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| [jJournal](http://docs.google.com/journal.html) | Recently, the idea of cloning has become a big controversy in the world. The idea of the cloning of sheep leading to the cloning of humans scares many people. However, cloning of plants and animals has been a beneficial way to reproduce desirable traits in living organisms.  I have chosen an experiment that looked at the cloning of Spider Plants, chlorophytum comosum, and which soil components would promote the fastest growth of these regenerated plants. When doing this, I looked at the three most common nutrients in soil: nitrogen, phosphorus and potassium. I chose this experiment because botany, the study of plants, has always interested me. I am very much interested in conservation biology in particular so this project seemed like an interesting topic. By finding out what nutrient promotes regenerated growth the most, this knowledge can be applied to endangered species. Plants that are in danger of going extinct can be cloned the best possible way if the right soil components are used. The idea of cloning plants was presented to me by my sister, Jessica Steele, who is currently a forestry major at Michigan Technological University. Clif Simms, a biology teacher at Amador Valley High School, suggested the experimental aspect of using different nutrients. He suggested that soil components would be an interesting and likely successful experimental aspect of my project. The materials were easy to come by and it was not a very complicated project to do.  Cloning in plants, such as in my experiment, is a relatively common occurrence. It can be used to create desirable plants and fruits. Often times, these plants and fruits are produced for sale in supermarkets. For example, seedless versions of grapes and watermelon are readily available in today's society. The plants these fruits come from however, can not reproduce so they must have been cloned to continue and expand production.  One way to clone plants is the method used in this experiment: grafting. In this method, rooted cuttings are taken from a parent-plant and replanted. It is based on the idea of normal wound healing in that as soon as a shoot is connected with a root or a rooted cutting is replanted, it will heal or continue growing. In this experiment, rooted cutting were taken of a spider plant and planted in different types of soil. This child-plant will then grow with the same genetic makeup as the parent-plant. This method can also be used to change the plant to make it more desirable. For example, grafting plants onto dwarfing rootstocks can make Dwarf fruit trees. Also, a desirable fruit bearing plant can be grafted onto a disease or drought resistant rootstock to make it more adaptable to its environmental surroundings. The clone is also in the same growth phase as the parent plant from which it came.**1** However, type of grafting was not used in this experiment since plants with the same genetic make-up were needed not plants with new or different rootstocks.  Another way that plants can be cloned is by using tissue cultures. In this process, a leaf is taken from a plant and cleaned thoroughly. It is then cut into small pieces and put into a chemical medium containing plant hormones to promote growth. In this medium, new shoot will form on the leaf clippings. These shoots are then cut off and placed in a different medium to enhance root growth. When a root system begins to develop, this new plant is placed in soil on it can grow and live on its own. After the cuttings had established roots, the cloned could have been out into different soil components to see which one was the most beneficial.**2** This process could have also been used in this experiment. However, this is a much longer, complicated, and tedious project than simple grafting. Tissue cultureing is common in marketable flowering plants such as the Africa Violet. Numerous copies with the same genetic make up as the mother plant can be made and on the market. Since they all have the same make up, they all flower at the same time, which helps the gardeners in the selling of the plants. This process can also be used to increase productivity of certain plants. For example, last May scientists at Penn State University discovered a way to clone cocoa trees. "Right now, cocoa plants are grown from seed, and these plants vary greatly in their yield and disease resistance," said Mark Guiltinan, associate professor of plant molecular biology in the College of Agricultural Sciences. "In some cases, up to 50 percent of the trees can be substandard. By selecting the best trees and producing identical clones, we potentially can increase plant productivity on farms."**3**  The cloning of animals is also widely studied and researched. There are numerous different ways to clone such as, molecular cloning, cellular cloning, embryo twinning, and nuclear somatic transfer (NST). In molecular cloning, strings of DNA containing genes are duplicated in host bacterium. Next, in cellular cloning, copies of cells are made called "call lines." This process had a very repeatable procedure and can thus make an infinite number of identical copies. Embryo twinning can also be used to clone animals. In this method, an embryo must be already formed by sexual means. It is then split into to halves. In theory this should be able to be done an Infiniti number of times but in reality, scientists are limited to the number of times they can twin an egg. In 1993 this process was used by Jerry N. Hall in New York to clone 17 human embryos into 48 embryos in a fertility clinic. In reality, Hall had just twinned the undifferentiated embryo and not really cloned them at all. In this experiment, Hall introduced an electric spark that causes cells to twin. This was not the first time this had been however. This technique is often used I to livestock industry to create more embryos. The final method of cloning animals is through NST. For this process, the nucleus of an adult cell is taken and implanted into an egg cell where the nucleus is removed. These two parts an also be ìfusedî together with a small electric current through the process of fusion. In 1981, Dr. Karl Illmensee and Dr. Peter Hoppe attempted to prove that the nuclei of adult mice cells could be inserted into mouse eggs to produce adult mice. The two men performed an experiment and presented much evidence to scientific journals to support their ideas. Soon however, people began to doubt their evidence when they could not repeat the results. Unfortunately, these two scientists were lying all the time and presenting fake data. They had even drawn spots on the mice with markers to try to pull off their scam.  In 1997, the idea of cloning animals through NST was finally made a reality by Ian Wilmut. At PPL Therapeutics in Edinburgh, Scotland Wilmut successfully cloned a adult sheep. This clone, known as Dolly, was finally successful because Wilmut starved host eggs to make sure that the nucleus entering and the host egg are in the same stages of delolpment. Thus, the clone could continue to develop without mutations or deformations. Wilmut attempted to this in order to explore work in transgenic animals or animals genetically altered for medical purposes.**4** What amazed people about Wilmutís sheep is that in the scientific world, it what he did was thought to be impossible. Scientists believed that once DNA is in a specialized cell, it looses its ability to use the commands for all different types of cells needed in an embryo. Although many people feared this break through and the idea for human cloning, scientists around the nation had different feelings on it. "What people don't understand is that with cloning you're creating twins, and like identical twins that occur naturally, they are not necessarily identical in the sense of personality," says Kelly Smith, professor of philosophy at the College of New Jersey. "If you cloned yourself, there's no guarantee that your clone would be just like you. In fact, there are a lot of reasons why your clone would probably be very different in some important ways." Also in support of cloning, Jennifer Lobo, a Palmer Square-based biotechnology venture capitalist and CEO of Peregrine Pharmaceuticals, said, "Cloning is already common in all kinds of research. People clone genes every day of the week to produce new drug products. Cloning a whole animal is a considerably greater task, certainly, but the only thing that makes it different is that it's pretty dramatic." This topic is most opposed my environmental activists and animal rights supporters. For example, as stated by Gregg Merritt, the leader of the Green Party in New Jersey, "not only makes my blood crawl, it makes it boil. I don't think we should be cloning any animals, let alone humans!� **5** Recently, in Virginia the team at PPL Therapeutics has created the first litter of cloned sheep. This and other companies are hurrying to develop pigs that can make up for the shortage of organ transplants needed by human patients.**6**  1 http://instruct.cit.cornell.edu/courses/hort400/graftage/Whygraft.htm  2 http://www.jmu.edu/biology/biofac/facfro/cloning/cloning.html  3 http://aginfo.psu.edu/news/may98/cocoa.html  4 Pence, Gregory E. Whoís Afraid of Human Cloning? 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