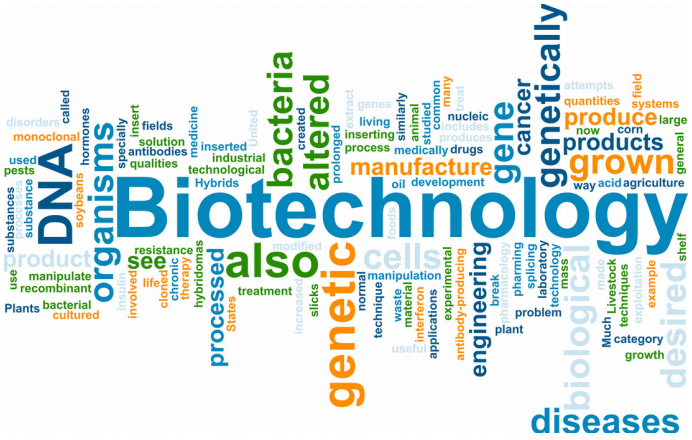
https://www.cnbc.com/2014/06/23/frankenstates-winning-the-agriculture-tech-war.html

Agricultural Technology

vs. organic gardening

Biotechnology

use of biological organisms in agricultural & industrial processes to make products valuable to humans ex. tearless onions



https://www.fchsstem.com/biotechnology.html

Breeding Technology

- Black Tomatoes

http://www.suttons.co.uk/Gardening/Vegetable+Seeds/Popular+Vegetable+Seeds/Tomato+Seeds/Tomato+Indigo+Rose+Seeds+-+The+Black+Tomato_182370.htm

Grafting

- TomTato
  - tomato + potato
- Potato Tom

https://www.gumtree.com/p/plants-flowers/tomtato-pomato-tomato-potato-plant-potted-and-ready-to-go-/1248004866

Hydroponics

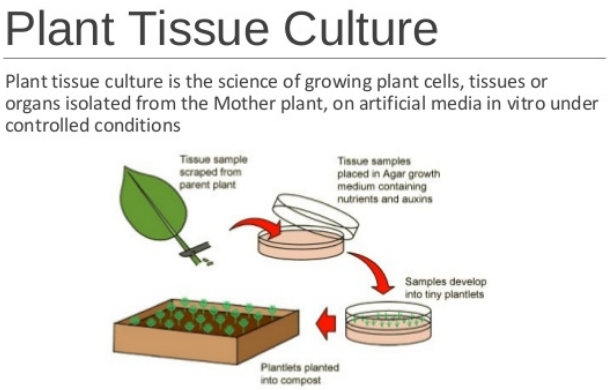
- grow plants in solution of nutrients necessary for plant growth rather than in direct soil
- uses some synthetic chemicals

https://foodandnutrition.org/september-october-2017/the-411-on-hydroponics/

Plant Tissue Culture

- growth and development of plant seeds, organs, explants, tissues, cells on nutrient media under sterile conditions
- generates lots of plants at a time
- reasons to use tissue culture:
  - virus-free reproduction
  - make many identical clones
- **micropropagation** (asexual reproduction)
- **tissue culture medium**
  - water, mineral salts, carbon sources, vitamins, plant growth regulators

http://www.scind.org/518/Science/history-of-plant-tissue-culture.html



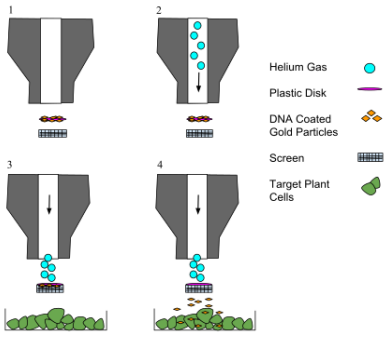
https://www.slideshare.net/mobile/DiptaBardhan/plant-tissue-culture-in-bangladesh

Transgenic Plant

- **Gene technology**
  - Foreign genes can be introduced
  - Faster than traditional plant breeding
  - Specific genes can be transferred
    - More control than traditional plant breeding
- **Transgenic plant technologies**
  - Require tissue culture
  - **DNA recombination (**taking DNA of one organism and moving it to another**)**
  - Result = **genetically modified organisms(GMOs)**
  - **Step 1 : get your gene**
  - **Step 2 : prepare your receiving tissue**
  - **Step 3 : get your DNA into target plant**

    - methods :
      - Gene gun
        - DNA coated onto surface of gold particles
        - Blasted into sample of plants cells
        - Placed on selective media containing herbicide for 3 weeks
        - Small plantlets transplanted into soil and acclimated under high humidity conditions
      - Agrobacterium tumefaciens
      - Electric pulse

http://www.bio-rad.com/en-ch/product/helios-gene-gun-system?



https://en.m.wikipedia.org/wiki/Gene_gun

- Survival of transformed cells on selection medium
  - **antibiotic** (kanamycin resistant gene)
  - **herbicide** (glyphosate resistant gene)
    - Kills all plants it come in contact with
    - Inhibits ESPS synthase in an amino acid pathway
      - No amino acid = plant dies
    - Resistant ESPS synthase gene allows crops to survive spraying
      - Roundup Ready
- Display of a reporter gene
  - Marker gene(makes plant show color)
- **Insect resistant plants**
  - BT toxin gene from bacteria
  - Bacillus thuringiensis
  - Provides resistance from insects without using insecticides
  - BT-corn, BT-cotton, BT-rice
    - monarch butterfly larvae consume leaves dusted with BT corn pollen
    - dies
- MerA gene [plants grow on mercurium contaminated soils]
- MerB gene [organomercurial lyase]
- **Flavr Savr tomato**
  - Harvest in green
  - Chemically ripened by ethylene gas
- **Virus resistance**
  - Coat protein

- Transgenic : papaya, tomato, plum
- Transgenes : PRSV coat protein, CymMV coat protein

✦ **Golden rice :** transgenic rice with genes for production of vitamin A