Supporting Information for:

Chrominance to Dimension: a Rapid and Real-time Method for Measuring the Size of Single Gold Nanoparticles

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1. Supplementary Methods

Data analysis: RGB to wavelength

The calculation process was carried out using the Matlab program. Each pixel in the color spot of a single nanoparticle in the dark-field image was translated into an RGB value, VR, VG, or VB. The intensity (I) of scattering light from GNPs was calculated by eq S-1 as below.

$$I=VR*0.299+VG*0.5876+VB*0.114 \quad \text{(S-1)}$$

The RGB values were converted into coordinates in the chromaticity diagram (Figure S-1). Then, the wavelengths and intensities of every pixel were calculated and wavelength with maximum intensity was considered as peak wavelength. The diameter of GNPs could be estimated by the relationship between the peak wavelength of scattering light and size. The detailed calculation process was illustrated in Figure S-2.

2. Supplementary Figuers:

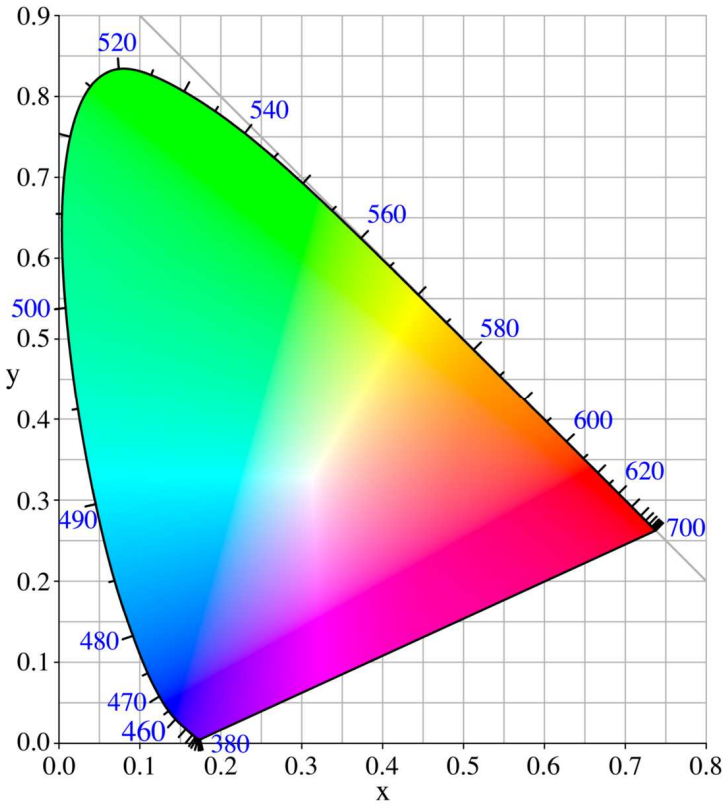

Figure S-1 The chromaticity diagram according to the 1931 Commission International de 1'Eclairage.[1]

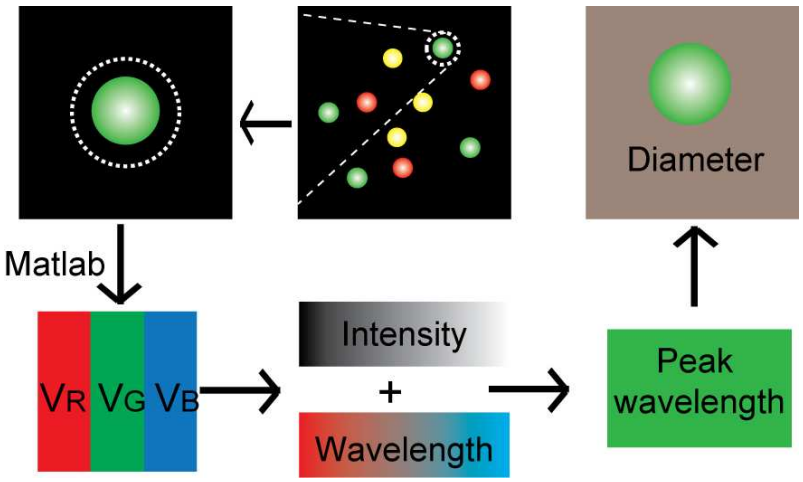

Figure S-2 The size calculation process of gold nanoparticles by Matlab.

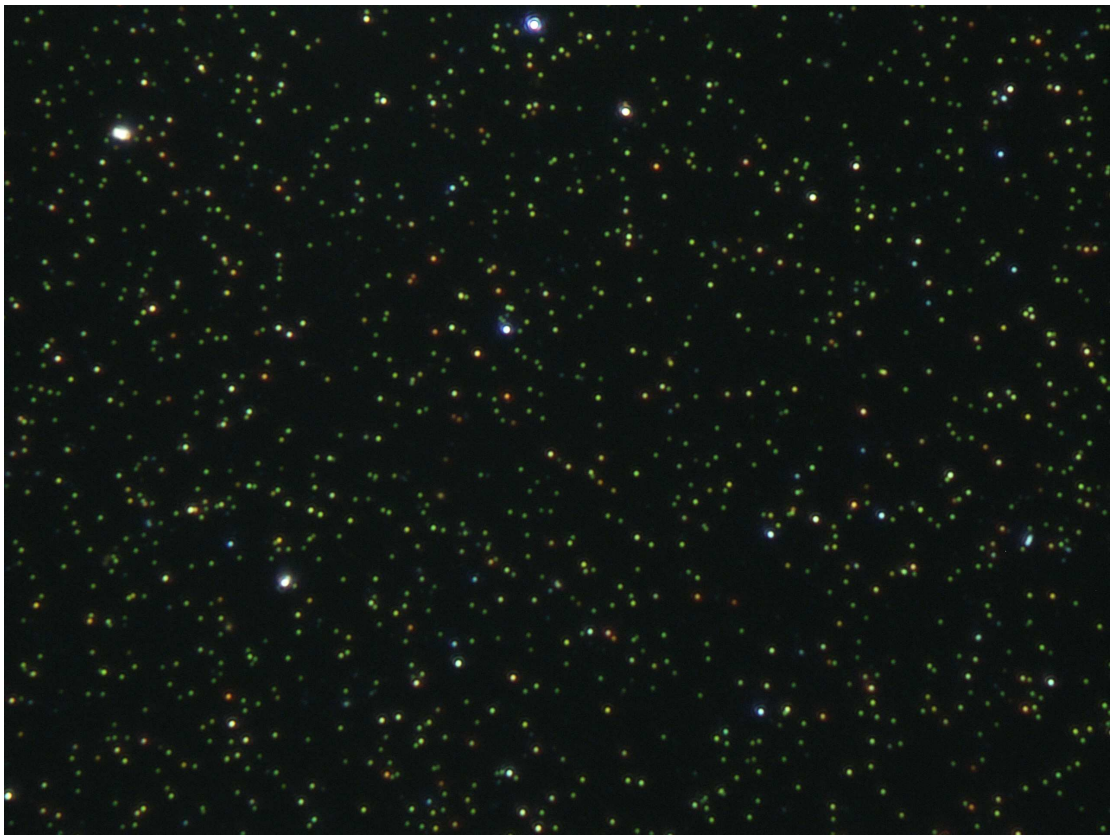

Figure S-3 Dark-field image of a mass of GNPs.

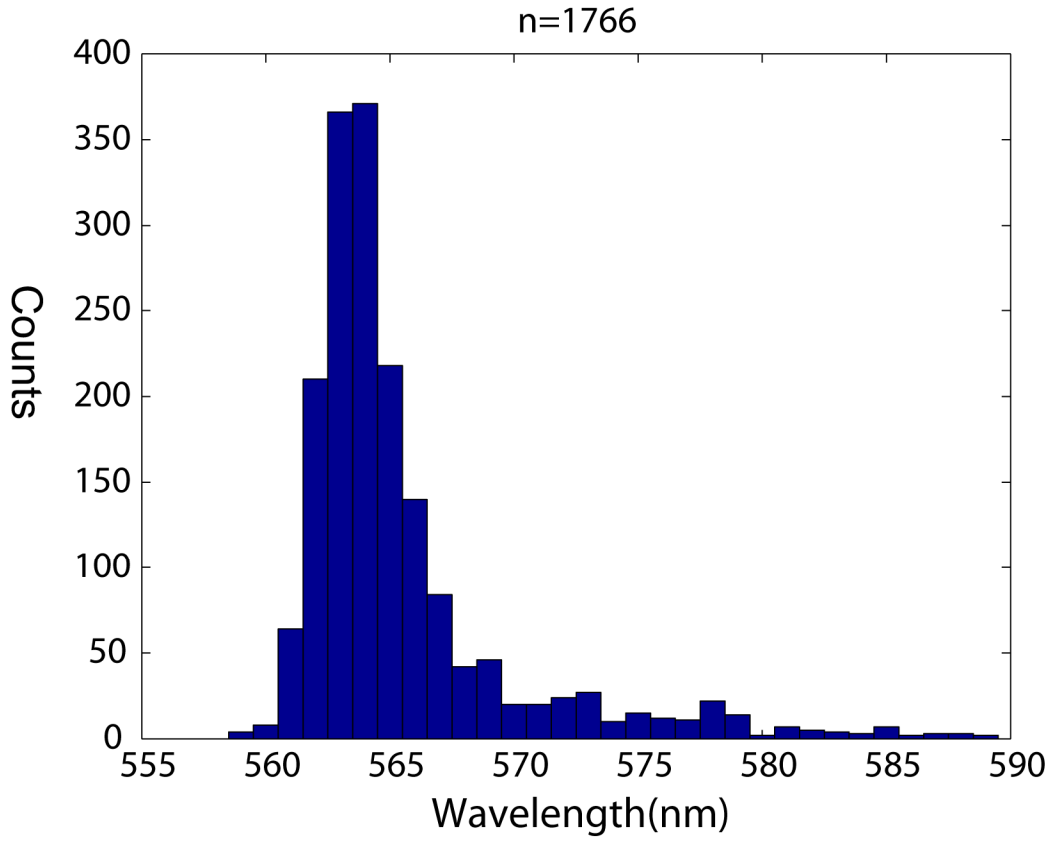

Figure S-4 The calculated wavelength peaks of scattering light from GNPs (N =1278) in Figure S-3 by Matlab.

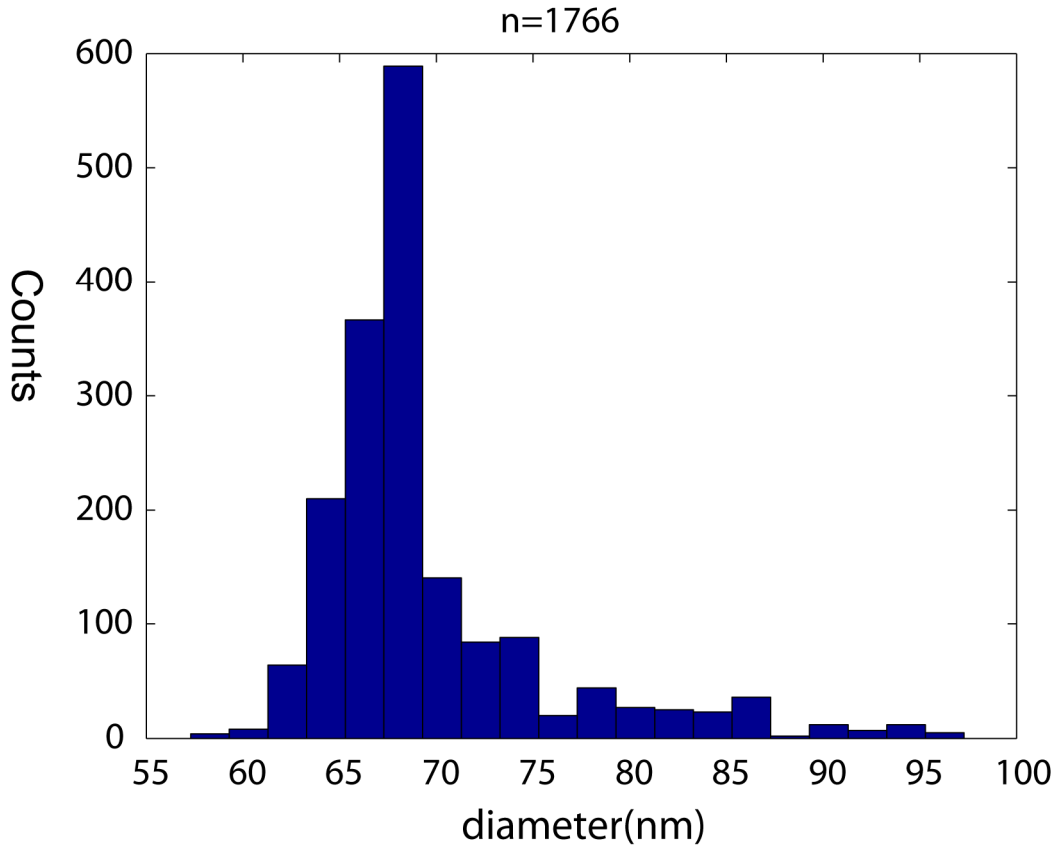

Figure S-5 The diameter distribution of 1766 GNPs in Figure 3 and 4 calculated by Matlab.

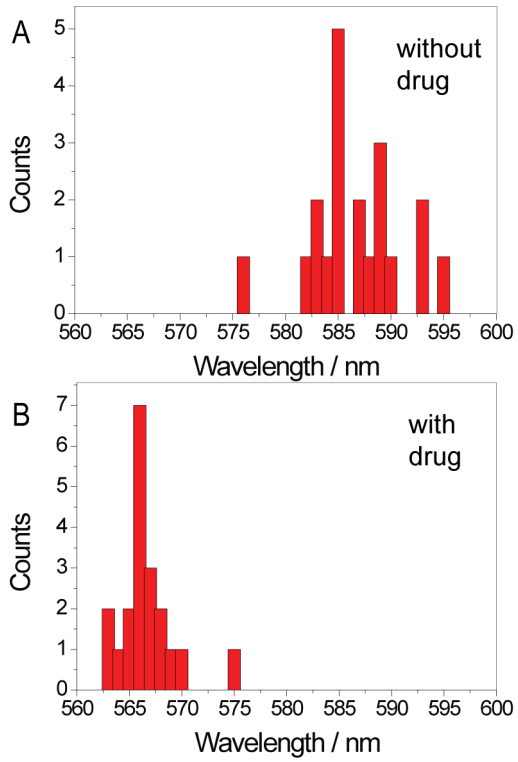

Figure S-6 Statistic data of nanoparticles' spectral changes without (A) and with (B) the treatment of cancer drug. The peak wavelengths of twenty nanoparticles were selected in each histogram.

3. References

(1) http://en.wikipedia.org/wiki/CIE_1931_color_space

4. The Matlab program for calculating wavelength and diameter for one nanoparticle.

```
clc;
clear;
A=imread('x.jpg');
imshow(A);
[a b c]=size(A);
A2=zeros(a*b,3);
for i=1:a
  for j=1:b
      A2((i-1)*b+j,:)=A(i,j,:);
  end
end

A3=A2*[0.49,0.31,0.2;0.177,0.812,0.011;0,0.01,0.99]';
A4=zeros(length(A3),1);
for i=1:length(A3);
A4(i)=sum(A3(i,:));
end
```

```
1
2       A5=[A4 A4 A4];
3       A6=A2./A5;
4       wavelengthA=zeros(a*b,1);
5       load 'RGB to wavelength.mat';
6       for i=1:length(A6)
7           vals=A6(i,1:2);
8           k=zeros(75,3);
9           g=zeros(75,1);
10          for j=1:75
11              k(j,1:2)=R(j,2:3)-vals;
12              g(j)=sqrt(sum(k(j,1:2).^2));
13          end
14          wp=R(g==min(g),1);
15          wavelengthA(i)=wp(1);
16      end
17
18
19      p=A2*[0.299;0.5876;0.114];
```

```
wavep=[wavelengthA p];
 waves=zeros(75,1);
 for i=1:a*b
   waves((wavep(i,1)-395)/5)=waves((wavep(i,1)-395)/5)+wavep(i,2);
end
pxwave=sort(waves);
maxwave=find(waves==pxwave(end));
maxwave2=find(waves==pxwave(end-1));
maxwave3=find(waves==pxwave(end-2));
 q1=waves(maxwave);
q2=waves(maxwave2);
q3=waves(maxwave3);
 maxwave=(maxwave*5+395);
maxwave2=(maxwave2*5+395);
maxwave3=(maxwave3*5+395);

if(maxwave<525)
  if(maxwave2<525)
    if(maxwave3<525)
```

```
            disp('error');
        else
            maxwave=maxwave3;
        end
    else
        maxwave=maxwave2;
    end
end

pjwave=maxwave;
disp('wavelength peak');
disp(maxwave);
load 'wavelength to diameter.mat';
goal=0;
disp('diameter:')
for i=1:81
    if(pjwave(1)<ljwave(i,1))
        if(i==1)
            disp('less than 30 nm')
```

```
                goal=1;
            else
                if((pjwave(1)-ljwave(i-1,1))>(ljwave(i,1)-pjwave(1)))
                  disp(ljwave(i,2));
                else
                   disp(ljwave(i-1,2))
                end
                goal=1;
            end
            break;
        end
    end

    if(goal==0)
        disp('more than108');
    end
```