

MATERIAL DOCENTE INTERACTIVO EN INGLÉS PARA LA ENSEÑANZA PRÁCTICA Y EL AUTOAPRENDIZAJE DE (BIO)SENSORES QUÍMICOS EN GRADO Y MÁSTER

MULTIPLE CHOICE QUESTIONS FOR THE PROVIDED AUDIOVISUAL MATERIAL

(Correct answer 1 point; Incorrect answer -0,25 points; No answer: 0 points):

VIDEO 1. DISCOVER YOUR HISTORY: GENETIC ANCESTORS TEST USING GENOSENSORS

1. Mitochondrial DNA:

- a) Has applications in food quality control.
- b) Is used in clinical diagnosis.
- c) Evolutionary genetics are applied, since paternal mitochondrial DNA is inherited over generations.
- d) It is a nucleotide fragment forming part of nuclear DNA.
- e) Is the DNA involved in cell mitosis in eukaryotes cells.

Right answer: b

2. What is the revised version of the rCRS sequence?:

- a) It is a sequence that serves as a starting point for DNA replication.
- b) It is a sequence used as a basis for the description and analysis of polymorphisms.
- c) It is a sequence that is hybridized with coloured polystyrene particles and indicates the presence of the target oligonucleotide in the sample under study.
- d) It is the mitochondrial DNA, sequenced in its entirety, of the oldest surviving human species.
- e) None of the above answers is true.

Right answer: b

3. What does it mean that one person belongs to the same haplogroup as another?:

- a) They possess the same group of haplotypes, which are series of alleles at specific places on the chromosome.
- b) They belong to the same genetic population.
- c) Identical polymorphisms exist in the mitochondrial DNA of that group by exchange of a single nucleotide.
- d) They share the same genetic ancestors.
- e) All of the above answers are true.

Right answer: e

4. What are the PCR and the OLA tests for?:

- a) The PCR assay amplifies the fragments of interest of the mitochondrial DNA while the OLA assay is used to detect the presence, or absence, of the SNP mutations being analysed.
- b) The OLA assay amplifies the fragments of interest of the mitochondrial DNA while the PCR assay allows identification of the haplogroup of the saliva donor.
- c) The PCR assay uses the enzyme DNA ligase and oligonucleotides marked with biotin and polydeoxyadenine for mitochondrial DNA amplification. The OLA assay allows the identification of the haplogroup of the saliva donor.
- d) The PCR assay uses the enzyme DNA polymerase for nuclear DNA amplification and the OLA assay helps us to identify our patrilineal ancestry.
- e) PCR and OLA are the same type of test and they only differ in the type of primers used for DNA amplification.

Right answer: a

5. **Considering the four test strips (genosensors) developed in the assay, indicate which of the following combined responses is not correct:**

- a) Positive on H and L3 test strips and negative on M and A test strips indicates that the individual belongs to a European-type haplogroup.
- b) Positive on H and A test strips and negative on L3 and M test strips indicates that the individual belongs to an American haplogroup.
- c) Positive on L3 and M test strips and negative on H and A test strips indicates that the individual belongs to an Asian haplogroup.
- d) Positive on L3 and A test strips and negative on H and M test strips indicates that the individual belongs to an American haplogroup.
- e) Positive on L3 test strips and negative on H, A and M test strips indicates that the individual belongs to an African haplogroup.

Right answer: b

VIDEO 2. SYNTHESIS OF SILICA NANOPARTICLES AND LUMINESCENT DOPING

1. **Which reagents are used for the synthesis of silica nanoparticles by the Stöber method?**

- a) Hexane, water, tetraethylorthosilicate and ethanol.
- b) Ethanol, tetraethylorthosilicate, ammonia and water in small quantities.
- c) Hexane, water, silicon and trimethylamine.
- d) Ethanol:water (1:1, v/v), tetraethylorthosilicate and pyridine.
- e) None of the above answers is correct.

Right answer: b

2. **Which factors can improve the sensitivity/performance of a fluorescent sensor using nanoparticles?**

- a) The possibility of incorporating a high number of fluorophores into a single nanoparticle.
- b) The possibility of incorporating a large number of recognition receptors/elements into a single nanoparticle.
- c) The fact that fluorescent molecules are protected from interfering species such as oxygen when encapsulated in the polymer matrix.
- d) The high specific surface area of nanometric materials improves sensor response kinetics with respect to similar systems of higher dimensions.
- e) All the above answers are correct.

Right answer: e

3. **For observing the luminescence of doped nanoparticles (NPs), they must be excited with UV-vis light. An inconvenience when working with NPs is a strong interference due to scattered light. Which of the next factors cause an increase of background due to an enhanced scattering?**

- a) The diameter of the NPs. Larger NPs provoke stronger scattering.
- b) The intensity of the light employed for excitation of the fluorophores.
- c) The wavelength used for excitation of the fluorophores. At shorter wavelengths the intensity of the scattering is stronger.
- d) The fluorescence of the probe because fluorophores with weaker emission require stronger excitation power for yielding the same output signal than a strongly fluorescent probe.
- e) All the above answers are correct.

Right answer: e

4. **Alternatively to luminiscently doped silica nanoparticles, also quantum dots (QDs) are used as fluorescent nanomaterials for labelling. Among the next possibilities, choose the main disadvantage of using QDs vs. silica NPs:**

- a) QDs do quickly photobleach.
- b) Most QDs are toxic because they are composed of elements such as Pb or Se.

- c) QDs have a narrow and intense emission band.
- d) QDs show very little light scattering due to their small particle size (*ca.* 2-20 nm).
- e) QDs possess a broad absorption band that allows excitation in a broad wavelength range.

Right answer: b

5. Which chemical function should be present in an organic fluorophore for allowing its covalent immobilization in a silica network?

- a) An amino function (...-NH₂).
- b) An anionic sulfonic group (...-SO₃⁻).
- c) A carboxylic acid (...-COOH).
- d) It is not possible to form a covalent bond between silica and an organic fluorophore.
- e) An alcoxysilane function (...-Si-OR).

Right answer: e