D- Biotechnology: CLONING

1. What is cloning?

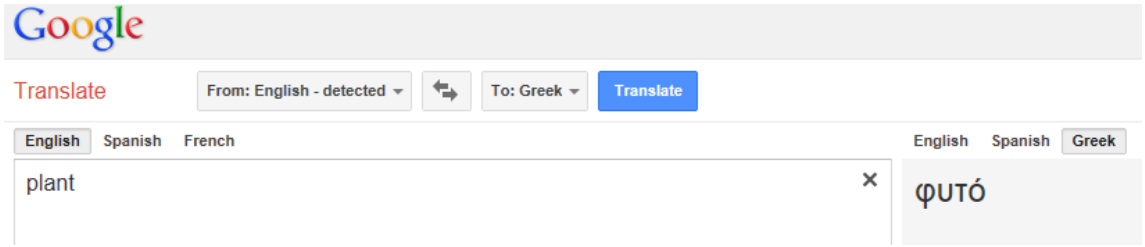
2. What are some natural examples of plant cloning?

3. What are some artificial examples of **plant cloning**? Mention both traditional and modern techniques.

4. How are animals cloned? Use a diagram which shows an egg from which the nucleus has been removed.

Biotechnology: Water Treatment

1. A) What is phytoremediation? Mention the role of cabbage or algae.



b)

SUMMARY

Cabbage plants were grown for 55 days with a nutrient solution containing 1 and 10 ppm of V, Cr(III), Cr(VI), Mn, Fe, Co, Ni, Cu, Zn, Cd, Hg(I), orHg (II). A comparison of the plant growth and chemical analysis revealed that Cr(VI), Cu, Cd, and Hg(II) in the solution are most toxic to the plant growth (hence detrimental to the cabbage-head formation) and Mn, Fe, and Zn are less toxic than other heavy metals, and that Mn, Zn, Co, Ni, and Cd are translocated into all the plant organs while V, Cr(III), Cr(VI), Fe, Cu, Hg(I), and Hg(II) are accumulated in the roots.

Read the above.

a) How many metallic elements do the roots filter out of the soil? What are Cr(III) and Cr(VI)? What is the difference between them?

2. What is the difference between a septic tank and a water treatment plant, and what is "lagooning"?

Exercises

1. Read the following:

This study assessed heavy metals (lead, cadmium, arsenic, nickel, copper, iron and zinc) concentration in lettuce, cabbage and spring onions grown along River Subin and its tributaries; Rivers Wiwi, Oda and Sisa which are extensively used by urban vegetable farmers in Kumasi to irrigate their vegetables. Atomic Absorption Spectrophotometry was used to evaluate the levels of heavy metals in the vegetable samples at four places along the river banks. There were no well defined trends in heavy metals concentration in all the vegetable samples. However, heavy metals in vegetables at the KNUST and Ayeduase sites were relatively higher compared to the Sepetimpon and Ofoase sites.
Levels of nickel, zinc, copper and iron in all three vegetable samples (lettuce, cabbage and spring onion) at the four sites were below the WHO/FAO recommended guideline levels of 67.90 mg/kg for nickel, 99.40 mg/kg for zinc, 73.3 mg/kg for copper and 425 mg/kg for iron.

However, comparing the three vegetables in terms of levels of heavy metals accumulation, averagely-nickel was highest (0.192mg/kg) in spring onion, zinc- (2.85mg/kg) in spring onions, copper (0.355mg/kg) in spring onion and iron (13.91 mg/kg) in cabbage.

Levels of cadmium, lead and arsenic in all three vegetable samples were above the WHO/FAO recommended guideline levels of 0.2 mg/kg, 0.3 mg/kg and 0.43 mg/kg, respectively. Cadmium was highest (1.06mg/kg) in spring onion, lead (1.57mg/kg) in spring onion and arsenic (4.14mg/kg) in lettuce. The presence of cadmium, lead and arsenic above the recommended WHO/FAO guidelines levels presents a potential hazard to the health of consumers.

a) How many moles of cadmium(Cd) would you expect to find in 10 kg of spring onion?

10 kg* 1.06 mg/kg *(g/1000mg)*(mol/112.4g) = 9.43×10^{-5} mole

   a. Was the arsenic in lettuce a problem? Yes it(4.14mg/kg) was greater than the maximum recommended amount of 0.43 mg/kg
   b. Is this an example of unintentional phytoremediation? Why? Yes although not by design they are still removing toxins from the soil.

2. In what kind of community is a septic tank practical? When is sewage better?

Rural areas are better off with septic tanks because sewage canals would be too expensive to spread over large areas. In urban areas tanks would let out too much bacteria in too little space.

3. What must be done to an egg during the cloning process?
Its DNA has to removed, then replaced with that of the animal to be cloned and finally implanted in a surrogate mother's uterus.

4. Can two females be used to clone a sheep? Why? or why not?
Yes as long as the cloned female supplies a full set of chromosomes.

5. Explain the difference between traditional and more modern techniques of plant cloning.

   In traditional cloning, we only use cuttings and water to generate roots. In modern plant fragments, hormones and nutrients are used to produce a larger number of clones.

6. If a strawberry plant sends a runner (looks like a long root) to a spot in the soil that's 1.0 m away, is it cloning itself, if a new plant grows from that runner?

   yes

7. Why do you think it is illegal in Canada to clone humans? (What's wrong with cloning a few Malkins and giving them to a talent-challenged team like the Montreal Canadiens?

   In selecting just a few individuals you are highlighting only a certain set of genes without full knowledge of undesirable genes that are also being cloned. Meanwhile desirable traits from uncloned people are being left out.