Chapter 1.1

* Benefit of Biotechnology:

1. Direct → such as using drugs to treat certain diseases

2. Indirect → cleaning the environment & eliminate pollution which will lead in humans having a healthy life by breathing clear air, eating a clean food & drinking a clean water free of contaminats (ملوثات) & toxic materials. (مواد سامة)

3. used to solve the pollution problem

- We have to know these 2 important things →

1. we were able to produce sth called casper zebrafish through selective breeding to study metastasis (هجرة)

Metastisis The migration of cancer cells

2. casper zebrafish is considered a model animal

* Gene cloning → making more copies of a gene by inserting it into a plasmid & then allowing bacteria to make more of the plasmid

* Genetic engineering → Introducing modifications into a sequence of a DNA, this sequence of a DNA could be

1. Sequence of a gene
2. Any piece of DNA

* Human Genome project → 1990 - 2003
Rely on the use of Gene cloning & Recombinant DNA technology

* Recombinant DNA technology →

Combine DNA from 2 different sources

Chromosome 13 → Bladder cancer

Chromosome 21 → Breast cancer
ushet syndrome, Hemolytic anemia

* following the human Genome project, scientist where able to map the locations of all human Genes in the human Genome & determine their location within chromosome,

also scientist where able to link certain chromosomal location with certain disease

also scientist determined which genes are involved in certain Genatic disease

- Now many scientists & companies are using Recombinant DNA technology to come up with products could be used to treat/ prevent diseases.

- candidates drug : drugs that still under developming, being develope to treat certain disease or medical conditions & some of them are vaccins.

- human Genome rely on Gene cloning & Recombinat DNA tech.

- Infectious disease → is disease caused by infection agent like: bacteria, viruses

some candidates drug are indirected against

- some drugs are for Gene therapy → to treat certain Genatic diseases

- some to treat certain conditions caused by viruses → Hepatitis C

* Some to treat AIDs caused by human immunodeficiency viruse (HIV)

- or certain disease caused from the immune system called automume disease

كتير منه candidates drug بيعالج cancer لكن

Hepatitis C is a disease caused by a virus called Hepatitic C virus لما it's affect one organ which is the liver, cancer can affect different parts of your body: liver, brain, bone marrow, pancreas digestive system. (cancer more common)

* ١ مستقدم سلايد ٩ ←

Humulin R → First drug which is basically is a recombinant insulen that is used to treat diabetes.

↓

Produced by a company called Genetech through recombinant DNA techn., the coding sequencing of this insulen

- it's a protein hormon made of a.a
- hormon used to regulate the levels of Glucose in our blood

They cloned the sequencing of the human insulen into the plasmid & intruduce them into bacterial cell (e.coli), then they Grow e.coli cells with the plasmids & with the coding sequencing of the human insulen inside large tank called fermenters to produce large quantities of the human insulen proteins.

Scanned with CamScanner

Eventually → the human insulen protein was purified (تنقية) & it was basically the first biotechnology product that is used as a drug to treat a human disease.

currently → there are hundreds of drugs that are produced the same way by cloning, for ex: Gene encoding these drugs

plasmids (into) bacterial cell / mammalian cell

then mass production of these proteins inside cells → the purification of these proteins outside these cells

Recombinant protein: produced by recombinant DNA tech., Some where genetically engineered, which mean the a.a sequences is different than a.a sequence of the natural proteins that are produced inside our bodies.

- scientist after the discovery of SNPs they utilized the knowledge about SNPs in order to come up with costmized medicine

* single nucleotide polymorphisms

↓

- single nucleotide changes, they contribute to the genatic diversity observed among individuals

- Typically these changes are present in more than 1% of a certain population (different from different individuals)

- These variations might play arole in many medical conditions

- Some of it have been found to determine how our bodies can respond to drugs, or to food or how our bodies intract with the inviroment surrounding

• اكتشفوا لعلاقة اي بان certain SNPs are linked to certain types of diseases or medical condition

So for ex their are some SNP's in BRCA1 & BRCA2 genes that is involved in promoting breast cancer

So certain females are at higher risk of breast cancer

- It turned out that certain SNPs are important for designing a specific type of treatment

• part of the management of breast cancer & many types of cancer is to determine the types of mutation & the types of SNP's that are found in certain types of promoter gene or tumor substructure

* Identifing these SNP's are important for designing a specific type of treatment , so we have sth called

Customized medicine

means each individuah might receive different treatment / closes of treatment based on the type of SNP's they have in their Genome

Practice in determining the treatment options for different diseases ex certain types of cancer

& these SNP's are found to be importanta whenever we take a drug

Some drugs can work for some people, another may be n°t, because the presenta of certain SNP's that allow some indiviuals to metabolism & benefit from the drug

But at the same time others snp's might not allow individuals to benefit /metabulize the drug correctly

Some people may take a drug & suffer from side effects because the present of certain snp's in their Genome, other people won't suffer.

- snp's are important whether their is a disease or whether we challenge our body with certain types of drugs

- snp's مهمة في وجود مرض وبدونا ناخذ علاج عادي

- 15 ←

- snp's can affect the activity of a protein produced a Gene

Most of SNP's they are in non-coding regions & they don't contribute directly to Genatic disease but they might became importante when ever a disease happen or we want to treat a disease with drug

- From multipule population scientists found more than 300 million snp's

- If we compair the Genomes of indiviuals we will found out between 4-5 million sites of variuation between indiviuals

99% of it are actually made of snp's

* Microarray → Could be used to determine all different types of SNP's that could be found in a specific Genome

→ used to determine all the SNP's found in indiviual

* Pharmacogenomic → بعض أمراض قبل ميرح يوصف العلاج بفحص بـ Genome بـ SNP's معينة وفيها دكتور يحدد الدوا وكمية الجرعة

↓

تخصيص علاج لناس عندها SNP's و طبيعة في Genome

* Metabolomics → involves determining all the types of small molecules found inside the body & all these body molecules are productes of metabolic reaction that is happening inside our cells

we could → look at the concentration of hundreds of small molecules, at the same time & based on the concentration we could determine wiether an indiviual is healthy or might have a specific type of disease

- كلمات بل نهايتها بـ omics in biot. have this suffix

genomics → Genes دراسة كل

proteomics → دراسة كل البروتينات

metagenomics → Multiple Genomes

transcriptomics → we look at all mRNA inside a cell / type of organism

were developed by scientists depending on the big Data. produced by the human Genome project

* Nanotechnology → use of mater on the atomic molecular, so we are talking about using molecules in the scale of nanometer

$1nm = 1 \times 10^{-9}$

very small substances smaller than cells

فرع منها ← Nanobiotechnology → biology مزيج من nano technology

↓ use very small lipid nanoparticle to dilievr drugs

for ex ده these nanoparticle might have receptors or protein on their surfaces that can recognaise only receptors on cancer cells,

Drugs will be inside nanoparticle & in this scenario the drug will be only dilevered to cancer cells & the drug willn't be affecting normal cells

so this could help with the chemotherapy ↓ used to kill cancers

- chemicals are used to kill cancer cells, but these chemicals can't distinguish cancer cells from normal cells, so it could kill or damage normal cells & this is way patient under chemotherapy might suffer

SO putting the chemotherapy drug inside the nanoparticle & this nanoparticle can only bind to cancer cells, this means that we have more targeted therapy & higher concentration of the drug will reach cancer cells & the normal cells will be protected from chemotherapy drug.

* so many drugs & certain types of vaccine

For ex pfizer - BioNTech coviD-19
شركة امريكية شركة German
هذه لقاح لكورونا

that actually dilivers the mRNA inside a nanoparticle, so the mRNA encoding the spike mRNA actually is capsules in a lipid nanoparticals

* Gene therapy technology

↓

Treating indiviuals affected with a Genatic disease caused defective gene or mutant Gene.

↓

Adding a normah copies of a Gene

← كاين في كتير مشاكل منها

- The dilivery of a Gene require a vector & vector typically is a virus (adenovirus)

& sometimes intruding Gene doesn't guarantee that the Gene will be expresed to produce a proper protein.

CRisPR → Is a hot topic in Gene therapy

تنثر سولفها جاولو يلخصوه

* SiRNA →

Some companies have successfuly utilize this technology to develop drugs that will treat certain medical conditions

2018 —first drug→ onpatro patisiran

2019 → Givlaari (Givosiran)

→ Small RNA molecule has a complemantry sequence to certain mRNA, & these mRNA once they are bind by SiRNA & other proteins 2 things could be happen

- mRNA willn't be translated
- mRNA will be Degrated

* stem cells

Adult | Embryonic

Could be used in Regenerative medicine

↓

use of stem cell to treat a Genatic disease

لو حد صار لو حادث وتضررت ال liver بقدرو يستخدموا Adult stem cell مثل صار لو الحادث و Grow a liver in the tissue culture or outside the body & then transfer into the liver.

يعني إذا في حد بعاني من مرض وراثي عنده mutant Gene

نقدر نشيل

obtain to stem cells from the pateint & intruduce the normal Gene to the stem cell & put back the stem cells to the patient body in order to make new cells & then will have the normah Gene

OR → we could take these stem cell & remove the mutation & put back the stem cell