Odontology and Serology

Discuss uses of odontology and serology studies in forensic medicine.
Odontology

- Forensic medicine is a science that deals with the relation and application of medical facts to legal problems. Dentists who work in forensics now can establish a positive identification of human remains -- sometimes in a matter of minutes, even without dental records.
Odontology

• Characteristics of teeth after death
  a. No other part lasts longer
  b. In fires, teeth usually only means to ID remains
  c. No two people have identical teeth
What can be learned from studying a set of teeth?

- The arrangement of each person's teeth is virtually unique, and almost all of us have had some kind of dental treatment. Where dental records are available, it is possible to study a set of teeth and compare the teeth with dental records. This comparison allows dentists to establish the identity of a body, just like fingerprints or DNA evidence.
• In the near future, 3D computer technology will make it possible to reconstruct a reasonable likeness of a person's face during life, using dental and physical information from skeletal remains.
Requirements for identification

• a. Need dental records
• b. Dentists chart five surfaces of each tooth in a grid (odontogram)
• c. Can also provide “bite mark” evidence
• d. Teeth useful in determining subject’s age
Bite marks
Serology

• The analysis of the properties and effects of serums (blood, semen, saliva, sweat, or fecal matter) is called serology.
• Blood evidence is found most often in "crimes of violence such as homicide, assault, and sexual assault."
• It may be in the form of fresh liquid, coagulated, dried, or as a small drop or stain, and each form involves a different method of preservation and collection.

• Blood types
• Rh factor
• Barr bodies
ABO groups

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<th>Anti-A</th>
<th>Anti-B</th>
<th>Anti-AB</th>
<th>A cells</th>
<th>B cells</th>
<th>O cells</th>
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## The ABO Blood System

<table>
<thead>
<tr>
<th>Blood Type (genotype)</th>
<th>Red Blood Cell Surface Proteins (phenotype)</th>
<th>Plasma Antibodies (phenotype)</th>
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</thead>
<tbody>
<tr>
<td>Type A (AA, AO)</td>
<td>A agglutinogens only</td>
<td>b agglutinin only</td>
</tr>
<tr>
<td>Type B (BB, BO)</td>
<td>B agglutinogens only</td>
<td>a agglutinin only</td>
</tr>
<tr>
<td>Type AB (AB)</td>
<td>A and B agglutinogens</td>
<td>None</td>
</tr>
<tr>
<td>Type O (OO)</td>
<td>No agglutinogens</td>
<td>a and b agglutinin</td>
</tr>
</tbody>
</table>
Frequency of Blood Types

- AB Neg 0.06%
- B Neg 1.5%
- AB Pos 3.4%
- A Neg 6.3%
- O Neg 6.6%
- B Pos 8.5%
- A Pos 35%
- O Pos 37%

Someone with this blood type...can only receive a kidney from someone with this blood type.
RH factor

http://nobelprize.org/medicine/educational/landsteiner/readmore.html
Females have: Barr Body

- **Barr body** Inactivated
- **X-chromosome** in mammalian females. Although inactivated, the Barr body is replicated prior to cell division and thus is passed on to all descendant cells of the embryonic cell that had one of its X-chromosomes inactivated.
Analysis Gone Wrong

• It should be kept in mind that analysis always involves interpretation. In the case below, an interpretation of the bloodstain evidence helped to convict a woman and stood up to two appeals, but turned out to have been in error.

http://www.law.umkc.edu/faculty/projects/ftrials/chamberlain/chamberlainimages.html
In Australia in 1980, Lindy and Michael Chamberlain took their three children camping near Ayers Rock. The youngest was nine-week-old Azaria.

One evening, according to Lindy and Michael, they were preparing dinner at the camp barbecue site when they heard a sudden sharp cry from the tent in which Azaria was sleeping. Lindy went to check and saw a dingo, or wild dog, backing out, shaking something large in its jaws. It ran away and that's when Lindy discovered that Azaria was gone. The dog had taken her!
Trackers searched the area to no avail. There was no sign of the missing baby or the dingo, except for footprints leading to the road and beyond. The parents grieved deeply, but eventually accepted their fate as the will of God. They assumed she was dead.
Eight days later a hiker discovered baby Azaria's clothing in a crumpled heap west of Ayer's Rock. Only the baby's jacket was missing, but oddly, her undershirt was inside out and the booties were neatly laced up inside the jumpsuit. On the neck of the jumpsuit and undershirt were bloodstains that were later thought to be consistent with the type of stain that would result from a knife cut, not a bite. There were also no tooth marks on the clothing.
• Lest there was doubt about whether the clothing belonged to the child, blood tests were done to determine type (no DNA testing was available then), and then compared to the Chamberlain's blood types. The conclusion was that the clothing had belonged to Azaria. Another test showed that the undershirt had been worn the right way when the wound was made, but then someone had removed it, leaving it inside out. There also appeared to be two bloodstained prints on the jumpsuit made by the hands of a small adult, like a woman.
A search of the Chamberlain's car produced what appeared to be the blood of an infant on the seats and on a pair of scissors in the vehicle. After that, the Chamberlains were arrested and tried for the murder of their baby daughter. They insisted they were innocent, but the evidence appeared to say otherwise. Lindy was convicted of murder and Michael was declared an accessory to the crime. Lindy went to prison.
Then in 1986, four years after the trial, Azaria's missing jacket was finally located—partly buried in sand near a dingo cave not far from the campsite. It was torn and bloodstained, but in good enough condition to be identified as the one Azaria wore the last time she was seen. It was sufficient for reasonable doubt and Lindy was released. The following year, the couple was officially pardoned. Not long afterward, their convictions were quashed.
Movie: A Cry in the Dark