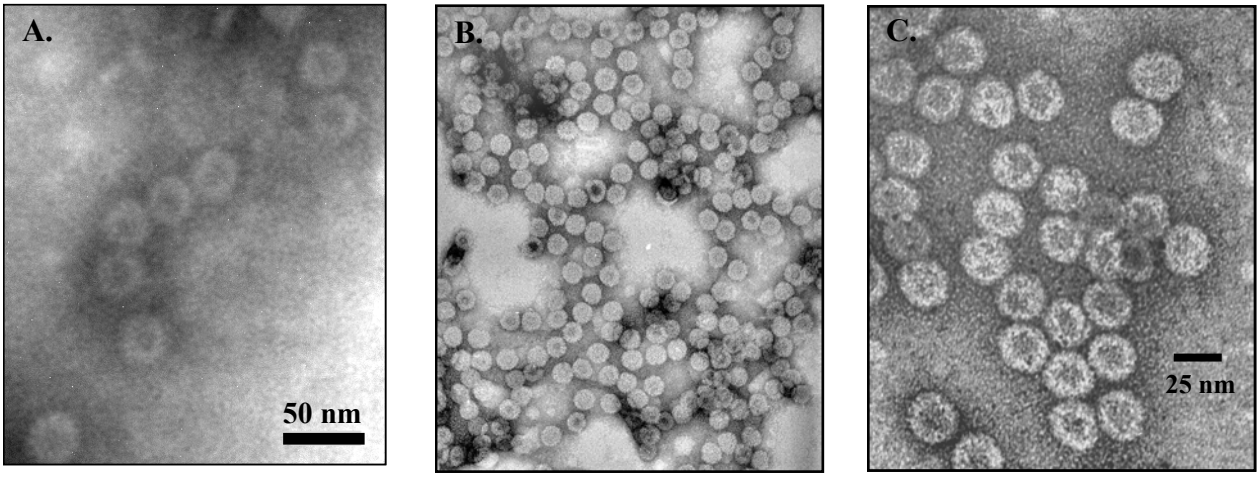
S-9.


Absorbance 550 nm
Time (sec)
pH 4.0
pH 5.0
pH 5.5
pH 7.0
pH 8.0
pH 8.6
pH 9.5

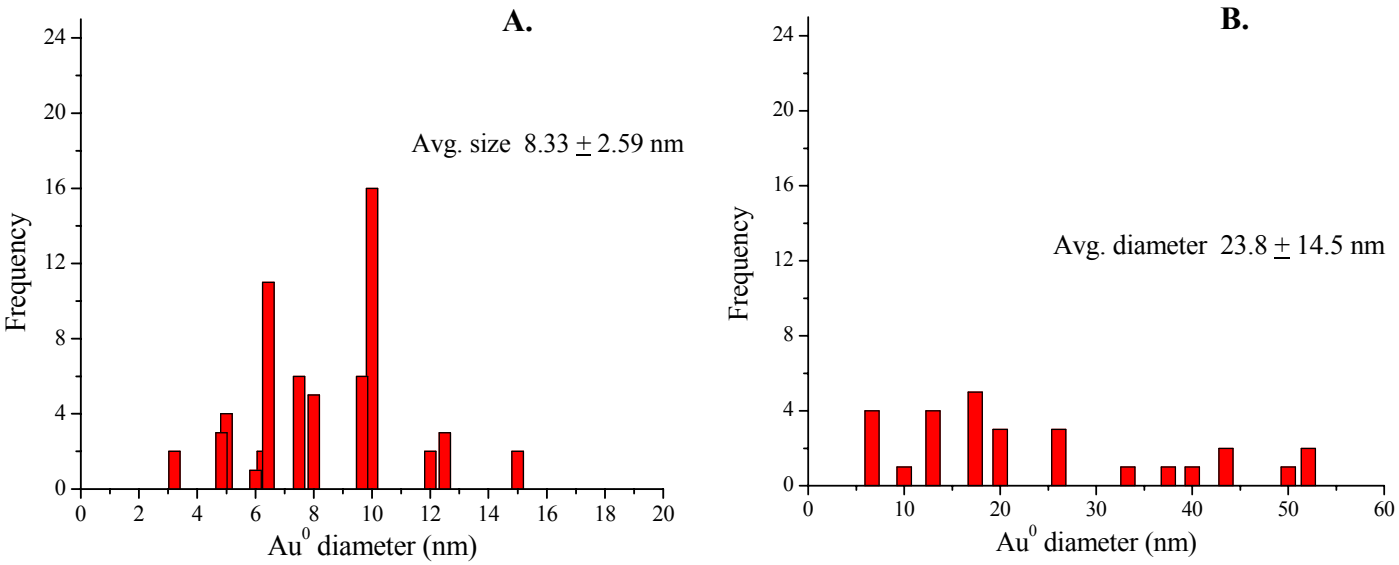
S-10.


Absorbance 550 nm
pH

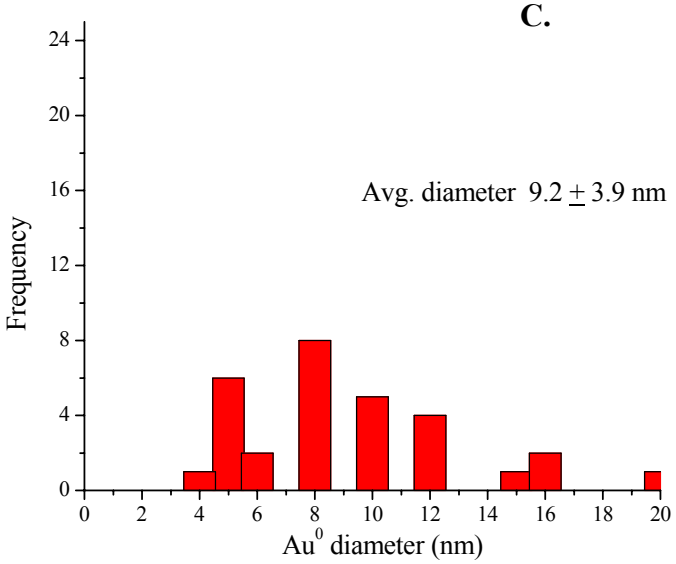
S-11.


A.
50 nm
B.
C.
25 nm

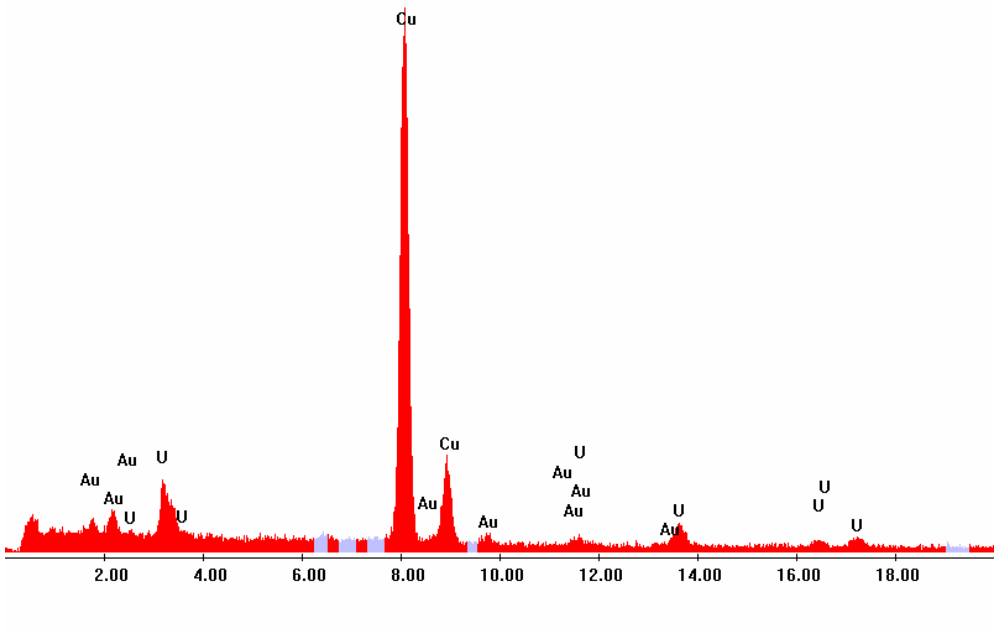
S-12.


A.
Avg. size 8.33 ± 2.59 nm
Frequency
Au0 diameter (nm)
B.
Avg. diameter 23.8 ± 14.5 nm
Frequency
Au0 diameter (nm)

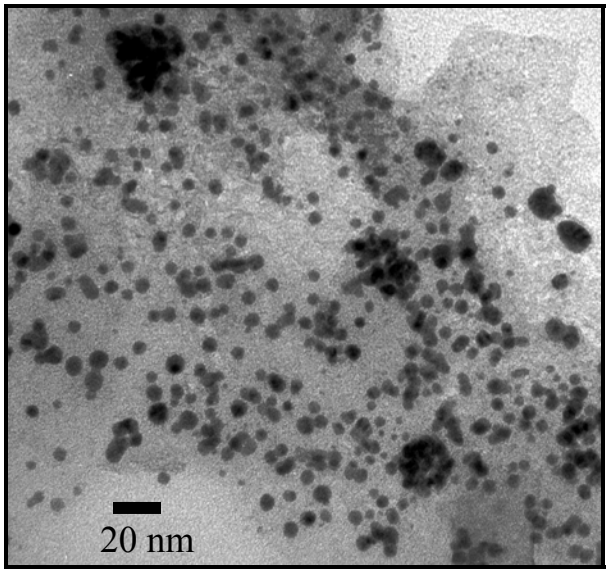
C.


Avg. diameter 9.2 ± 3.9 nm
Frequency
Au0 diameter (nm)
0
4
8
12
16
20
24
0
2
4
6
8
10
12
14
16
18
20

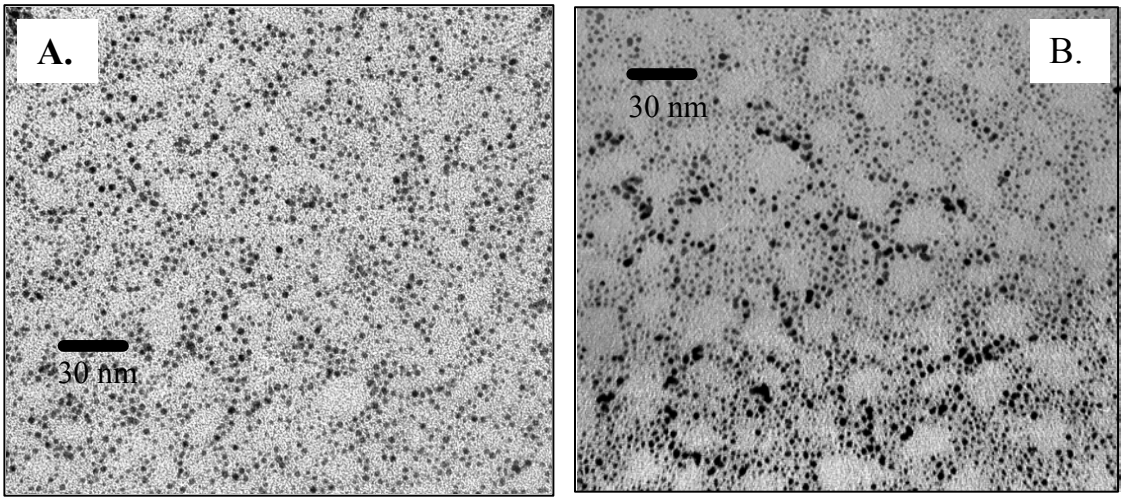
S-13.


Cu
Au
Au
Au
U
U
Au
U
Cu
Au
Au
U
Au
Au
Au
U
Au
U
U
U
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00

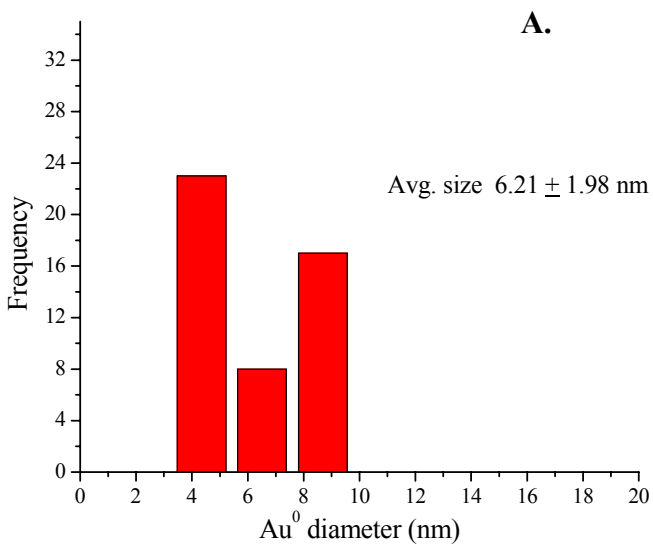
S-14.

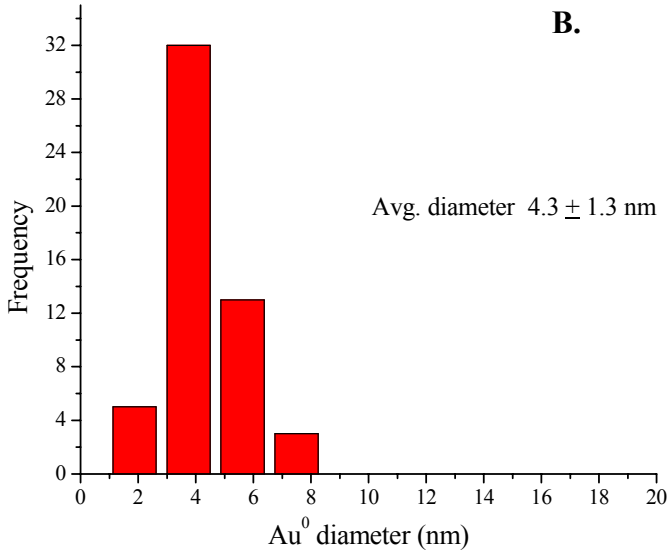


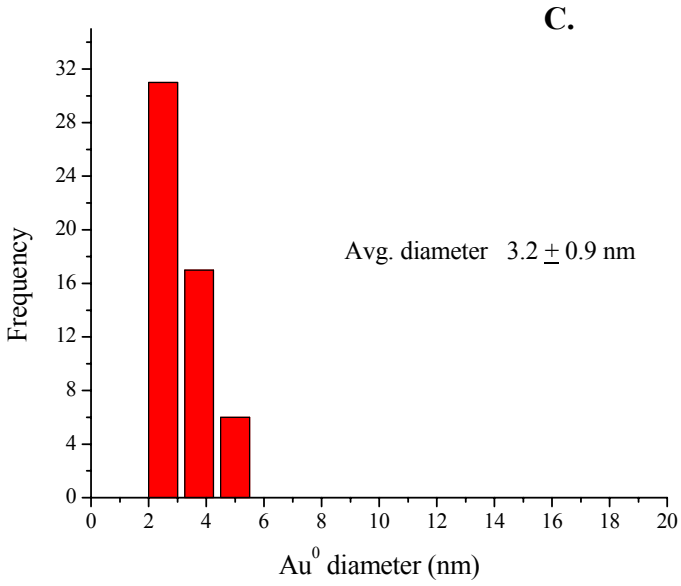
S-15.



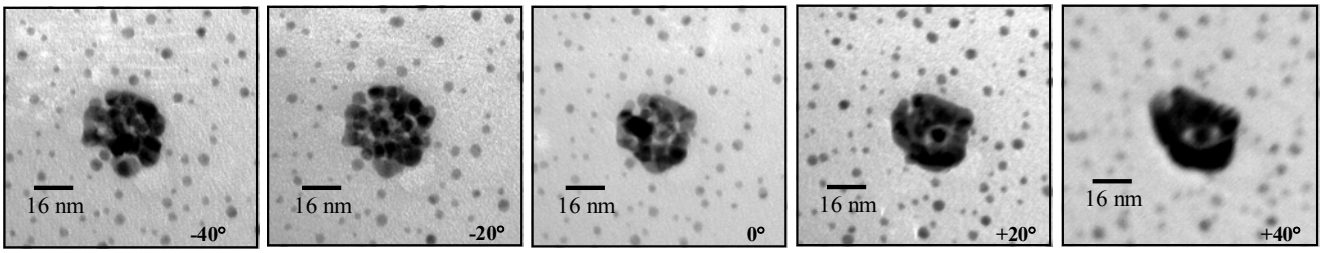
S-16.


A.
Avg. size 6.21 ± 1.98 nm
Frequency
Au0 diameter (nm)

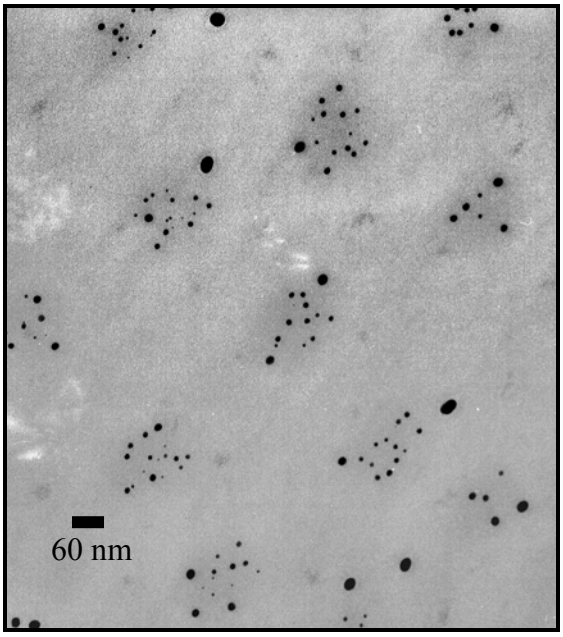

B.
Avg. diameter 4.3 ± 1.3 nm
Frequency
Au0 diameter (nm)


C.
Avg. diameter 3.2 ± 0.9 nm
Frequency
Au0 diameter (nm)

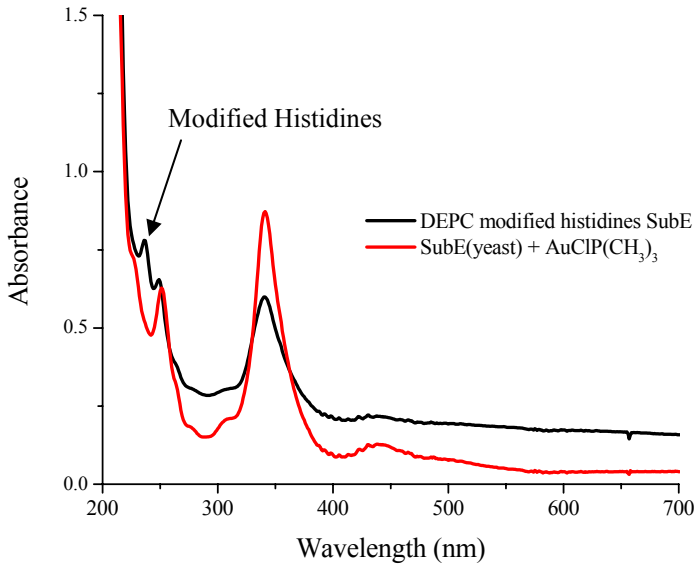
S-17.



S-18.



S-19.


Modified Histidines
DEPC modified histidines SubE
SubE(yeast) + AuClP(CH3)3
Absorbance
Wavelength (nm)
1.5
1.0
0.5
0.0
200
300
400
500
600
700