

FORENSIC MEDICINE

Medicolegal report & animal identification

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Objectives:

- **Definition of forensic medicine.**
- **Medicolegal report for alive or dead animal.**
- **Animal identification.**
- **Identification of animal remains.**
- **DNA profiling.**

Definition

- Forensic Medicine is defined as the adaptation of medical knowledge in the **solution** of legal case (crime).
- Interaction of medical sciences with the law.

- **Synonyms**

Legal Medicine,
Medical Jurisprudence and
State Medicine.

- Forensic is derived from the word **(Forum)**, the Roman market place for lawyers in ancient times.

Medico-legal Reports تقارير الطب الشرعي

- These documents (certificates) are prepared by a medicolegal practitioner on the **request** of legal authorities (police or investigating agencies) in criminal cases, poisoning or death of an animal.
- The reports contain all data related to the examined case in the form of:
 - (a) **facts** observed on examination (subject), and
 - (b) **opinion** drawn from the facts (conclusion)

How to write a medicolegal report

Medicolegal Report consists of (Parts)

- 1- Introduction (Preamble).
- 2- Body (Subject).
- 3- Results (Conclusion).



Introduction

- **This part contains:**
- **The name, job and address of both medicolegal practitioner who writes the report and the authority (judge, government, or vet. authorities) ordering for the examination.**
- **The number of sign (الإشارة), type, date and time.**
- **A summary about the case must be mentioned.**

THE BODY (**SUBJECT**)

- The date, time and place of examination in presence of an official witness. Complete description for external and internal examination of the body.
- **Alive animal: identification**, external examination, clinical signs, samples for analysis, described treatment, time required for treatment and percentage of expected losses should be recorded.
- **Dead animal: identification**, carcass position, external examination, PM changes, internal examination and samples for analysis.

Conclusion (results)

- **This part contains:**
- The characteristic signs, treatment, expected time for treatment and expected losses (alive animal)
- While in dead animal: **cause of death** and **time of death.**
- Signature and qualification of the examiner.
- N.B.: don't use difficult and complicated scientific terms in the report.

Case study

- **Example:**
- **A case admitted to the vet. Teaching hospital, female horse, it had several injuries at different parts of the body (eye, tongue and hind limb).**
- **A firearm wound was found in the hind limb.**
- **It was a criminal case because someone shoots the owner of the horse and killed him.**

تقرير طبي شرعي

بناءً على الإشارة الواردة بتاريخ 16/12/2010م من السيد وكيل النائب العام لنيابة ديروط بشأن فحص فرس مصاب في القضية رقم 6564 لسنة 2010م والمتواجدة في المستشفى البيطري التعليمي بجامعة أسبوط. قمت أنا الدكتور/ عادل شحاتة محمود - أستاذ ورئيس قسم الطب الشرعي والسموم بكلية الطب البيطري جامعة أسبوط بفحص الحالة بتاريخ 18/12/2010م الساعة الحادية عشرة صباحاً وتبين الآتي: الحيوان المفحوص فرس (أنثى حصان) حمراء اللون وتوجد بها جبهة بيضاء وكذلك علامات بيضاء على الجزء الأسفل للقائمة اليسرى الأمامية وكذلك القانمتين الخلفيتين وعمرها حوالي سبعة عشر عاماً ، وبالكشف الظاهري وجد جرح قطره حوالي واحد سنتيمتر خلف الركن الوحشي للعين اليسرى وكذلك التهابات وتزيف وتهتك شديد وتلف بالعين اليسرى. وبفحص الفم وجد به جروح قطعية متعددة باللسان وكذا الجانب الأيسر للشفة السفلى. وبفحص باقي الجسم وجد جرح غائر بالقائمة اليمنى الخلفية في منطقة أعلى الفخذ من الخلف متهتك الحواف متعفن الرائحة وبفحصه من الداخل وجد بداخله مقذوف ناري مصنوع من النحاس ومفرغ من الداخل قطره حوالي خمسة ملليمتر ومحطم في جزئه الأعلى. ونظراً لتأخر الفحص الطبي لم تكن آثار الإطلاق واضحة. وقد تم تحرير المقذوف وتسليمه مع التقرير لمندوب النيابة. وقد تم عمل أشعة سينية على منطقتي الرأس والفخذ ولم يتبين وجود أي مقذوفات أخرى داخل المنطقتين. وقد تم علاج الحيوان محل الفحص بعمل خياطة جراحية للسان والشفة وتم تنظيف جرح الفخذ بالمطهرات وأعطى الحيوان مضاد حيوي ومصل التيتانوس.

مما سبق يتضح أن الحيوان محل الفحص أصيب بطلق ناري من الجهة الخلفية للحيوان في منطقة الفخذ وقد تعزى إصابة العين اليسرى إلى دخول مقذوف ناري من الجرح المجاور وخروجه من فتحة العين مما أدى إلى تلفها وتعزى إصابات الفم إلى سقوط الحيوان أرضاً.

كتب هذا التقرير من ثلاث نسخ أحداها للسيد وكيل النائب العام ديروط والثانية سلمت للسيد الأستاذ الدكتور مدير المستشفى البيطري بجامعة أسبوط وحفظت النسخة الثالثة طرف السيد الأستاذ الدكتور كاتب التقرير.

تحريراً في يوم السبت الموافق 18/12/2010م

دكتور/ عادل شحاتة محمود

أستاذ ورئيس قسم الطب الشرعي والسموم
كلية الطب البيطري - جامعة أسبوط

Animal Identification

Definition:

- ❑ Animal identification is the detection of special characters (marks) which differentiate individual animal from others.
- ❑ Alive or dead animal,
- ❑ Permanent or Temporary marks.

✓ Natural and artificial marks (characters):

1- Natural marks:

Species, sex, breed, color, age and height.

2- Scar:

Scar is a connective tissue, which is formed due to healing of injury, burn, lesion of disease or surgical operation. The scar is examined carefully for its shape, place, area, and color.

3- Hereditary & Teratogenic marks.

4- Tattoo marks

5- Firing

6- Freeze numbering.

7- Temporary marks:

Painting and aluminum rings or plastic marks.

Identification of Animal Remains

- 1- Bones
- 2- Muscles
- 3- Fat
- 4- Teeth
- 5- hoofs & Claws
- 6- Hair

- Are the examined remains of animal origin????

- 1- Classical methods or
- 2- Identification by DNA profiling

Classical Methods for species identification

- Precipitation
- Electrophoresis
- Agglutination

-These methods have limited application in old samples (protein exposed to aging and Environmental influences).

✓ **The recent methods (DNA profiling):** based on genetic differences between animal species or human individuals (sample at the crime scene & DNA of the suspect).

DNA profiling (DNA finger printing):

- ✓ DNA fingerprinting is a method used to **distinguish between individuals of the same species** using samples of their DNA.
- ✓ There is no question that DNA profiling is now the single most powerful tool possessed by forensic science.
- ✓ It is 100 percent reliable.

DNA samples (at crime scene):

**Blood & blood stains, bone, teeth, hair (root & shaft),
saliva , feces, semen & muscle tissue.**

Collection and preservation of samples:

- Avoid contaminating the sample area by:
- Use clean latex gloves.
- Each item of evidence packaged separately.
- Stains must dried prior to sealing packaged.
- Use paper envelopes or bags after drying
- Stains on unmovable surfaces are transferred by sterile cotton swabs and distilled water then air dried and packaged.
- Storage of sample as dry & cold to reduce bacterial growth & degradation of DNA.
- Storage in refrigerator (4°C) or freezer (-20°C).

حادث حريق محطة مصر: استخدام تحليل الحمض النووي للتعرف علي الجثث.



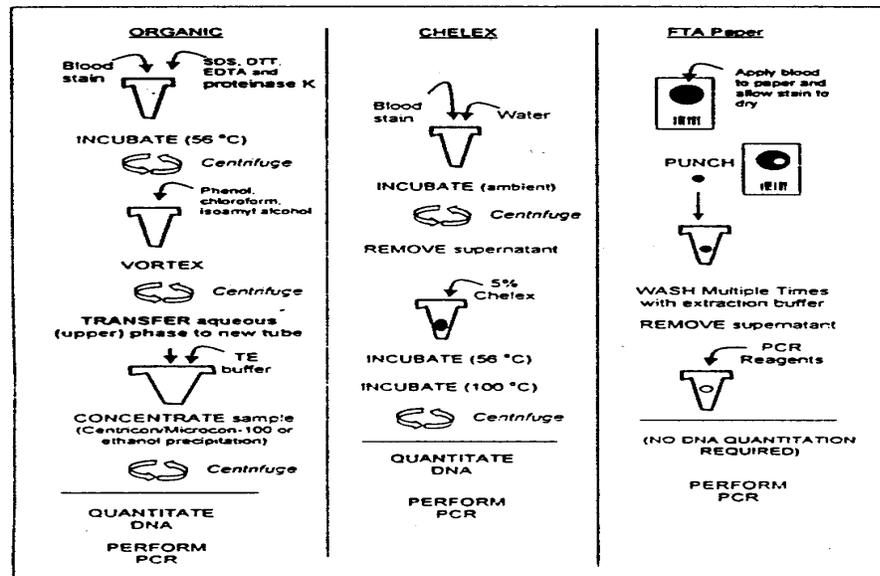
How is DNA Tested:

1. **Isolation of DNA (Extraction):** This DNA is recovered from the tissue using chemicals and enzymes to break and open the cells and release the DNA into a solution.
 - **Commonly used primary extraction techniques in forensic laboratory are:**
 - 1- **Organic extraction:** phenol and chloroform
 - 2- **Chelex extraction**
 - 3- **FTA paper**
 - ✓ 4- **DNA extraction kits.**



DNeasy blood and tissue kit
(for extraction of DNA)

Commonly used DNA extraction processes.



2- DNA Quantification:

➤ using spectrophotometer (nano Drop), absorbance at 260 nm to determine the concentration of DNA in the extract to be able to perform the next step.



Nano Drop for estimation of DNA concentration in extracted sample.

➤ **3- Amplification of DNA by polymerase chain reaction (PCR)** selectively copies the unique parts of DNA.

✓ **The polymerase chain Reaction PCR (DNA amplification)**

Ability to make millions of copies of specific sequence of DNA in few hours.

- PCR is an enzymatic process in which specific region of DNA is replicated to yield many copies of particular sequence.

- Process (Amplification) involves heating and cooling samples in thermal cycling pattern over 30 cycles. During each cycle, a copy of the target sequence (amplicon is generated).

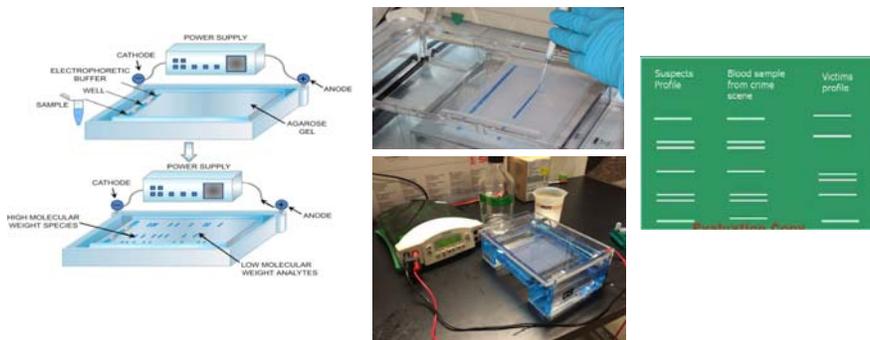
- The target sequence (amplicon) linked to a radioactive isotope and compared to standard samples.



Thermocycler for PCR

4- **Cutting, Sizing and Sorting**: Restriction enzymes are used to cut DNA at specific places.

5- **Electrophoresis** to separate the DNA bands on agarose gel then matching with reference sample.

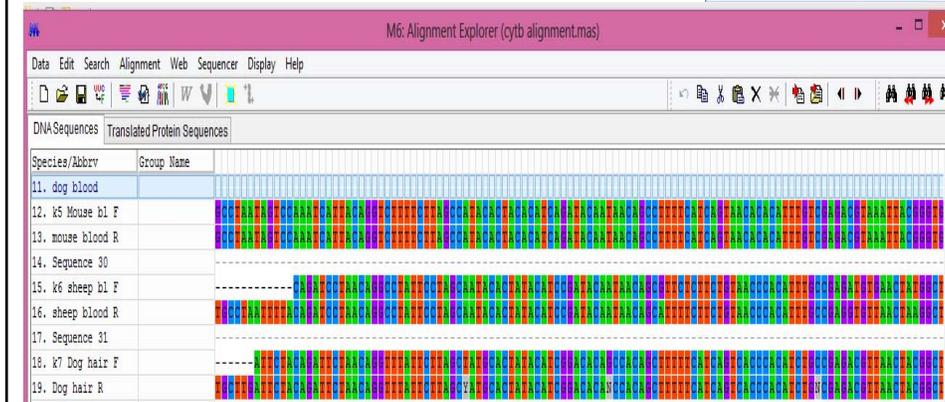


If there is no reference sample???? DNA sequencing will be performed



6- Sequencing of DNA using Automated DNA Sequencer, in case of unknown sample and compare with gene bank data to know the species.

<https://blast.ncbi.nlm.nih.gov/Blast>.



- Typically these methods identify **variable regions of DNA** termed **simple tandem repeats (STR)** or **microsatellite DNA**. Hundreds of such variable regions have been described in livestock but **only five to ten such regions** need to be tested to individually identify an animal within a population of tens of millions.
- **Identical twins** are the rare exceptions to **unique DNA identification** of individuals; these typically have **identical DNA profiles**.
- DNA tests can be routinely carried out from a swab of tissue, hair follicles or a drop of blood.

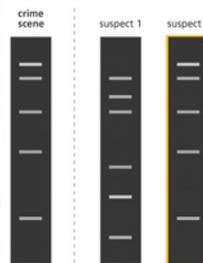
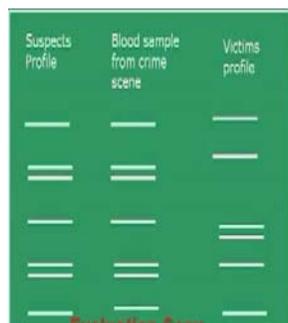
Importance and uses of DNA profiling

- 1- Used to solve crimes.
- 2- Used for paternity testing.
- 3- Individual identification (human).
- 4- Animal identification:
 - animal remains.
 - meat adulteration.
 - traceability of meat products

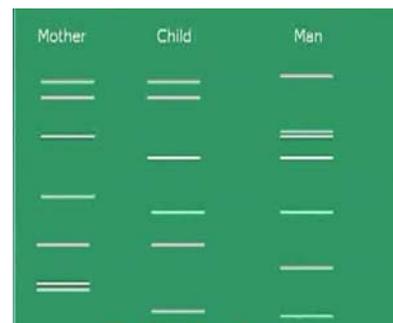
Stage 4:

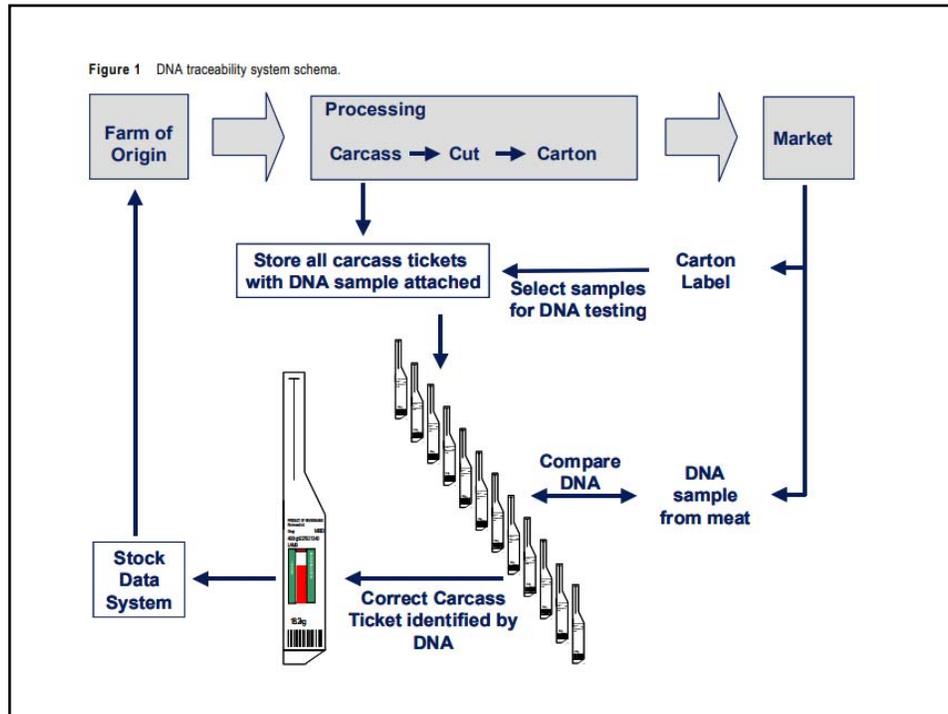
- ◆ The pattern of fragment distribution is then analysed.

Used to solve crimes



Used for paternity testing





DNA Profiling

(DNA fingerprinting)

What is DNA Profiling?

A technique used by scientists to distinguish between individuals of the same species using only samples of their DNA

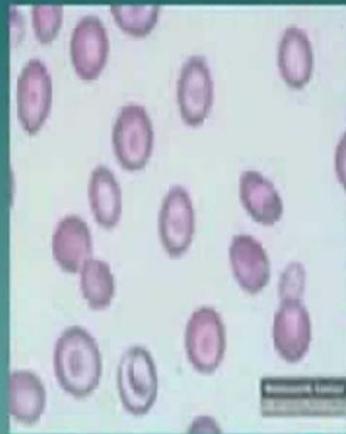
Who Invented it?

- ◆ The process of DNA fingerprinting was invented by Alec Jeffreys at the University of Leicester in 1985.
- ◆ He was knighted in 1994.



Stages of DNA Profiling

- ◆ **Stage 1:**
Cells are broken down to release DNA
- If only a small amount of DNA is available it can be amplified using the polymerase chain reaction (PCR)



Stages of DNA Profiling

- ◆ **Step 2:**

The DNA is cut into fragments using **restriction enzymes**.

Each restriction enzyme cuts DNA at a specific base sequence.



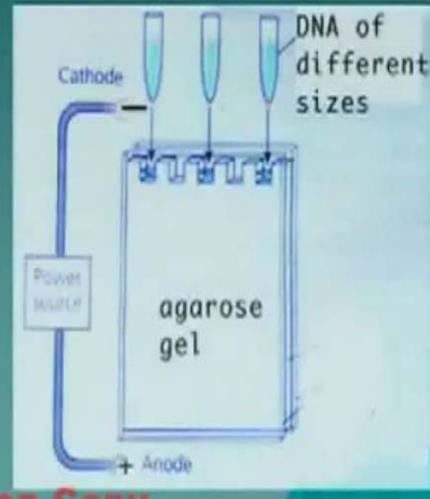
Stages of DNA Profiling

- ◆ The sections of DNA that are cut out are called **restriction fragments**.
- ◆ This yields thousands of restriction fragments of all different sizes because the base sequences being cut may be far apart (long fragment) or close together (short fragment).

Stages of DNA Profiling

Stage 3:

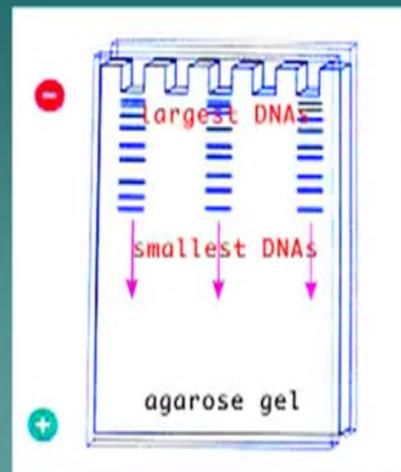
- ◆ Fragments are separated on the basis of size using a process called gel electrophoresis.
- ◆ DNA fragments are injected into wells and an electric current is applied along the gel.



Stages of DNA Profiling

DNA is negatively charged so it is attracted to the positive end of the gel.

The shorter DNA fragments move faster than the longer fragments.



Stages of DNA Profiling

- ◆ A radioactive material is added which combines with the DNA fragments to produce a fluorescent image.
- ◆ A photographic copy of the DNA bands is obtained.



Stage 4:

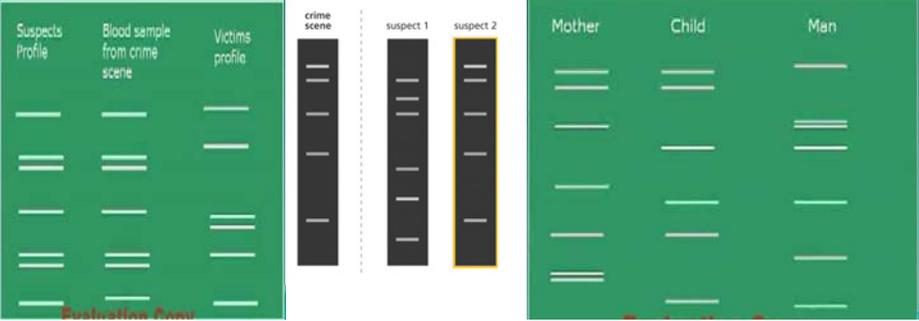
- ◆ The pattern of fragment distribution is then analysed.

Used to solve crimes

Suspects Profile	Blood sample from crime scene	Victims profile
—	—	—
==	==	—
—	—	==
==	==	—
—	—	—

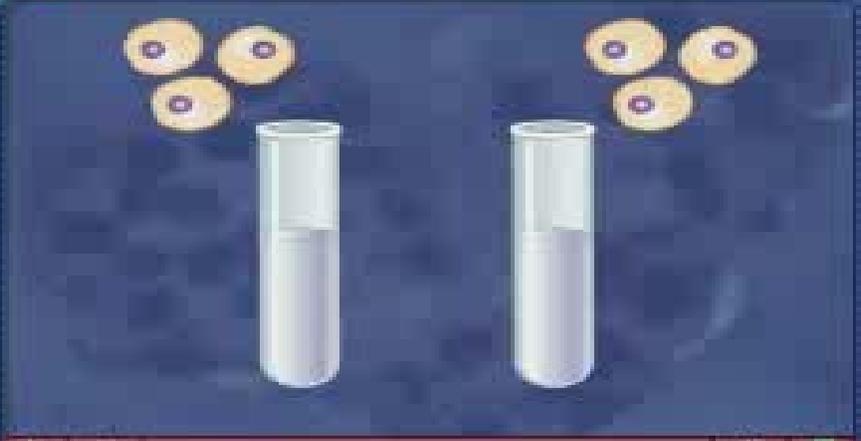
Used for paternity testing

Mother	Child	Man
—	—	—
==	==	==
—	—	—
==	==	—
—	—	—
==	==	—



Mc
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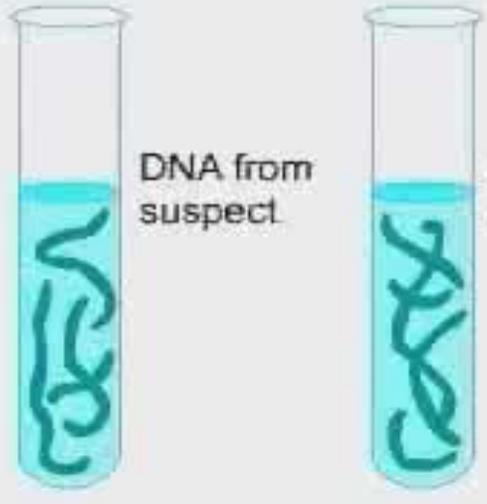
DNA Fingerprinting



The diagram shows two test tubes on a dark blue background. Above each test tube are three yellow circular cells, each with a blue nucleus. The test tubes contain a clear liquid. Below the test tubes is a red control bar with buttons for 'Play', 'Pause', 'Back', 'Forward', 'Auto', and 'Test'. Below the control bar is a text box with the following text:

DNA fingerprinting is a method of identification based on an individual's DNA.

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Two test tubes are shown side-by-side. Each contains a blue liquid with a green, double-helix DNA structure. The left test tube is labeled "DNA from suspect" and the right test tube is labeled "DNA from blood stain".