



**XXX CONGRESSO NAZIONALE**

**SIAAIC**

Società Italiana di Allergologia,  
Asma ed Immunologia Clinica



**FIRENZE 6/9 APRILE 2017 | [WWW.SIAAIC2017.ORG](http://WWW.SIAAIC2017.ORG)**



Basic Medical Allergy Knowledge Action

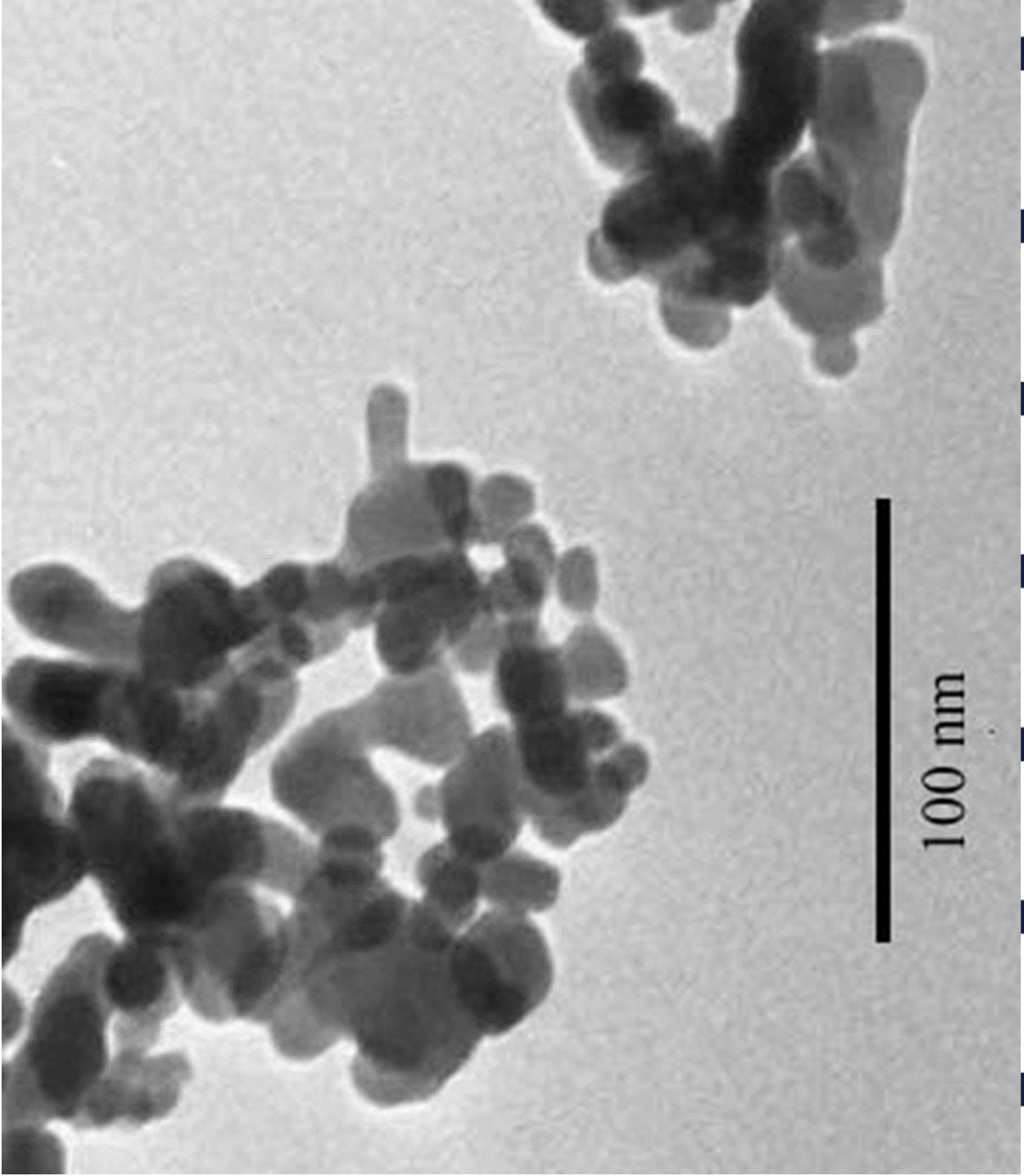


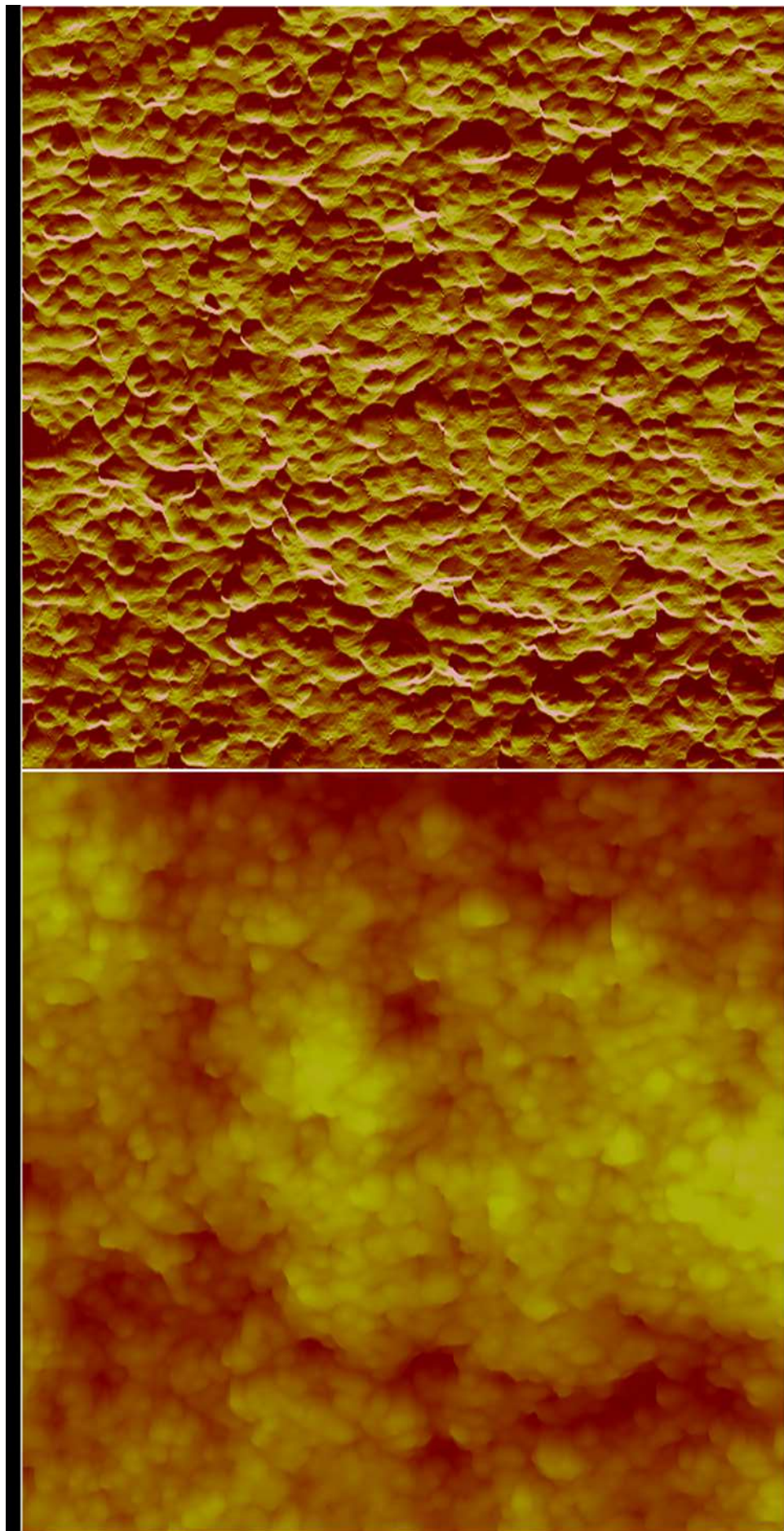


# What's so special about the nanoscale?

- Scale at which quantum effects dominate properties of materials.
- Scale at which much of biology occurs.
- Scale at which surfaces play an important role in material properties and interactions.







0      2.00  $\mu\text{m}$       2.00  $\mu\text{m}$

Data type      Height      Data type      Amplitude

Z range      500.0 nm      Z range      0.5000 V



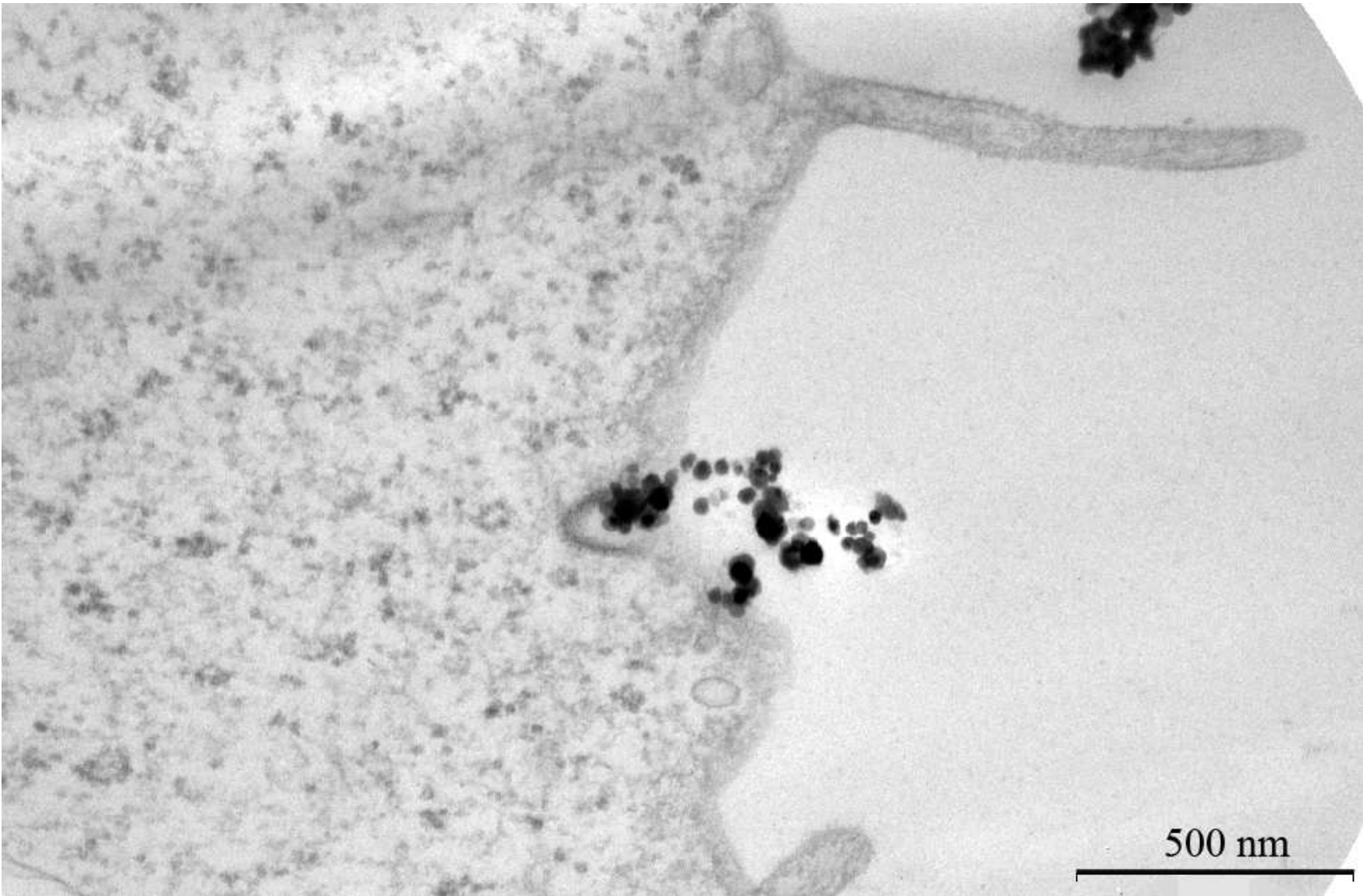


# NANOPARTICLES CAN COME IN CONTACT WITH CELLS

Let's see what happens!

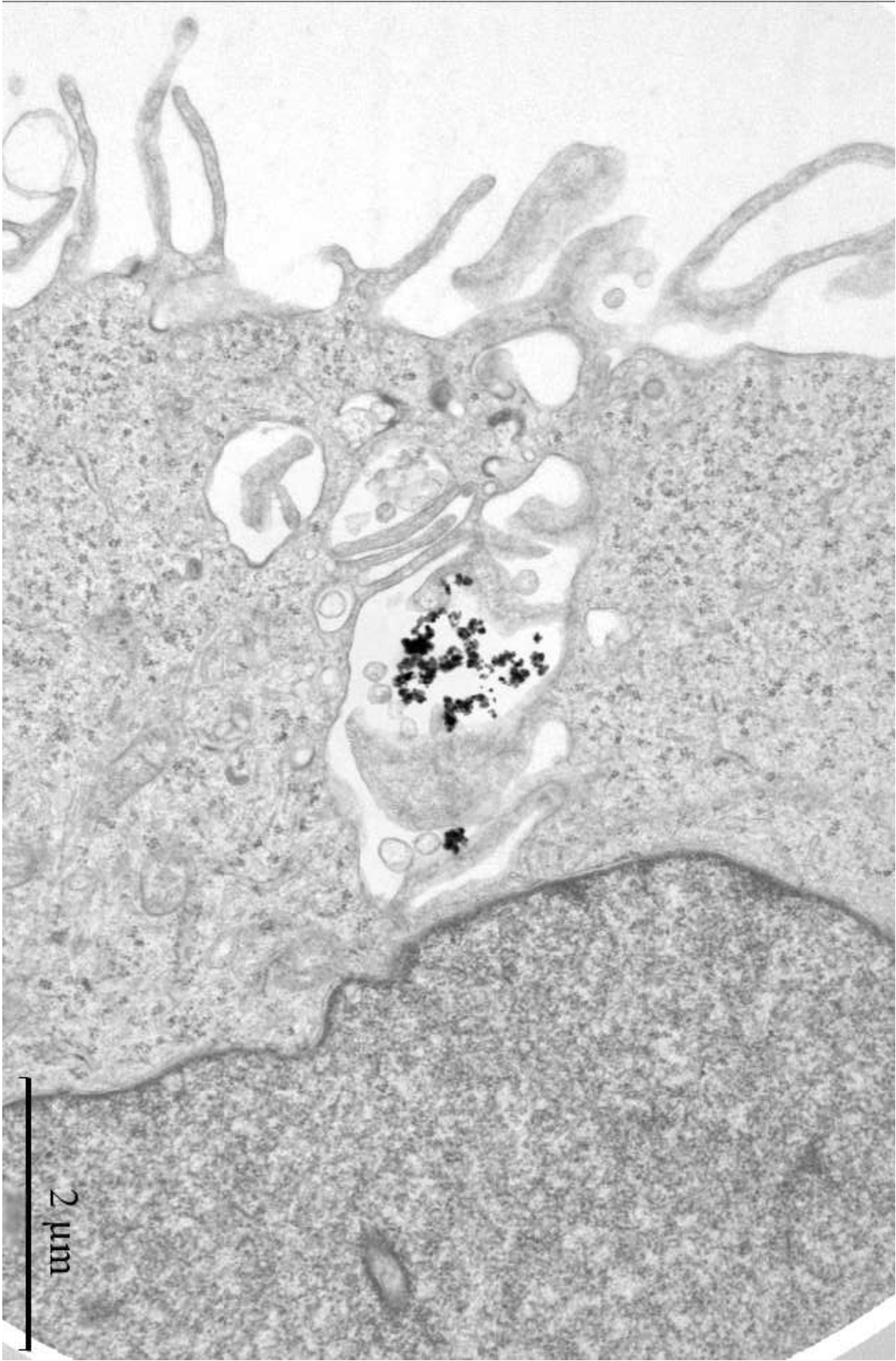


**SKOV-3:** 3.3  $\mu\text{g}/100 \mu\text{l}$  24 h

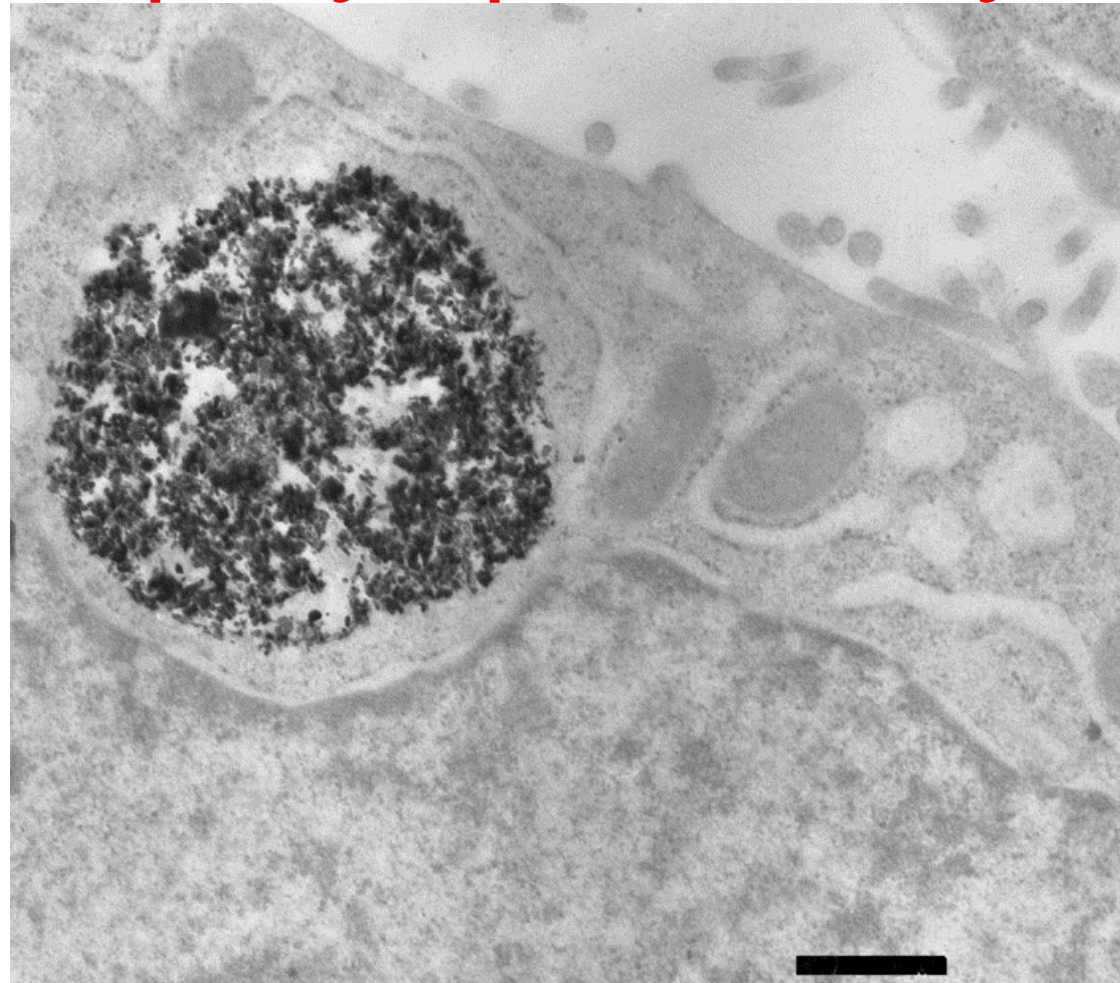


500 nm

**U87:** 3.3  $\mu\text{g}/100 \mu\text{l}$  24 h



NP are rapidly up-taken by the cells,

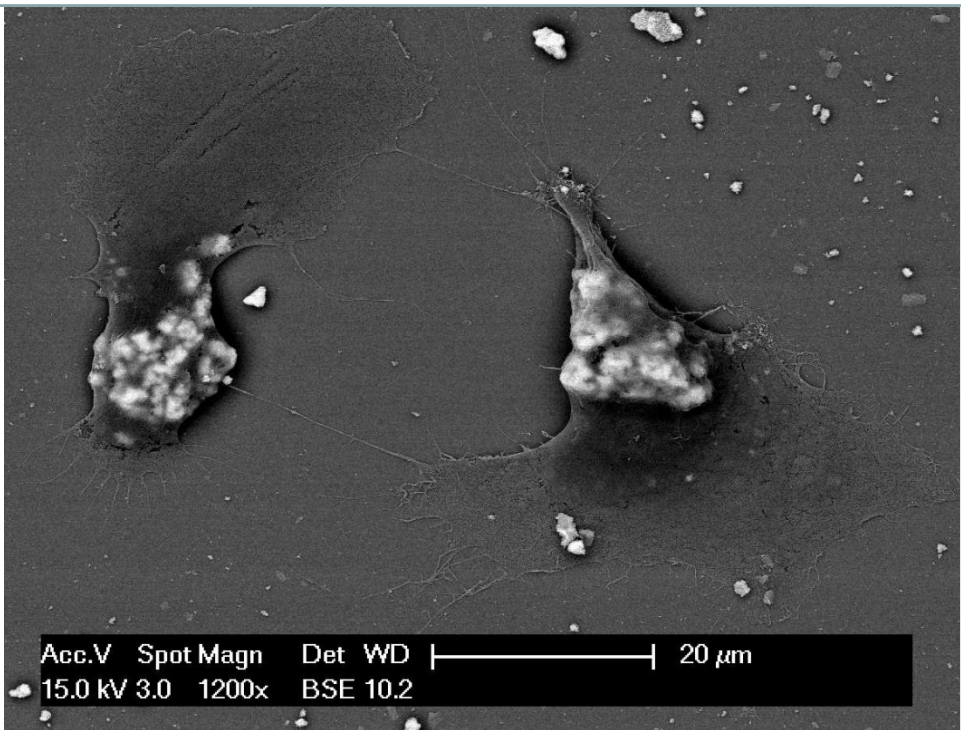
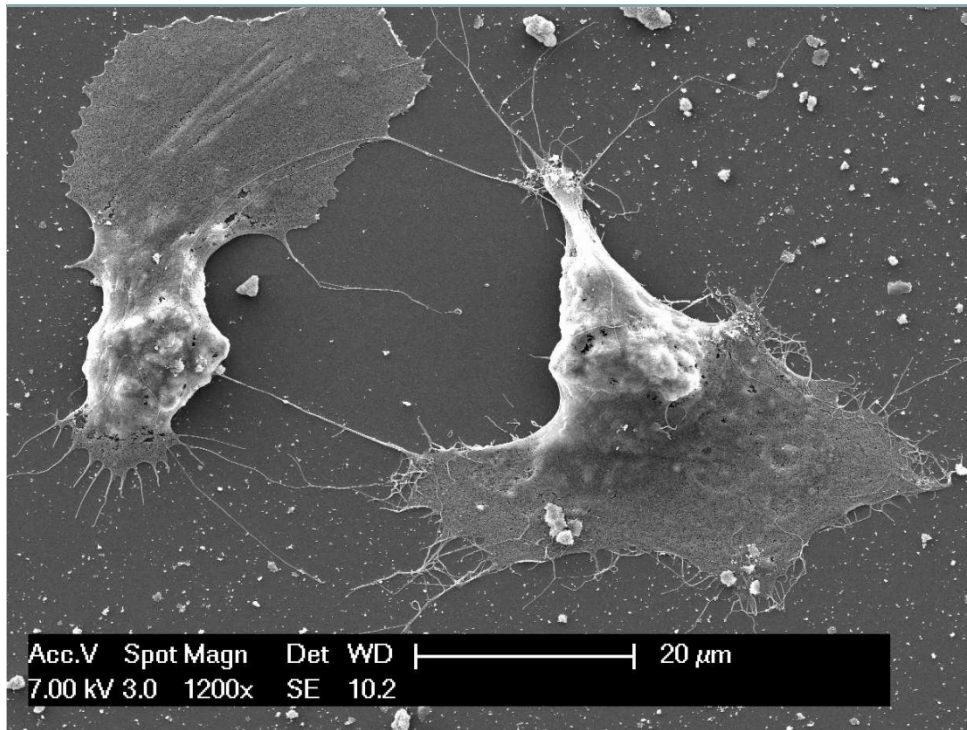


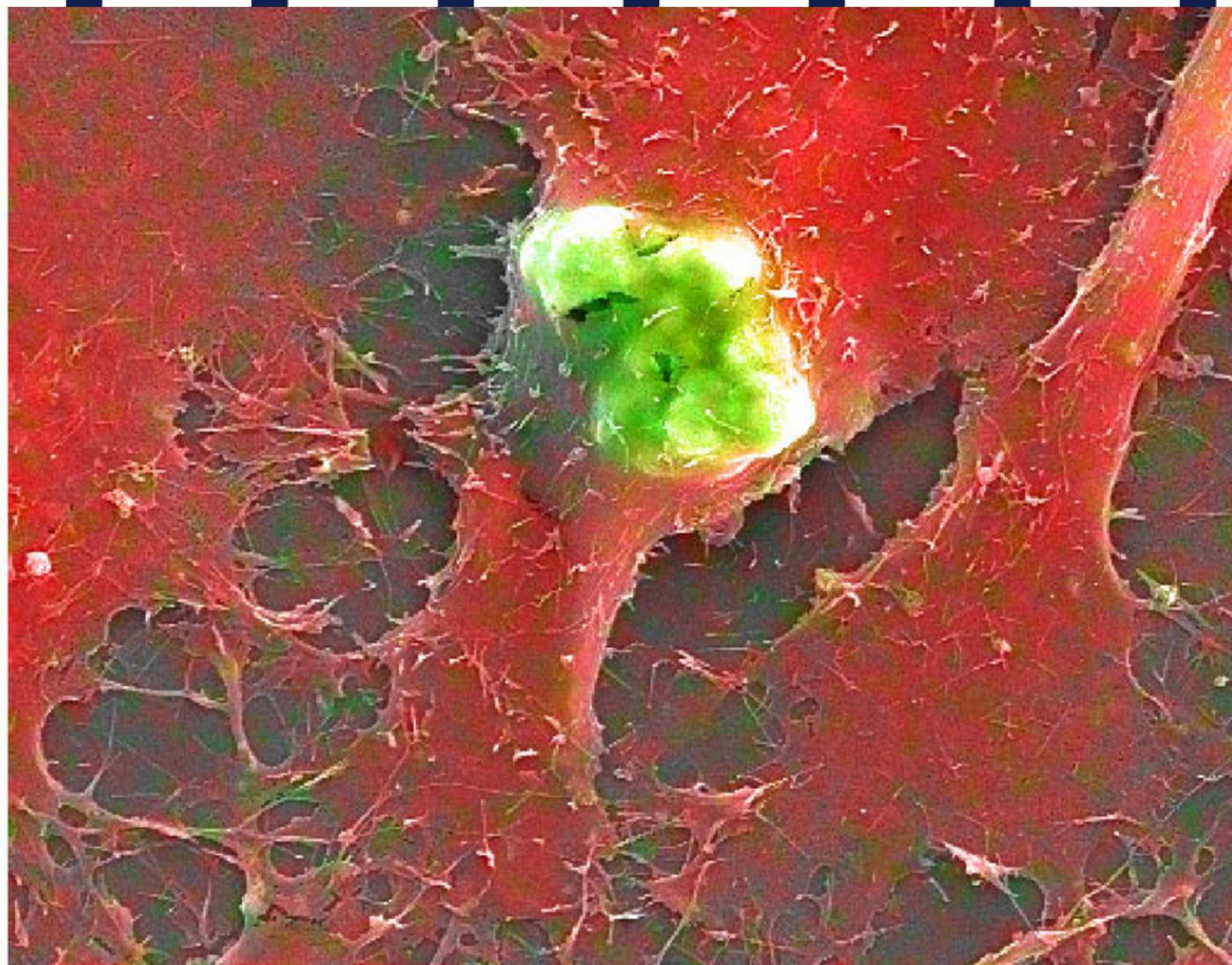
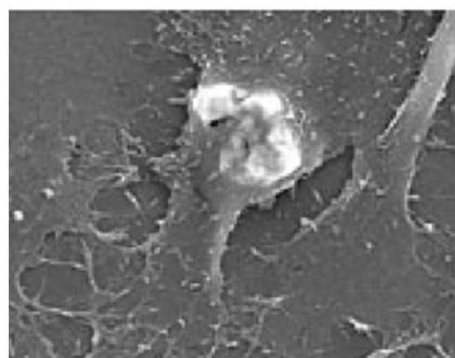
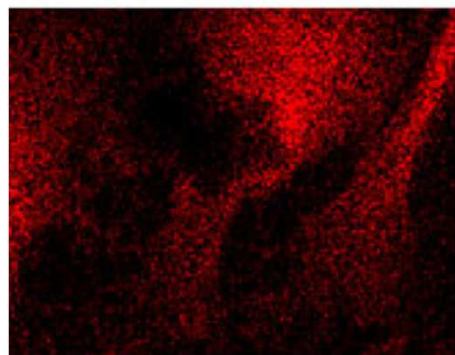
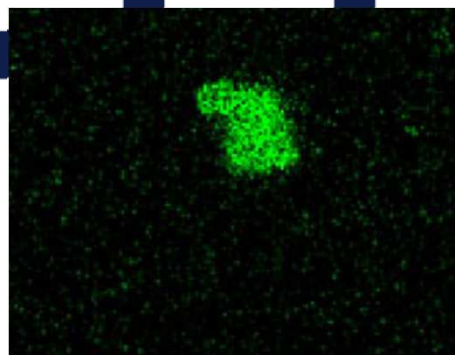
... a

prerequisite to exert their toxicity.



# ECV-304 exposed to cobalt NPs





X-ray spectroscopy of cells exposed to  $\text{Co}_3\text{O}_4$ -NPs. On the left the distribution of cobalt (green) and carbon (red) is shown in false colors in the field of view shown on the SEM image at the bottom left. On the right the elemental mapping has been superimposed onto the micrograph. The horizontal field of view spans approximately 50 $\mu\text{m}$ .

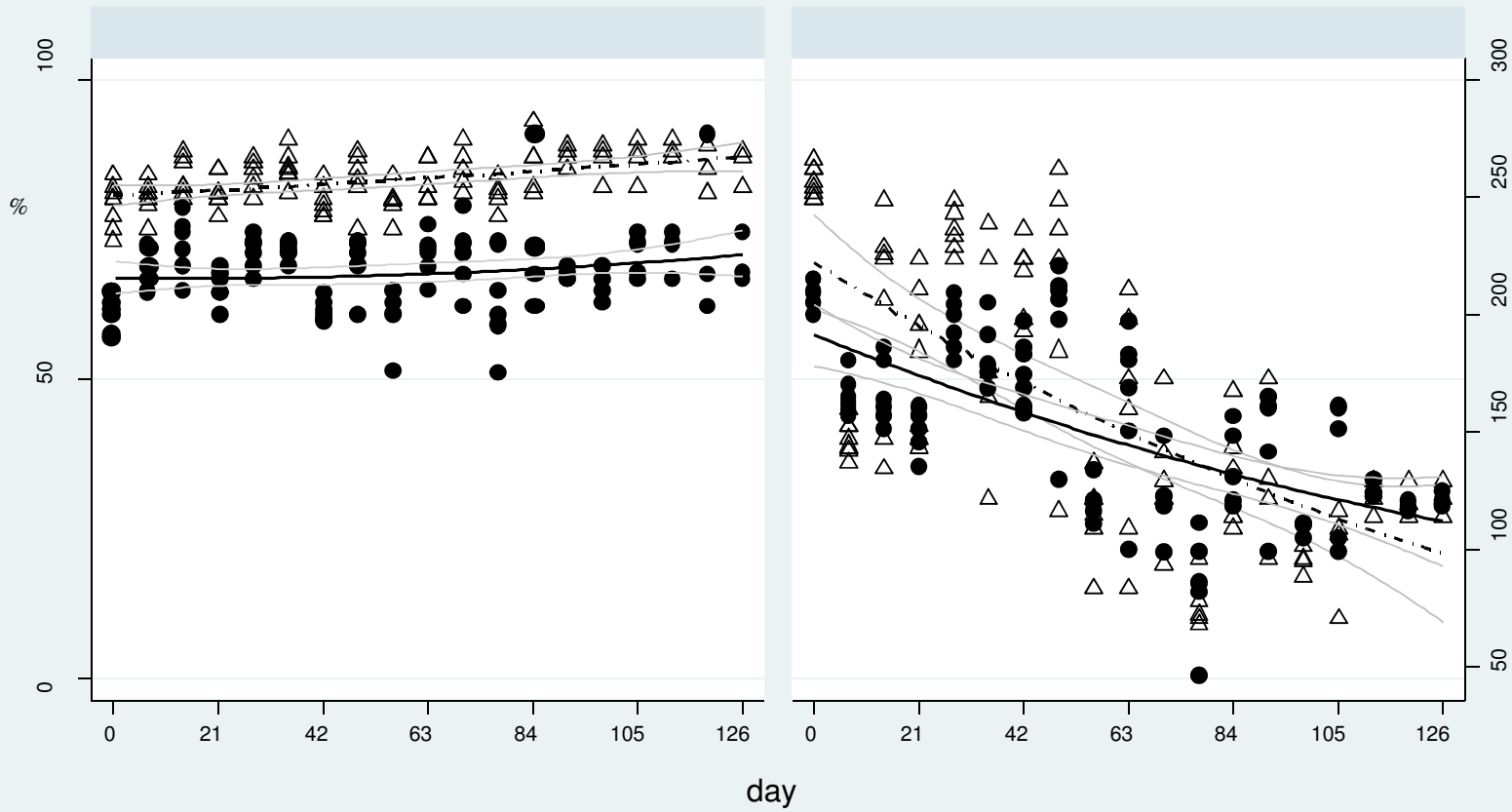




# NANOPARTICLES CAN

- stick to the cell surface
- enter cell by endocytosis
- **AND CROSS BIOLOGICAL BARRIERS**





△ motile cells      — Predicted motile cells  
 ● vcl                    - - - Predicted vcl



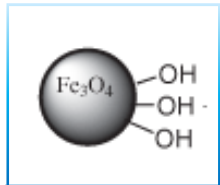
**Silver NPs cross ETB**



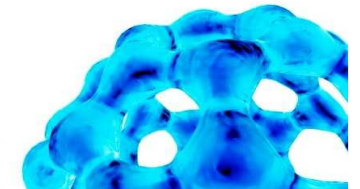
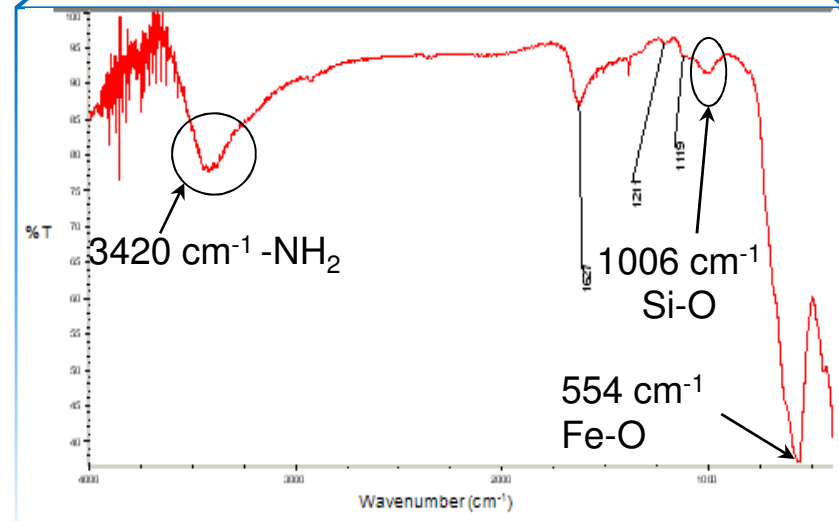
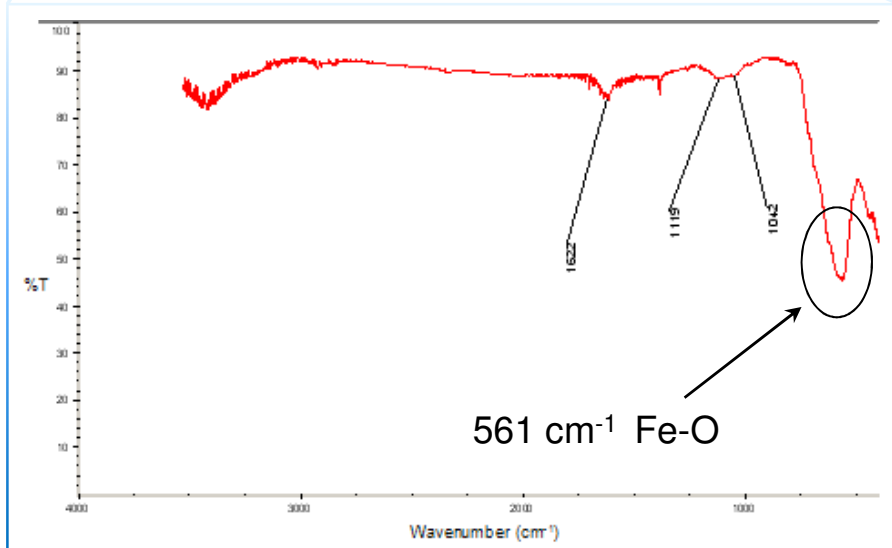
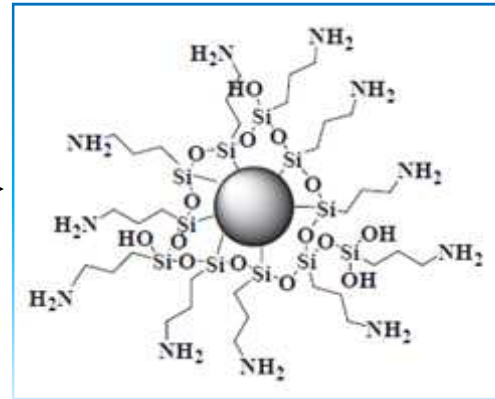
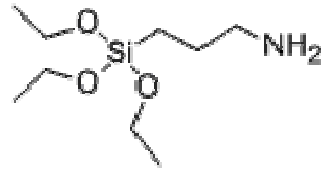
# NANOPARTICLES CAN

- stick to the cell surface
- enter cell by endocytosis
- cross biological barriers
- **AND BE FUNCTIONALIZED**

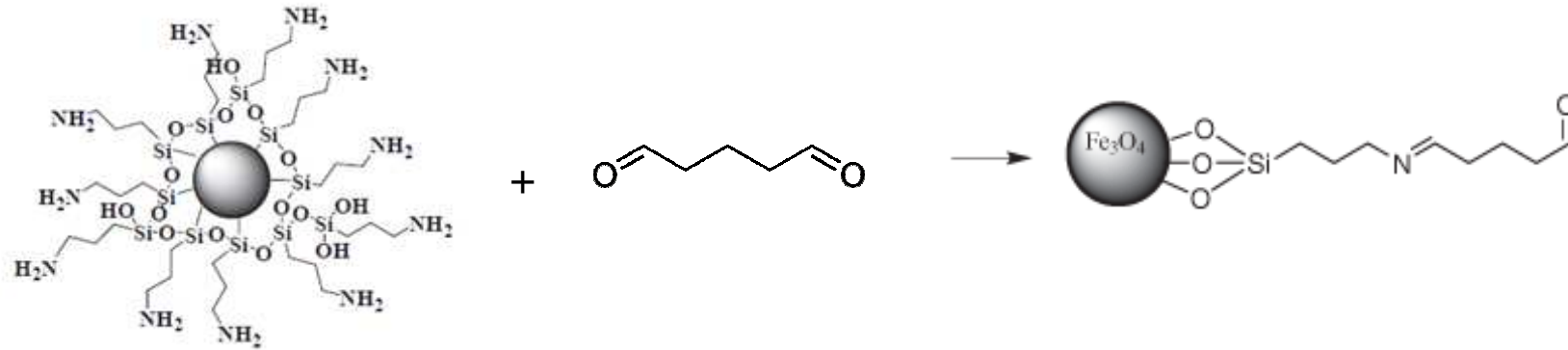




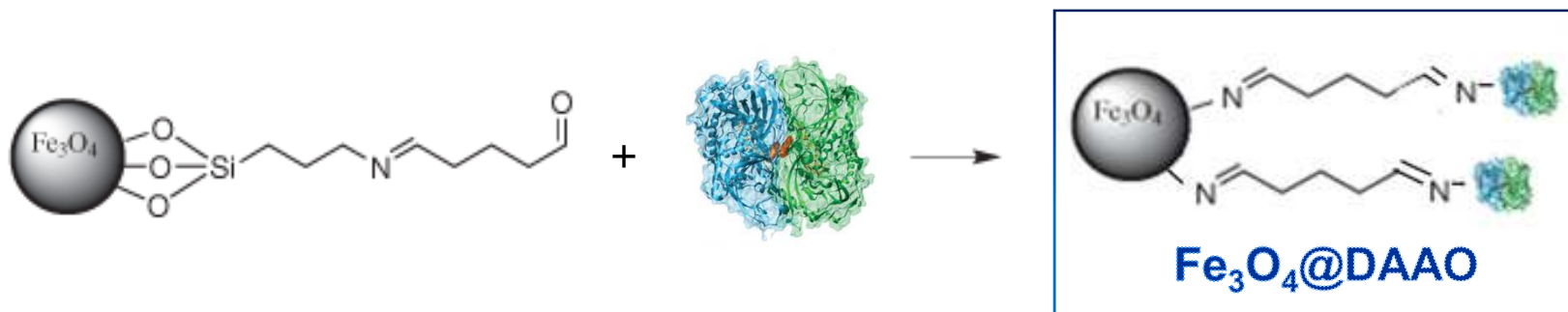
+



## Activation



## Conjugation







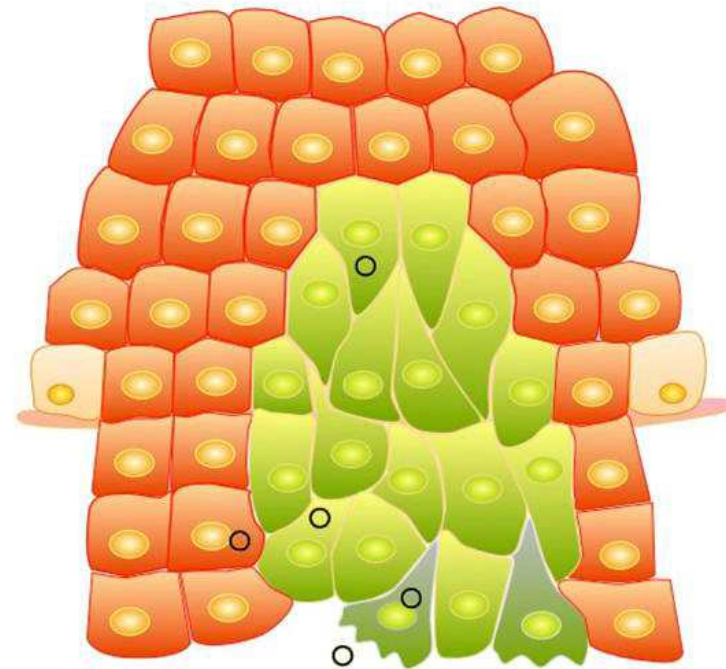
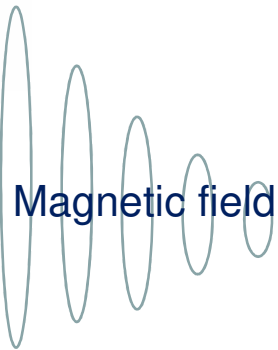
# NANOPARTICLES CAN






- stick to the cell surface
- enter cell by endocytosis
- cross biological barriers
- be functionalized
- **AND POSSES SUPERPARAMAGNETIC PROPERTIES**

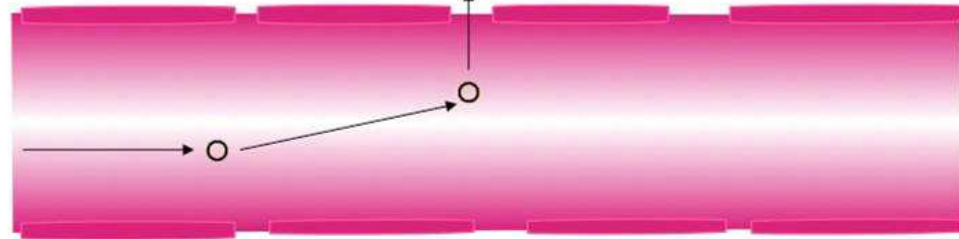


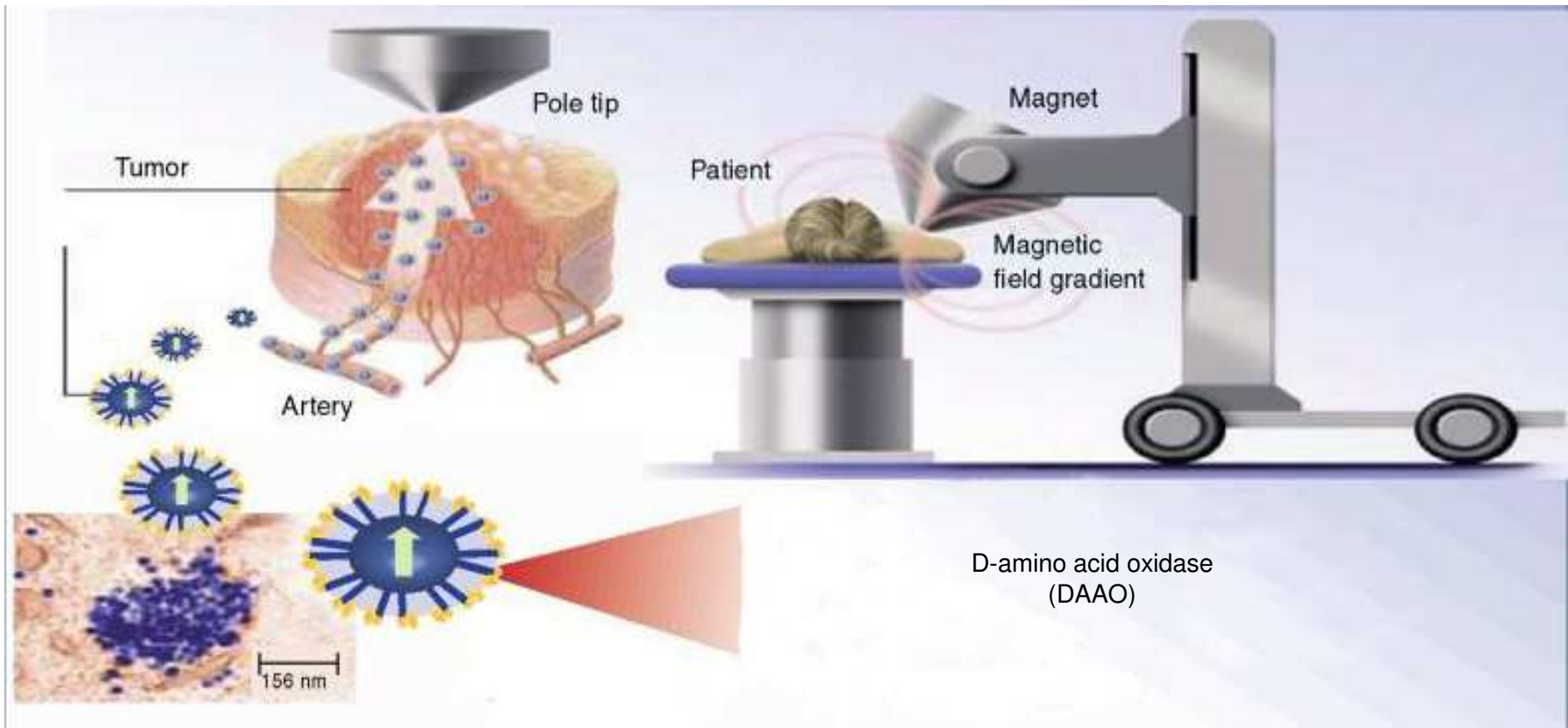


Magnetic NPs can be manipulated by a external magnetic field

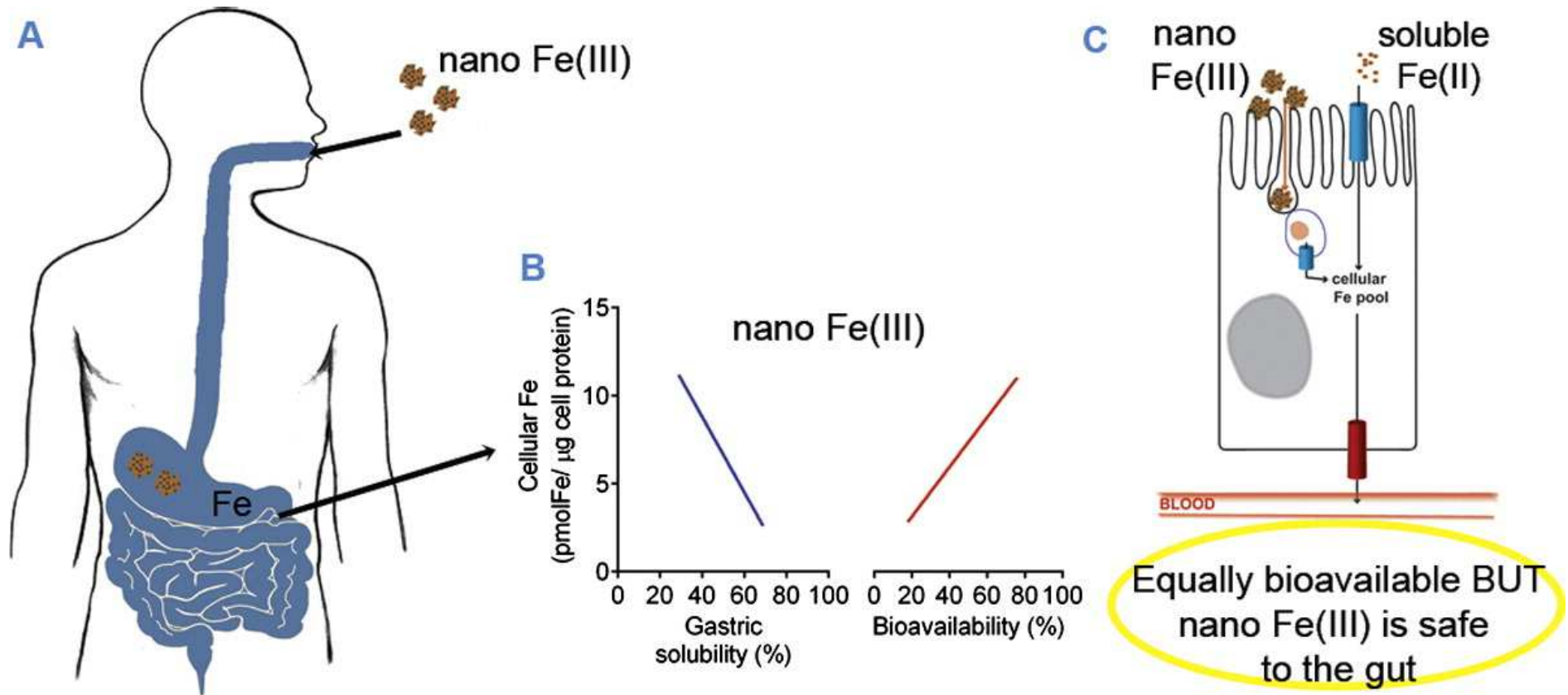


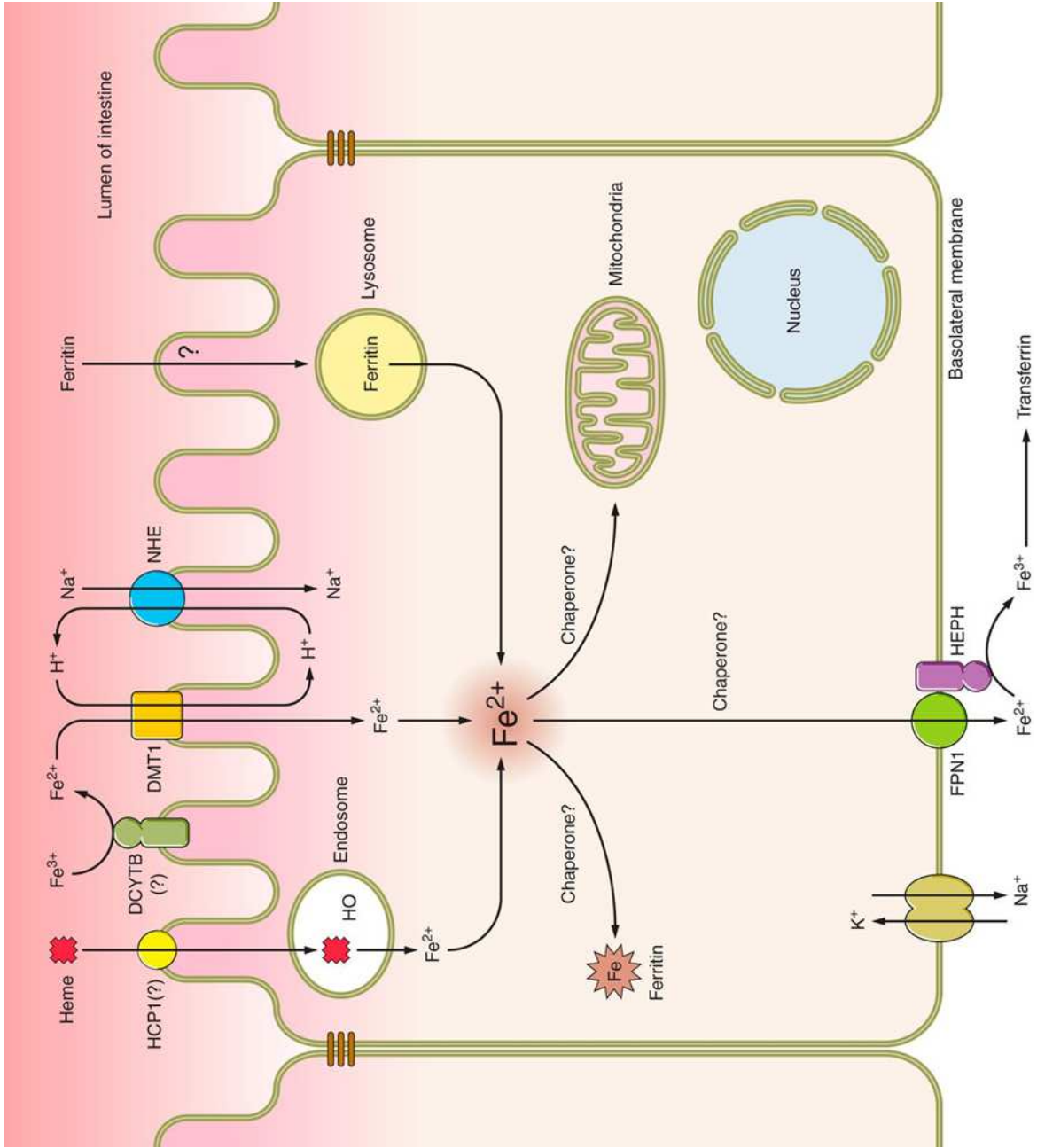
-   $\text{Fe}_3\text{O}_4@DAAO$
-  Normal cells
-  Tumor cells
-  Invasive cells
-  Metastatic cells





# FOOD and FEED SUPPLEMENTATION





# Size and charge affect the rate of diffusion across a membrane.

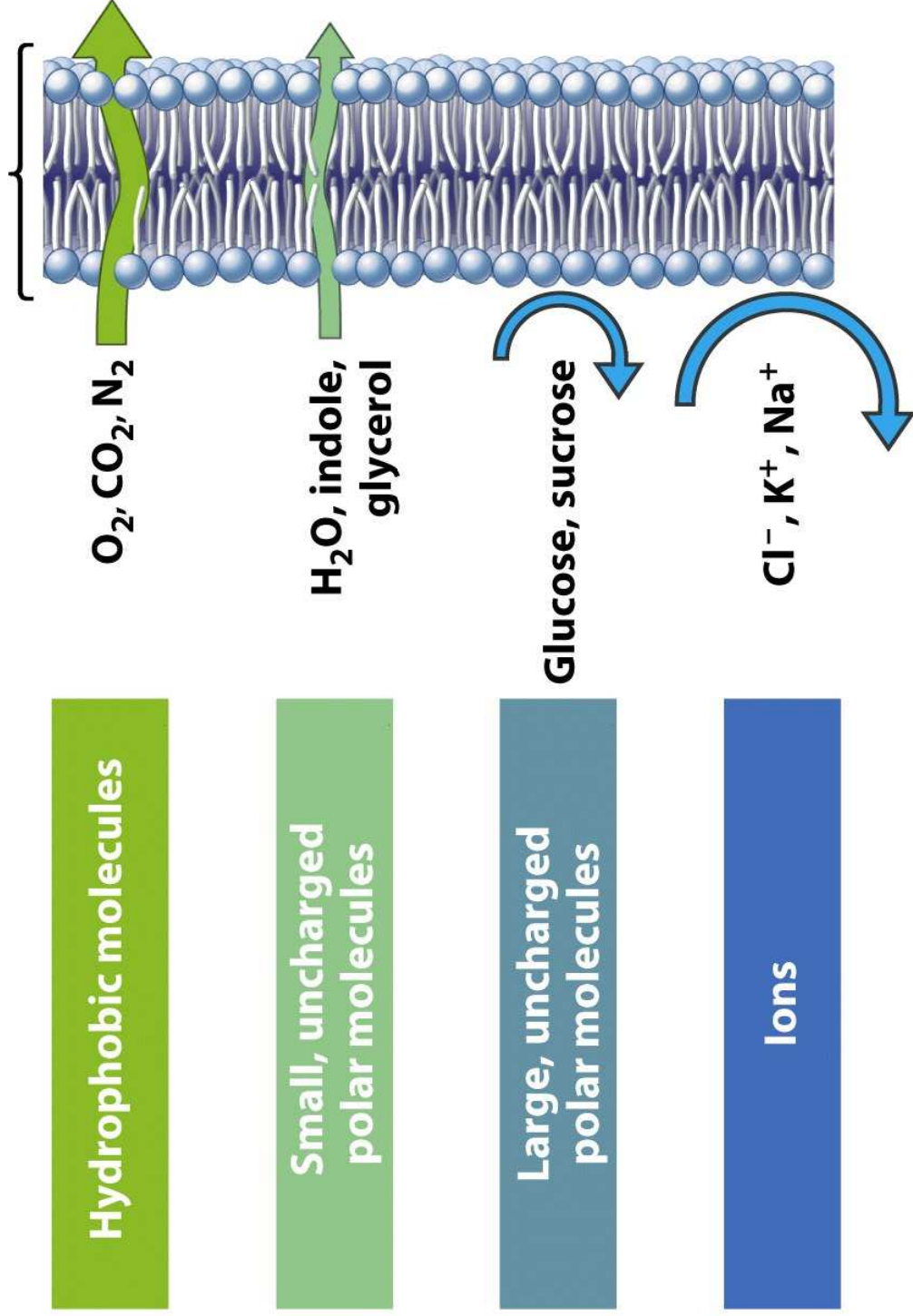
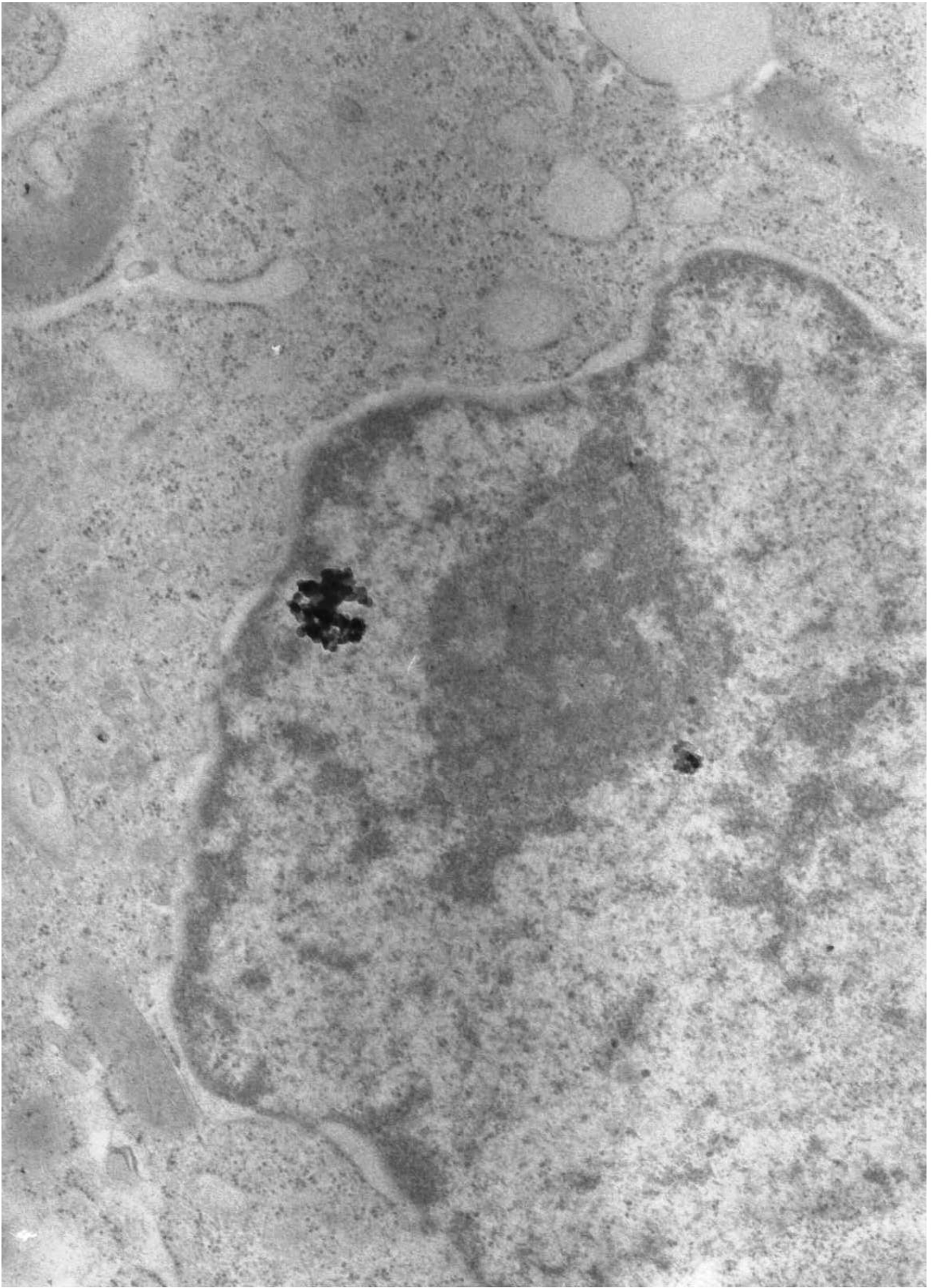
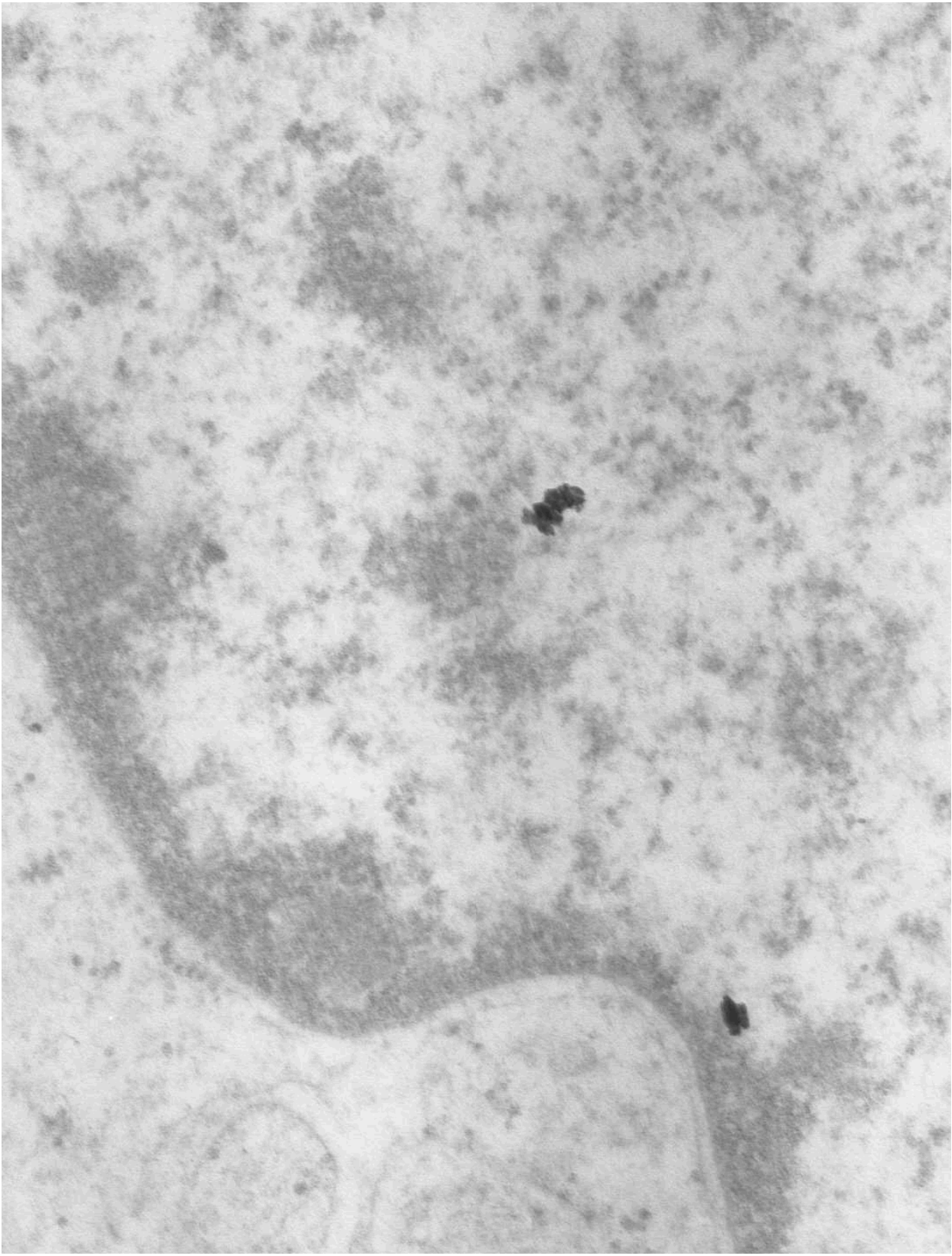


Figure 6-9b Biological Science, 2/e

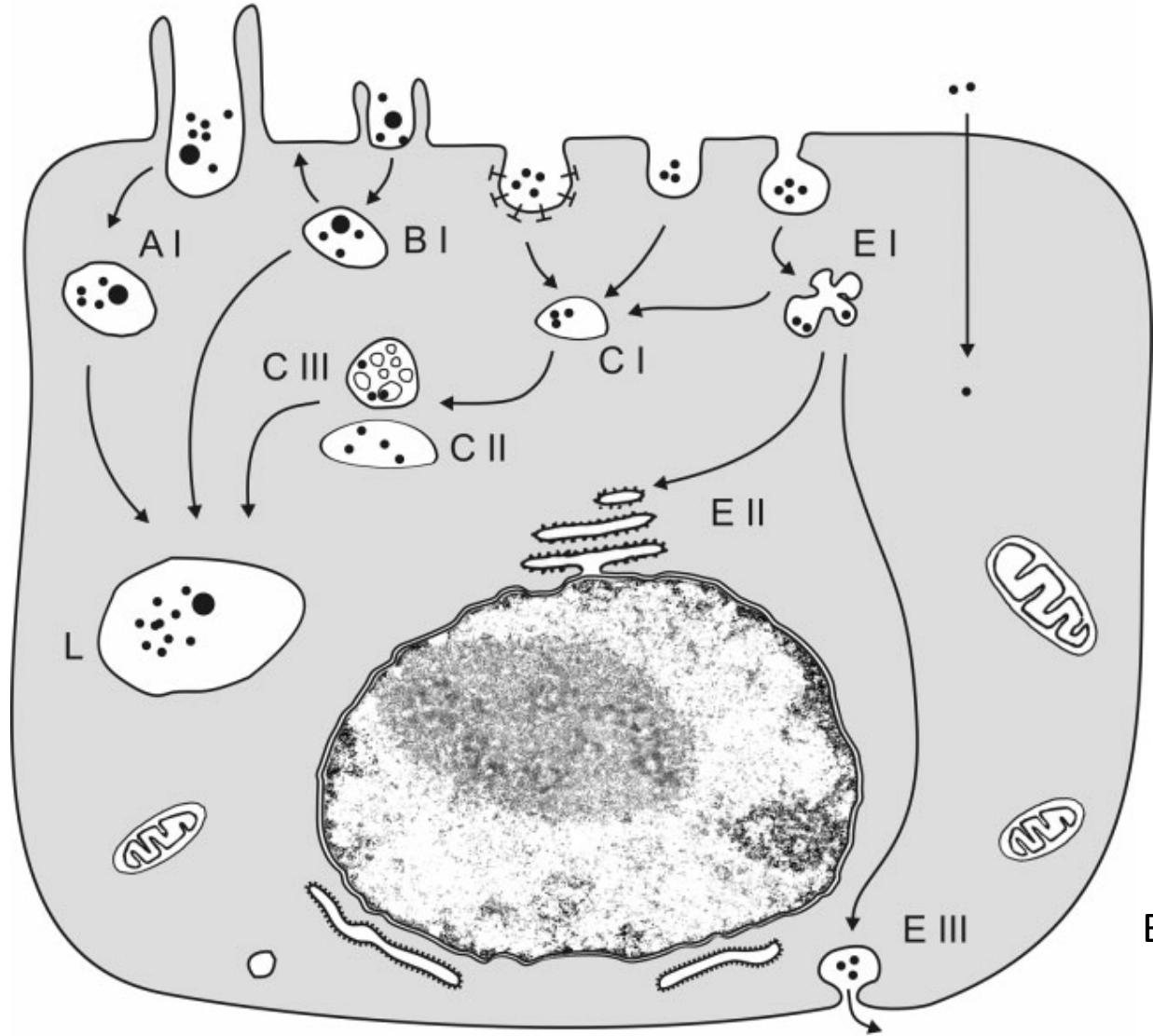






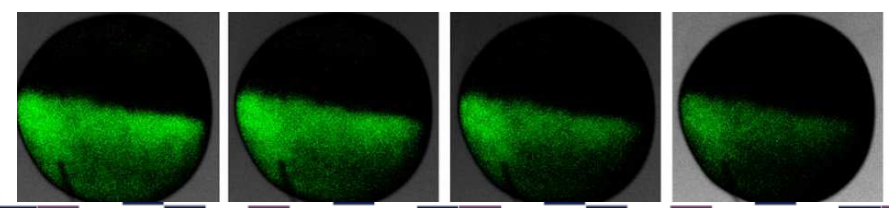
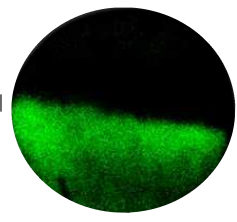
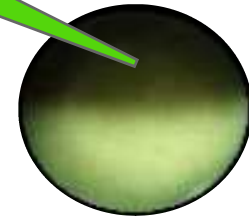
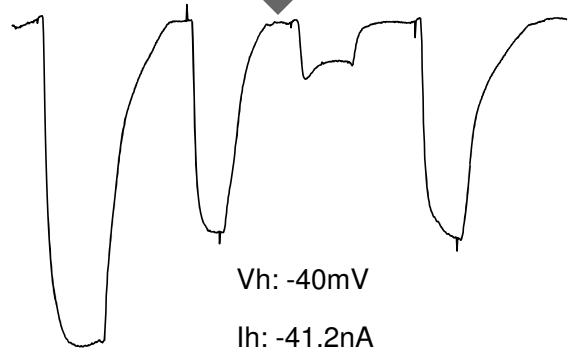
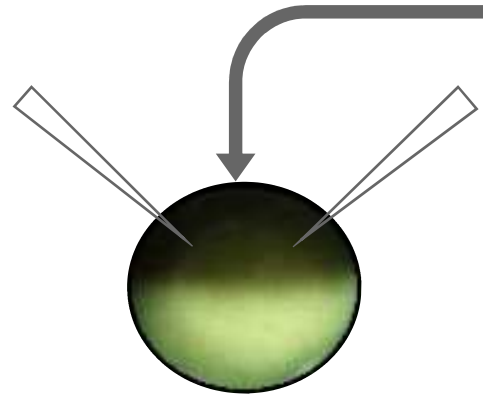
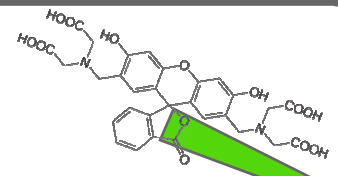
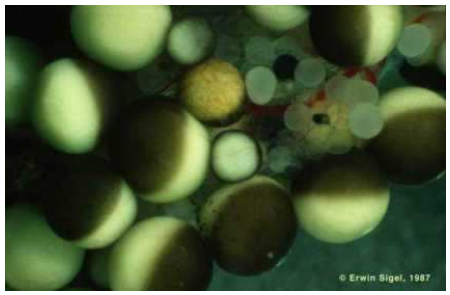
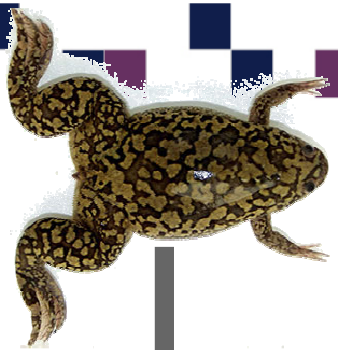


A B C D E F



Branderberger et al., 2010







Co oxide NPs in control solution, pH 7

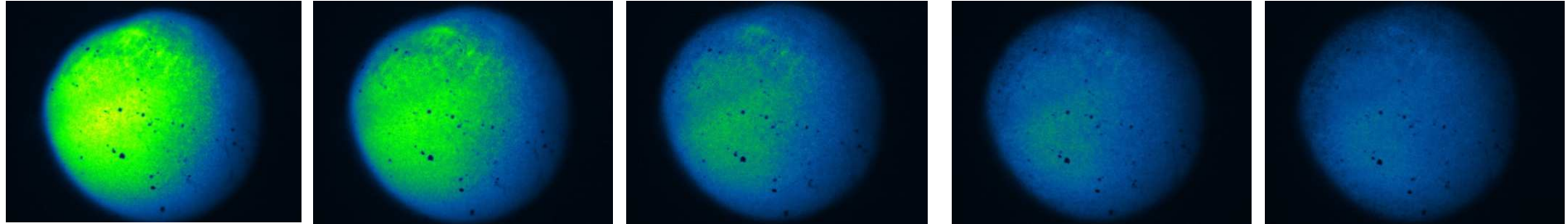
0

3'

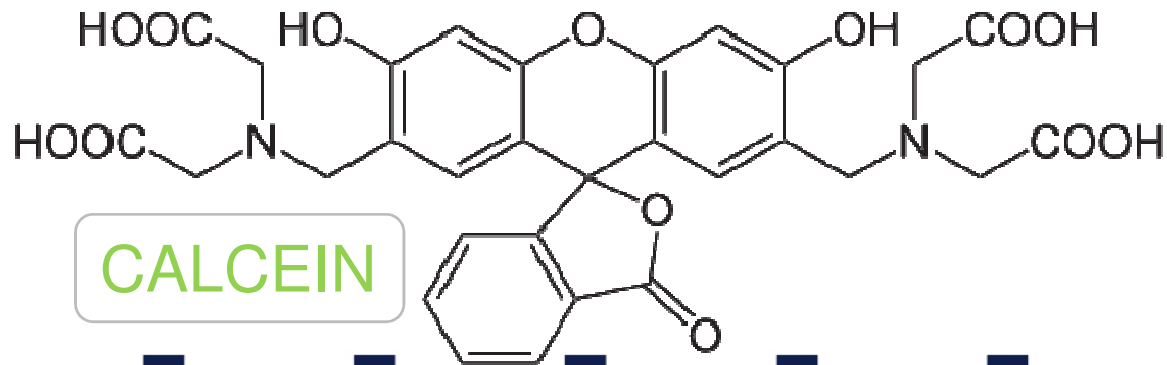
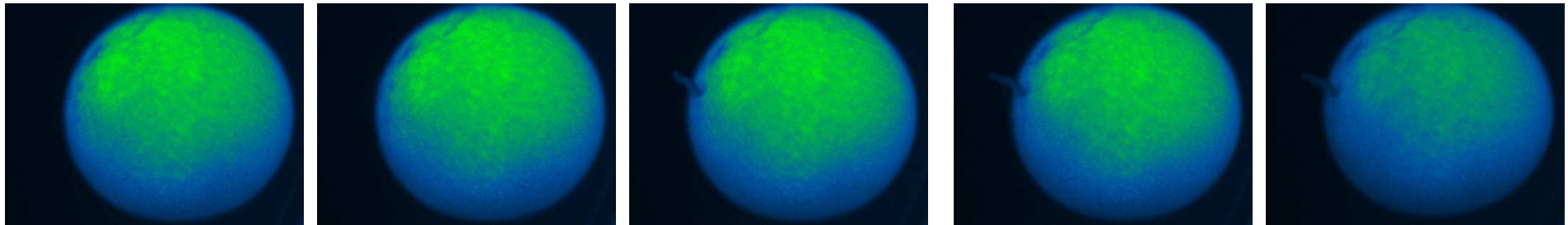
10'

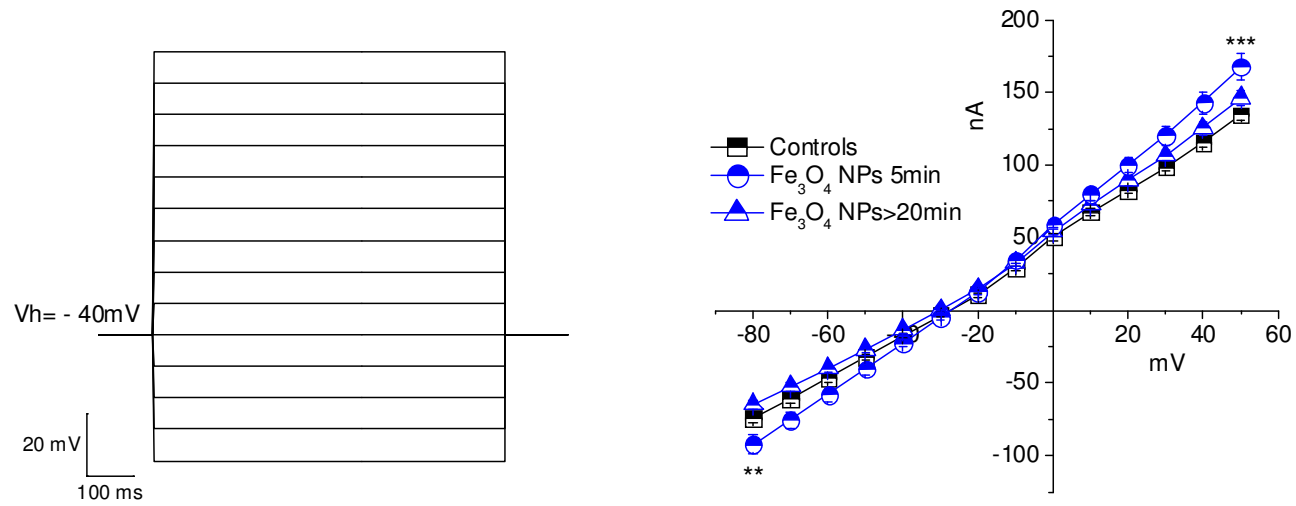
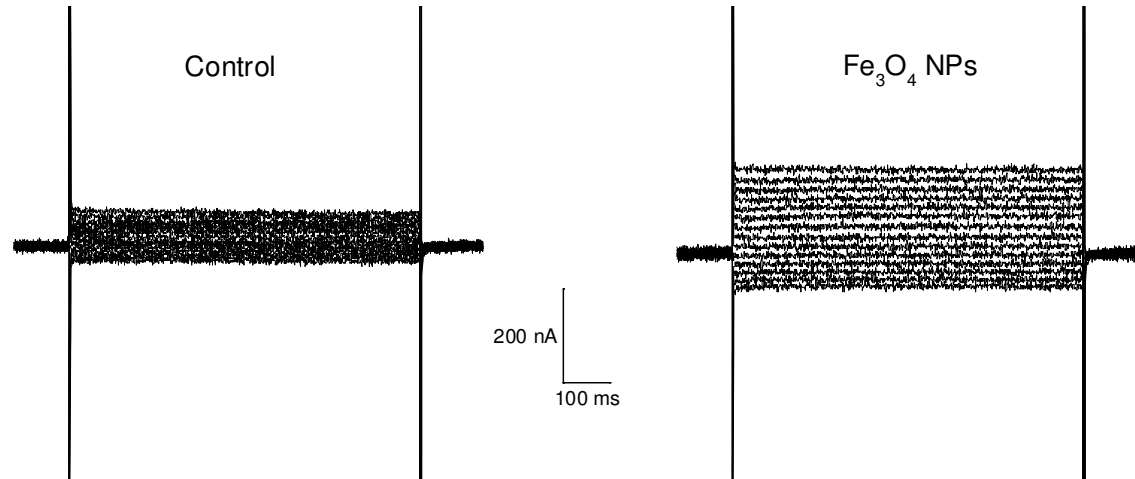
20'

60'



Control solution, pH 7



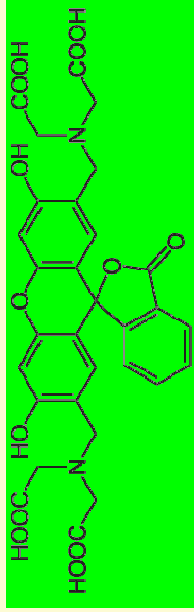


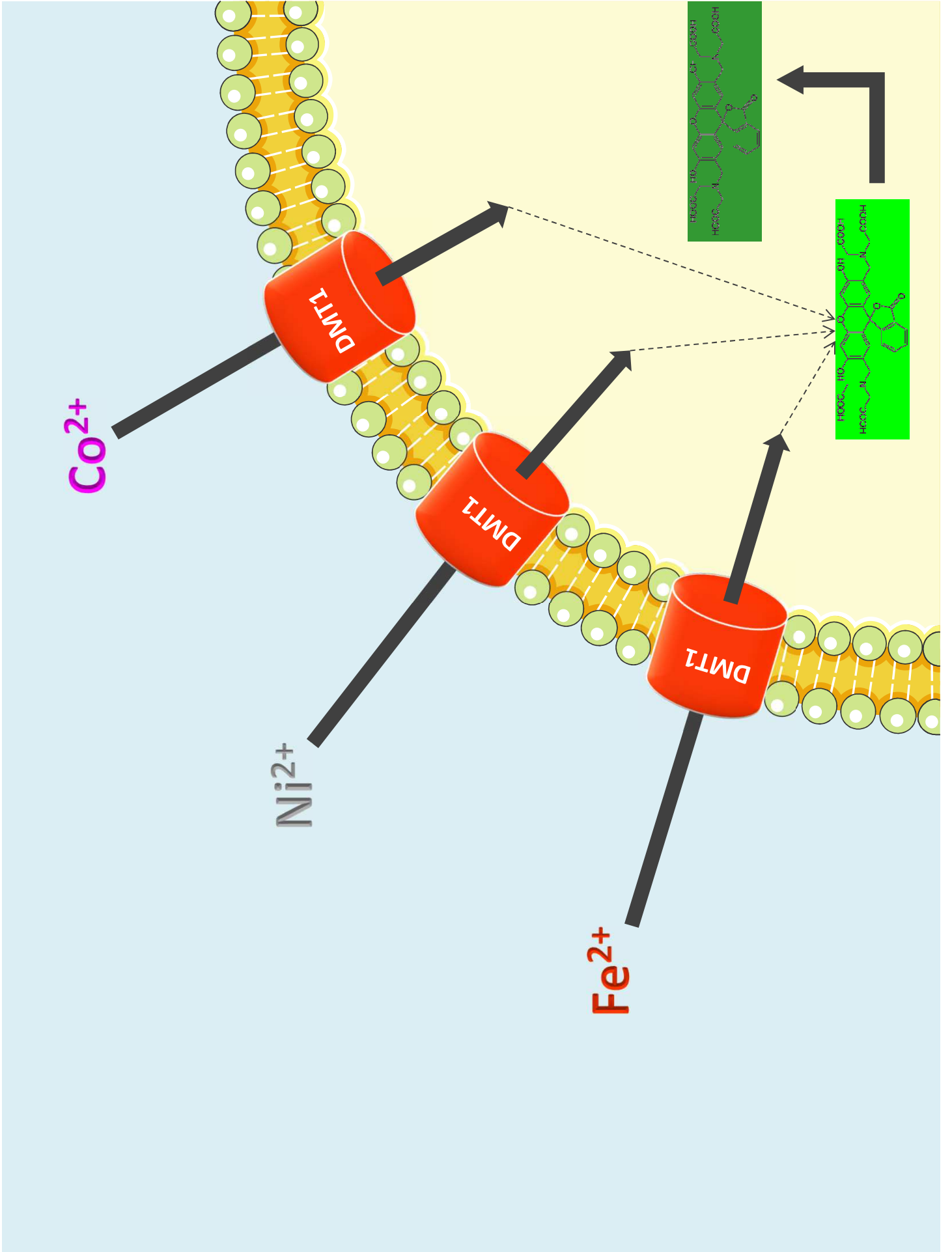
$Co^{2+}$

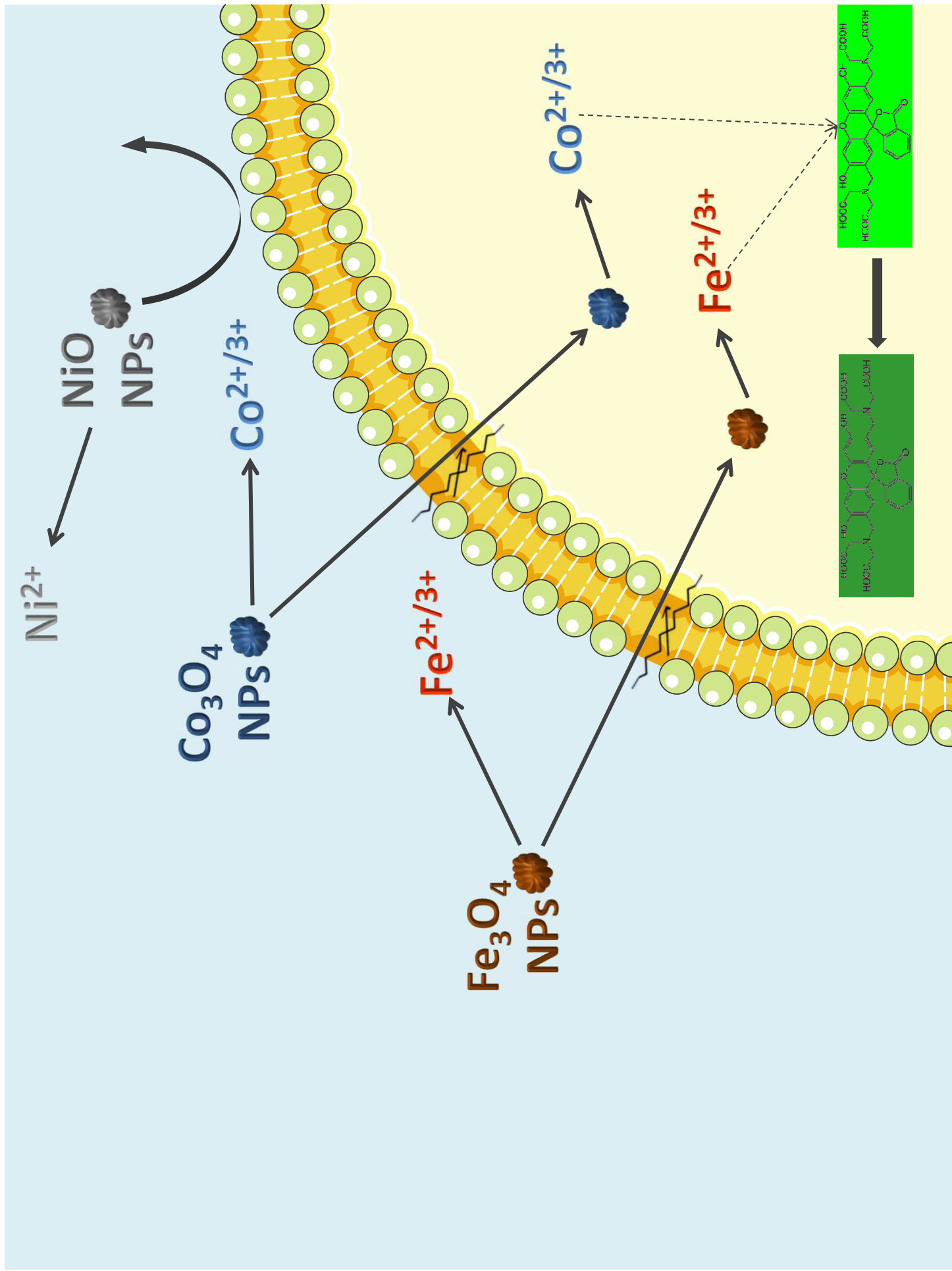
$Ni^{2+}$

$Fe^{2+}$

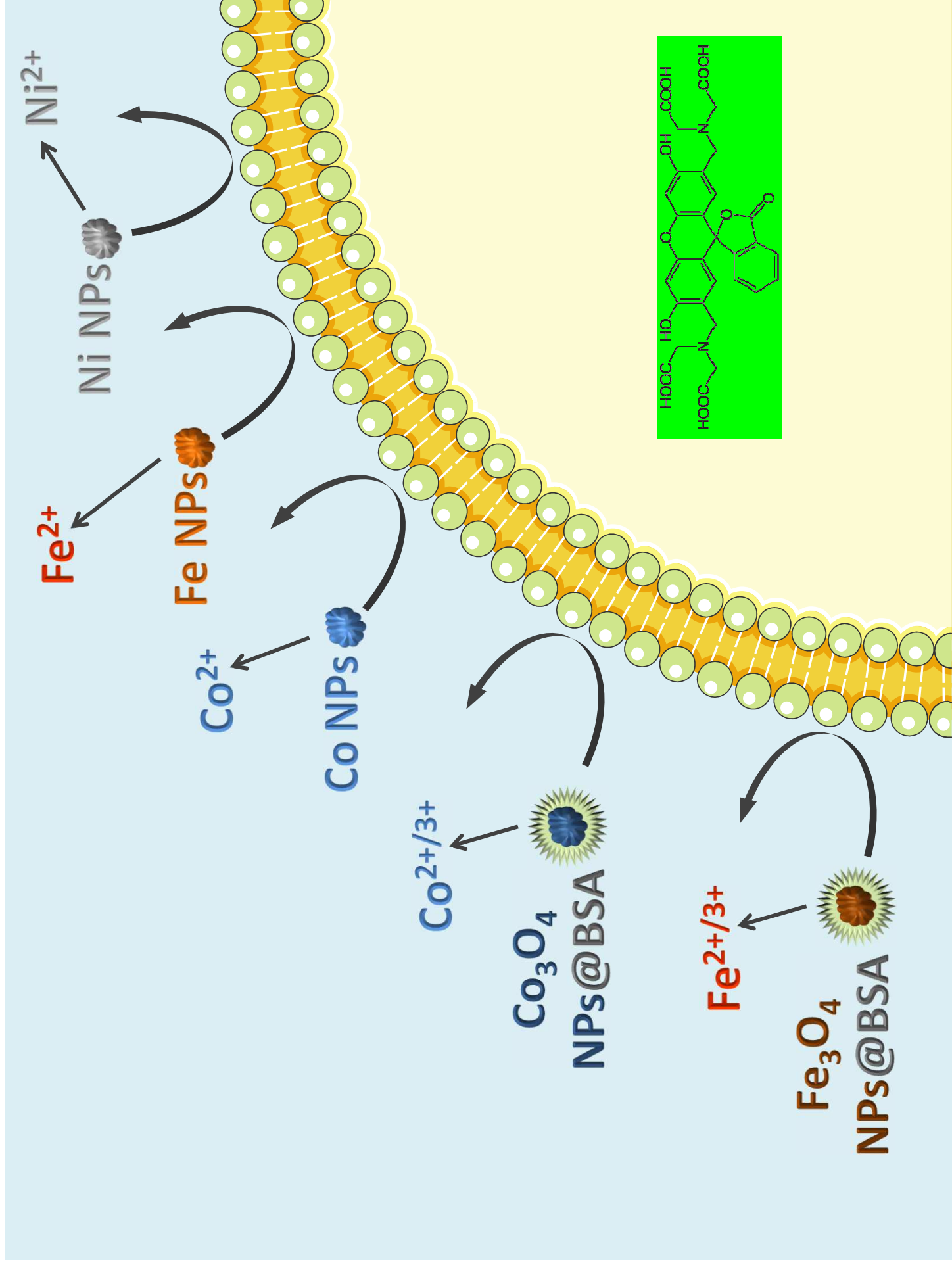
$Fe^{3+}$



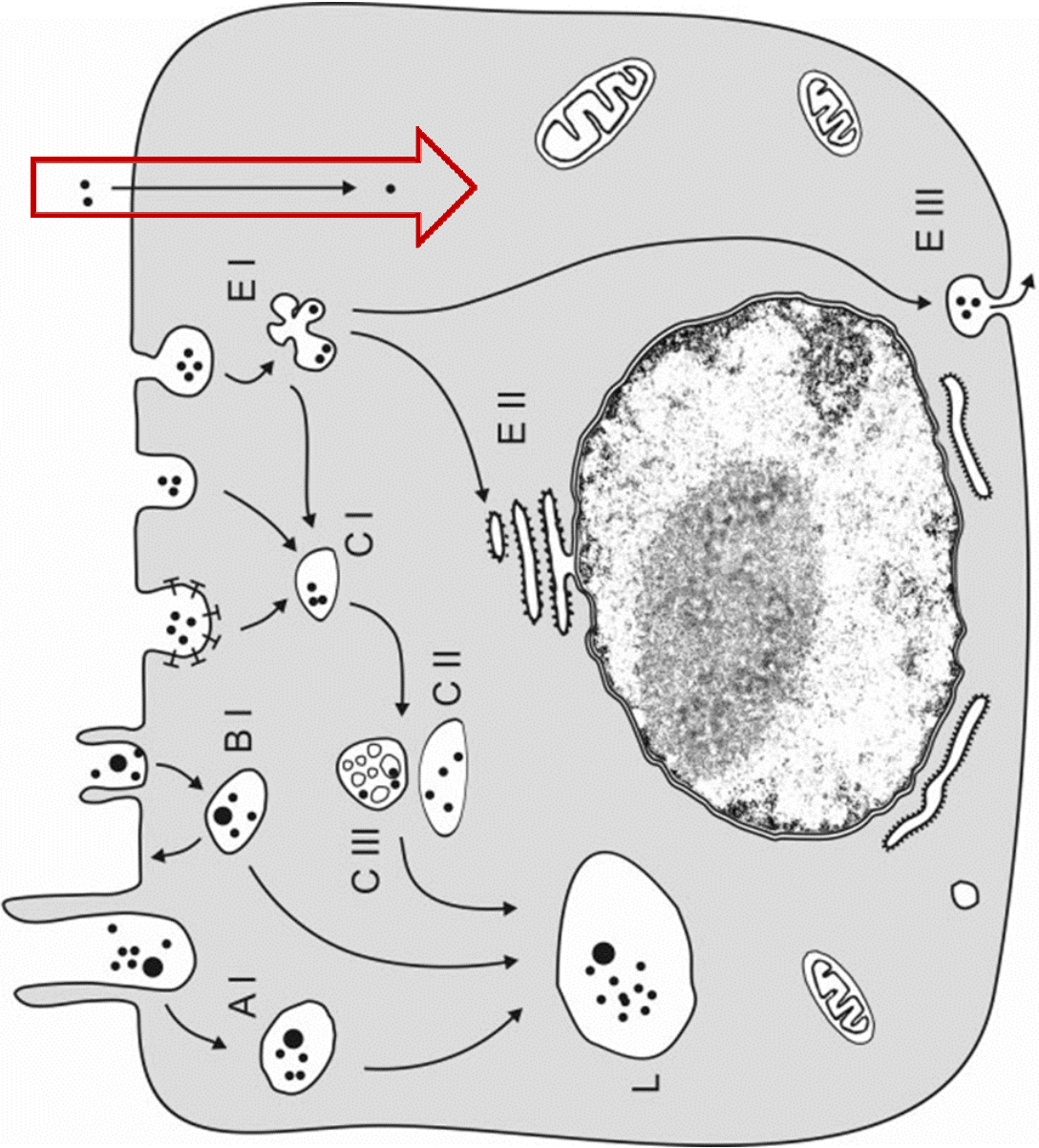








A B C D E F





# NANOPARTICLES IN MEDICINE

- Can be used for drug delivery
- Can be used for cell targeting
- Can be used for diagnosis
- Can be exploited for their antimicrobial activity
- Can help in food supplementation





