5 | TRACES OF EVIDENCE

- Important in the examination of crime scenes.
- Examples of evidence
  o Bloodstain
  o Seminal stain
  o Hair sample
- Edmond Locard, a French criminologist is considered as the Father of Forensics.
- **Important contributions of Locard**
  o **Poroscopy** - Used in the identification.
  o **Locard Exchange Principle** - Important in crime scene examination.

What is the Locard Exchange Principle?
- When two things come in contact there is always an exchange of materials from one to another.
- **Example:** A criminal commits a crime, he/she leaves some traces like blood, semen, and hair sample at the scene.
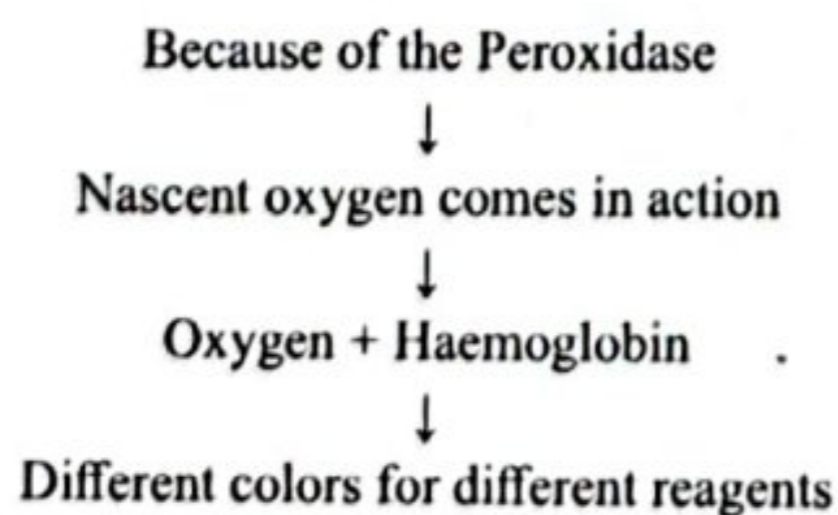
1. Blood Stains   00:04:06
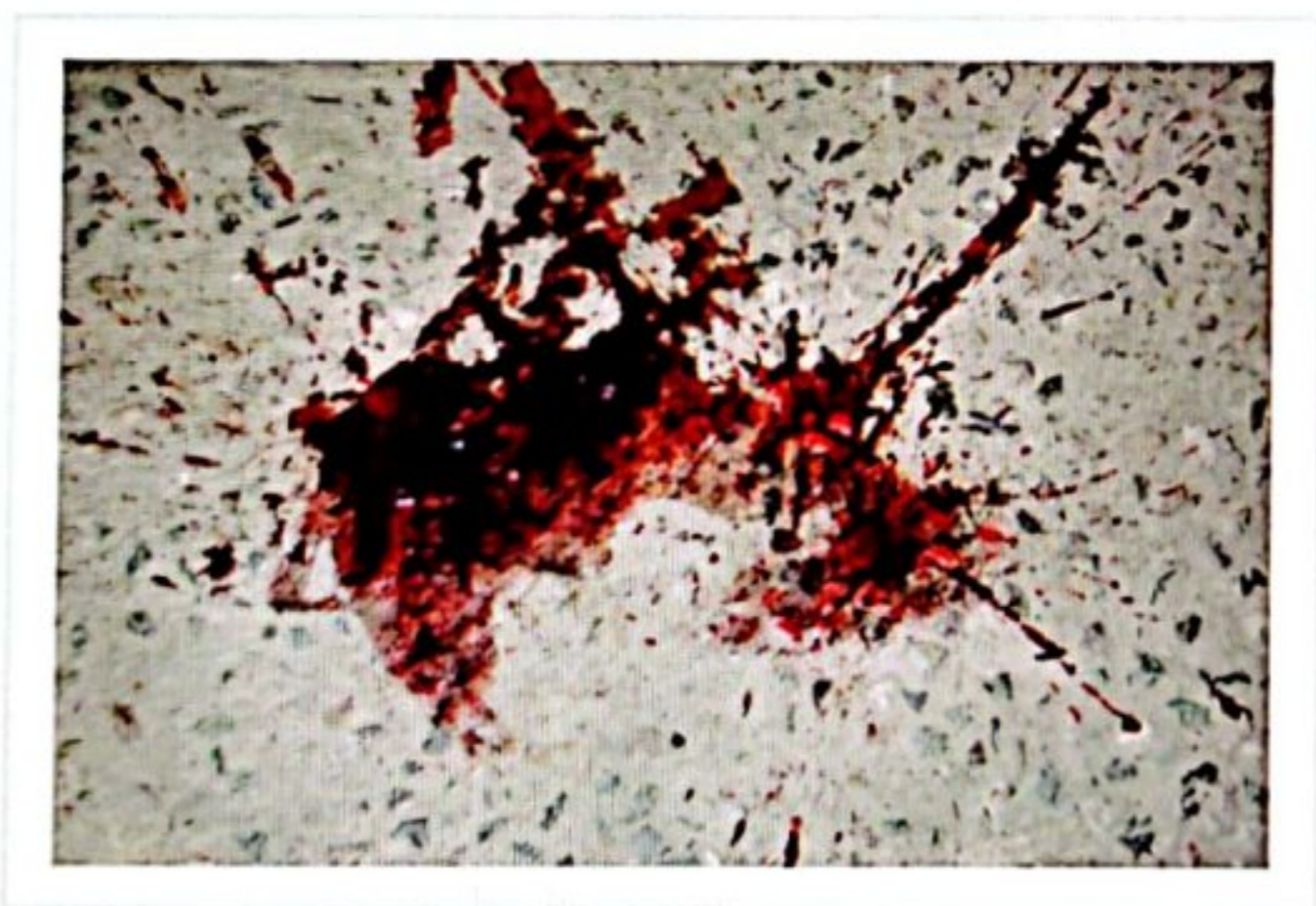
A. Screening Tests
  o Every blood stain has peroxidase activity.
  o Screening tests are performed based on peroxidase activity.
  o Screening tests are also called Presumptive tests.

Because of the Peroxidase
↓
Nascent oxygen comes in action
↓
Oxygen + Haemoglobin
↓
Different colors for different reagents

Different Screening Tests for Blood Stains (Questions might be asked)

- Tests based on Peroxidase enzyme activity.

Test	Color
Benzidine test	Blue
Phenolphthalein test/ Kastle-Mayer test	Pink
Orthotolidine test	Blue
Leucomalachite test	Peacock blue

- **Benzidine test**
  o Most sensitive test
  o Very good to detect old blood stains.
  o **Problem** - Benzidine is a carcinogen.
  o There are few things which give false + ve results for Benzidine test.
    → Milk
    → Plant juices
    → Pus
    → Saliva
    → Few bacteria (peroxidase +ve)

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Q1. Which is the most sensitive test in blood stain screening?
Ans. Benzidine test

- **Other screening tests**
  o Luminescence test - Luminol spray and UV rays are used.
    → Required if blood stain is invisible or old/washed stain.

B. Confirmatory Tests
i. Microchemical Tests

Test	Crystal & Color
Teichmann test	Brown rhombic crystal color (A dark brown man)
Takayama test	Pink feathery crystal (Takatak is pink)

ii. Spectroscopy Tests
  o Gives bands.
  o Most specific confirmatory test.

Q2. Which is the most sensitive test in blood stain confirmation?
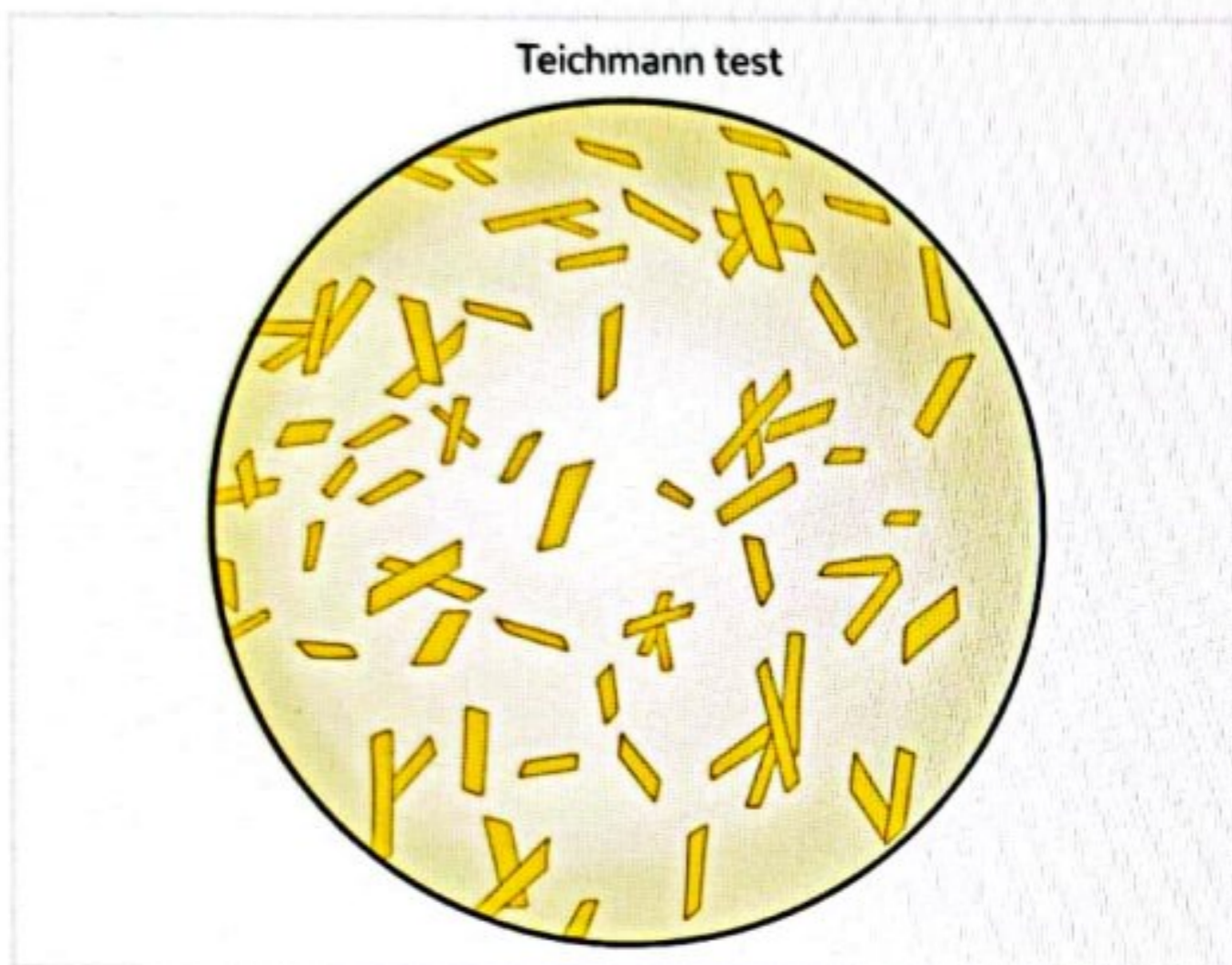**Ans.** Spectroscopy test.

### iii. Microscopy
  o Differentiation between human and animal blood.

Animal Blood (RBC)	Human Blood (RBC)
Oval	Round
Convex	Concave
Nucleus +ve	Nucleus -ve

- **Teichmann test**

Teichmann test

- o **Appearance:** Brown rhombic dark crystals are seen.
- o **Chemicals used:** NaCl + GAA (Glacial acetic acid).
- o Mnemonic: Men are brown, Teichmann has 'man', thus 'brown rhombic dark crystals'.
- o **Type of crystals:** Hemin Cl⁻ crystals/ Hematin Cl⁻ crystals (like Heman and also NaCl is used).

- **Takayama test**

Takayama test
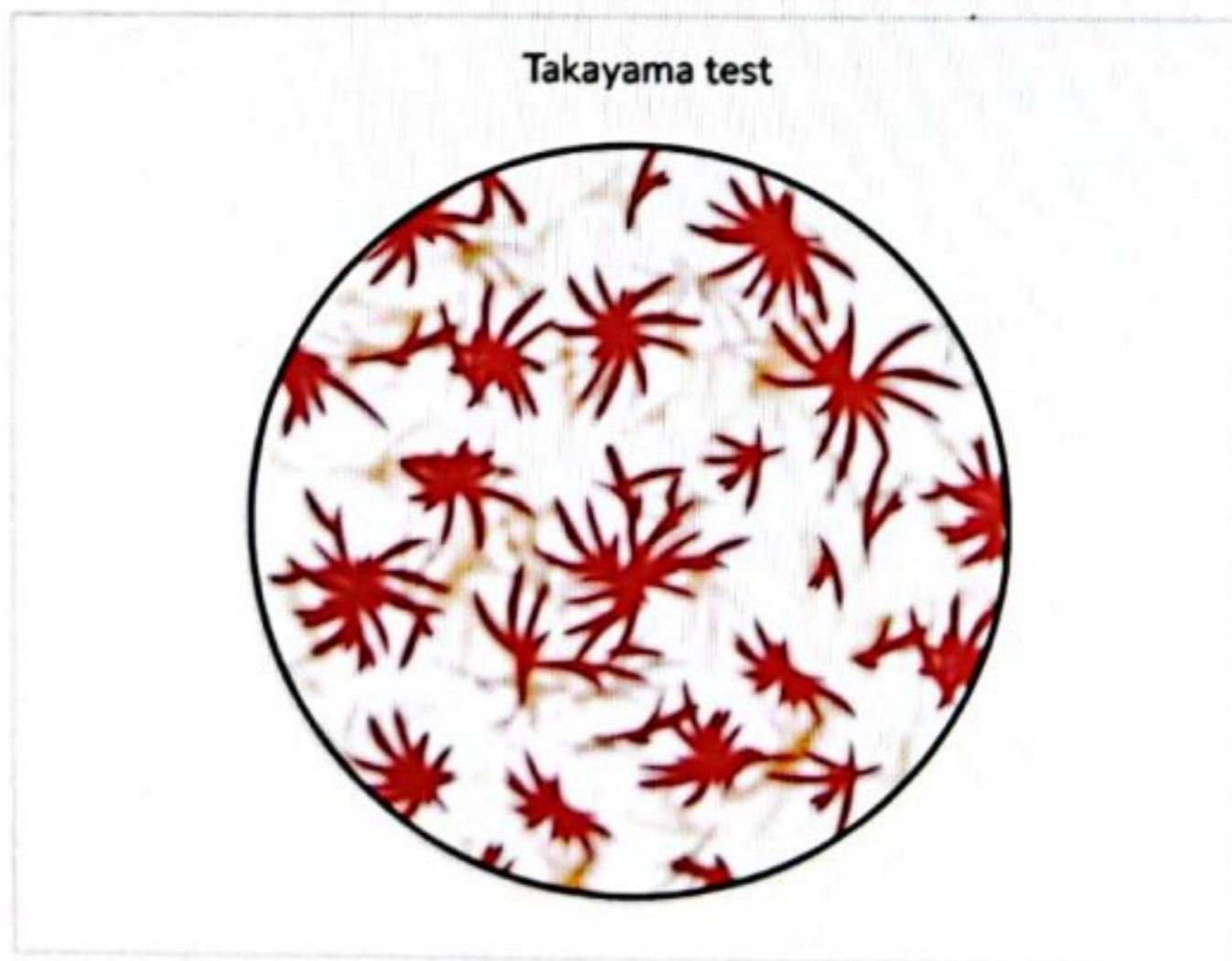
- **Appearance:** Pink feathery crystals.
- **Chemicals used:** GPS (Glucose + Pyridine + NaOH)
- Mnemonic: Takatak is pink color.
- **Type of crystals:** Hemo-chromogen crystal.

To Remember: The test which can give the species differentiation is the **Precipitin test.**
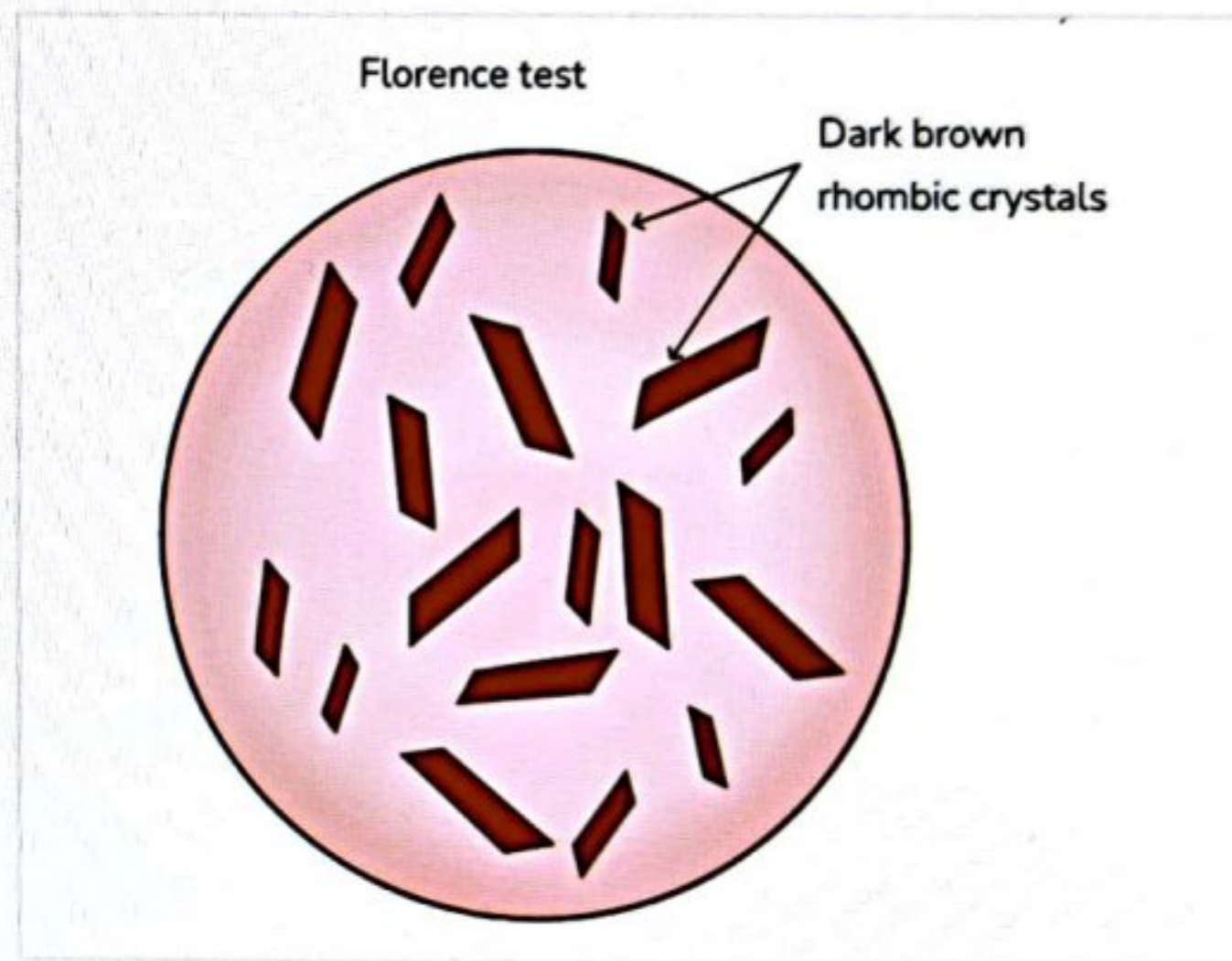
2. Semen Analysis   00:16:38
- Usually found in rape and unnatural sex cases.
- Semen constituents
  - o 10% - Sperm
  - o 90% - Seminal fluid

A. Florence Test
- **Detects** - Choline crystals (Dark brown rhombic crystals)
- **Reagent** – KI is used.
- Mnemonic: Florence has 'C', C for Choline.
- **Type of crystals:** Choline iodide.

Florence test — Dark brown rhombic crystals

B. Barberios Test
- **Detects** - Spermine crystals (yellow needle-shaped crystals)
- **Reagent** - Picric acid.
- Mnemonic: Barbar picks your hair with a needle.
- **Type of crystals:** Spermine Picrate.

Barberio test — prince kumar princeeeekum@gmail com 9928609733 — Yellow needle-shaped crystals
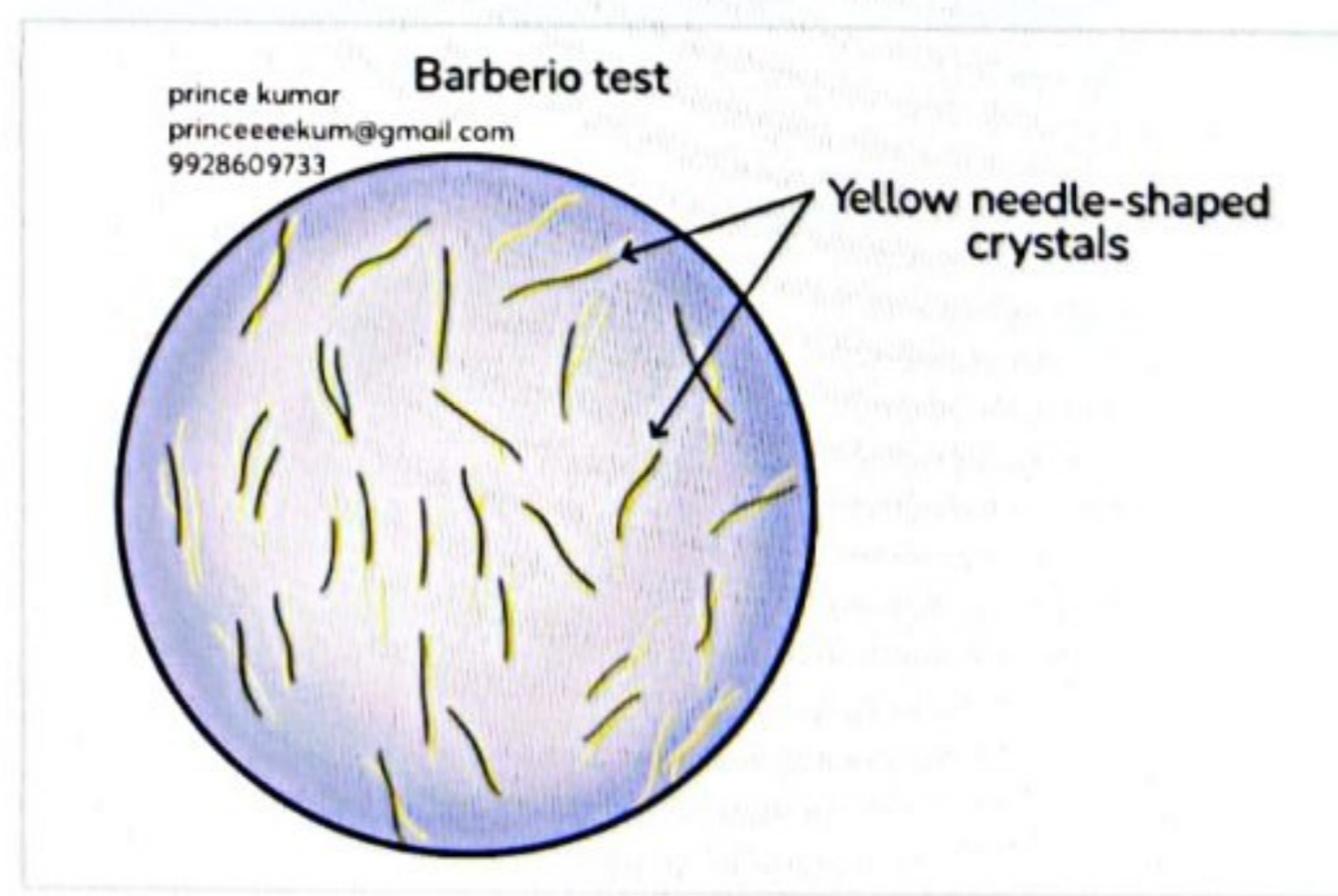
C. Other Tests for Semen Analysis
- **Fluorescence test:** Seminal stain + UV light → Bluish white color.
- **Acid phosphatase test**

- o Positive even in the cases of Aspermia (absence of sperms)
- o **Normal range:** 320-360 Bodansky unit

- **CPK (Creatinine Phospho Kinase)**
  - o Mnemonic: CPK - Old (Pakahua - means old in Hindi).
  - o Detects: Old seminal stains (6 months old as well)
  - o **Normal range:** 660 IU/ml.
- **Ammonium molybdate test** - Detects Phosphorus content of Semen.
- **Ag tests**
  - o **Glycoprotein P30 test:** Prostate Specific Ag (PSA)
  - o **MHS-5:** Seminal vesicle-specific Ag
  - o **MAB-4eb:** Sperm specific Ag

- **LDH isoenzyme detection of sperm**
  - o Most specific test of semen
  - o Absolute proof = One unbroken sperm.
- **Phadebas test** - In case of **oral sex**, saliva can be detected by L-amylase.

To Remember
- **Barberios test**
  - o Presence of Spermine (from the prostate) is detected.
  - o Gives yellow needle-shaped crystals of Spermine Picrate.
- **Florence test**
  - o Presence of Choline (from the seminal vesicle) is detected.
  - o Gives dark brown rhombic crystals of Choline iodide.

3. Hair Analysis
00:25:14
- Study of hair - Trichology.

Q3. What is the growth rate of human scalp hair?
**Ans.** 0.44 mm/day

- Hair is significant in the detection of many things like
  - o DNA
  - o Bar body
  - o Race of a person
- **3 parts of the hair**
  - o Root
  - o Shaft
  - o Tip

Why is hair very important in Forensic medicine?
There are many instances.
- Burned cases - Singeing of hair (curled or twisted hair).
- Sharp trauma - Cut hair (end of the hair is cut).

- Blunt trauma - Crushed hair (blurred or irregular margin).

- **Cross section of hair**
  - o Cuticle (imbricate scales
  - o Cortex
  - o Medulla

Cuticle (imbricate scales)
Cortex
Medulla
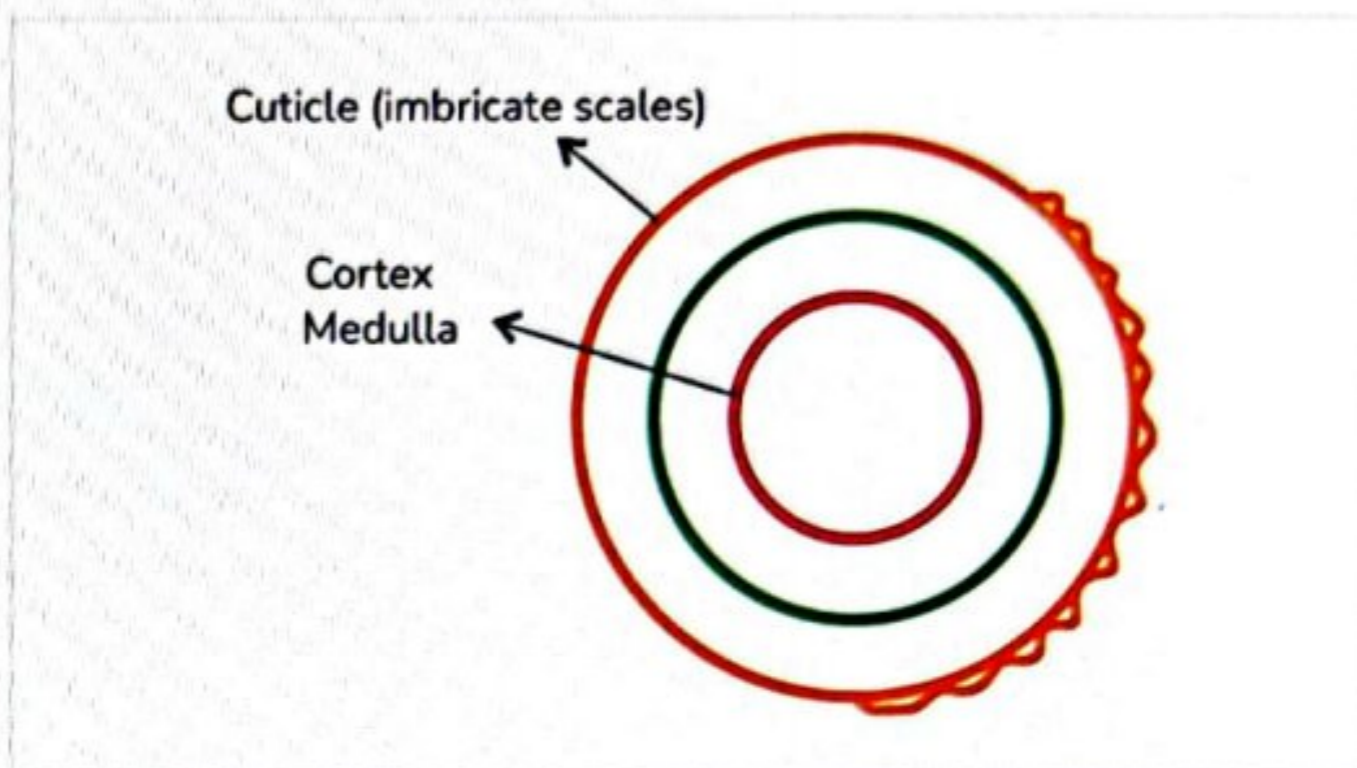
- Outermost - Cuticle (imbricate scales)
- Middle - Cortex
- Innermost - Medulla.

Human vs Animal Hair

Medulla
Cortex

Animal Hair	Human Hair
Medulla is thick.	The cortex is thick.
Coronal scales (C for Cattle, C for Coronal)	Imbricate scales (I for Insane means human in Hindi, I for Imbricate)
Coarse and think	Fine and thin
Continuous Medulla	Narrow Medulla
Pigment is at the Center.	Pigment is at the Periphery.
Medullary index (MI) is more (>0.5)	Medullary index (MI) is less (0.33 or less)

$$Medullary\ index\ (MI) = \frac{Diameter\ of\ medulla}{Diameter\ of\ entire\ hair}$$

- **Confirmation of species is done by Precipitin test.**

Other Important Information
- Alec Jeffreys - Father of DNA analysis or DNA fingerprinting.

- DNA fingerprinting is the best test for paternity/ maternity disputes.
- Other tests like HLA typing and Blood grouping are also used.

Q. Which is the best test for blood grouping?

Ans. Modified acid elution test/ acid elution test.
- Important tests to remember: Teichmann test, Takayama test, Florence Test, Barberios Test.

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18 | IDENTIFICATION PART - 1

Corpus Delicti
- **Means:** Body of offense/crime
- Also known as the essence of crime
- Components of Corpus Delicti
  - Crime
  - Reason (motive of the crime)
  - Source of evidence
    - → Dead body
    - → Crime scene evidence
    - → Primary and secondary evidences ((blood stain, seminal stain, blood stain on clothes)

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Identification
00:01:53
- Age, sex
- Race and religion
- External peculiarities (tattoos, scars, moles)
- General development, complexion, and stature
- Anthropometric measurements (length of bone, stature)
- Fingerprints (Galton system) and Footprints (Podogram)
- Teeth

Race
- **Negroid**
  - Africans
  - Pure Aryans
- **Mongoloid**
  - Japanese
  - Few Americans
- **Caucasoid**
  - Europeans
  - Chinese

Cephalic Index
- Index of a skull bone
- 3 types
  - **Dolicocephalic**
    - → Value: 70-74.9
    - → Negros, Pure Aryans
  - **Mesaticephalic**
    - → Value: 75-79.9
    - → Indians, Chinese, and Europeans
    - → Mnemonic: M-ICE
  - **Brachycephalic**
    - → Value: 80-84.9
    - → Mongol

Note: Brachycephalic is due to Early fusion of the coronal suture

Cephalic Index= Breadth of skull bone/Length of skull bone × 100

Golden Points
- Indians are not pure Aryans.
- Indians have both Dolichocephalic and Brachycephalic features (Mesati cephalic)
- Caliper is used for measurement

Other Indices
- **Mnemonic: BCCI**
- **Brachial Index**
  - Length of Radius/Length of humerus × 100.
  - Upper limb index.
- **Crural Index**
  - Length of Tibia/Length of Femur × 100.
  - Lower limb index.
- **Cephalic Index:** Skull bone index
- **Intermembral Index**
  - Length of Humerus+ Radius/ Length of Tibia+Femur× 100.

Orbit and Palate

Part	Negro	Mongol (Gol = Round)	Caucasian (C 3rd letter, 3 for Tri)
Orbit	Square	Round	Triangle
Palate	Rectangular	Round	Triangle

Teeth

Negro	Mongol (PE S T)	Caucasian (C C)
More cusp	• PE - Premolar Enamel pearl • S - Shovel-shaped incisor • T - Taurodontism (Bull tooth) • Congenital absence of 3rd molar can be present	Carbelli Cusp (maxillary molar)

Hair

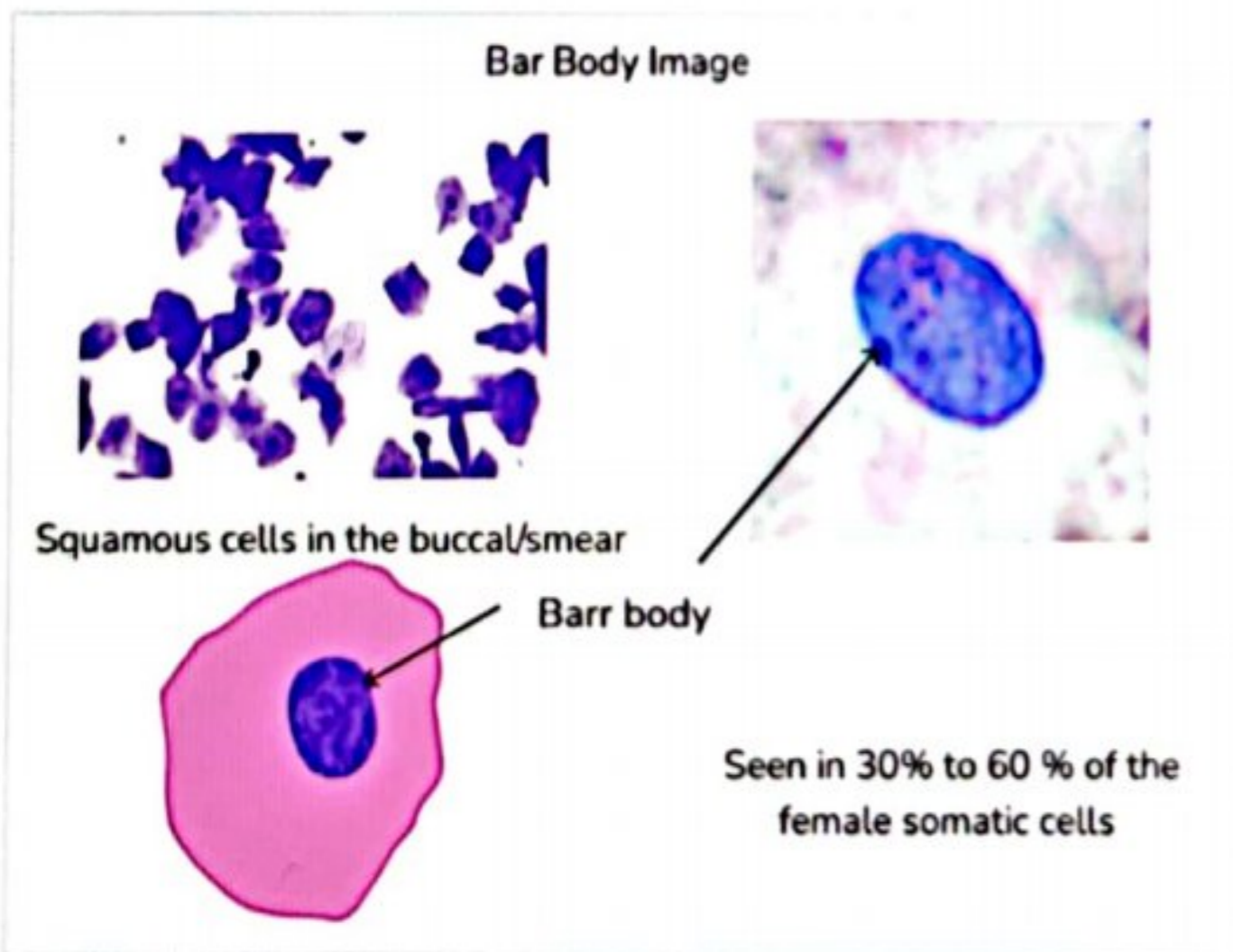| Feature	Negro	Mongol (Gol = Round)	Caucasian
Cross section	Elliptical	Cylindrical/Round	Round to oval
Medulla	Fragmented	Non-fragmented	Fragmented
Cuticle	Absent	Thick	Medium

Sexual Differentiation

00:14:52

Methods

- External morphology
- Sex chromatin
- Sexing of skeletal remains in death.
- Gonadal biopsy (confirmatory method).

Sex Chromatin

- **2 bodies**
  - o **Barr body**
    - → It is a plano-convex nuclear mass near nucleus .
    - → Present in somatic cells (buccal mucosa, saliva, hair follicle).
    - → It is an inactivated X chromosome.
    - → Female 20-80%.
    - → Male 0-4%
  - o **Davidson body**
    - → Blood sample is taken.
    - → Present in 6% of Female Neutrophils.
    - → Drumstick appearance.
    - → Absent in males.
    - → Better indicator compared to Bar body.

Bar Body Image

Squamous cells in the buccal/smear

Barr body

Seen in 30% to 60 % of the female somatic cells

Refer Image 18.1

- **2 reactions**
  - o **Feulgen reaction**
    - → Used for the X chromosome.
    - → **Stain:** Acriflavin
    - → **End point:** yellow color
  - o **Quinacrine Staining**
    - → Used for the Y chromosome.
    - → **Mnemonic:** Qui means Why (Y)

Sexing of Skeletal Remains

- Given by Krogman
- Known as Krogman Table

Part	Accuracy
Entire skeleton	100%
Pelvis and skull	98%
Pelvis alone: Single best bone	95%
Skull alone	90-92% (Go for 90%)
Long bones alone	80%

Differentiating Male and Female Skeleton

Characteristic	Male	Female
Bones	Large Heavy	Small Light
Prominence (Muscles) Ridges	More prominent	Less **Exception** Frontal eminence Parietal eminence
Glabella	More prominent	Less prominent
Supraorbital ridge	More prominent	Less prominent
Zygomatic Arch	More prominent	Less prominent
Orbits	Square	Round
Forehead	Steeper	Vertical
Palate	Large U Shape	Parabola Small
Angle	Less	More
Sub Pubic angle	70-75	>90
Mandible	<125 Less obtuse	>125 More obtuse
Shape	Square	Round
Obturator foramen	Oval	Triangular
Chin	Square	Round
Chilotic Line (M S)	Sacral Length	Pelvic ↑
Index (Value)	↓144	↑ 166
Sciatic notch (Best index) $\dfrac{width}{depth} \times 100$	↓	↑
Sacral Sacrum bone	↓	↑
Sternal		

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Washburn or Ischio-Pubic Index $\frac{\text{Length of pubic}}{\text{Length of ischio in 200}}$	↓ <95	↑ >95
Corpobasal $\frac{\text{Breadth of 1st sacral vertebra}}{\text{Breadth of base of sacrum}} \times 100$	↑	↓
Chilotic Line Index	↑	↓
Pelvis(inlet)	Heart shape	Oval
Shape	Deep funnel	Flat Bowl
Greater Sciatic notch (Best parameter)	↓ Small Narrow and deep	↑ Wide large and shallow
Ischial Tuberosity	Inverted	Everted
Preauricular sulcus aka Tertiary sexual character	Less frequent or very rare	More frequent
Sacrum	Long and narrow 3	Short and broad 2-2.5

Ashley's S Rule

A: Ashley
Hyrtl's Rule

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- Ashley Sternum Rule
  o Used in sternum bone.
  o Sternum length in males>149mm.
  o Sternum length in females <149mm.
- Hyrtl S Rule
  o Body is longer and more than twice the length of Manubrium in males.
  o Shorter and less than twice the length of manubrium in females.

Age of Fetus   00:35:37
- **Rule of Hasse:** First 5-month age of the fetus

$$\text{Month} = \sqrt{Length \ (cm)}$$

  o Length: CHL Crown heel length
- **Modified Morrisons rule:** Next 5 months.

$$\text{Month} = \frac{Length}{5cm}$$

- CRL = Crown-rump length = $\frac{2}{3}$ CHL

Example

Age of Fetus	Length
1	1
2	4
3	9
4	16
5	25
Next 5 months	
6	30
7	35
8	40
9	45
10	50

Things To remember.
- **1st month:** Limb buds appear.
- **2nd month:** Webbing of hand and feet.
- **3rd month:** Nail appears, pupillary membrane,
- **4th month:** Lanugo hair, Sexual differentiation.
- **5th month:** Scalp hair appears.
- **6th month:** Eyebrows, eyelashes vernix.
- **7th month:** Eye open, pupillary membrane disappears.
- **8th month:** Nail grows at the tip, left testis goes into the scrotum.
- **9th month:** Right testis goes in scrotum

Ossification Centres   00:42:29
- Appearance of the center
  o **Appears in 5-6 weeks.**
  o **Appears 1st:** Clavicle.
  o **In 5 months:** Calcanium
  o **Seventh month:**
    → Second and third piece of sternum
    → Talus
  o **36 weeks (9th month):**
    → 3rd alphabet Capitate and cuboid
    → 6th alphabet Femur
  o Full term: Upper end of tibia

Elbow joint: Appearance of Centre
- **Capitulum:** 1yr
- **Radial head:** 3-4 yr
- **Inner epicondyle(medial):** 6yr
- **Trochlea:** 8yr
- **Olecranon:** 10yr
- **External epicondyle:** 11-12 yr

Carpal Bone Fusion
- Lateral to medial.
- **Proximal**
  - o 12-year rule = 5+4+3
  - o She Looks Too Pretty
    - → Scaphoid = 5yr
    - → Lunate = 4yr
    - → Triquetral = 3yr
    - → Pisiform(last) = 12 yr
- **Distal**
  - o Try To Catch Her
    - → Trapezium - 6 yrs
    - → Trapezoid - 6 yrs
    - → Capitate: 1st carpal bone to be fused - 1 yr
    - → Hamate: 2nd Carpal bone to be a fuse - 2 yrs

Fusion
- **TRY**
  - o TriRadiate Cartilage of Acetabulum (13-15 yr)
- **IIT**
  - o **Iliac crest**: 20yr
  - o **Inner end of clavicle**: 21yr (Medial end of Clavicle 22-25yr)
  - o **Tuberosity Ischial**: 22yr

Upper Limb Fusion Vs Lower Limb Fusion

Upper Limb	Age	Lower Limb	Age
Shoulder	18	Hip	17-18
Elbow	16	Knee	18
Wrist	18	Ankle	16-17

> **Important Information**
>
> Female Ossification center fuses: Comparatively 1-2 years earlier.

Skull fontanelles
- Anterior Fontanelle - Bregma (18-24 months)
- Posterior Fontanelle - Lambda (3 month)
- Lateral Fontanelle
  - o **Anterior**: 2 (Sphenoid)
  - o **Posterior**: 2 (Mastoid)
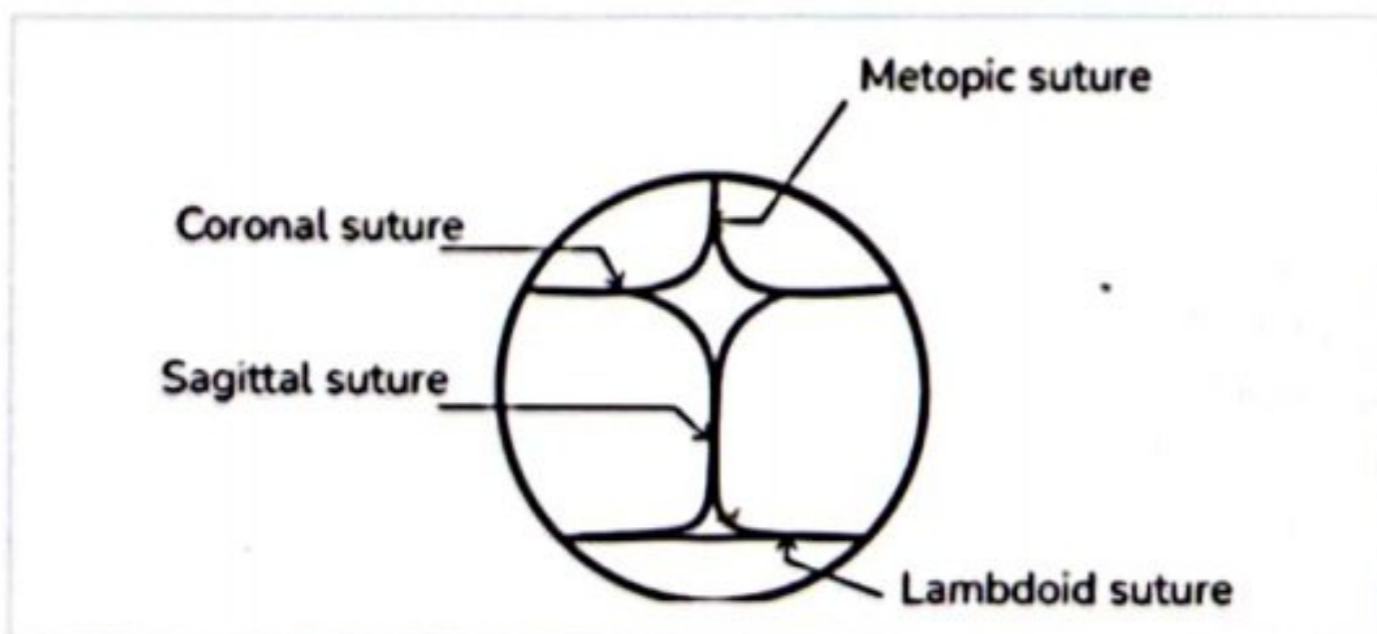
Skull Sutures
- **1st Suture**: Metopic at 9 months
- **Last Suture**: Squamous temporal >= 80 yr
- **Saggital (best)**:
  - o Posterior ⅓ 20-40 yrs
  - o Anterior ⅓ 40-50 yrs
  - o Middle ⅓ >50 yrs
- **Coronal**:
  - o Upper half
    - → 50-60yrs
  - o Lower half
    - → 40-50 yrs
- **Lambdoid**:
  - o Upper half
    - → 50-60 yrs
  - o Lower half
    - → 60-70 yrs
- **Basiocciput with Basisphenoid**:
  - o 18-21 years
- **Lateral skiagram**

Sternum
- Appearance
  - o Manubrium and 1st piece take 5 month of IUL (Fuses at 40-60 yrs)
  - o 2nd and 3rd piece takes place in 7 months.
  - o 4th piece 1yr.
  - o Xiphoid in 3-4yrs (4th and xiphoid at 40yrs).

Sternum
- **Sacrum**: becomes a single bone
  - o In 20 to 25 yr
- Two halves of the mandible
  - o In 2 yrs
- Greater cornu of hyoid with the body.
  - o 40-60yr

Dentition
- Can decide the age of the children.
- **Temporary teeth**: 20
- **Permanent teeth**: 32
- Formula:

Temporary

Molar	Premolar	Canine	Incisor	Incisor	Canine	Premolar	Molar
2	0	1	2	2	1	0	2
2	0	1	2	2	1	0	2

Permanent Teeth

Molar	Premolar	Canine	Incisor	Incisor	Canine	Premolar	Molar
3	2	1	2	2	1	2	3
3	2	1	2	2	1	2	3

The sequence of Eruption of Temporary Teeth

Teeth	Molar	Premolar	Canine	Incisor
Age	12m	24m	18m	6m

To Remember

- Lower central incisor(6m) > upper central incisor(7m) > ULI (8m) > LLI (9m)
- All temporary teeth come in 24 months (2- 2.5 yr)
- Mummy: 6 yr (molar 1) =4
- Is: 7 yr (Incisor 1) =4
- In: 8 yr (Incisor 2) =4
- Pain: 9 yr (PM 1) =4
- Pappa: 10 yr (PM2) =4
- Can: 11 yr (Canine)=4
- Make: 11-12yr (molar 2) =4
- Medicine: 17-25 yr (molar 3) =4
- Total= 32
- 1st permanent eruption in 6th year

Permanent and Mixed teeth

- **At 6yrs:** 4 permanent and 20 temporaries.
- **At 6-11yr:** 4 temporary will decrease and 4 permanent will increase.
- **Mixed dentition:** Teeth after 6yrs.

- **Example**
  - At 6 yr 20 temp and 4 permanents.
  - At 7 yr 16 temp 8 permanents.
  - At 8 yr 12 temp 12 permanents.
  - At 9 yr 8 temp 16 permanents
  - At 10 yr 4 temp and 20 permanents.
  - At 11yr 0 temp 24permanents.
- 12-14 yr 28 permanents.
- 17-25 yr 32 permanents.
- Last molar is a wisdom tooth.
- **Successional**
- Permanent in place of temporary
- 20 teeth

SUCCEESSIONAL Teeth	SUPERADDED TEETH
Permanent in place of temporary	No replacement, added on extra
3 2 1 2 | 2 1 2 3 P 2 0 1 2 | 2 1 0 2 = T 2 0 1 2 | 2 1 0 2 3 2 1 2 | 2 1 2 3	12 Molar
NUMBER: 20	12

- **Superadded Teeth**
  - No replacement
  - Added on extra.
  - 12 molars

Other Methods for Teeth for Age Estimation   01:20:00

- **Stack formula**
  - Age group: Infant
  - Weight and height of tooth used.
- **Boyde's method**
  - Age in terms of days.
  - Best for the neonates.
  - Striation developed in the enamel of teeth aka incremental lines.
  - incremental lines are seen on electron microscope.
  - Calculate the number of days after birth.
  - 1st line is a neonatal line.
  - After birth line can be seen in an electron microscope in 1-2 days or 3 weeks by the naked eye.
  - It is 1st and darkest line.

Gustafson Method

- Obsolete method not used now.
- >25yrs age
- Most common: Anterior teeth is Incisor.
- Molar is unsuitable.

Important Criteria of the Gustafson Method

- 6 x-ray criteria (S C R I P T)
  - Secondary dentine (2nd best)
  - Cementum Apposition
  - Root Resorption
  - Attrition
  - Paradentosis
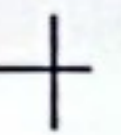 - Transparency of root of tooth (Best)

Dalitz method

- Modification of Gustafson's method.
- Criteria
  - Paradentosis
  - Attrition
  - Secondary dentine.
  - Transparency of root of tooth.
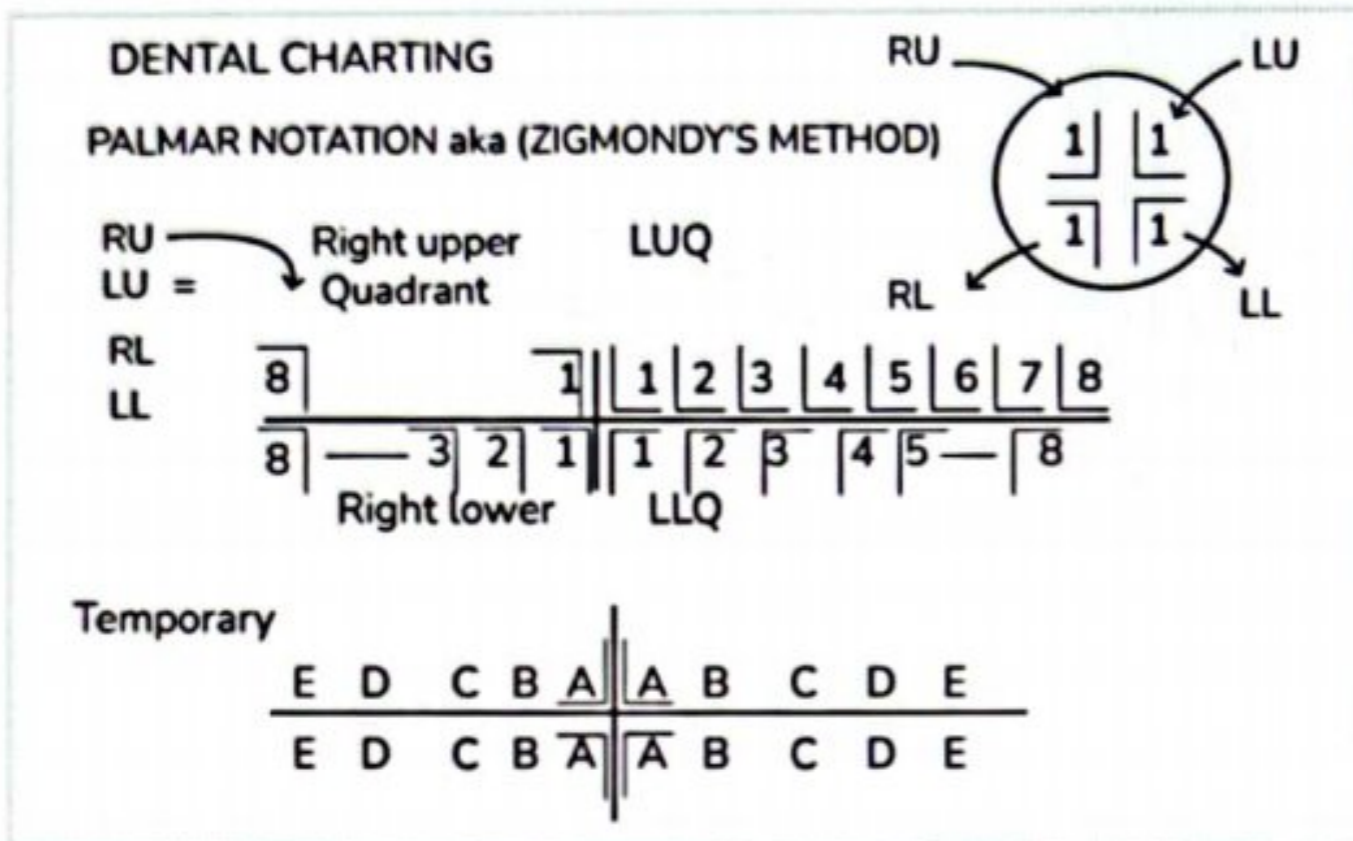
Lamendin Method

- **Better** Method
- Used in postmortem.
  - Paradentosis
  - Transparency of the root of the tooth

Dental Charting

1. Palmer notation (Zigmondy's method)

DENTAL CHARTING

PALMAR NOTATION aka (ZIGMONDY'S METHOD)

RU → Right upper LUQ
LU = ↓ Quadrant

RU ⟍ ⟋ LU

| 1 | 1 |
| 1 | 1 |

RL ⟋ ⟍ LL

RL
LL

| 8 | | | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8 | — | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | — | 8 |

Right lower   LLQ

Temporary

| E | D | C | B | A | A | B | C | D | E |
| E | D | C | B | A | A | B | C | D | E |

2. Haderup's System

- + for Upper.
- - for lower.

| +8 | +7 | +6 | +5 | +4 | +3 | +2 | +1 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 |
| -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 | -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 |

Universal Method (Cunningham's)

- Permanent 1-32

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |

- Temporary: A-J K-T

| A | B | C | D | E | F | G | H | I | J |
| T | S | R | Q | P | O | N | M | L | K |

Federation dental International (FDI)

- Most commonly used worldwide.
- Most accepted method.
- For permanent prefix 1 2 3 4 added.

1 Right upper	2 Left upper												
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

4 left lower	3 Left lower

- For temporary 5 6 7 8 prefixes added

5 Right upper	6 Left upper								
55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75

8 left lower	7 Left lower

Modified FDI

1	2												
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
38	37	36	35	34	33	32	31	41	42	43	44	45	46	47	48
3													

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Picture of tooth given

- Anatomical chart formula

Images 18.1

Other tissue from which Barr bodies can be studied
Corneal epithelium, vaginal mucosa, fibroblasts etc.
Also seen in polymorphonuclear leukocytes in peripheral blood smears
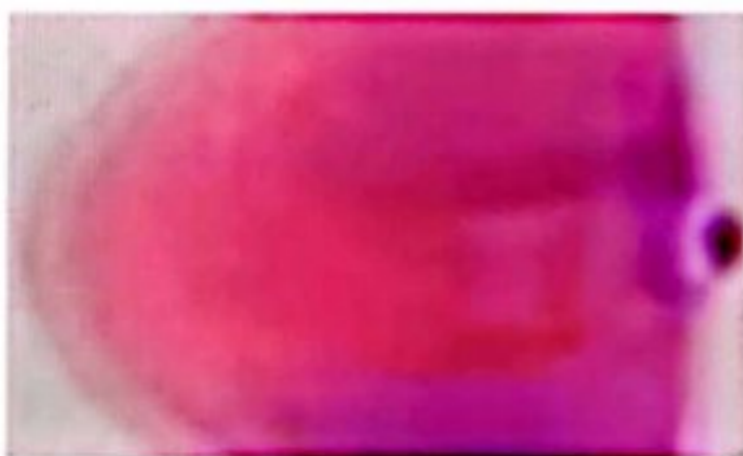
Variable forms

Drumstick- Most Common Small deeply
stained nuclear mass of about 1.5 μ
in diameter, attached to the body of the
nucleus by means of a thin stalk.
1% to 17% with an average of 2.9%

Others   Racquet forms, sessile
nodules, small
clubs and minor lobes

prof William
Mackay
Davidson
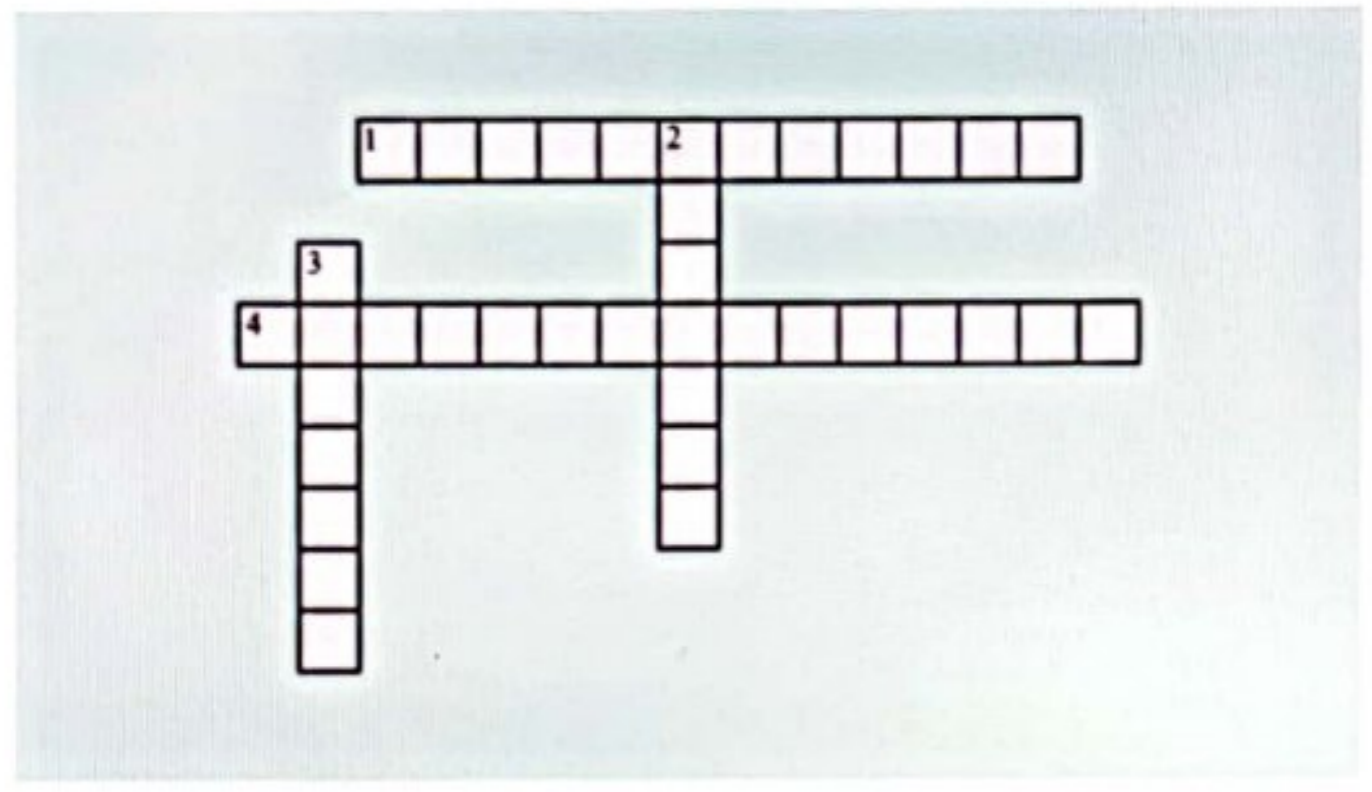(1909-1991)
Scottish
pathologist
hematologist

Davidson
body

CROSS WORD PUZZLES

Crossword Puzzle

Across
1. Metopic at 9 month
4. Used for X chromosome

Down
2. Manubrium
3. Africans

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19 | IDENTIFICATION PART-2

Stature-Best Bone
- Best bone to decide stature is the femur bone.
- Stature is the height.
- By bones we can decide the stature.

Regression and Formula
- Karl and Pearson formula
- Trotter Glessor formula

- **How to get the multiplication factor?**
- **Fe THUR**
  - Femur = 3.7
    - → Add 0.8 for 3.7 in rest (Except radius)
  - Tibia / Fibula = 4.5
  - Humerus = 5.3
  - Ulna = 6.1
  - Radius = 6.5
- If the length of the femur given as 30cm
  - You can decide the stature.
  - 30 x 3.7 = 111 cm
  - Percentage is around 27% of the length of the body.
- If a vertebral column is given, it is 35% of the stature of the whole body.

Length of Bone
- Measure by Hepburn osteometric bone

Stature from bony fragments
- Steele's formula
- Bidmos formula

Medicolegal Importance of Different Ages   00:05:12
- **1Yr** Below of 1 year is infant.
  - Killing an infant is infanticide.
  - Same IPC as age
- **7yr:** Below 7 yr no one is a criminal.
  - 82 IPC
- **7-12 yr:** Can be responsible for the crime if attained maturity.
  - It should be decided by a psychiatrist.
  - 83 IPC

- **12 yr:**
  - Below 12 yrs no oath required.
  - Consent is not valid: 90 IPC.
  - Consent from guardian or parents: 89 IPC
  - >12yr can give consent for physical examination.
- **14yr:**
  - <14 Cannot work in the factory according to factory act.
  - 14-18 years can work in non-hazardous factories for fixed hours
    - → Maximum 6 hours
    - → Require fitness certificate.
- **16yr:**
  - <16yr kidnapping age of boy.
  - <18yr kidnapping age of girl.
  - 361 IPC
  - Below 18 child is known as juvenile.
  - At 18 you become major
  - License in 18
  - Marriage age for girl is 18.
- **20yr:**
  - Major In courtship above 21yr
  - Marriage age for a boys is 21yr.

To Remember
- **Procuring a girl for sexual intercourse in India:** age is below 18.
  - Punishable under 366 A IPC
- **Procuring a girl's sexual intercourse from any country:** Ags below 21.
  - 366 B IPC

Identification Method   00:11:28
- **Most reliable method:** Fingerprinting aka Dactylography, galton system
  - Best method
- Not inherited and not same in identical twins or other people (Quetlet rule).
  - Fingerprints are the papillary ridges of skin.
- **World 1st finger-print bureau:** in Kolkata 1897
- First used by William Herschel in 1858
- **Classification:** Galton system
- **In fetus life:** In 12-16 weeks starts and completes in 24 weeks.
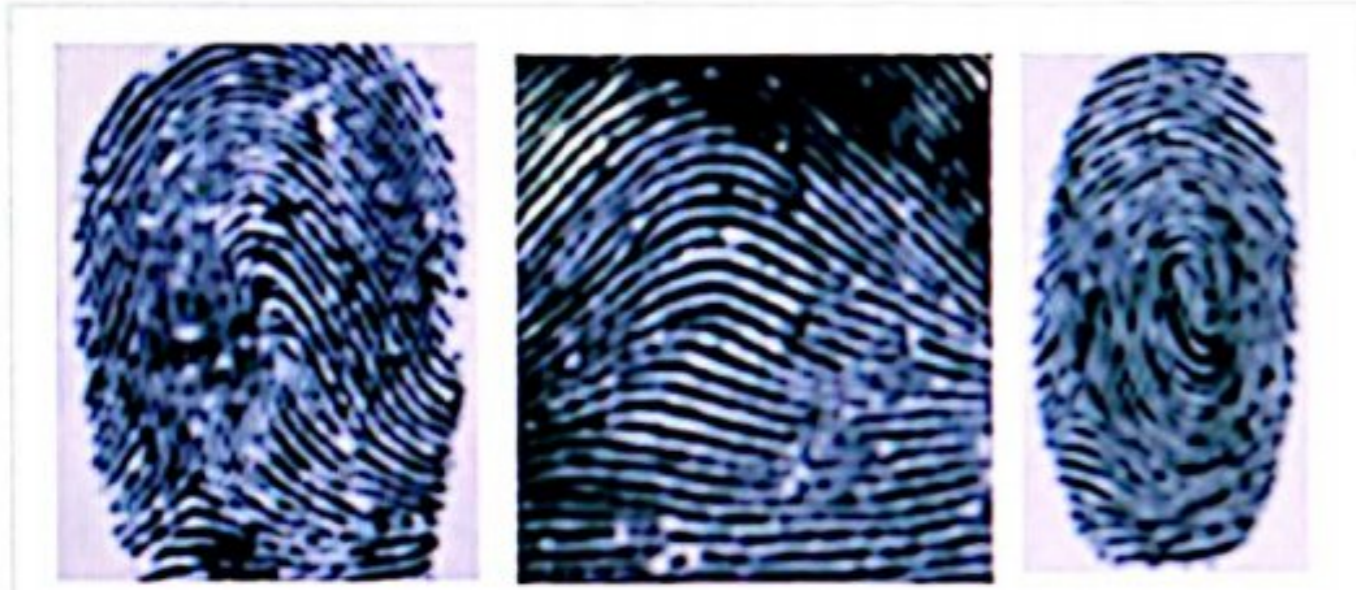
1. **Fingerprint**
- **Types**
  - **Visible:** Visible on the stain, like blood
  - **Latent (Chance):** invisible or barely visible.
  - **Plastic:** Which is on the soap surface, cheese surface.

- **Pattern**
  - (Love wife and children)
    - → **Loop (common):** 70% of the population
      - Like hairpin
      - Ridges come towards each other.
    - → **Whorl:**
      - Just like a circle
    - → **Arch:**
      - Diverges.
      - Just like mountain
    - → **Composite:**
      - Least common
      - 1-3% of the population
      - Mixed pattern

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- Ridges coming towards each other is core.
- Ridges coming from 3 directions its delta.
- **Loop:** 1 core and 1 delta
- **Arch:** No core or delta
- **Whorl:** 2 delta and no core

Matching of Fingerprint

1. **Pattern:** Level 1
- Loop, whorl , arch or composite
2. **Ridges character:** Level 2
- Termination: Ridge terminated
- Bifurcation: divided into 2 parts
- Independent
- Point: Island
- Lake: Like a lake
- Spur
- crossover
- **Patterns:** Are known as minutiae
- **Study of minutiae:** Ridgeoscopy

3. **Part of the ridge:** That contains pores: level 3
- Pore is opening of sweat gland.
- Size
- Number
- Shape
- Edges
- Location
- Study of pore along the ride is Edgeoscopy
- Study of the individual pore is poroscopy

Minimum Comparison Points
- 10-12
- Variable from state to state.
- Histological section is up to 0.6mm in depth.

Altered Fingerprint
- Permanently lost:
  - Leprosy
  - Electric burn
  - Radiation
- Complete loss of pattern with ridges atrophy.
  - Celiac Disease
- Incomplete ridge Atrophy
  - Dermatitis
- Ridge alteration
  - S E A
    - → Scleroderma
    - → Eczema
    - → Acanthosis nigricans
    - → Skin atrophy
- Pattern retained but the change in the distance between ridges:

(A I R All India Radio)
  - Acromegaly
  - Infantile paralysis
  - Rickets

No Fingerprint
- No fingerprint Syndrome
  - Adermatoglyphia
  - Baird syndrome
  - Zinsser-cole syndrome

Latent Fingerprint-Visible
- **Fabric:** 5%
  - Use AgNO3
- **Paper:** Vapor of iodine or Osmium Tetroxide
- **Glass by:** Scanning electron microscope
- Live scan of fingerprint captured by: O-FTIR
  - Optical Frustrated Total Internal Reflection
- Computerized automated system used for biometric fingerprint.
- Left thumb is commonly used for civil purposes.

2. **Poroscopy Pores**
- Unique method of Identification.
- Discovered by Edmod Locard
- Locard Exchange principle
- Each mm of fingerprint has 9-18 pores.

3. **Palatoscopy**
- Study of the hard palate
- Aka Rugoscopy: Rugae
- Discovered by Allen
- Hard Palate: Anterior ⅓ rd of the hard palate contain rugae.
- Rugae are individually unique for each person.

- Primary Rugae: p for palm: 5-10mm
- Secondary Rugae: 3-5mm
- Tertiary: Rugae: 0-3 mm

4. Cheiloscopy
- C - Car
- Study of lip prints
- Classified by: Suzuki.
- In the car we like A/C
  - Aqua print
  - Cyanoacrylate
- 5 types
  - Complete and partial straight groove
  - Forked grove.
    → Branched grove.
  - Intersecting grove
  - Reticular
    → Reticular pattern
  - Undetermined (Any pattern)
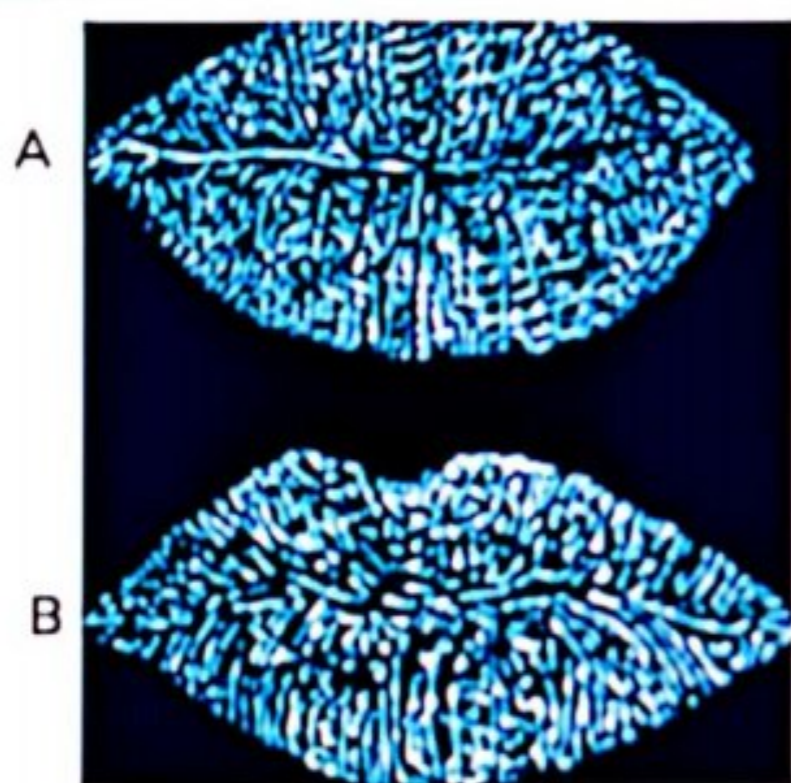
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5. Tattoo Mark
- Injecting dye into skin
- Dyes we use.
  - VIP Car
    → Vermillion Dye
    → Indigo dye/India ink dye
    → Prusian blue
    → Cinnabar dye, Cadmium dye, cobalt
- Inject in the depth of dermis.
- Goes in the regional lymph nodes.
  - Can detect this by regional lymph node biopsy.
- For Old tattoos marks we use IR rays.
- For faded we use UV rays

Tattoo Mark Removal
- Methods: A B C D E
  1. Surgical Ablation
  2. laser Beam or burn.
  3. Chemical or caustic
  4. Dry ice
  5. Electrolysis, excision, and grafting, enzymes like papain.

- Case: Sydney shark Arm case
- Used in:
  - Personal identification
  - Regional identification
  - Place identification
  - Political mark
  - Drug IV
  - Homosexual (bluebird tattoo mark)

6. Podogram
- Study of footprint
- It is used in a maternity hospital.

7. Superimposition technique
- S: Screening test, skull, and superimposition
1. Photograph of skull bone
2. Photo of face
   - Superimpose with face photo.
3. Anatomical landmark
   - Matching or not matching
   - Not matching is important.
   - It means the test is negative.
   - It has importance.
   - Test of a negative value is more important.

Anthropometry   00:42:05
- Discovered by Bertillon
- Bertillon system or Portrae Parle
- 4 Criteria for identification
  - Body mark
    → Tattoo or scar etc.
  - Body measurement
    → AKA anthropological analysis
    → Height
  - Descriptive data
    → Skin color, eye color
  - Photographs
    → 4 photographs taken generally.
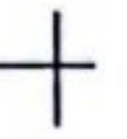
Scar

- Ages:

Duration	Features
5-6 days	• Reddish blue • Angry • Firm • Union
2 weeks-2 months	• Pale • Vascular • Soft • Tenderness present
2-6 months	• Brown • Tough • Glistening • Tenderness Mild
>6 months	• White • Tough • Non-tender

Frontal Sinus Pattern

- Important method of identification
- > 15 yr
- If X-ray available

Concealed Sex

- Hiding sex for the criminal intention.
- Case: Colonel Victor Barker

To Remember

- **Pterion fuses: 65 years of Age**
- **Masto-Occipital fuses: 80 years of age**
Squamous Temporal: More than 80 of years

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