Forensic Molecular Biology
Molecular Techniques in Crime Busting
At the end of the session, the students should:

1. Be able to define Forensics and Forensic Sciences
2. Be able to basic procedures in a crime scene investigation
3. Be able to understand how molecular biology plays a very important role in solving crime
Forensics

- Public debate
- Law

Forensic Sciences

- Application of science to law

What is Forensic Science?
Forensic Science:
Is the application of a broad spectrum of sciences to answer questions of interest to the legal system. This may be in relation to a crime or to a civil action.

-American Academy of Forensic Sciences
“It was Locard’s belief that when a criminal came into contact with an object or person, a cross--transfer of evidence occurs.”

-- Richard Saferstein

Edmond Locard’s Exchange Principle
“Wherever he steps, whatever he touches, whatever he leaves --
even unconsciously-- will serve as silent evidence against him.
Not only his fingerprints or his shoeprints, but also his hair, the
fibers from his clothes, the glass he breaks, the tool mark he
leaves, the paint he scratches, the blood or semen that he
deposits or collects -- all these and more bear mute witness
against him. This is evidence that does not forget. It is not
confused by the excitement of the moment. It is not absent
because human witnesses are. It is factual evidence. Physical
evidence cannot be wrong; it cannot perjure itself; it cannot
wholly be absent. Only in its interpretation can there be error.
Only human failure to find, study, and understand it can diminish
its value.”

-- Paul L. Kirk
“...one who performs investigatory examinations and laboratory tests to reach a conclusion”

“...a communicator and interpreter of those finding... he must be able to explain the methods used to reach those conclusion in a court of law...”
Field Scientists
- collection, transfer, and initial interpretation of evidences (e.g. investigators, policemen)

Laboratory Science
- Analysis of physical and chemical evidences

Medical Science
- Medical procedures, autopsies
1. Crime Investigations
   Civil/Criminal Cases

2. Disputable Parentage Cases

3. Mass Disasters

IDENTIFICATION!!!

Applications of Forensic Sciences
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<thead>
<tr>
<th>Left Column</th>
<th>Right Column</th>
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<tbody>
<tr>
<td>Bite Marks</td>
<td>Blood and Body Fluids</td>
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<tr>
<td>Bones</td>
<td>Broken Fingernails</td>
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<td>Drugs</td>
<td>Explosives</td>
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<tr>
<td>Fiber</td>
<td>Fingerprints</td>
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<td>Glass</td>
<td>Hair</td>
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<td>Ink</td>
<td>Paint</td>
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<tr>
<td>Teeth</td>
<td>Soil and minerals</td>
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<td>Firearm Powder</td>
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Evidence of whatever type must be carefully and properly documented and evaluated!

The Chain of Custody
Forensic Molecular Biology And DNA fingerprinting
• The use of techniques and principles of molecular biology to solve the problems of forensic science.

• This includes crime and paternity disputes.

• Deals with molecules, which include DNA, RNA, carbohydrates, proteins, even lipids.
Two types of Finger Printing
Trillions of cells
Each cell:
- 46 human chromosomes
- 2 meters of DNA
- 3 billion DNA subunits (the bases: A, T, C, G)
- Approximately 30,000 genes code for proteins that perform most life functions
Sources of DNA

- Teeth
- Skin
- Bone
- Hair
- Saliva
- Blood
- Semen
The human genome contains $3 \times 10^9$ base pairs.

99 - 99.9% of DNA sequence is identical from one individual to the next.

The other 0.1-1% contains highly variable regions:
- Focus of DNA fingerprinting analysis
- Used as genetic markers for DNA fingerprinting
**VNTRs**
Variable number tandem repeat
contain repeated sequences of 15-70 bases

**STRs**
Short tandem repeats
contain repeated sequences of 2-4 bases

Number of repeats varies greatly between individuals.
VNTR

...ACAGGGTGTTGGGG...

12

17

Variable number tandem repeat
Restriction Fragment Length Polymorphism (RFLP)/Southern blot
Uses VNTRs as genetic markers

Polymerase Chain Reaction (PCR)
Uses STRs as genetic markers
QUESTIONS?
TO BE CONTINUED 😊