

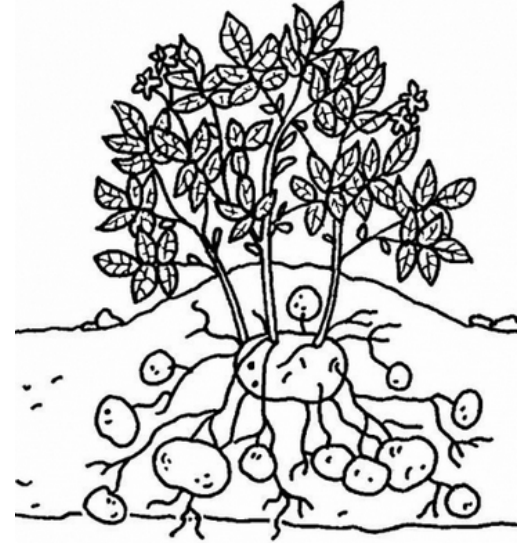
D- Biotechnology: Cloning

1. What is cloning?

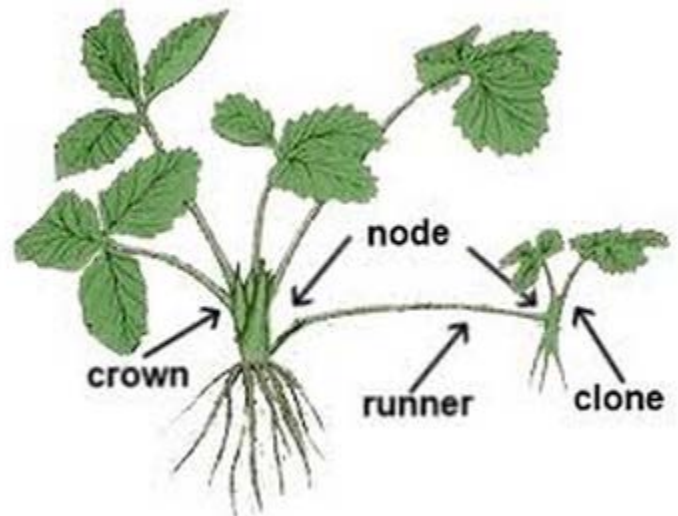
Cloning is a process which creates a genetic copy of an individual. It involves mitosis and not meiosis

2. What are some natural examples of plant cloning?

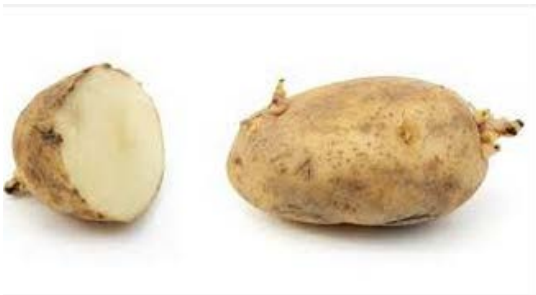
1) Although a potato can produce flower fruit and seed like its relative, the tomato, it is also capable of cloning itself or reproducing asexually. While growing, it accumulates round structures (potatoes) of protein, starch and DNA around its roots. The next growing season, even though the top of the plant will have died, each potato can develop into a clone of the original plant. (unless there were mutations that changed the genetic code)



2) Strawberries send runners (long thin stems) along the surface of the ground. When they penetrate the soil, each runner turns into a clone of the original plant.



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



Traditional: You can cut a potato into two or three pieces. Each "eye", which is tiny growth, will grow into stems and roots

Modern Cloning. Different pieces of the same carrot can be treated with growth hormones and nutrients, and each piece will develop into a clone of the original carrot plant.

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

1) We start off with a body cell of the human to be cloned.

2) Only its nucleus is taken.

3) Then a human egg is stripped of its nucleus.

4) The nucleus from the body cell is placed into the egg whose original nucleus was pulled out.

5) It's activated by shock so that egg can start dividing.
(normally that signal comes from the fertilization process, but we have not used sperm, nor have used the egg's original DNA)

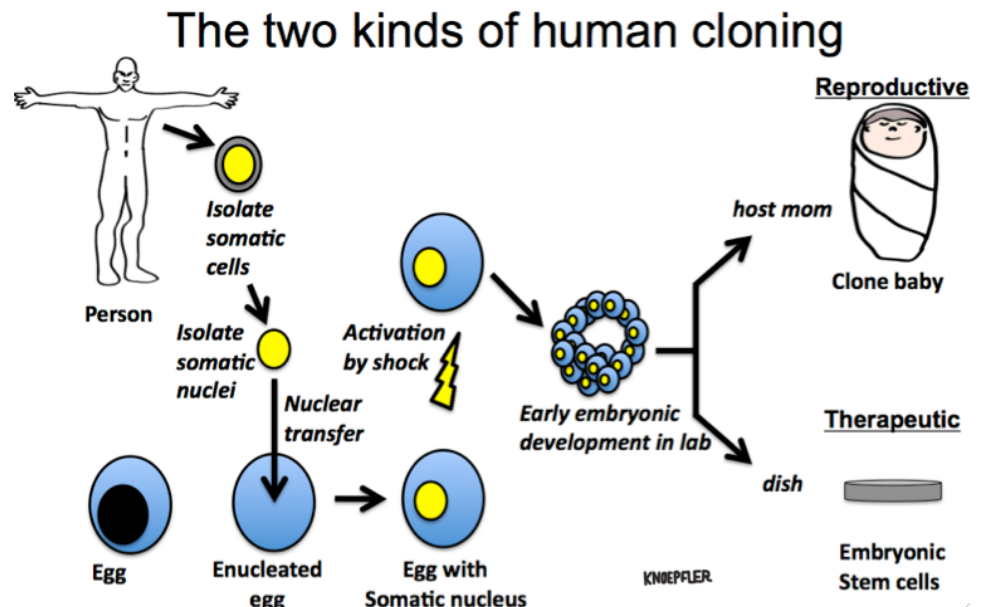
6) The original cells grow by mitosis, and these are not specialized yet. These are called **stem** cells.

a) One option (illegal) would be to place them in a womb. This would produce a clone of the human in #1.

b) Or the stem cells can be used therapeutically, to treat diseases or repair organs.

(Note that there are other sources of stem cells. The above technique is also not their only source; they can get them from organs and umbilical cords. Simple human parts such as the bladder have already been cloned using stem cells. Mice hearts and spinal cords have also been repaired with such cells.)

Diagram is recopied with permission from Paul Knoepfler



23. Biotechnology: Water Treatment

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

It's a method that relies on plants to treat sewage water. Cabbage and algae can be used to remove toxins. (they bioconcentrate it)

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), or Hg(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?

The elements that are removed from soil by cabbage roots are
V, Cr(III), Cr(VI), Fe, Cu, Hg(I), and Hg(II)

Cr(III) means Cr^{+3} and is not cancer-causing. But Cr(VI) = Cr^{+6} does cause cancer. Its unusually high charge makes it very reactive and an oxidizing agent (electron thief).

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

A septic tank is used in rural areas and at Lauren Hill! It allows solid bathroom waste to deposit and cleaner water to flow out. Periodically a special truck comes by to vacuum out the solid waste.

A water treatment plant is used in urban areas. It filters out solid waste before letting it into a lake or river. In the lagoons, plants may be used for phytoremediation, and there is often some ozone-treatment or chlorination done as well to reduce the bacterial content of the sewage.

