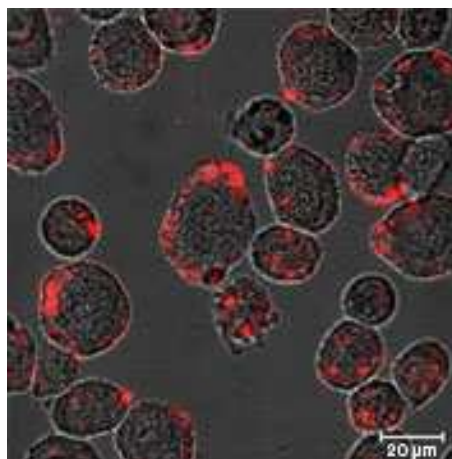


A new biosensor for cancer

A new biosensor for cancer consists of fluorescent quantum dots (core-shell CdSe/ZnS nanoparticles) with smaller gold nanoparticles covalently attached via a short (10-15 aminoacid) peptide. This sensor utilizes the fact that certain types of cancer cells express unique proteases not present in normal cells. In a typical experiment, cells obtained from a biopsy are treated by a suspension of these nanoparticles and fluorescence of quantum dots is monitored. Observation of fluorescence indicates presence of cancer (Fig. 1), while in normal cells fluorescence is not observed.



- A) Explain the principle of work of this biosensor (2 балла).
- B) Why fluorescence is not observed in the case of normal cells? (2 балла)
- C) Explain why uncoated CdSe quantum dots cannot be used instead of core-shell CdSe/ZnS quantum dots. (1 балл)
- D) What can you tell about amino acid sequence of the peptide used for the attachment of Au nanoparticles to core-shell CdSe/ZnS quantum dots? (1 балл)
- E) Describe a detailed synthetic route to prepare the nanodevices described above. You can use any commercially available reagents (for uncommon reagent, please provide the name of the supplier and verifiable catalog number). (2 балла)
- F) Researchers decided to use the system described above to monitor the progression of metastasis for a squamous cell carcinoma in a mouse model. What modifications should be done to the sensor so that it could be used for this in vivo study? (1 балл)
- G) Would you recommend in vivo use of this biosensor in human patients? Provide your arguments. (2 балла)

При ответе на английском языке – плюс три балла.