

I. Cloning

A. Definition

- An exact genetic duplicate

B. Dolly the Sheep

1. Remove udder cells from a juvenile sheep
2. Egg cell removed from an sheep
3. **Remove nucleus** from cells
 - Diploid udder nucleus
 - Haploid egg nucleus
4. Place udder nucleus into egg cell
5. Implant egg into surrogate sheep

I. Cloning

C. Problems with cloning

1. It worked once in 277 tries
2. Very expensive
3. Clones are larger than normal
4. Organisms are genetically older

I. Cloning

C. What did scientists learn from cloning Dolly?

- All body cells carry all the DNA/genes for making the whole body.
- Genes that were once "turned off" can be "turned on" again
 - Nerves and limbs

I. Cloning

D. What we learned/can do with cloning today:

For each of these procedures, somatic cell nuclear transplantation is an essential part of the process.


- One recent example is introducing the polled (no horns) gene into dairy cattle, thus eliminating the need for the painful process of dehorning.
- To produce a strain of pigs that is incapable of being infected by the very contagious and debilitating PRRS virus.
- Researchers have even made cattle that cannot develop Mad Cow Disease.

<http://theconversation.com/20-years-after-dolly>

I. Cloning

E. Cloning humans?

- Scientists not interested in entire humans
 - Very expensive
 - Humans reproduce just fine



I. Cloning

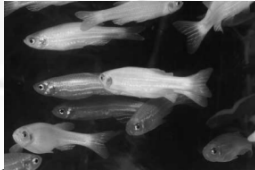
F. Why clone?

1. Place gene of interest into humans or other organisms for human use
2. Shortage of donor organs
 - a) Very political process
 - b) Can design "naked" organs to avoid rejection

II. GMO – Genetically Modified Organisms

A. DNA structure

1. All DNA is the same
 - Sugar, phosphate, base
 - helix
2. Differences
 - Sequences of bases
 - Amount of DNA



B. DNA structure and function same in all organisms so scientists can cut and paste DNA together

- Uses restriction enzymes
- Know: one gene = one protein (polypeptide)

What do genetic engineers look like?



Is a Serbian researcher in genetics with the Institute of Human Genetics at Newcastle University. Map the Y chromosome.

What do genetic engineers look like?

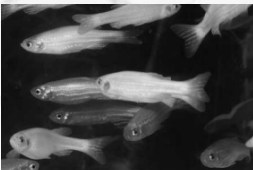


Eva Nogales (Madrid, Spain) is a biophysicist. She was the first to determine the atomic structure of tubulin. Geneticist by training.

II. GMO

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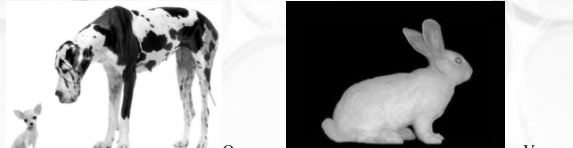
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II. GMO

<https://gmoanswers.com/>

A. For years, plant breeders have used induced mutation breeding to create favorable traits in plants as well as other **organisms. **Transgenic** refers to the movement or insertion of a gene into an **organism** that normally does not have a copy of that gene. It also can be natural or it can be induced.**




Quora Venngage


II. GMO

Primer Recognition

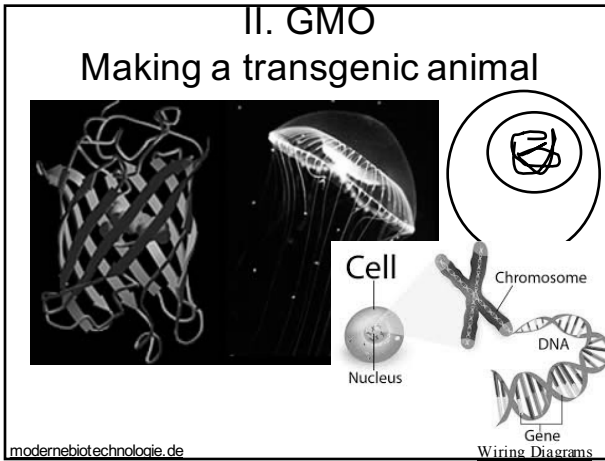
Target Sequence #1 Primer sequence not complimentary = **No Recognition**

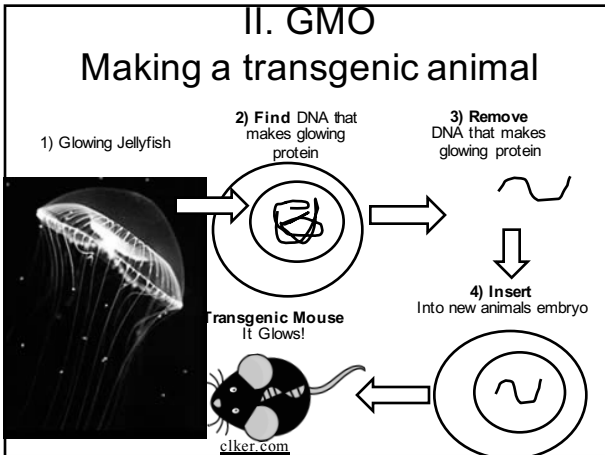


Target Sequence #2 Primer sequence complimentary = **Recognition**



GMO Testing





II. GMO

C. Examples of genetic engineering


1. Human insulin produced by bacteria
 - Diabetics had problems with pig insulin
2. Clotting factors for hemophiliacs
3. Vaccines (new HPV for cancer!)

Livestrong.com

II. GMO

4. Plants

- Increase yields and flavor
- Decrease use of insecticides
- Genetically Modified Foods (GMO) – are they bad for you?



What could go wrong?

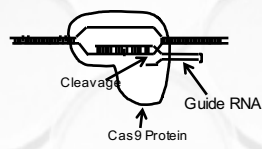
II. GMO

5. Crisper

CRISPR-Cas system – an form of acquired immunity found in bacteria.

The guide RNA directs the Cas9 protein to a target site.

Creating a guide RNA is very simple.

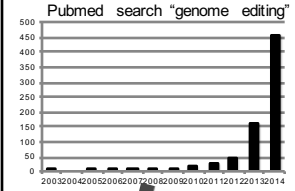


Pete Jones: <https://www2.le.ac.uk/departments/cardiovascular-science/.../genome-editing-pj>

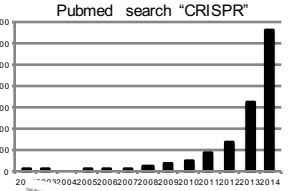
Genome editing

Growing interest in genome editing

Pubmed search "genome editing"



Pubmed search "CRISPR"



CRISPR-Cas systems for editing, regulating and targeting genomes

TALENs: a widely applicable technology for targeted genome editing

Genome editing of human pluripotent stem cells to generate human cellular disease models

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