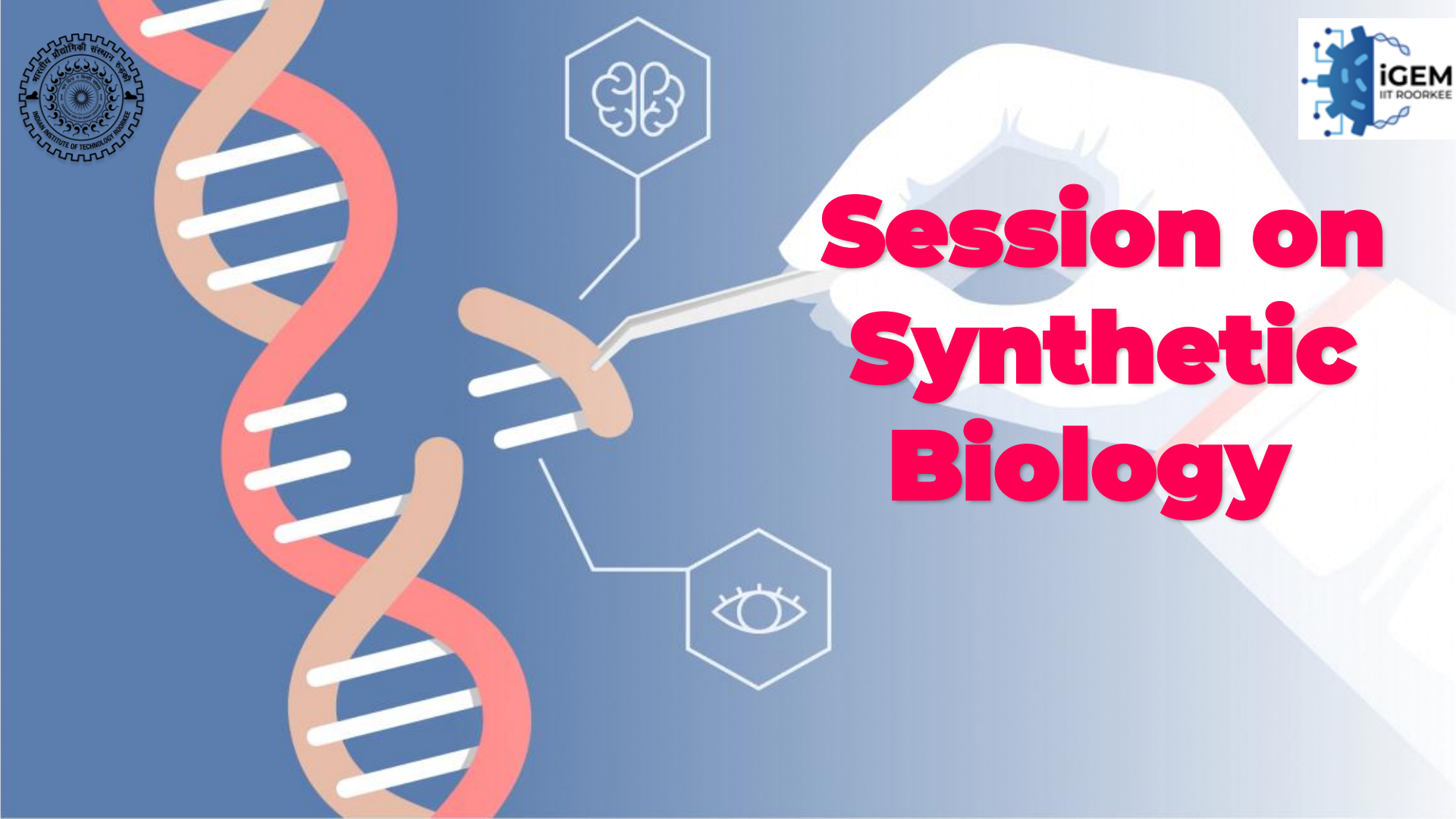

Session on
Synthetic
Biology

Have u ever wondered if HULK could be brought to reality?

DNA and GENE

DNA - DeoxyriboNucleic Acid

- Molecules form a shape of long spiralling ladder.
- Molecular blueprint of a living system.
- 1gm of DNA holds 700 TB of information.

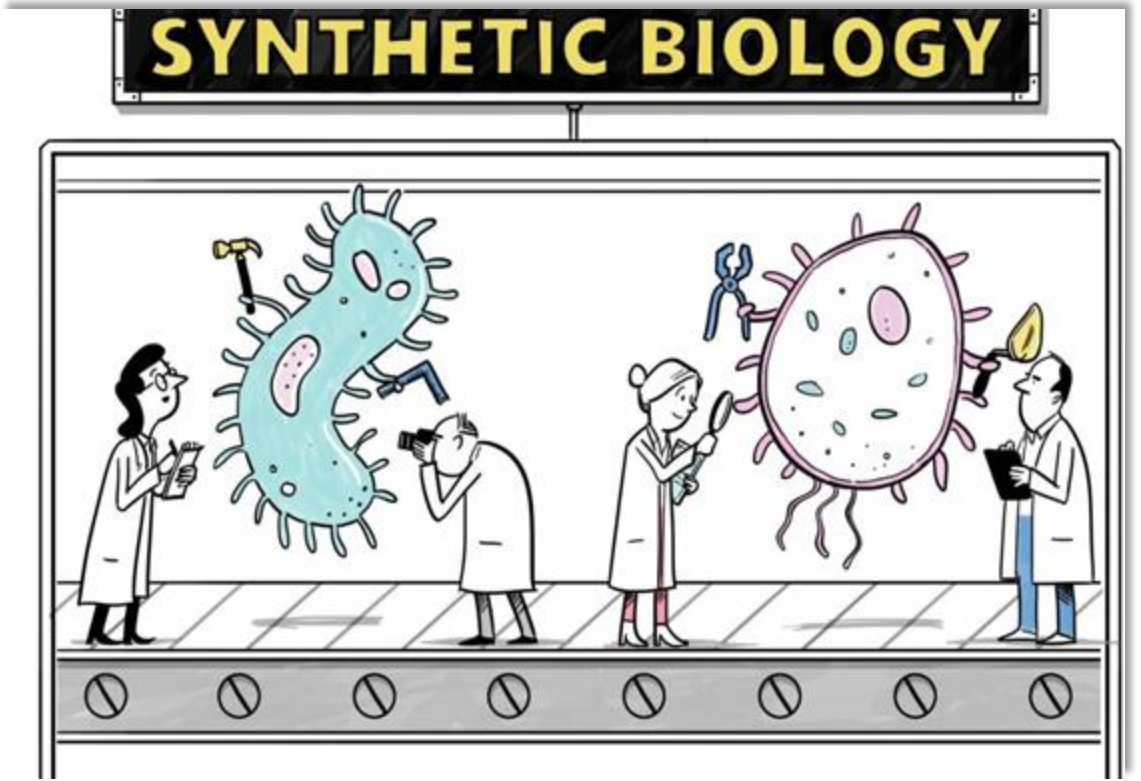
Genes - Segments of DNA

- Encodes a specific protein that functions in cells in the body.
- Genes are contained in chromosomes in nucleus.
- It is the basic physical and functional unit of heredity.

Welcome to the world of SynBio!

What is SynBio?

- Scientific discipline providing ability to **engineer life** according to our benefits.
- Harnessing the power of nature and solving problems in different disciplines of life
- Constructing **artificial biological pathways**
- Redesigning existing natural biological systems.



SynBio: Combining Engineering and Biology

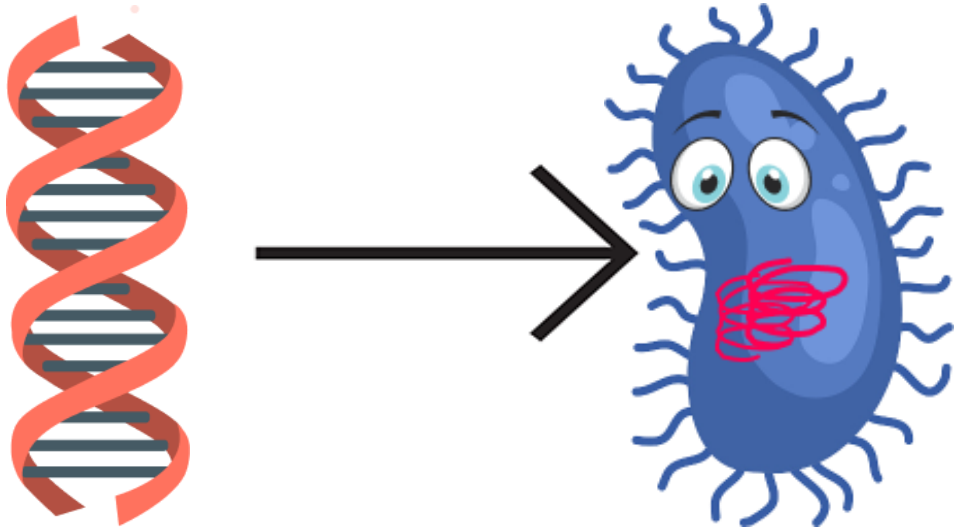
Molecular Biology

+

Engineering Principles

Power of SynBio

SynBio gives the biologists liberty of altering an organism's DNA so that it behaves "**according to specifications**".



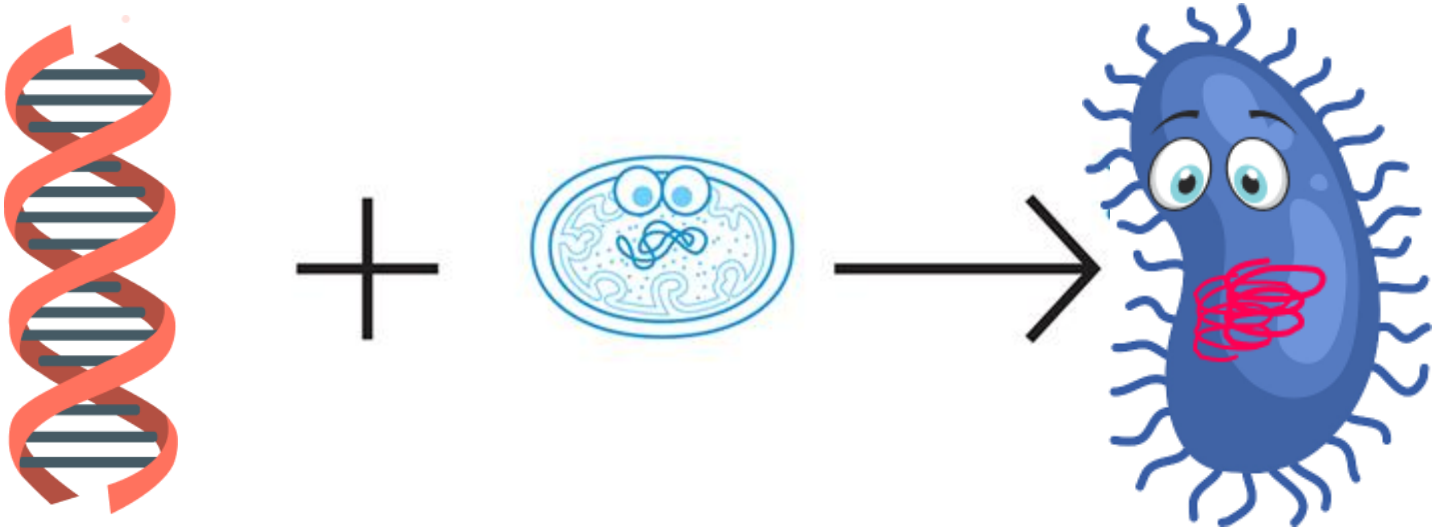
DNA

Organism

It involves Redesigning organisms for useful purposes by engineering them to have new abilities.

Revolutionising the Life!

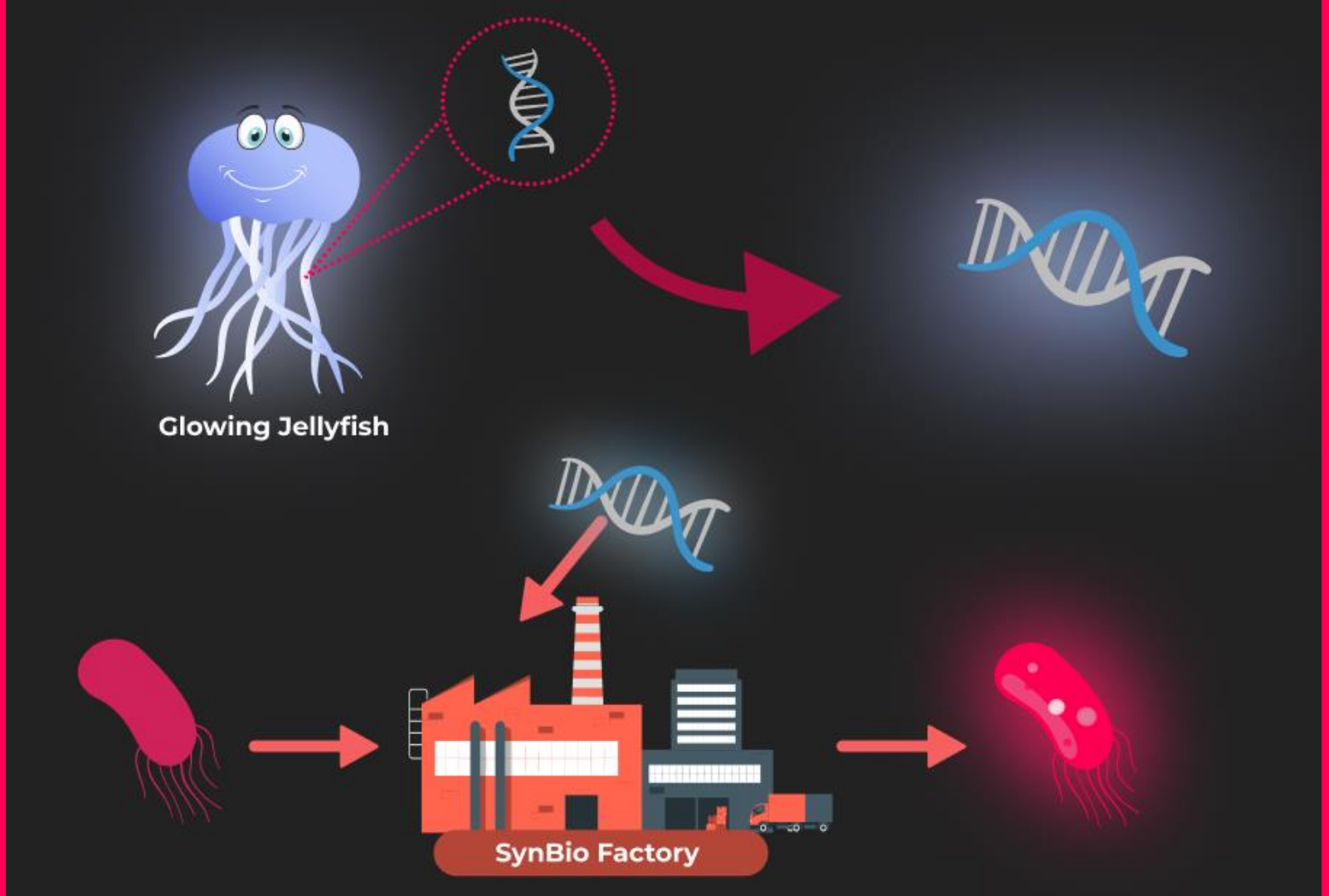
Synthetic biologists can **change** a cell's DNA so that the cell takes on new useful functions.



DNA **Organism** **New Organism**

The **ultimate goal** of SynBio is to provide the biologists with the ability to build specialized living organisms from scratch using designed DNA.

SynBio



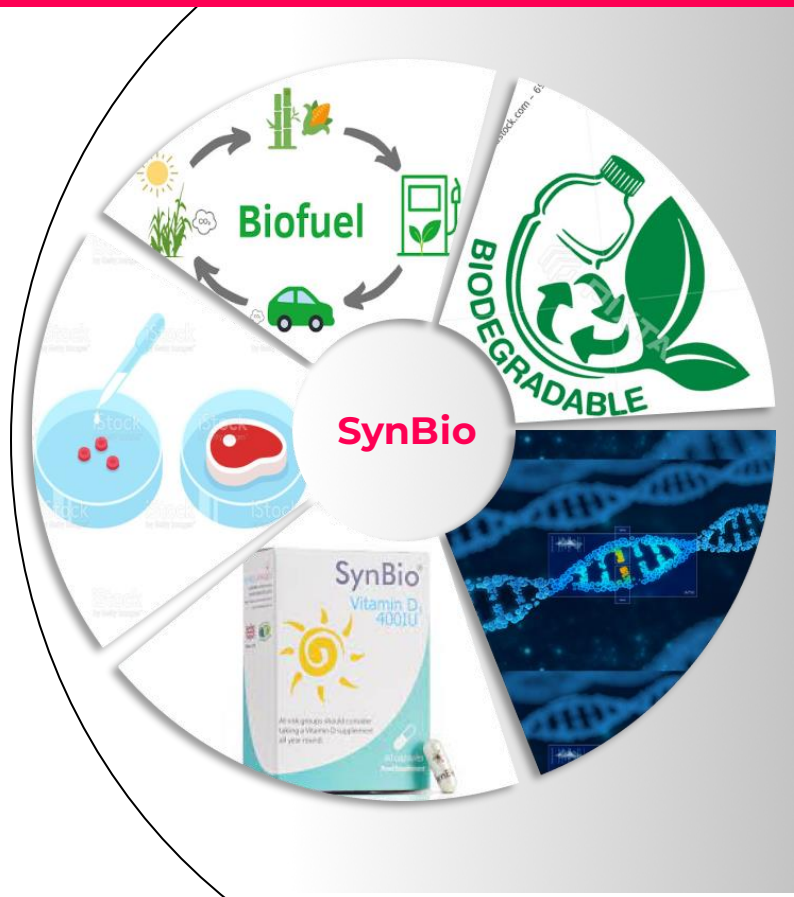
Factory

Glow in the Dark: Video

SynBio around You!

Existing applications consist of:

- Biofuels to replace harmful and non-renewable fossil fuels
- Lab grown meat
- Biodegradable plastics
- Detection and treatment of diseases
- Food and nutrient production

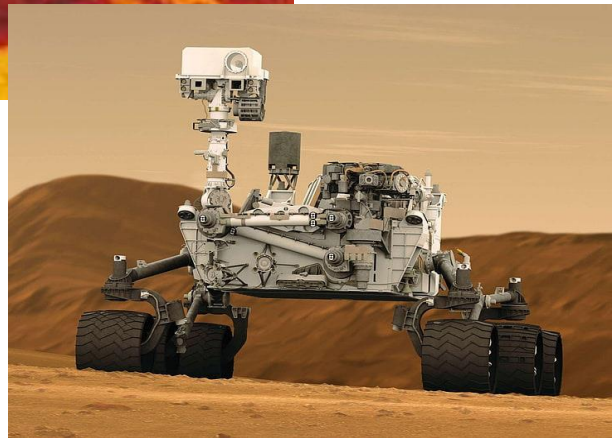


The Transit of Synthetic Biology!

With NASA's Curiosity Rover landed safely on Mars and ready to search for signs of life, back on Earth attempts are underway to engineer bacteria that could thrive on the Red Planet.

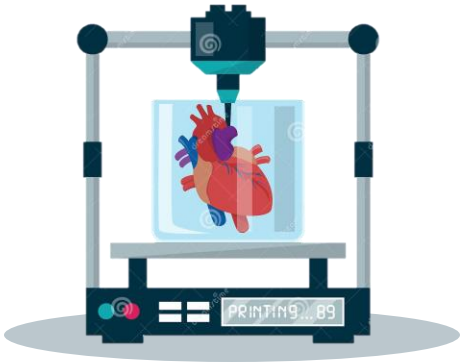
Synthetic Biology is blooming in the field of space exploration as well!

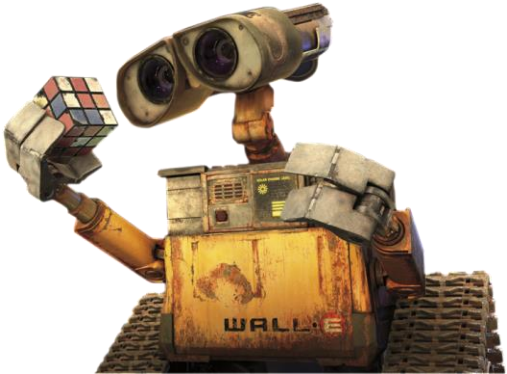
Curiosity Mars rover



Outrageous Applications

- Biofilm coatings on **Rovers** with materials that can regenerate and **self-heal when damaged.**
- Microorganisms that continuously produce food supplements for astronauts' nourishment needs.
- Synbio also has a lot of scope in the healthcare sector ranging from biotherapeutics to whole **3D bioprinted organ replacements**.





Machine Learning

The science of getting machines to learn without specifically being programmed.

DATA (INPUT)

Program

Traditional Programming

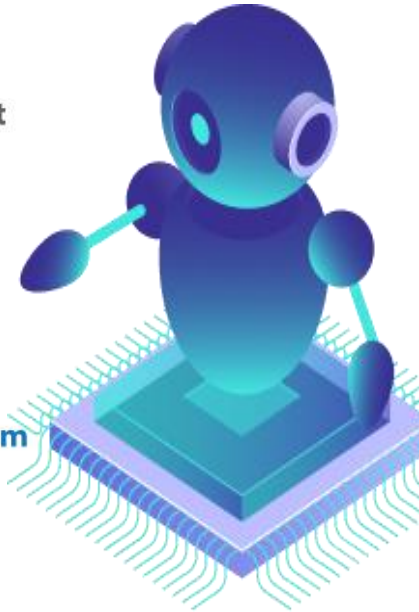
Output

DATA (INPUT)

Output

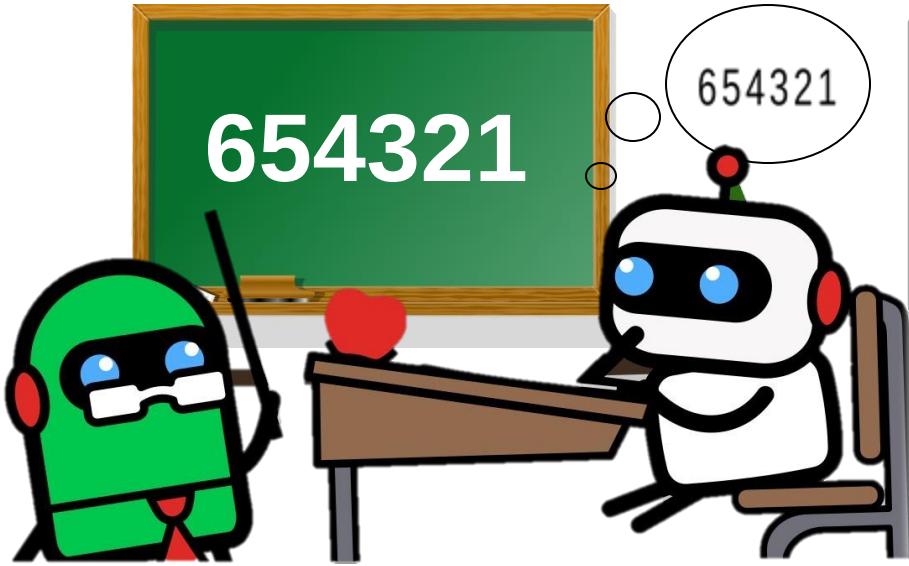
Machine Learning

Program



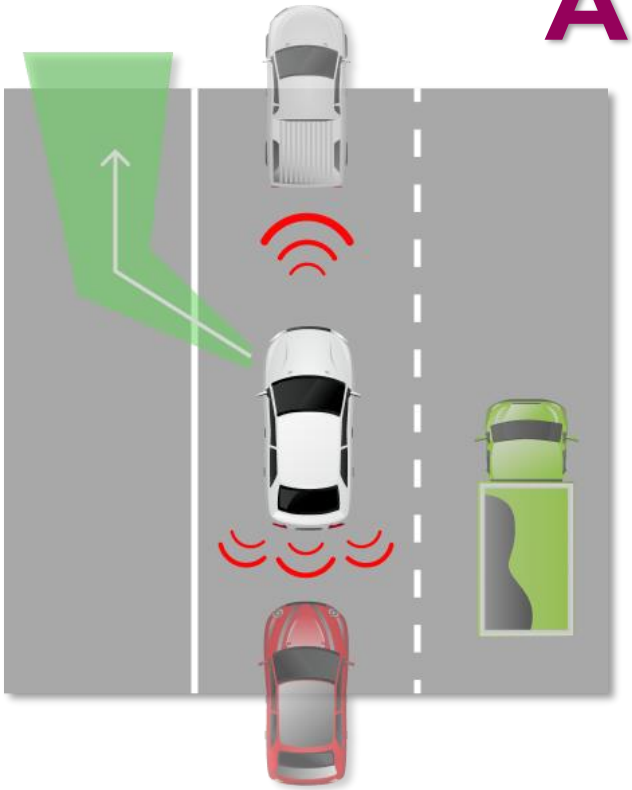
But how do Machines learn?

- We all easily recognise the digits (or number) mentioned above.
- But we never appreciate our visual recognition system.
- Similarly, **Machines learn through data**. Given set of handwritten digits images, with their correct labels, computer program can be developed which can classify digits.



Machine Learning

Auto Pilot



- Tesla cars record all traffic data e.g. Relative position of other cars, speed of cars around etc.
- All this data from each car is recorded and processed.
- A subfield of ML called Deep Learning uses this data to improve accuracy of the autopilot.

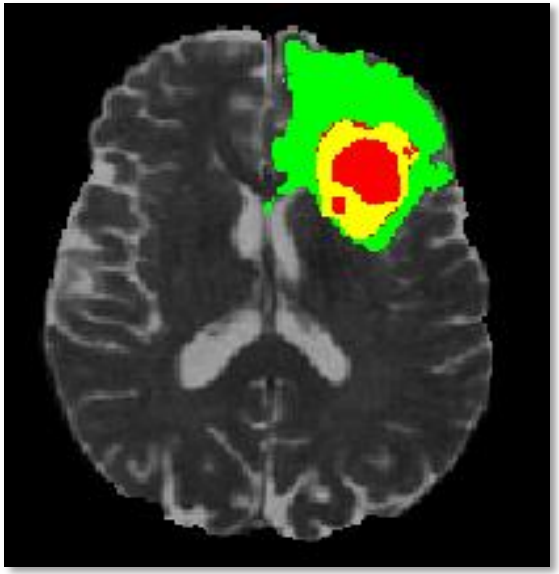
More the number of tesla cars driven

↕

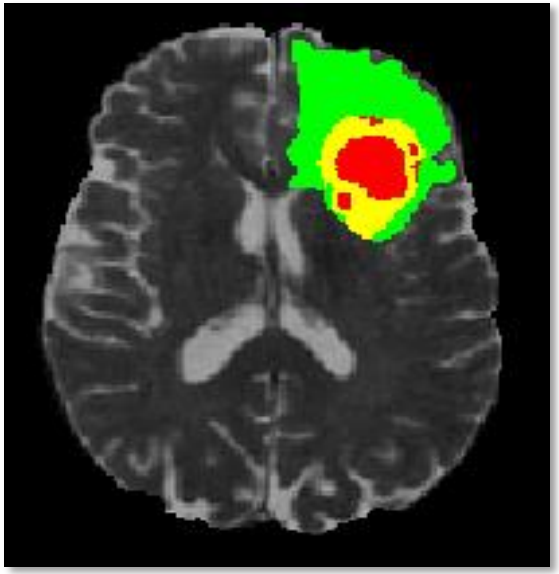
Safer will their autopilot.

Real world Applications

Machine Learning helps in **detection of tumors in brain** using MRI or CT scans



Segmented by Experts



Segmented by Machine Learning algorithm

Something for Art lovers too...

Machine Learning algorithm can help you to transfer style of one image to another

Original Image

+

Style Image

=

Modified Image

Fighting Pollution with ML

Machine Learning algorithm is used to train Drones to identify PET plastic bottles floating in the sea

- The Drone flies to the bottle and using a bacteria releases an enzyme called PETase, completely degrading the plastic.

What is iGEM?

- **World's Largest Synthetic Biology Competition**
- Started in **Massachusetts Institute of Technology in 2003**
- **Engineering + Biology** →Solve local and global problems

iGEM

47+ Countries | 350+ Teams | 4000+ Participants

MIT

Know our team!

- We are a bunch of undergraduate students from IIT Roorkee conjoining from various disciplines to participate in the world's largest Synthetic Biology competition, iGEM (International Genetically Engineered Machine), hosted by MIT, Boston, USA.

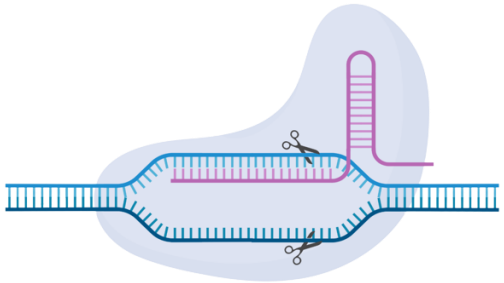
- We aim to solve one of the major problems the healthcare industry faces today using the tools of Bioengineering and Machine Learning.

Meet our Project!

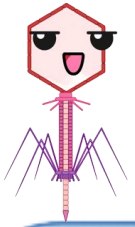
CRISPRLY

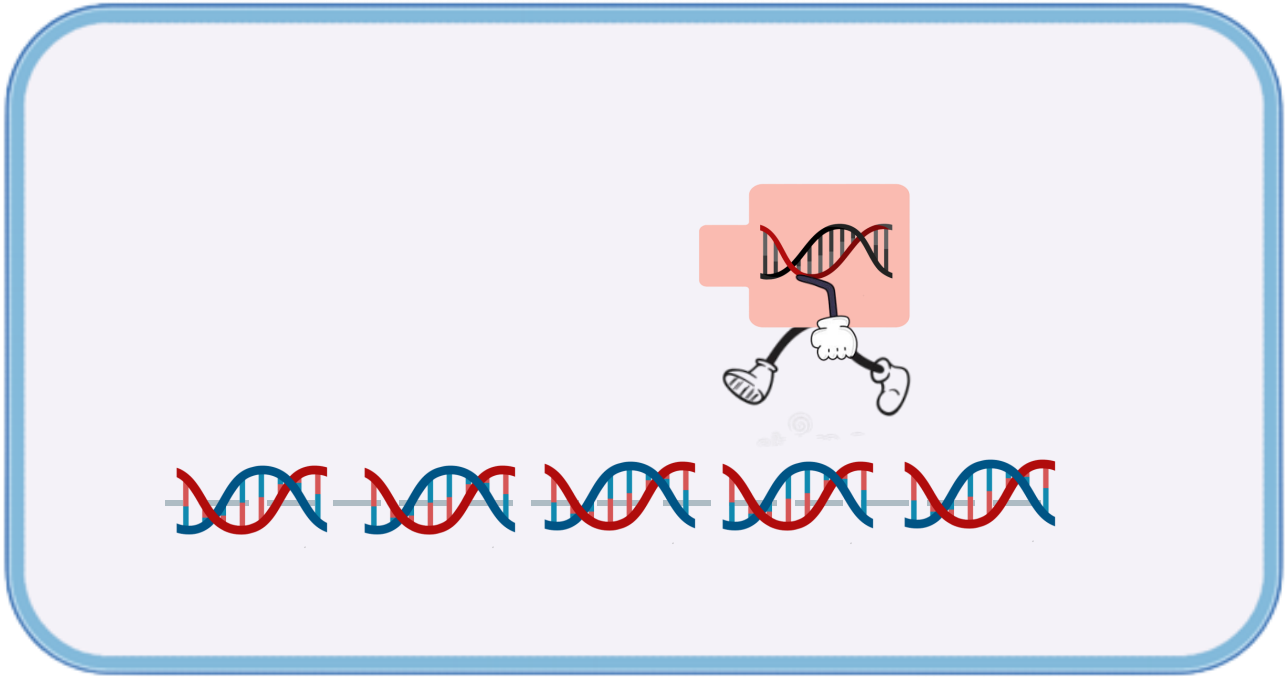
A simple way to detect cervical cancer

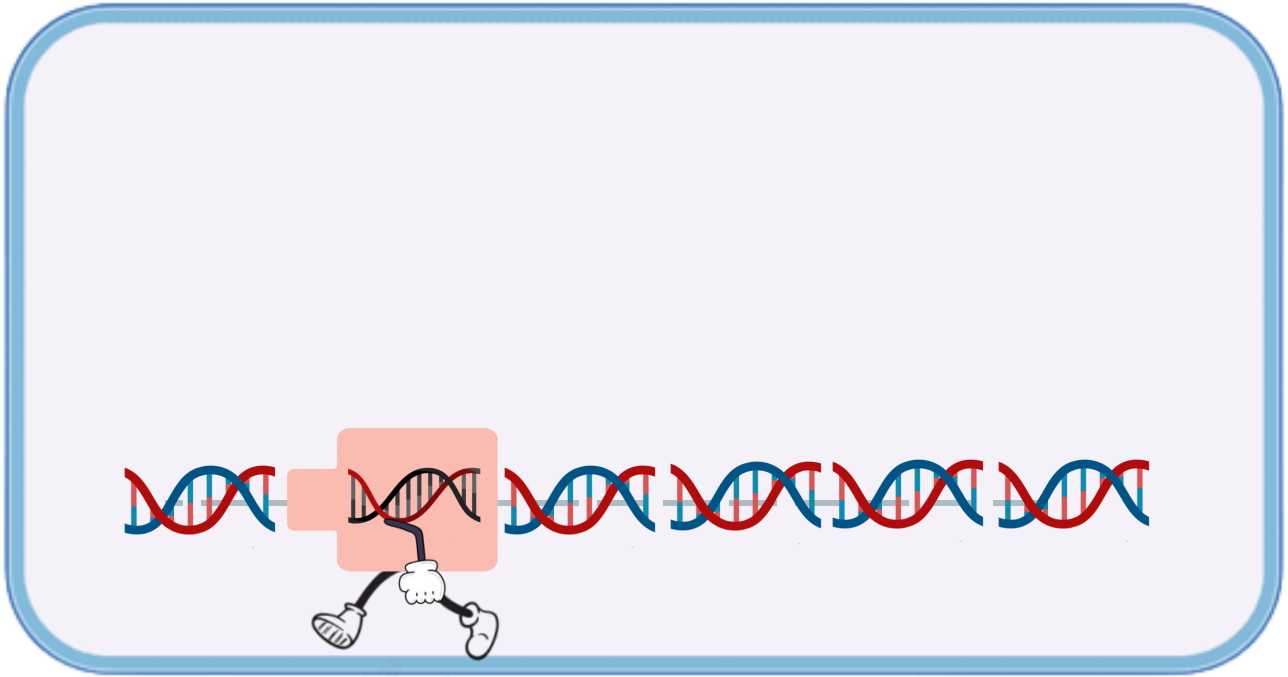
HUMAN PAPILLOMAVIRUS
HPV

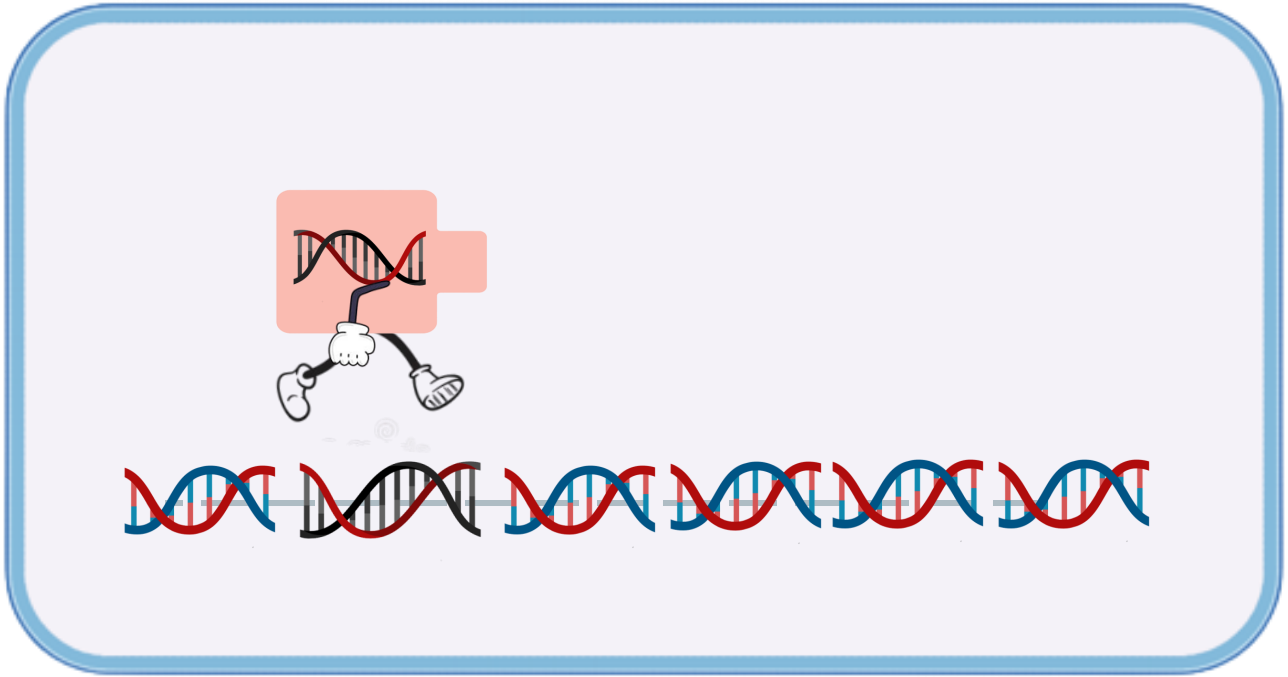


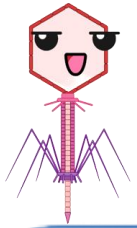
CRISPR

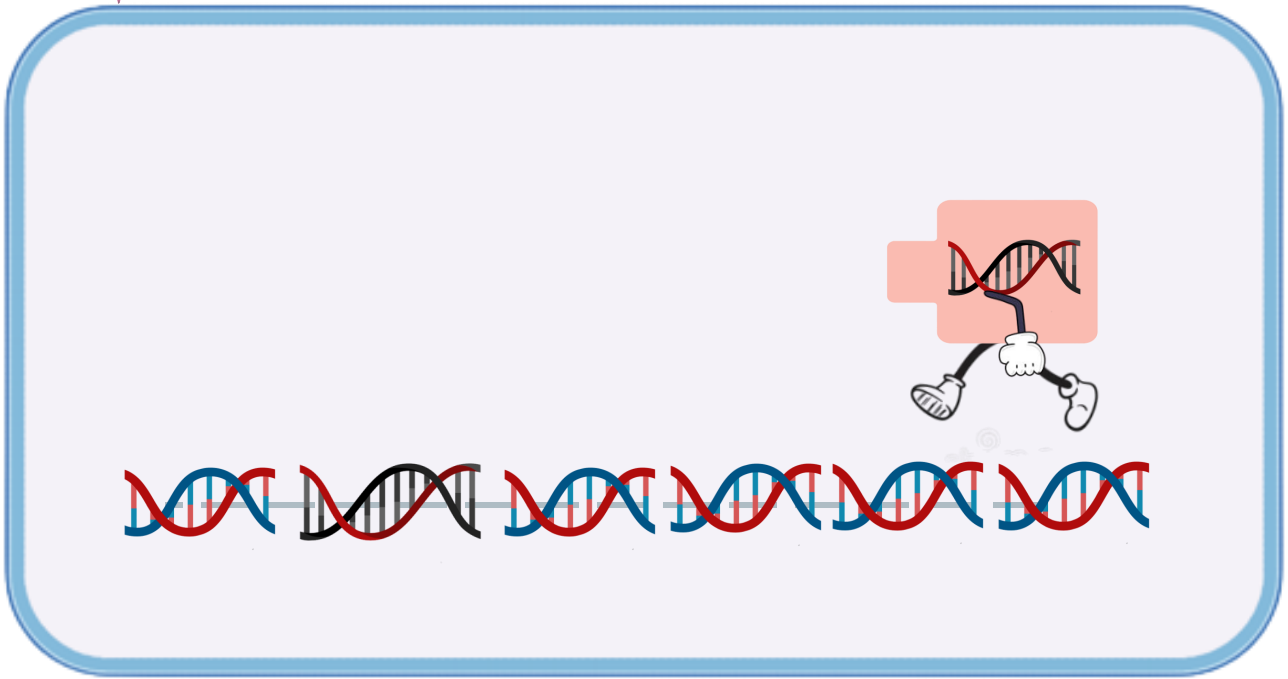


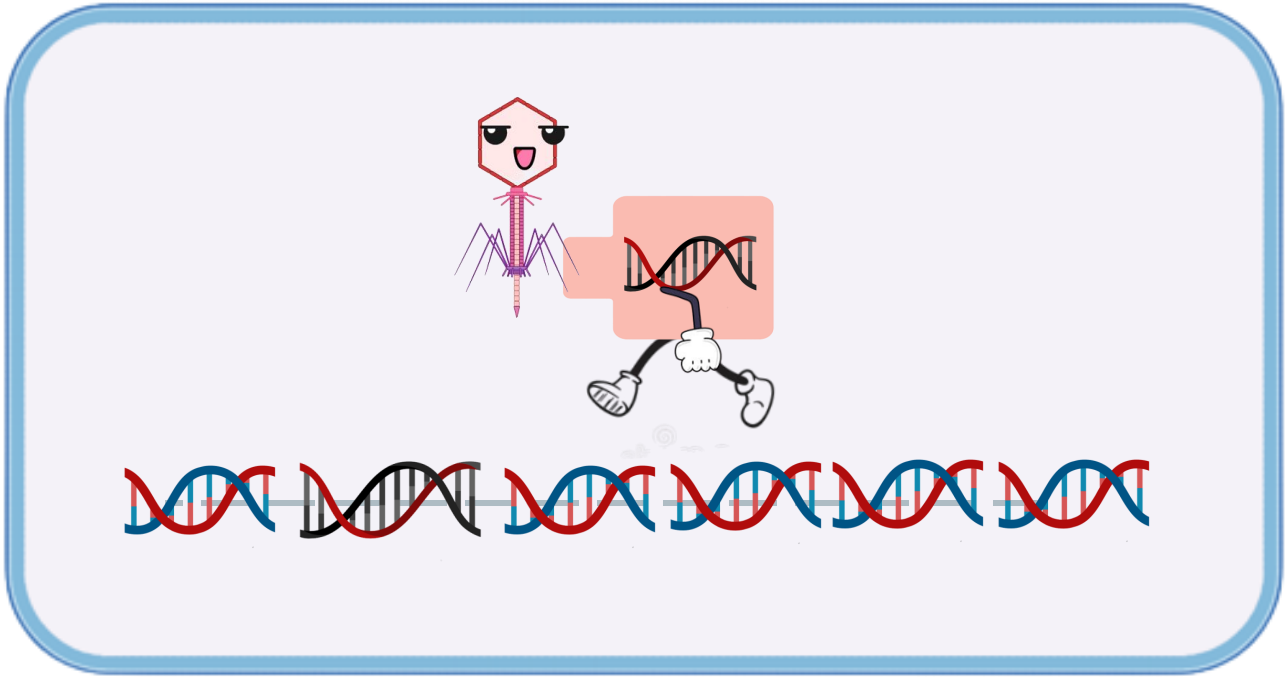


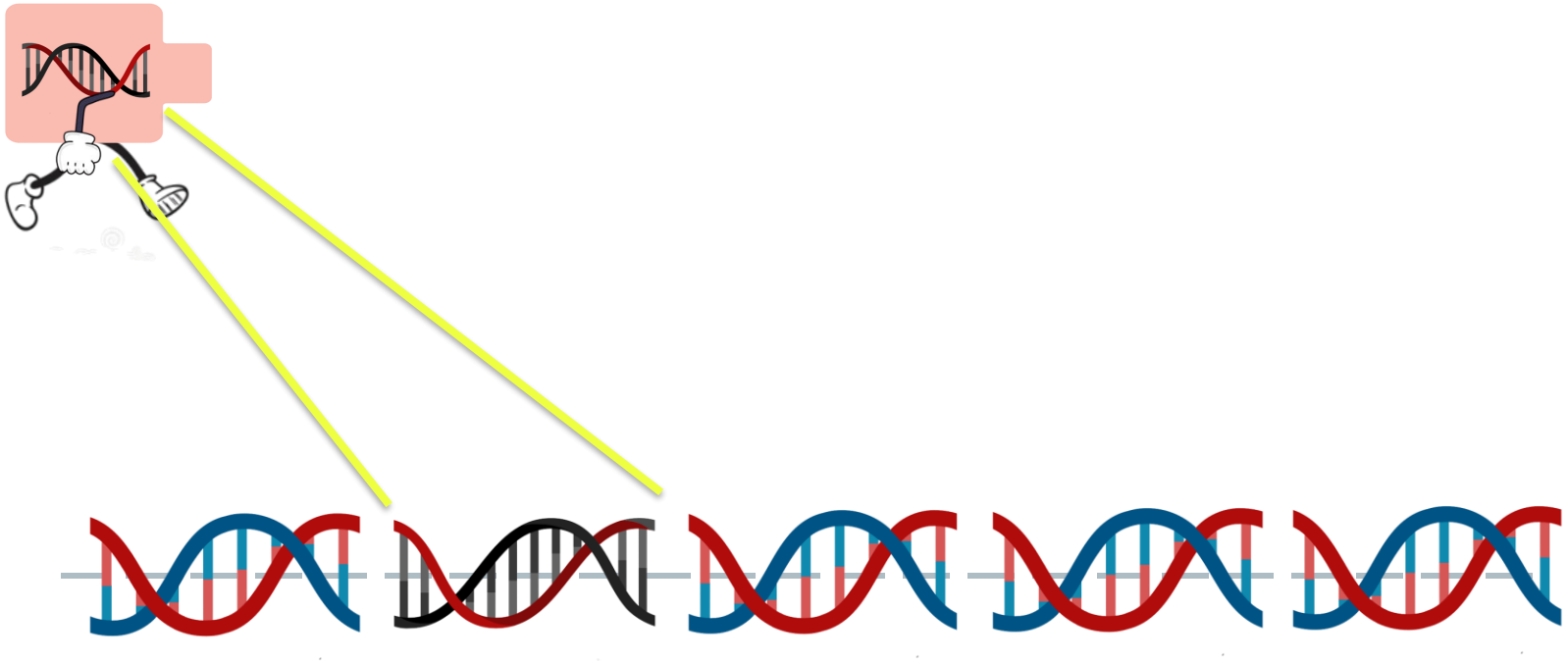












CRISPR

CRISPR

- Genes are like an instruction manual for our cells.
- CRISPR is the fastest and cheapest way to edit these genes.
- The tech uses two things - repeating DNA sequences called CRISPR and DNA cutting proteins called cas which act like scissors.
- Crispr can act like a find and replace button and change any DNA sequence we want to change.

CRISPR based apples that never brown

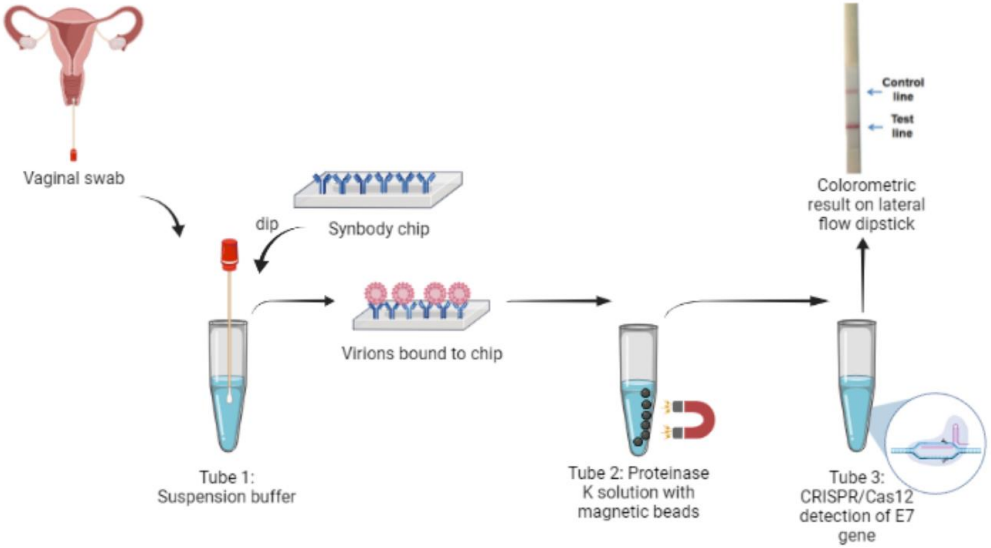
Normal apples brown

The Big Problem : Cervical Cancer

- Cervical cancer affects the cervix and is caused by the human papillomavirus (HPV). It is a sexually transmitted infection.
- It affects 6,00,000 woman every year of which 3,00,00 die
- It is very treatable but in India people are very reluctant to get tested for STIs.
- Thus, by the time the cancer shows symptoms it is too late.

Our Solution

- To detect cervical cancer in its early stage we used the CRISPR technology to create an easy-to-use diagnostic kit.




Thank
You