

Types of Biotechnology

- **Animal Biotechnology**

- **transgenic animal:** way to achieve large scale production of therapeutic proteins from animals for use in humans
- Female transgenic animals express therapeutic proteins in milk (contains genes from another source) *as goats*
- Example: human genes coding for clotting proteins can be introduced into female goats for production of these proteins in their milk

➤ Types of Biotechnology

• ⁷Animal Biotechnology

– **Gene knockout:** *mainly for research process to know the function of certain gene و protein*

- ^{تعطل}Disrupt a gene in the animal and then look at what functions are affected in the animal as a result of the loss of the gene

- This allows researchers to determine the role and function of the gene”

- Since humans are similar to ^{فئران}rats and ^{جرذان}mice, gene knockout studies in rats and mice can lead to better understanding of gene function in humans.

خارج مفرقا

لما أزيل الجين

التي يعجل

expression

لرصد البروتين.

Types of Biotechnology

4 • Forensic Biotechnology

– DNA fingerprinting

- Inclusion or exclusion of a person from suspicion ^{السُّكَّ}

- Paternity cases ^{قضايا الأبوة} ^{إثبات الأبوة} ^{بقايا}

- Identification of human remains

- Endangered species ^{محمود بالانقراض} ^{سوا حيوان}

- Tracking and confirmation of the spread of disease

• ^{خطر} ^{بجسيمات} ^{أوبئة} ^{حتى}

تتبع

تأكيد

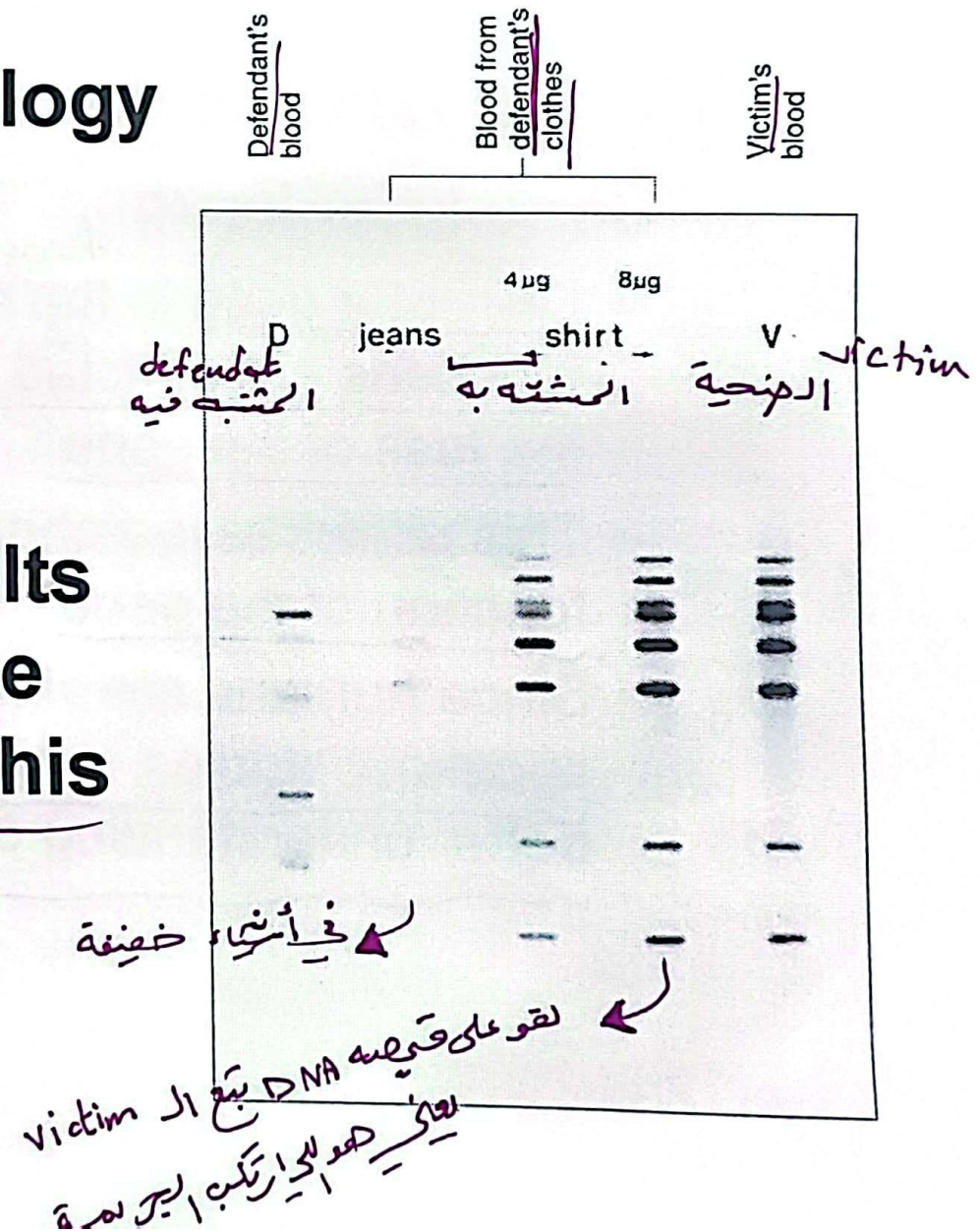
منعدين آجي؟ وكيف آجي!

Types of Biotechnology

- Forensic Biotechnology

- Based on DNA results from this gel, did the defendant commit this crime?

yes.



Types of Biotechnology

المعالجة البيولوجية

[5] • Bioremediation

– The use of biotechnology to ^{معالجة} process and ^{تدهور} degrade a variety of natural and manmade substances ^{صنع الانسان}

^{على وجه الخصوص} • Particularly those that ^{تأثير} contribute to environmental ^{تلوث} pollution

* Example – stimulated growth of bacteria that ^{النقط الخمر} degrade components in crude oil

- 1989 Exxon Valdez oil ^{سكب} spill in Alaska
- 2010 Deep Water Horizon ^{سكب} spill ^{التسريبات} promoted research into natural oil-degrading organisms and enzymes

Types of Biotechnology

حقے نزیہ د ۲۵ وہی بعدین رج تنغی علی د spill oil

- Bioremediation – adding nutrients to stimulate growth of bacteria to clean up oil spill

کسب بلفظ



Types of Biotechnology

المياه

6 • Aquatic Biotechnology

– **Aquaculture** – ^{الاصهار} raising finfish or ^{المحار} shellfish in controlled conditions for use as food sources

- 50% of all fish consumed by humans worldwide

– **Genetic engineering**

- Disease-resistant strains of oysters ^{المحار} *مقاوم للأمراض*
- Vaccines against viruses that infect salmon and other finfish
- Transgenic salmon that overproduce growth hormone
↳ as source for antitumor drugs / certain proteins.

التنقيب البيولوجي

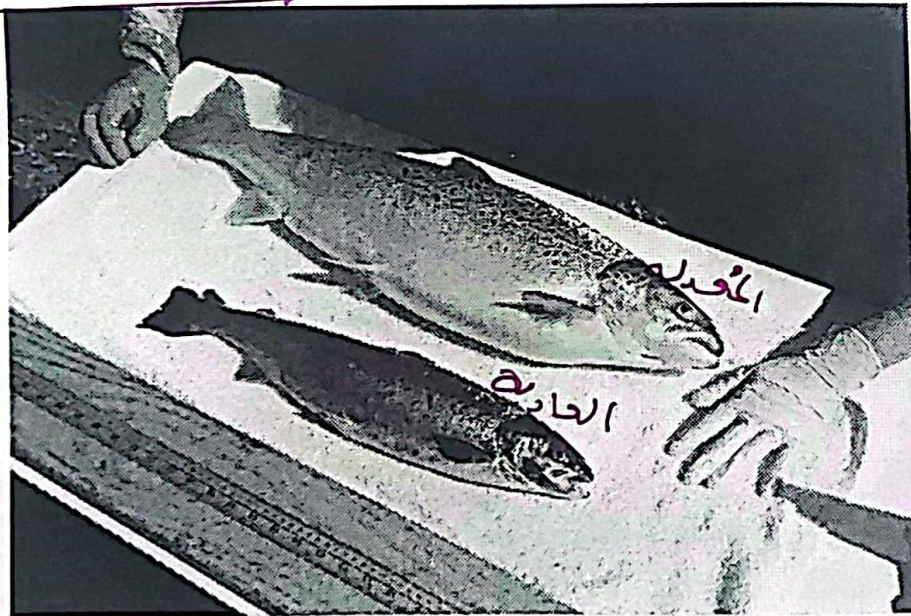
– **Bioprospecting**: rich and valuable sources of new genes, proteins and metabolic processes with important applications for human benefits

- ^{قواقع} Marine plankton and snails found to be rich sources of antitumor and anticancer molecules

عوالق بحرية

Types of Biotechnology

- Aquatic Biotechnology
- Why create transgenic salmon overproducing growth hormone?



transgenic

normal

Two different salmon

- How does this modified salmon help humans? //
- بتخفف من كمية السكر ...

Types of Biotechnology

7 • Medical Biotechnology

1 ^{بشكل} Involved with the whole spectrum of human medicine

- ^{وقاية} • Preventive medicine as vit. C
- ^{تشخيص} • Diagnosis of health and illness as enzymes
- Treatment of human diseases as clotting hormones

2 New information from Human Genome Project

- Gene therapy

3 Stem cell technologies

لعلاج بعض الأمراض

Types of Biotechnology

الخلايا التي هي لها موهبة differentiation و يمكن تحويلها لأي نوع

كولون من الخلايا ← B cells الخلايا الجذعية

- **Stem cells** – grown in lab and then treated with different chemicals to allow them to develop into specific kinds of tissues needed for transplant للزراعة

- Current use: stem cells are used for diabetes; spinal cord injuries الاستخدام الحالي

الناس التي عندهم مشاكل بسبب spinal cord

Types of Biotechnology

- **Medical biotechnology**
 - **Genes are headline news items**

New test uses mother's blood
to test for fetal genetic defects

Genetic switch puts hair on chest

■ Researchers have isolated
biological changes in the
embryo that separate
boys from girls.

Genes induce human obesity

Gene evidence could give
life-term prisoner new trial

Scientists find gene that causes skin cancer

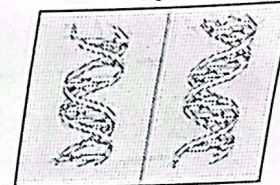
Genetic studies of fruit flies uncover
mutated gene that causes common
basal cell carcinoma.

Gene defect for muscle disorder identified

Science Notebook

Team nabs second
breast cancer gene

DNA study:



Cavemen not same
as humans

Parkinson's disease
gene mutation found

• Gene that causes bed-wetting found •

Program to identify
cancer genes

Fat gene a
lead in
solving
obesity

Types of Biotechnology

• Regulatory Biotechnology

8 - Quality Assurance (QA)

ضمان الجودة

- All activities involved in regulating the final quality of a product

9 - Quality Control (QC)

ضمان الجودة

- Part of QA process that involves lab testing and monitoring of processes and applications to ensure consistent product standards
 - Together QA and QC ensure that biotechnology products meet strict standards for purity and performance
- Why as a consumer should you care about a product undergoing intense regulations?

Biological Challenges of the 21st Century

- How will medical biotechnology change our lives in the years ahead?

* Human Genome Project

تحليل کامل و sequencing کامل
تکلیف جينات الله عزنا ...

- Research on the function of human genes and controlling factors that regulate genes

* Human proteome

- Collection of proteins responsible for activity in a human cell

های جينات شويخل بروتين وکل پروتين شو
الفایده منه و وفایته بالزبط ...

أكثر شي شافها بال CYP450

* Single Nucleotide Polymorphisms (SNPs)

ممكن يكون

benign

ممكن يكون

مرتب

• Single nucleotide changes (mutations) in DNA sequences that vary from individual to individual

تسلسل

• These variations are the cause of some genetic diseases (sickle cell anemia)

فقر الدم المنجلي

كثير

• SNPs will help identify genes involved in medical conditions including arthritis, stroke, cancer, heart disease, diabetes, and behavioral and emotional illnesses

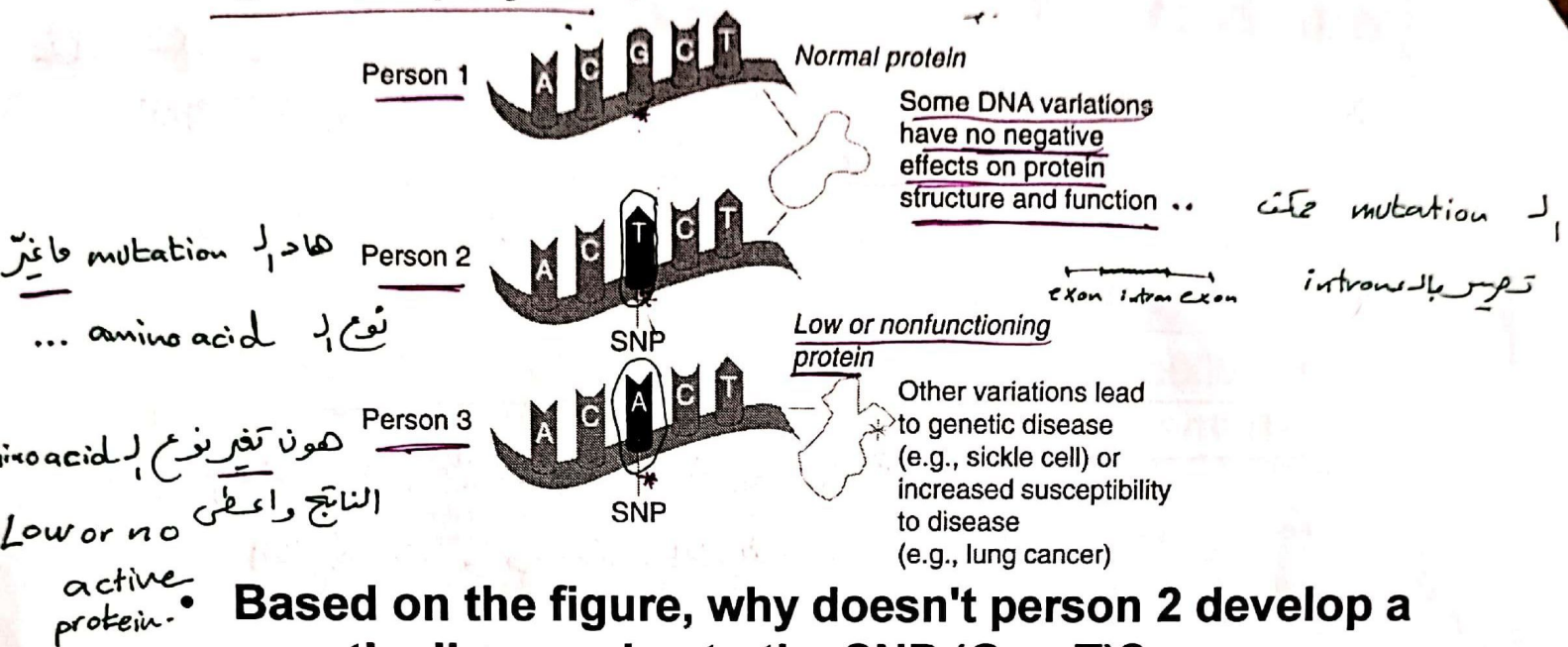
الرجل المصاب بالتهرب

• Example of SNPs and breast cancer

• Identification of SNPs in BRCA1 and BRCA2 genes involved in promoting breast cancer led to development of better targeted treatments for people who have those specific gene mutations

2/5/2

- Example of how we can benefit from the human genome project ?



Based on the figure, why doesn't person 2 develop a genetic disease due to the SNP (G → T)?

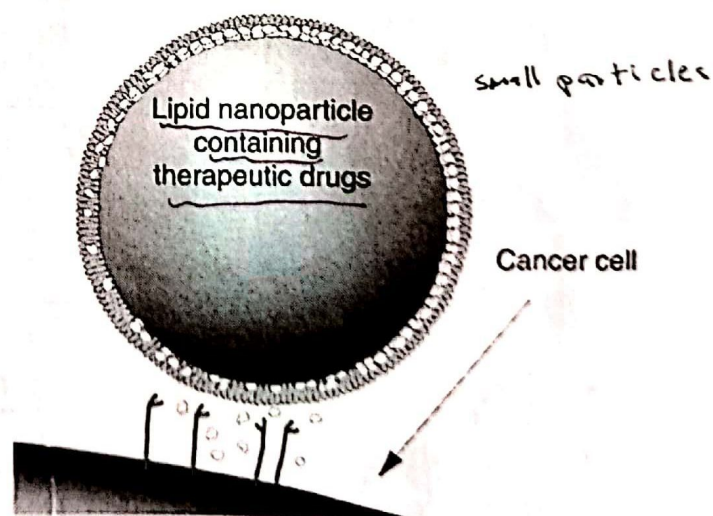
لا يتغير نوع amino acid

Biological Challenges of the 21st Century

- How will medical biotechnology change our lives in the years ahead?

* Nanotechnology

- Applications that incorporate extremely small devices
- Small particles that can deliver drugs to cells توصيل



insulin (anticancer) drug, Small particle

... Lipid nanoparticle ...

Biological Challenges of the 21st Century

• Gene therapy technology

– Replacing or augmenting defective genes with normal copies of the gene

- Still have barriers to overcome before this technology becomes safe and effective

العوائق تشمل؟

- Obstacles include:

- * How can normal genes be delivered to virtually all cells in the body? (ممكن كل مشكلة بمكان معين وإيها)
- * What are the long-term effects of introducing extra genes in humans? (ما من تأثيرات سلبية على جينوماتنا؟)
- * What must be done to ensure the proper protein is made after the genes are delivered to the body? (ما سنبه)

Biological Challenges of the 21st Century

- Small interfering RNA (siRNA) is emerging technology to silence genes that are involved in disease progression

Biological Challenges of the 21st Century

• Stem cell technology

- Stem cells are immature cells that grow and divide to produce different cell types
- Most stem cells are from embryos called embryonic stem cells (ESCs) but they are controversial since the process involves death of an embryo
- Some stem cells are from adult cells (ASCs)
 - Either type of stem cell can be coaxed to grow into cells of interest to replace damaged tissue or failing organs (liver, pancreas, retina)

• Embryonic vs. adult stem cells?

Unlimited
differentiation

differentiation
لا تفرغ في وقتها
مع الكمية

Biotechnology in the 21st Century

embryonic stem cells...

• ESCs can give rise to many types of differentiated cells

