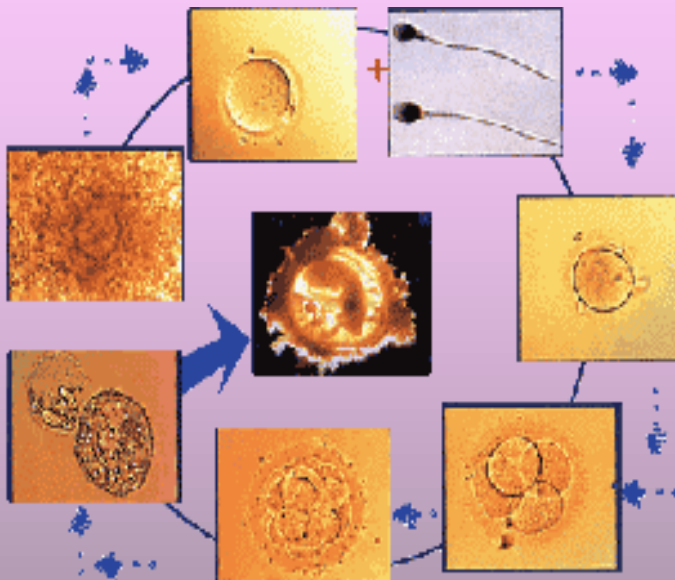
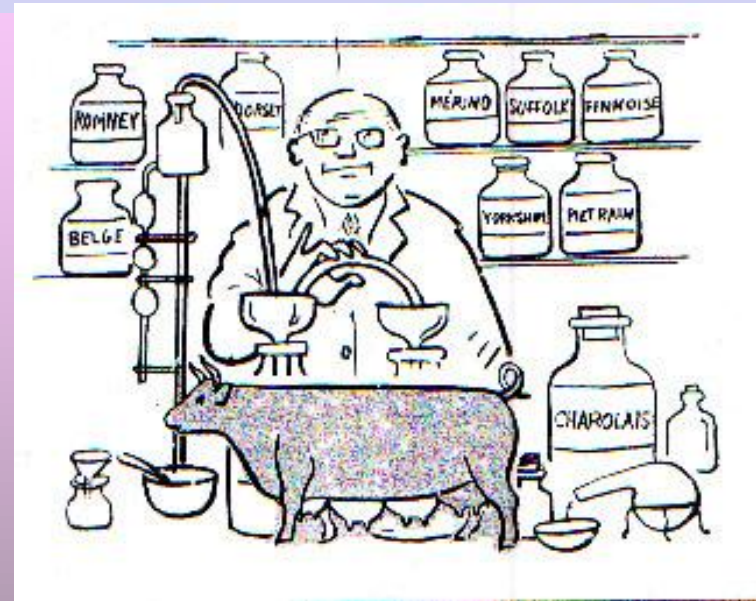


# DASAR REKAYASA GENETIKA:

CLONING, DNA REKOMBINAN AND TRANSGENIC ANIMAL, GMO.



Fertilisasi  
: Fusi  
Materi  
genetik



Rekayasa genetika : penerapan genetika untuk kepentingan manusia. Dengan pengertian ini kegiatan pemuliaan hewan melalui seleksi, mutasi, rekombinasi , insersi/injeksi, fusi materi genetik .

## **Transfer Gen ke dalam sel**

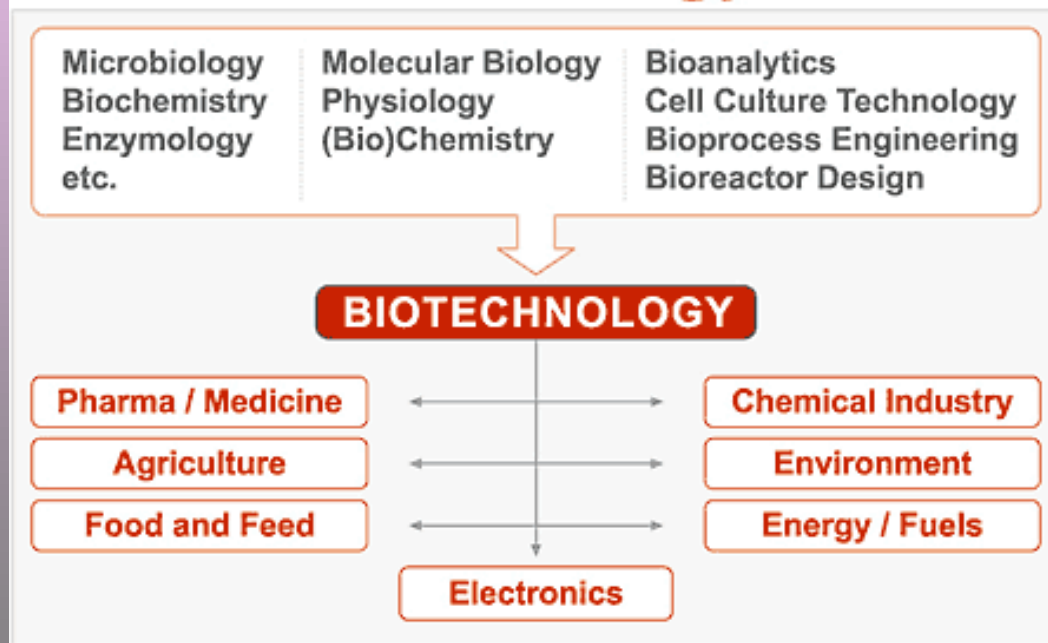
Rekayasa genetika bermain pada tingkat molekuler khususnya DNA.

# Molecular Genetetics :

## Rekayasa Genetik/Biotechnology

- Technology based on biology (molecular)
- Biotechnology is the integration of natural sciences and engineering sciences in order to achieve the application of organisms, cells, parts thereof and molecular analogues for products and services

### What is **Biotechnology**?



Rekayasa genetika: memanipulasikan gen untuk menghasilkan makhluk hidup baru dengan sifat yang diinginkan.

Pencangkokan gen atau rekombinasi DNA.

Digunakan DNA untuk menggabungkan sifat makhluk hidup

# Current Applications of Biotech

it is important to gain a brief understanding of the many applications of biotechnological advancements.

- Microbial
- Agricultural
- **Animal**
- Forensic
- Environmental
- Aquatic
- Medical

## Contoh bidang peternakan:

hormon pertumbuhan yang dapat merangsang pertumbuhan hewan ternak.

Dengan rekayasa genetika dapat diciptakan hormon pertumbuhan hewan buatan atau BST (Bovin Somatotropin Hormon). Hormon tersebut direkayasa dari bakteri yang, jika diinfeksi pada hewan dapat mendorong pertumbuhan dan menaikkan produksi sampai 20%.

# Animal Applications

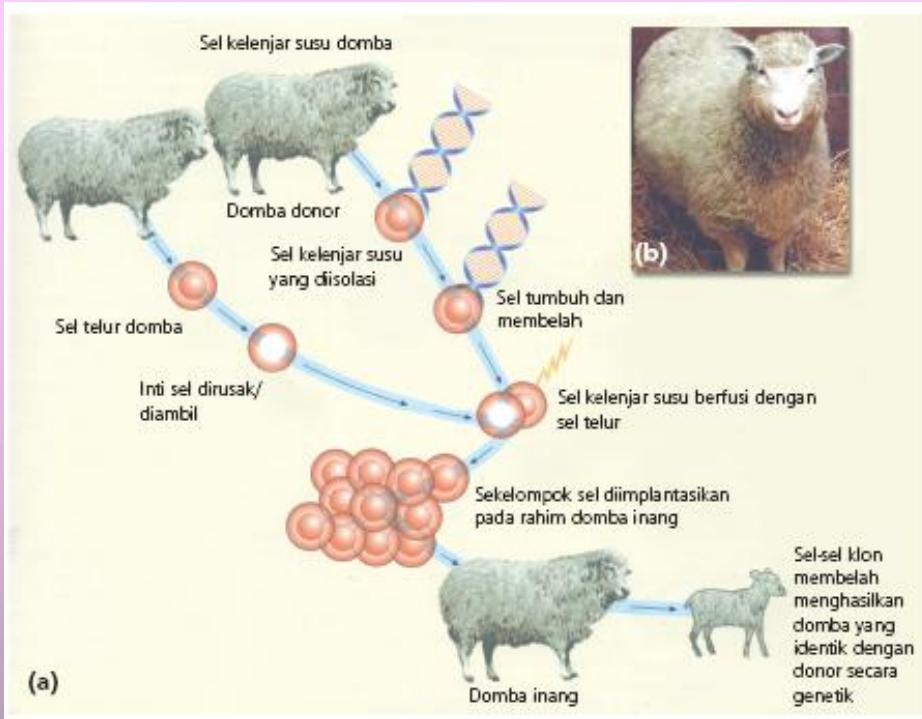
- Animals can be used as *bioreactors*!
- Many human therapeutic proteins are needed in massive quantities (>100s of kgs), so scientists create female **transgenic animals** to express therapeutic proteins in milk.



- Goats, cattle, sheep, & chickens are sources of **antibodies** (protective proteins that recognize & destroy foreign material)
- **Transgenic** refers to containing genes from another source



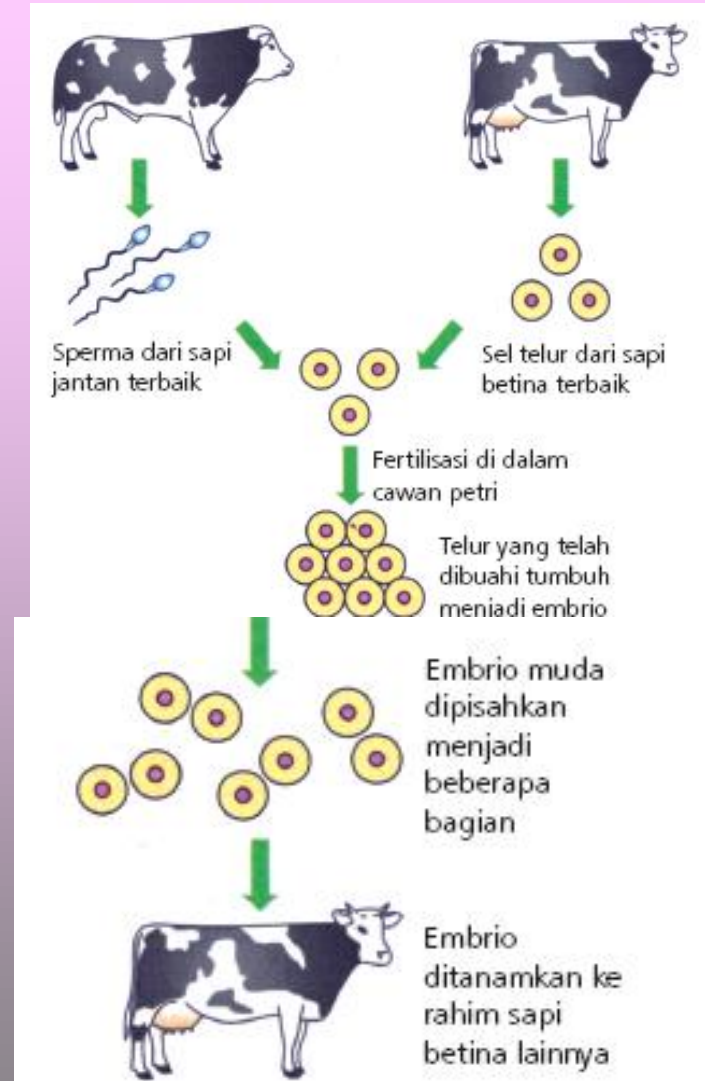
# Manfaat rekayasa genetik di bidang peternakan



(a) Tahapan kloning dengan transfer inti pada domba Dolly. (b) Domba Dolly.

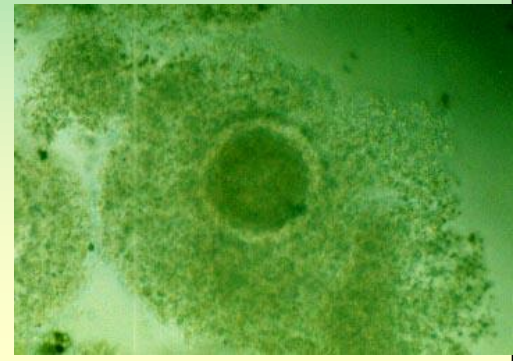
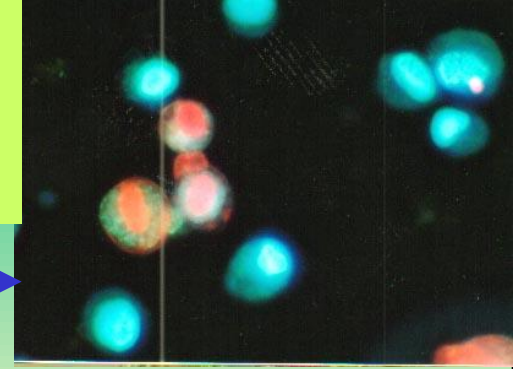
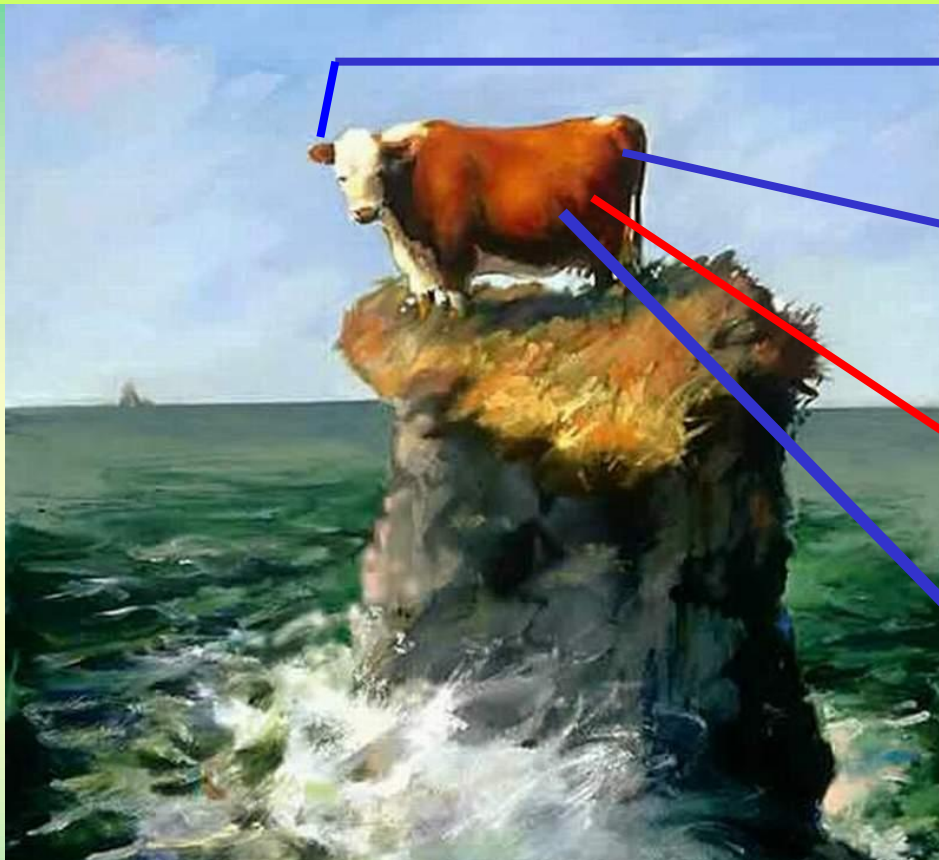
Rekayasa Genetika:

Untuk mengubah DNA (materi genetik) sel dapat dilakukan melalui banyak cara, misalnya melalui transplantasi inti, fusi sel, teknologi plasmid, dan rekombinasi DNA.



Tahapan kloning embrio pada hewan ternak.

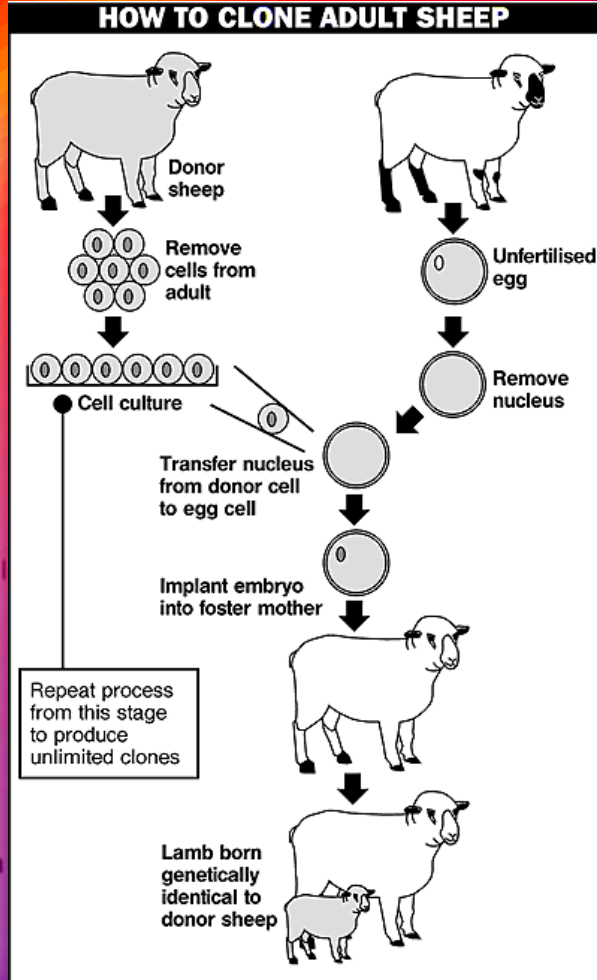
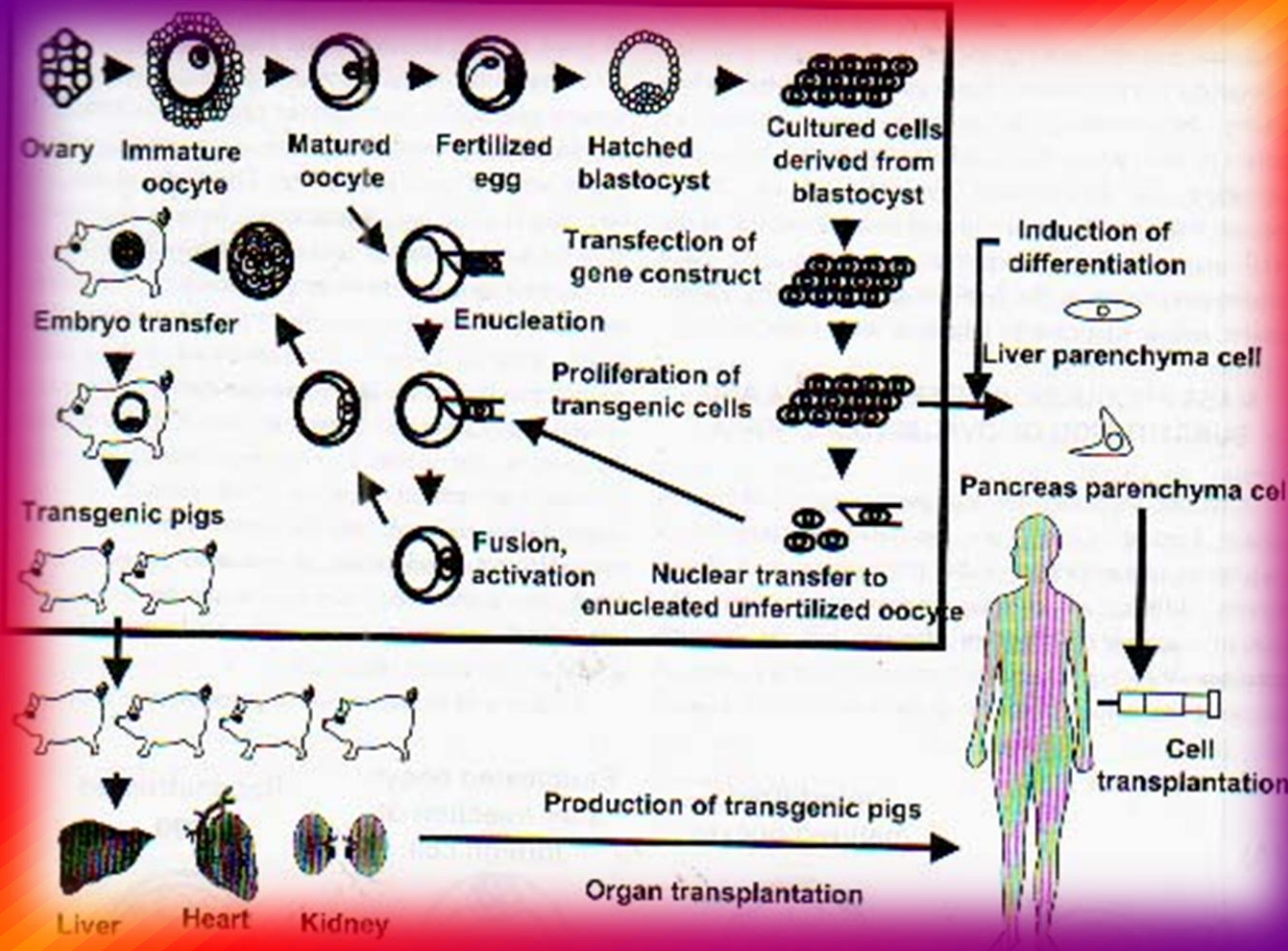
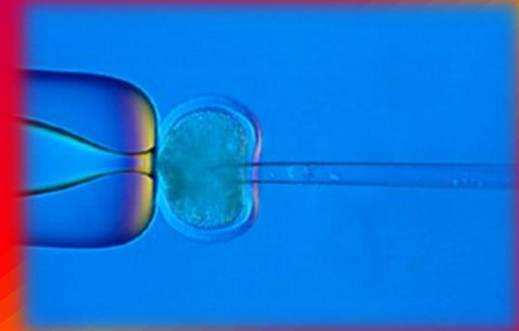
# Peran Bioteknologi dan Rekayasa Genetika di masa depan ?



**BIOTEKNOLOGI /RG MAMPU  
MENYELAMATKAN SUMBER GENETIK  
HEWAN LANGKA**



# BIOTECH-Rekayasa Genetika : IMPLEMENTATION Ternak ke Manusia



# THE HISTORY OF GENETICS

1900  
1905  
1910  
1915  
1920  
1925  
1930  
1935  
1940  
1945  
1950  
1955  
1960  
1965  
1970  
1975  
1980  
1985  
1990  
1995  
2000  
2005

## CLASSICAL GENETIC

Genetic mapping

Transformation demonstrated

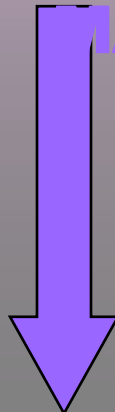
## MICROBIAL GENETIC

Molecular genetics

## GENE

Development of technologies

Applications





# **Traditional** vs. Modern Biotechnology= Rekayasa Genetika ( Animals)

## **Traditional**

- Based on microorganisms
- Cells are not manipulated
- Production of antibiotics by fermentation

## **Modern ( Rekayasa Genetika)**

- Based on microorganisms and **cell culture**
- Cells are **manipulated**
- Production of protein products based on **recombinant DNA** and **cell culture**
- Modern biotech refers to **Molecular Biology, Molecular Genetics and Genetic Engineering**

# DEVELOPMENT OF NEW TECH. IN ANIMAL (REKAYASA GENETIKA)

1	1997	Birth of dolly (1 st animal cloning)
2	1998	Birth of cows: Charlie/george: ( serum albumin) Specific protein for human blood aglutination
3	2000	Pig cloning (transgenic) for organ transpnatation (human),
4.	2001	Inter species nuclear trasnfer

**advantages: non conventional product of livestock:**

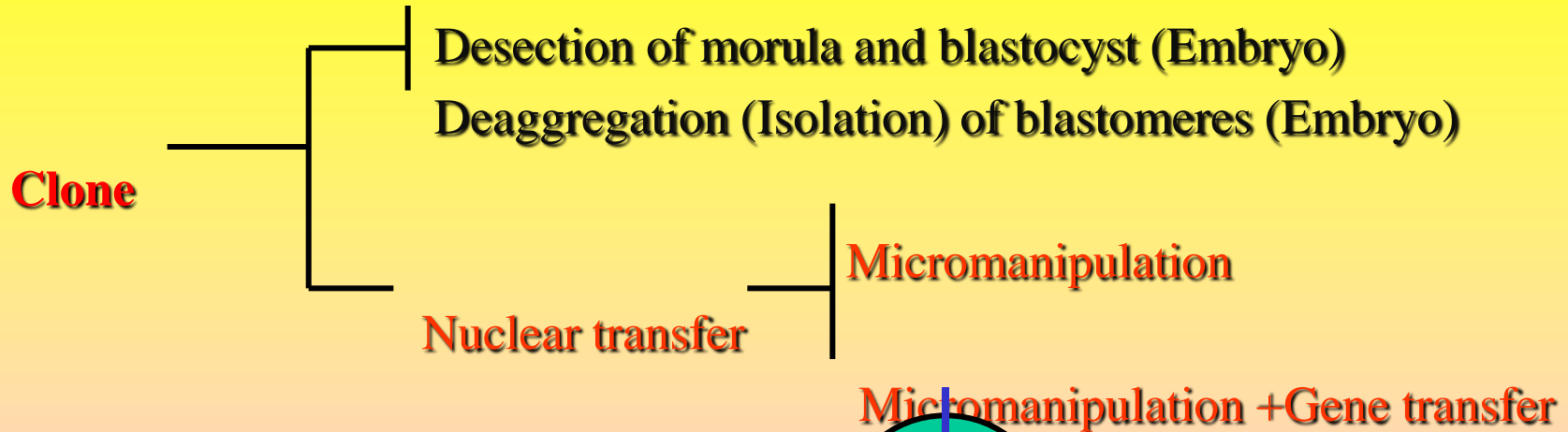
**-Genetic quality improvement**

**-Biopharmacies**

**-Organ Transplantation (Biomedic industry))**

**-Genetic concervation of endangered animals**

# Cloning Techniques : Nuclear Transfer



1. Desection of morula and blastocyst (Embryo)

2. Deaggregation (Isolation) of blastomeres (Embryo)

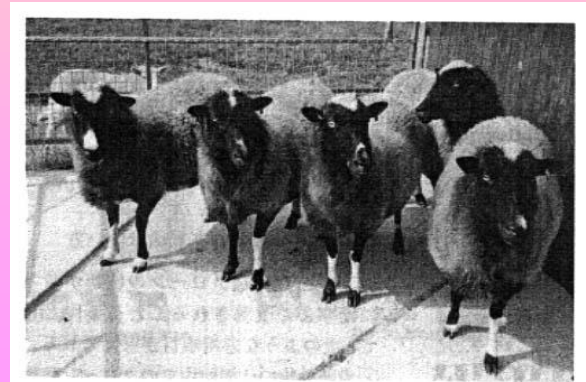
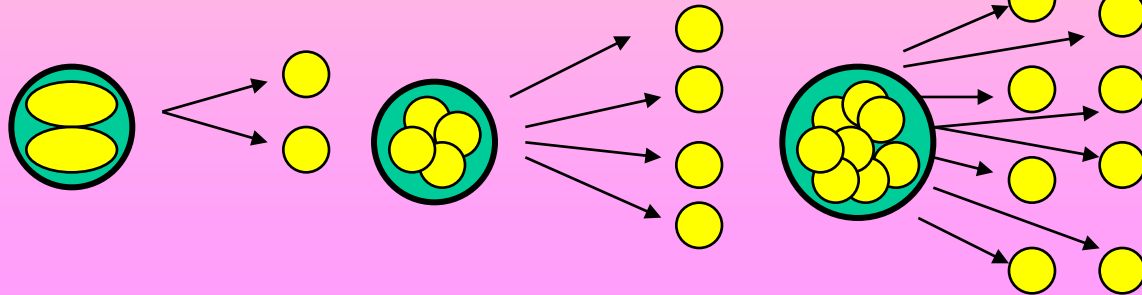


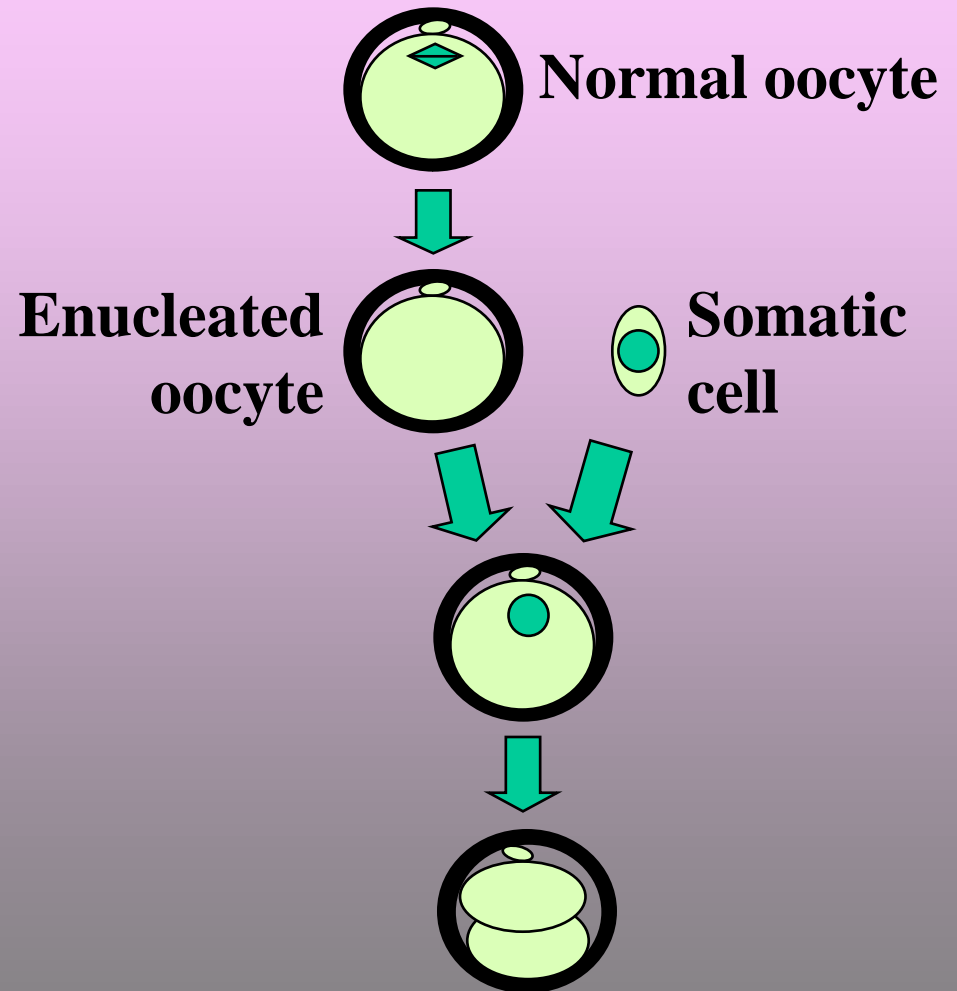
図6 ヒツジ初期胚(8細胞期)の割球分離によって生産された一卵性5つ子  
ケンブリッジ畜産研究所で筆者撮影(1984年7月)。

# Somatic nuclear transfer



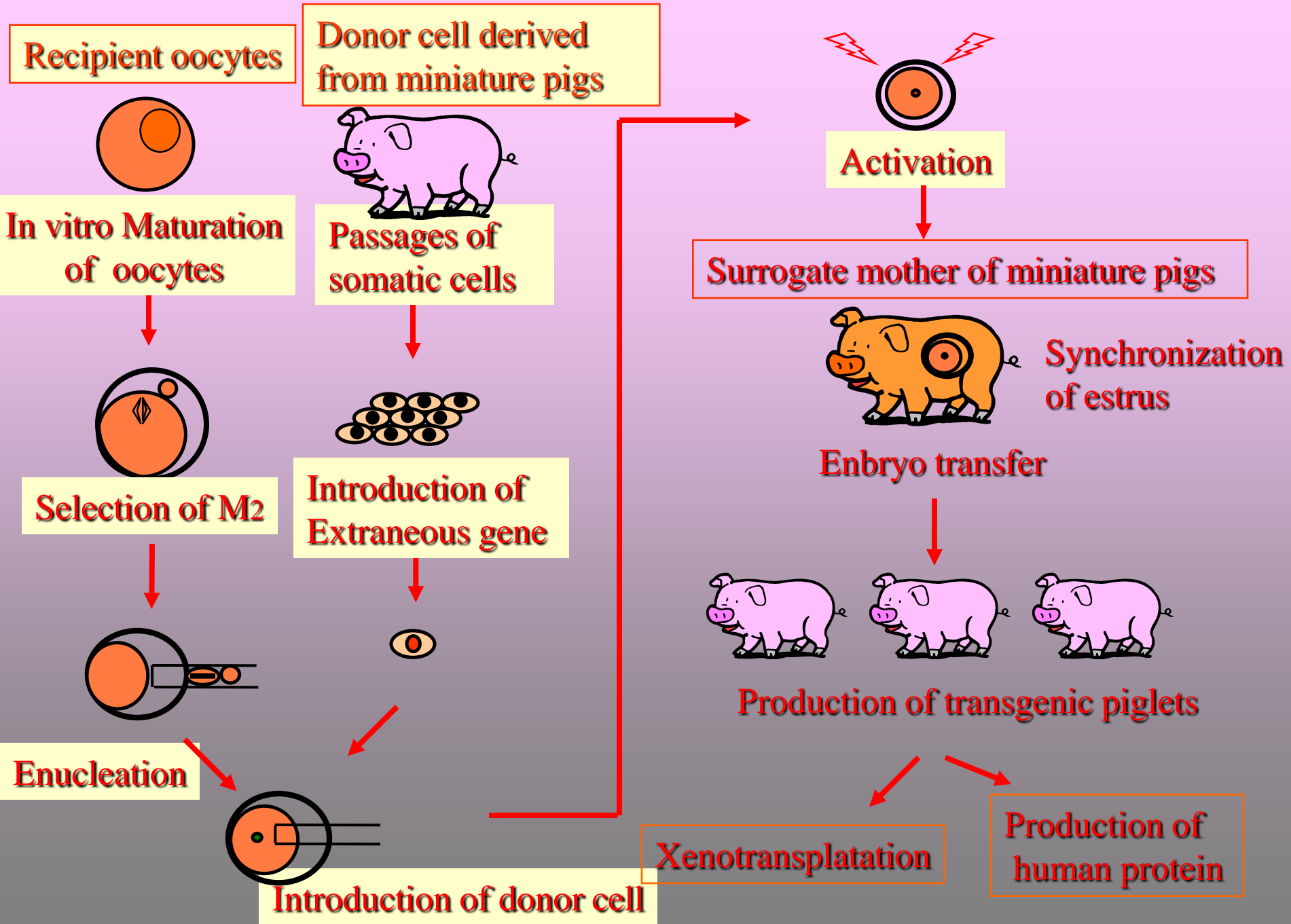
Dolly (February 1997)

277	nuclear transferred
29	implanted
1	live birth





# Nuclear transfer



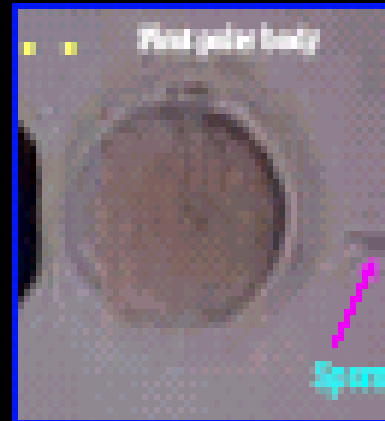
# ICSI=Intra Cytoplasmic Sperm Injection



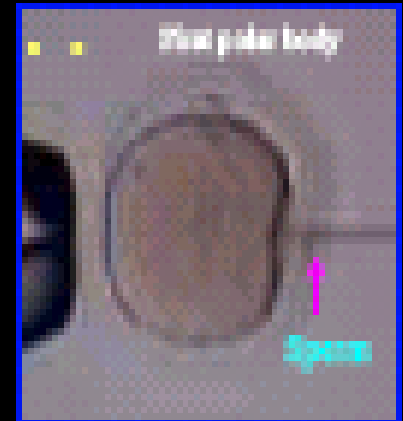
Stop sperm movement



Aspirate sperm



Injection pipette



Zona penetration complete



Injection pipette

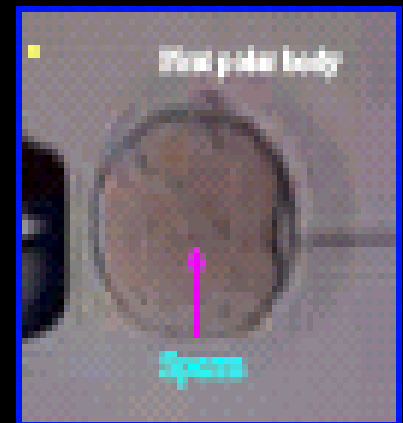
Sperm



Sperm injection



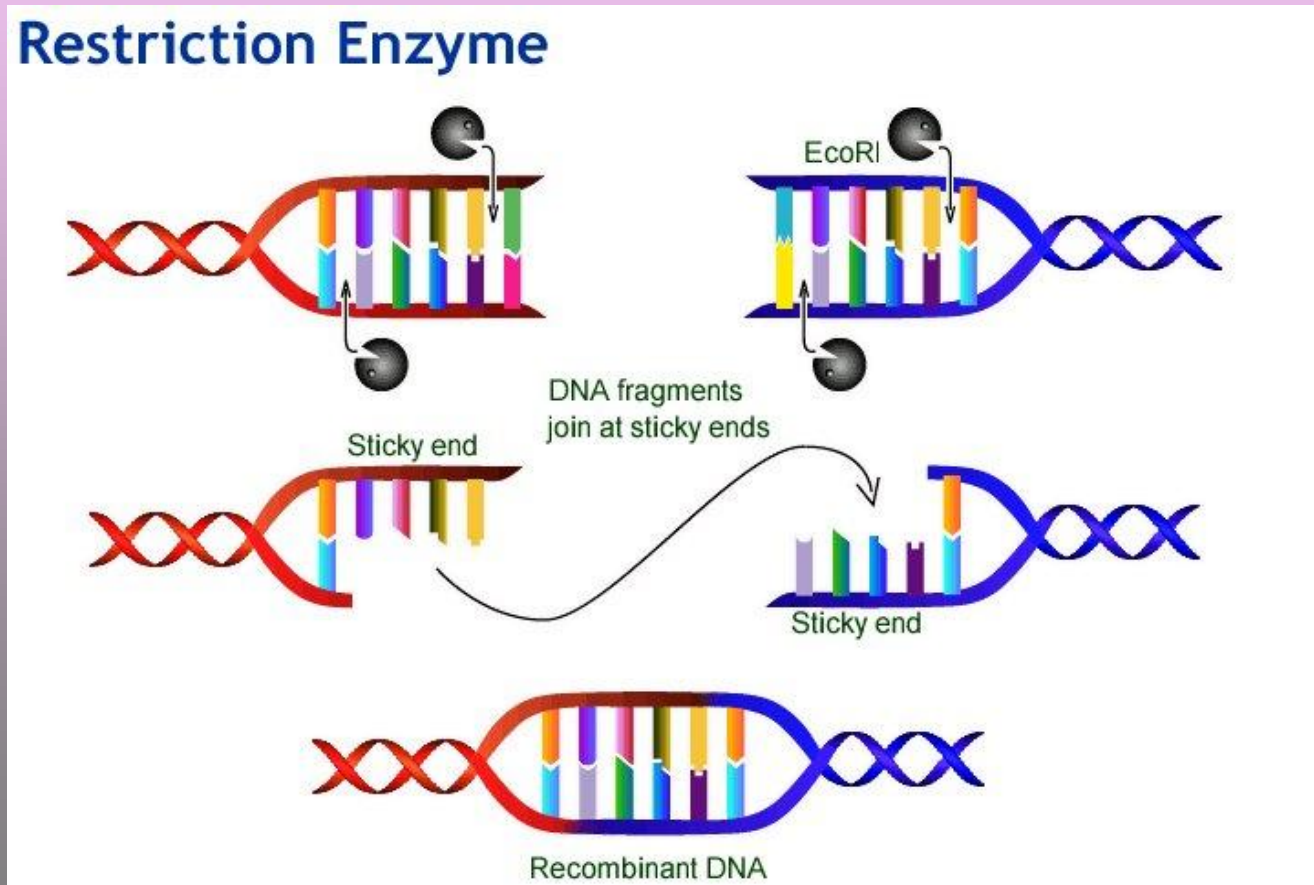
Removal of injection pipette



Sperm

# DNA

## Recombinant Technology



# RECOMBINANT DNA TECHNOLOGY

## Animal and Nutrition

### DNA Fingerprinting Real World Applications

- Crime scene
- Human relatedness
- Paternity
- **Animal relatedness**
- Anthropology studies
- **Disease-causing organisms**
- **Food identification**
- Human remains
- **Animals Genetic: Early Selection**
- Monitoring transplants

DR. Gatot Ciptadi



# Definition of recombinant DNA technology

- A series of procedures used to recombine DNA segments.. Under certain conditions, a recombinant DNA molecule can enter a cell and replicate.

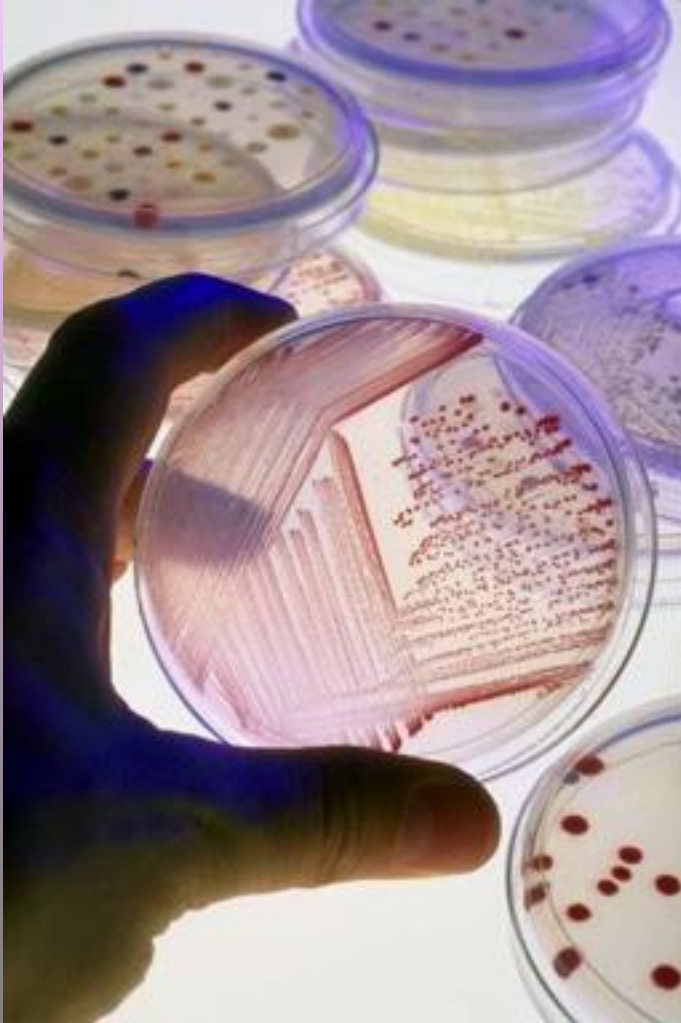
## Basic principle of recombinant DNA tech.

- The DNA is inserted into another DNA molecule called 'vector'
- The recombinant vector is then introduced into a host cell where it replicates itself, the gene is then produced

# Biotechnology: Molecular Genetics

- Broad definition can include many traditional food preparation processes
  - Beer and wine
  - Leavened bread
- **Usually refers to recombinant DNA or tissue culture based processes**
  - **emphasizes modern technology**
  - **generate genetically modified organisms**

# Biotech Laboratory



- Most widely used biotech products are recombinant proteins (produced by gene cloning in cell culture)
- **Cell culture** refers to the technique of growing cells in a lab under controlled conditions; similar to *in vitro*
- “*in vitro*” refers to working in a controlled environment outside of a living organism
- **Bioreactors** (large culturing “containers” where DNA of interest can be mass produced) are also used

# Biotech Treatments

- In the near future, it may be commonplace for treatments to include the use of **gene therapy** (attempt to replace “defective” gene with “normal” gene) and **tissue engineering** (designing & growing tissues for use in regenerative medicines).

- 1st Genetically Modified Organism (GMO) to produce human protein was ***E. coli*** (pictured right) that was given DNA to produce *somatostatin* (hGH - human growth hormone - 1977)





# Molecular Pharming

- **Molecular pharming** is the use of genetically modified plants (or animals) as a source of pharmaceutical products.
- These are usually recombinant proteins with a therapeutic value.
- This is an emerging but very challenging field that requires:
  - manipulation (at the genetic engineering level) of protein **glycosylation** (addition of polysaccharide chain)
  - subcellular protein targeting in plant cells



# Knock Outs



- Basic research in biotech uses *knock-out* experiments, which are very helpful for learning about the function of a gene.
- A **knock-out** is created when an active gene is replaced with DNA that has no functional information.
- Without the gene present, it may be possible to determine how the gene affects the organism (its function)

# Dolly

In 1996, Dolly the sheep became the first cloned animal created by the somatic cell nuclear transfer process.



- Born: July 5, 1996
- Announced: February 22, 1997
- Died: February 14, 2003
- Dolly was cloned from a cell taken from a six-year-old ewe
- She became the center of much controversy that still exists today

# Forensic Applications

- **DNA fingerprinting** is the classic example of a forensic application. It is used most commonly for law enforcement and crime scene investigation (CSI).
- It was first used in 1987 to convict a rapist in England.



- Other applications of DNA fingerprinting include:
  - identifying human remains
  - paternity tests
  - endangered species (reduces poaching)
  - **epidemiology** (spread of disease )