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CHAPTER 3-SPECIFIC ISSUES IN SCIENCE, TECHNOLOGY AND SOCIETY

LESSON 3 - GENETICALLY MODIFIED ORGANISMS

LESSON 4- THE PERIOD OF NANOTECHNOLOGY

LESSON 5 – CLIMATE CHANGE

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LESSON 3 GENETICALLY MODIFIED ORGANISMS

Genetically Modified Organism (GMO)

The term GMO or genetically modified organisms are usually employed to crop plants produced for human or animal consumption using the latest molecular biology techniques. These organisms are modified in the laboratory to incorporate desired traits such as improving the nutritional content or to increase resistance to pests. According to the FDA and United States Department of Agriculture (USDA), there are over 40 plant varieties that have completed all the federal requirement for commercialization.



Here are some of the advantages of GM in foods:

1. **Pest Resistance** -These GM foods that are pest-resistant help eliminate the application of chemical pesticides and as well cut the cost of production of the crop.
2. **Herbicide Tolerance** –Farmers grow these soybeans which only require one application of weed-killer instead of multiple applications. This can as well reduce the production cost and limits the danger of agricultural waste run-off.
3. **Drought Tolerance and Salinity Tolerance** – creating plants that can withstand long periods of drought or high salt content in soil and in groundwater will help people to grow crops in formerly harsh places.
4. **Nutrition** – rice is a common staple food in third world countries. Researchers at the Swiss Federal Institute of Technology Institute for Plant Sciences have created a strain of golden rice containing an unusually high content of beta-carotene (vitamin A).



Reported Issues against GM foods

- 1. *Unintended harm to organisms*** – There was a study published that pollen from Bt corn caused high mortality rate in monarch butterfly caterpillars. **Bacillus thuringiensis** (Bt) is a common bacteria that has played a very uncommon role in agriculture and the development of genetically modified foods. The natural insecticidal abilities of these bacteria have made them an important pest control tool for nearly a century
- 2. *Reduced effectiveness of pesticides*** – Many people are concerned that insects will become resistant to Bt or other crops that have been genetically modified to produce their own pesticides.



3. **Gene-transfer to non-target species** – The genetically modified crops, plants and weeds may cross-breed, resulting in the transfer of the herbicidal resistant genes from the crops into weeds, resulting to the weeds tolerance to the herbicides as well.
4. **Unknown effects on human health** - There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health.
5. **Allergenicity** - The classical understanding of why a GM crop might create new allergies is that the imported genes produce a new protein, which has never before been present. The novel protein may trigger reactions.



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Top 10 Genetically Modified Foods



Corn



Soy



Cotton



Papaya



Rice



**Rapeseed
(Canola)**



Potatoes



Tomatoes



Dairy products



Peas

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GMO Foods

Tomato



70% of tomatoes sold in the United States are genetically modified and they are not being grown commercially in the U.S.

Alfalfa



95% of alfalfa is genetically modified and 90% of alfalfa used as a feed for cattle.

Cotton



At least half of cotton grown in the world is GMO.

Rice



GMO rice has been approved but is not yet being sold commercially.

Wheat



Approximately 20% of wheat grown in the U.S. is GMO and is not yet being sold commercially.

Sweet Corn



More than 99 percent of sweet corn grown in the United States has been genetically engineered.

Sugar Beets



99% of sugar beets used to make 80% of our sugar are GMO.

Summer Squash



Farmers plant like GMO squash but some experts say the squash is not identical with wild squash.

Salmon



GMO salmon has not been approved by the FDA, but it is being sold.

Soy



More than 90% of soybeans in the United States produced are genetically modified.

Canola Oil



87% of canola grown commercially, and 100% of wild canola is GMO.

Peas



Peas have been genetically modified but are not approved for sale.

Yeast



GMO yeast for brewing beer is approved.

Hawaiian Papaya



Most Hawaiian papaya is GMO, but many organic stores are non-GMO.

For more information go to olmag.co/gmo-foods

organic lifestyle

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LESSON 4 - THE PERIOD OF NANOTECHNOLOGY

Do you know that there are things so minute that is so important to us? And how tiny are they? They are 1 – 100 nanometer (nm) in scale which could be 100 to 10,000 times smaller than human cells but are similar in size to large biomolecules such as enzymes and receptors. These objects are in the range of a nano scale (nanoscopic). According to Nikalje (2015), a **nano scale** is the place where the properties of most common things are determined just above the scale of an atom. Furthermore, nano scale objects have at least one dimension that measures **between 1 and 999 nanometers**.

Nanotechnology is the study of extremely small structures thus the etymology “**nano**” a Greek word that means “**dwarf**” in short, miniature or very small in size. It deals with things that is the size of **0.1 to 100 nm**; nevertheless it is also inherent that these materials should display different properties such as electrical conductance chemical reactivity, magnetism, optical effects and physical strength, from bulk materials as a result of their small size (Nikalje, 2015).



Nanomedicine is one of the applications of technology. This discipline refers to nanoscale or nanostructured materials, which are engineered to have unique medical effects. Nanomedicine is a promising field for early detection and prevention; for the improvement of diagnosis; for proper treatment; follow up of diseases; and becoming more efficient in gene sequencing. In medicine we can classify the use of nanotechnology as (1) **nanomaterials and nanoparticles**; (2) **nanotechnology tools**; and (3) **medical applications**.

One common example of nanomaterial is **carbon nanotube**. According to Geertsma et al (2005) carbon nanotubes and magnetic carbon oxide nanoparticles, gold coated silica nanoshells, can transform electromagnetic energy into heat, causing a temperature increase lethal to cancer cells merely by increasing the magnetic field or by irradiation by an external laser source of near infrared light at the very location where these nanoparticles are bound to or internalized within tumor cells.



Other advanced applications of nanotechnology in medicine are in chips for molecular diagnostics. The **lab-on-a-chip** is used for quick test results using very small samples. Lab-on-a chip miniatures all the steps needed to process all the medical sample and to detect diseases.

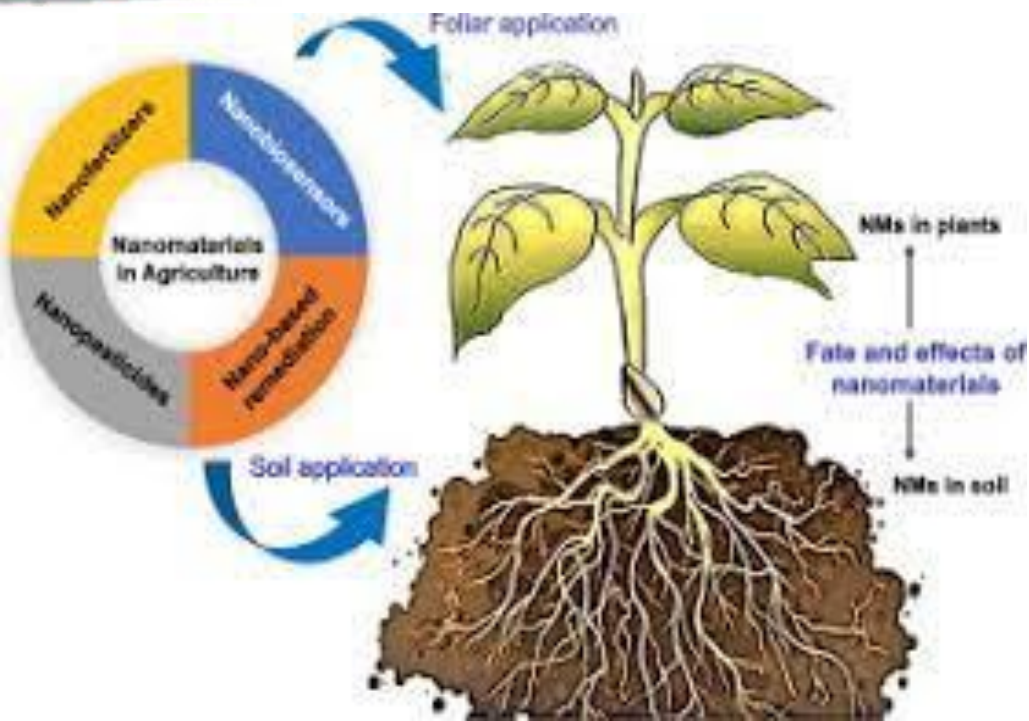
Another essential tool is a scanning probe microscope that allows three-dimensional type topographical atomic and molecular views or optical responses of nano scale structure.

In nanomedicine, some applications of nanotechnology is focused on topics in genetics, **nanostuctured probes** for gene detection in living cells, that can also detect UV damage to individual DNA molecules with **Atomic Force Microscopy**.

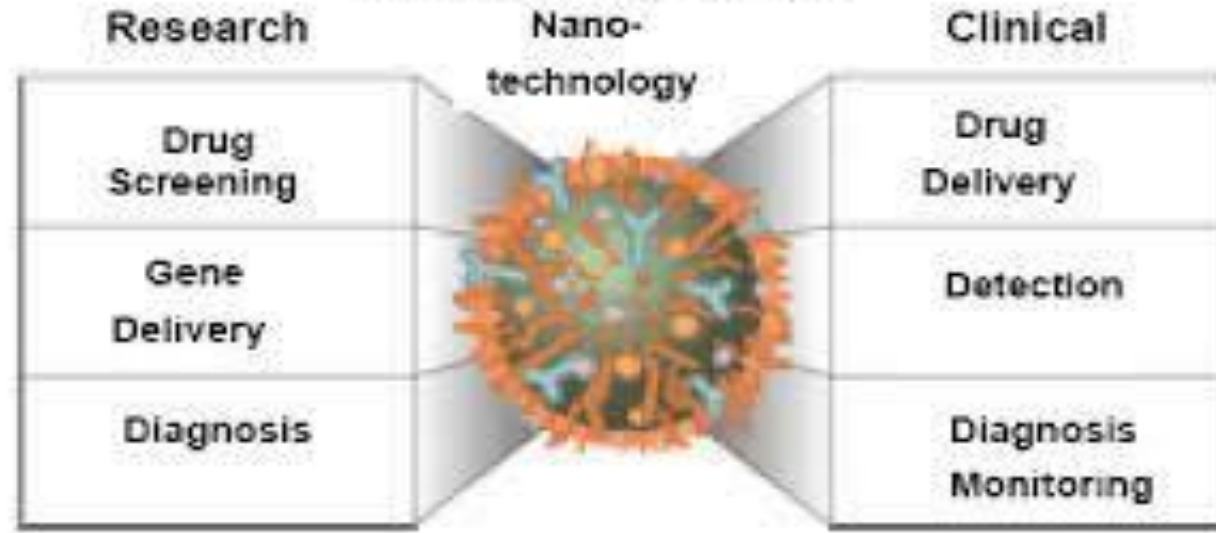
An important field of application for nanotechnology in medicine is the biomaterials, used for example in orthopedic implants or as scaffolds for tissue engineered products. **OSferion** is an artificial bone replacement material with excellent biocompatibility.



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Medical Application



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LESSON 5 -CLIMATE CHANGE

NASA defined climate change as the usual change in the usual weather found in a place moreover it can also denote the change that is happening in the Earth's climate.

The issues about the cause of global warming are divided into ***natural*** and ***human influences***.

NATURAL CAUSES

1. Natural Greenhouse Gas – there are natural greenhouse gas in the atmosphere such as carbon dioxide, methane, water vapor and nitrous oxide.

Methane – the decomposition of carbon containing organic material by anaerobic bacteria and moist places as varied as rice paddies, sanitary landfills, and the intestinal tracts of carabaos, and other large animals, including humans is a major source of methane.



Carbon dioxide -Burning carbon-containing fossil fuels- coal, oil and natural gas accounts for most of the human contribution to total carbon dioxide. Land conversion, such as when the tracts of tropical forest are logged or burned, it also releases CO₂ and cause an increase in the atmospheric carbon dioxide concentration.

2. **Volcanic Eruption** - a single volcanic eruption will release amount of carbon dioxide and ash to the atmosphere. Once carbon dioxide increase, the temperature of earth increase and greenhouse trap the solar radiations in the earth.

HUMAN INFLUENCES

1. **Use of CFC (Chlorofluorocarbon)** – CFCs are refrigerants released into the atmosphere from old leaking refrigerators and air conditioners. CFCs act to trap heat in the lower atmosphere, causing the earth to warm and climate and weather to change.



2. **Industrial Revolution** –During the combustion process of these fossil fuels to provide enough energy there is a drastic release of carbon dioxide (CO₂).

3. **Mining** – According to the Global Forest Atlas (GFA) that mining is responsible for the seven percent (7%) of the deforestation in subtropics. Moreover, we all know that trees absorb CO₂ because it is one of the primary ingredients for photosynthesis, in short there will be less trees but more carbon dioxide.

4. **Deforestation** - Deforestation is a human influence because humans have been cutting down trees to produce papers, wood, build houses or more. If humans continue deforestation, carbon dioxide will concentrate in the atmosphere because trees can absorb carbon dioxide from the atmosphere.



EFFECTS OF CLIMATE CHANGE

1. **Intensified Tropical Cyclones** – from the report made by the Global Climate Risk Index in 2015, the Philippines was listed as the number one most affected country by climate change using the 2013's data. Because of its geography and development, more tropical cyclones struck the nation more often and more severely which scientists believe is due to climate change.

2. **More intense El Niño** – El Niño is an unusual warming in the Central and Eastern Equatorial Pacific. It occurs in the Pacific basin for every 2 – 9 years. Usually, it starts between December to February. In the Philippines, we can indicate whether there is El Niño if there are delays in the onset of rainy season or an early termination of the wet season.

3. **Sea Surface Temperature (SST) to rise** – according to a study done by a scientist from the University of the Philippines that the country's SST have been rising over the past decades. These fluctuations in SSTs may lead to typhoon-induced wave action and high sedimentation that may lead to the coral's brittleness and increased sensitivity to siltation and resultingly death of sea grass. Furthermore, this may result to the loss of nursery grounds for fish and support system for endangered species.



4. **Ocean Acidification** – due to the release of CO₂ and its increasing number in the atmosphere, it can react to the water of the Earth's oceans, there is an ongoing decrease of its pH.

5. **Sea Levels to rise** – current data show an increase in sea surface heights. Scientists say that this is due to the melting of ice sheets in the northern position of the Earth like Antarctica and Greenland. Sea level rise by 4 to 6 meters can submerge low-lying communities like Tacloban City which stands only 3 meters.

6. **Rainfall, Flooding and River flow to intensify** – some cities in the Philippines already experienced unprecedented amounts of rainfall. One example is Tacloban city, that received an increase of rainfall for about 257% from 1998 to 2011. Consequently, it will lead to more flooding and can trigger landslides in upland community.



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Priorities	Outcomes
1. Food Security	Ensure food availability, stability, access, and safety amidst increasing climate change and disaster risks.
2. Water Sufficiency	Manage water resources sustainably and ensure equitable access.
3. Ecosystem and Environmental Stability	Enhance resilience and stability of natural systems and communities.
4. Human Security	Reduce risks to women and men due to climate change and disasters.
5. Climate-smart Industries and Services	Develop, promote, and sustain climate-resilient, eco-efficient, and environment-friendly industries and services.
6. Sustainable Energy	Adopt sustainable and renewable energy and ecologically efficient technologies as major components of sustainable development.
7. Knowledge and Capacity Development	Enhance knowledge and capacity of women and men to address climate change.

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5 MAIN STEPS THAT SOCIETY NEEDS TO TAKE TO DEFEAT CLIMATE CHANGE



1. COMMITMENT

The current climate crisis requires people to demand **political action** from their governments.



2. PARTICIPATION

Climate change requires individuals to contribute to sustainability in their communities through practical solutions.



3. HEALTHY HABITS

Walking, riding a bike and healthy eating are habits that will help in the fight against climate change.



4. ENVIRONMENTAL AWARENESS

Societies that love and respect nature play their part by setting an example in the fight against global warming.

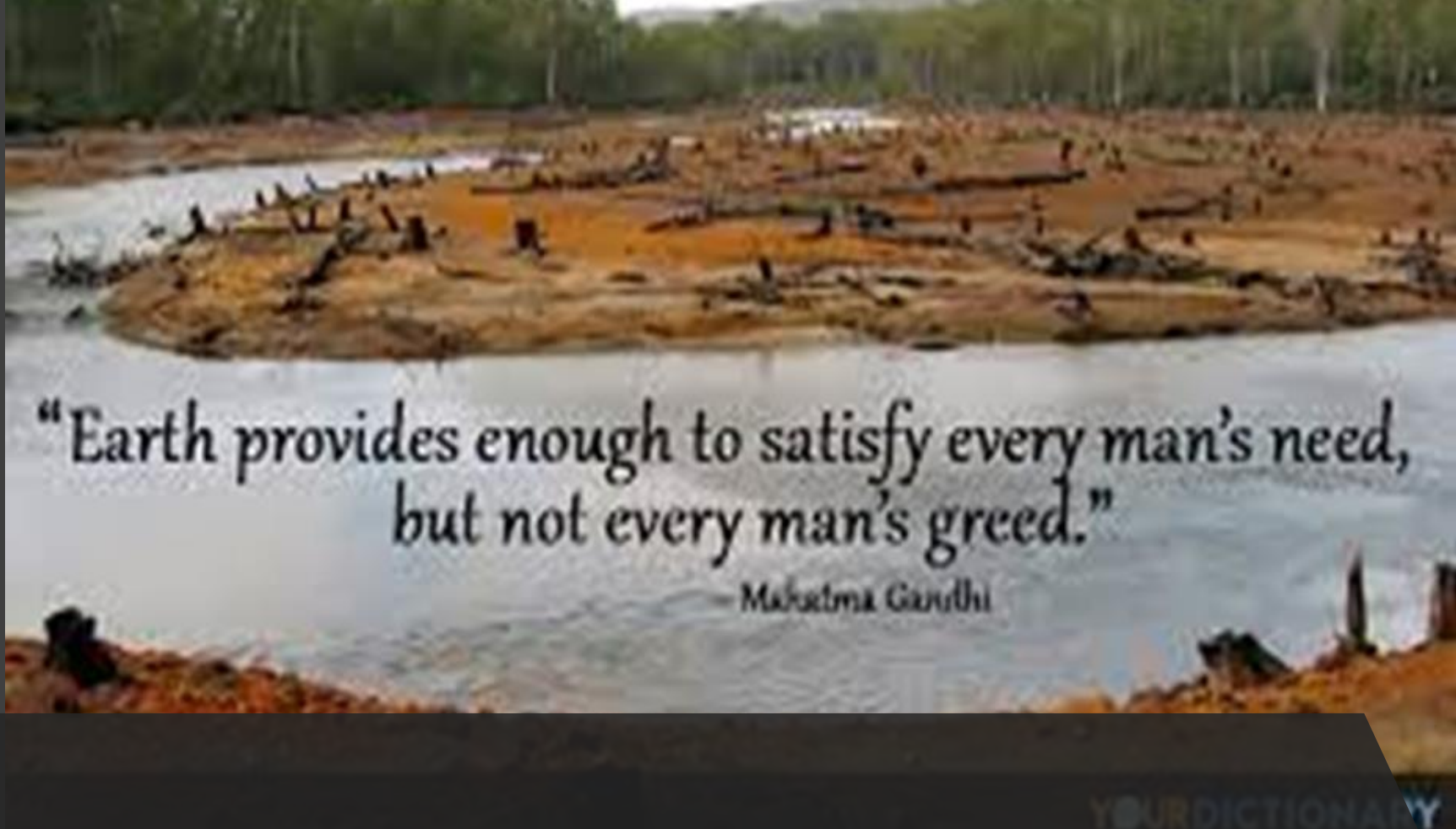


5. EFFICIENCY AND INNOVATION

Climate change needs people to prioritise energy saving and the use of renewable energy.



Source: Friends of the Earth.



Thank You !
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