BLOCK II
Physical and Biological Variation among Indigenous Population

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UNIT 5 MAJOR MORPHOLOGICAL AND ANTHROPOMETRIC CHARACTERISTICS*

Contents

Learning Objectives

After reading this unit, you would be able to:

- Understand what are Morphological Characters;
- Explain what are Somatometric Characters; and
- Delineate the distribution of Somatometric characters among the Indigenous people of India.

5.0 INTRODUCTION

In Block 1, you are enlightened with who are Indigenous people. In this unit a brief introduction to the Anthropology is presented followed by a detailed description on morphological and anthropometric characteristics.

Anthropology is the scientific study of humans using a holistic approach. It deals with the cultural and biological variation and evolution of humans. Anthropology could be described as the science of human cultural and biological variation and evolution. Traditionally, anthropology could be broadly divided into four sub-fields: social-cultural anthropology, physical/biological anthropology, linguistic anthropology and archaeological anthropology or prehistoric archaeology.

Social-Cultural Anthropology: Social-Cultural anthropology deals primarily with variations in the cultures of populations in the present or recent past. Its

*Contributed by Dr. Palla Venkatramana, Discipline of Anthropology, SOSS, IGNOU

subjects include social, political, economic and ideological aspects of human cultures.

Physical/Biological Anthropology: Physical/Biological Anthropology is the study of the human evolution, human variation, mechanism of biological variation, genetic inheritance, human adaptability, human growth and development and primatology.

Linguistic Anthropology: Linguistic Anthropology is the study of languages. Spoken language is a behaviour that appears to be uniquely human. This subfield of anthropology deals with the analysis of languages usually in non-literate societies. Some of its concerns include how language is used to understand culture and how languages are distributed across the world, and their contemporary and historical relationships.

Archaeological Anthropology/Prehistoric Archaeology: This sub-field deals with the study of cultural behaviour in the historic and pre-historic past. The archeologist deals with such remains from the past human societies as tools, shelters, remains of animals eaten as food, and other objects that have survived. These remains are termed as artifacts and are used to reconstruct past behaviour.

In this unit we discuss the variation among indigenous peoples of India with respect to morphological (somatoscopic) and anthropometric (somatometric) characters. Now let us talk about what are these morphological and somatometric characters.

5.1 MORPHOLOGICAL CHARACTERS

In anthropology the study of morphological characters is called 'Somatoscopy'. Somatoscopy is the systematic visual observation of physical features of different parts of human body for accurate description. These morphological characters are quantitative in nature hence descriptive in approach. Most somatoscopic characters show geographical variation. Hence these morphological characters were used by Anthropologists to classify human populations. Characters such as skin colour, hair colour, hair form, hair texture, hair whorl, nose form, face form, which are considered in this unit are described as under:

5.1.1 Skin Colour

The colour of the skin is determined by the presence of melanin pigment, which is brown in colour. Broadly three shades of skin colour are found in human beings. They are: white skin, yellow skin and black skin. Most white skinned people are found in Europe. Mongoloids have yellow skin and people from African countries have generally black skin.

5.1.2 Hair

This somatoscopic character includes hair colour, hair from, hair texture and hair whorl.

Hair colour: Different hair colours are seen across the globe. Fisher-Saller have prepared a colour chart with hair samples of thirty different shades. All the thirty shades fall in to three broad categories: Blond, Dark Brown and Red.

The range of the hair colour among the Indian population would be categorized as light brown, medium brown, dark brown and black.

Hair form: Form of hair may broadly be divided into three types viz., Straight hair (*Leiotrichy*), wavy hair (*Cymotrichy*) and Woolly hair (*Ulotrichy*). Leiotrichous hair (straight hairs) include subtypes such as, *stretched* (usually straight), *smooth* (thinner and flatter), and *flat wavy* (hair has the tendency to become wavy). Similarly, wavy hair also include three subtypes such as, *broad wave, narrow wave and curly*. Of these three, both broad and narrow wavy types lie in the same plane, but the curly type dose not because of large spirals. Woolly hair (*Ulotrichy*) may be of different types such as, *Frizzly*-waves with very strong curvature; *Loose frizzles* – circular and flat spirals (about 1.5 cm dia.); *Thick Frizzles*- flat spiral hair (less than mm dia.); and *Filfil* – small knots of thick rolled hair (Peppercorn). Various hair forms are depicted in Figure 5.1.

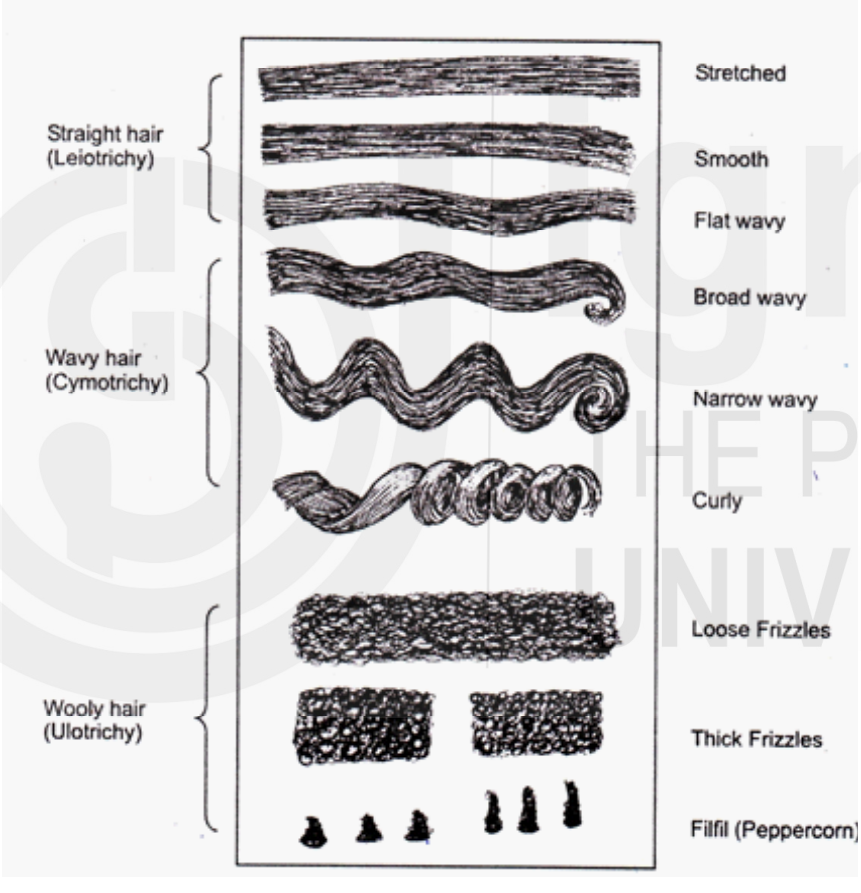

Fig. 5.1: Different Types of Hair Form

Hair texture: Hair texture may be fine, medium and coarse.

Hair whorl: Hair whorls are usually found on the occipital region (back of head). Whorls are very rarely found in front portion of the head. Whorls are of two types, clockwise and anti clockwise.

5.1.3 Eyes

Somatoscopic observation on eyes include colour of the iris, eye fold and direction of the eye. Colour of the iris may be black brown, dark brown, brown, light brown, greenish, grey, light grey, dark blue and light blue.

Eye fold: In this somatoscopic character presence or absence of eye fold is considered. A common variety of eye fold is 'epicanthic fold' or Mongolian fold. In Mongolian fold, the fold covers the free edge of the inner angle of the eye and may extend on to the cheek (Figure 5.2).

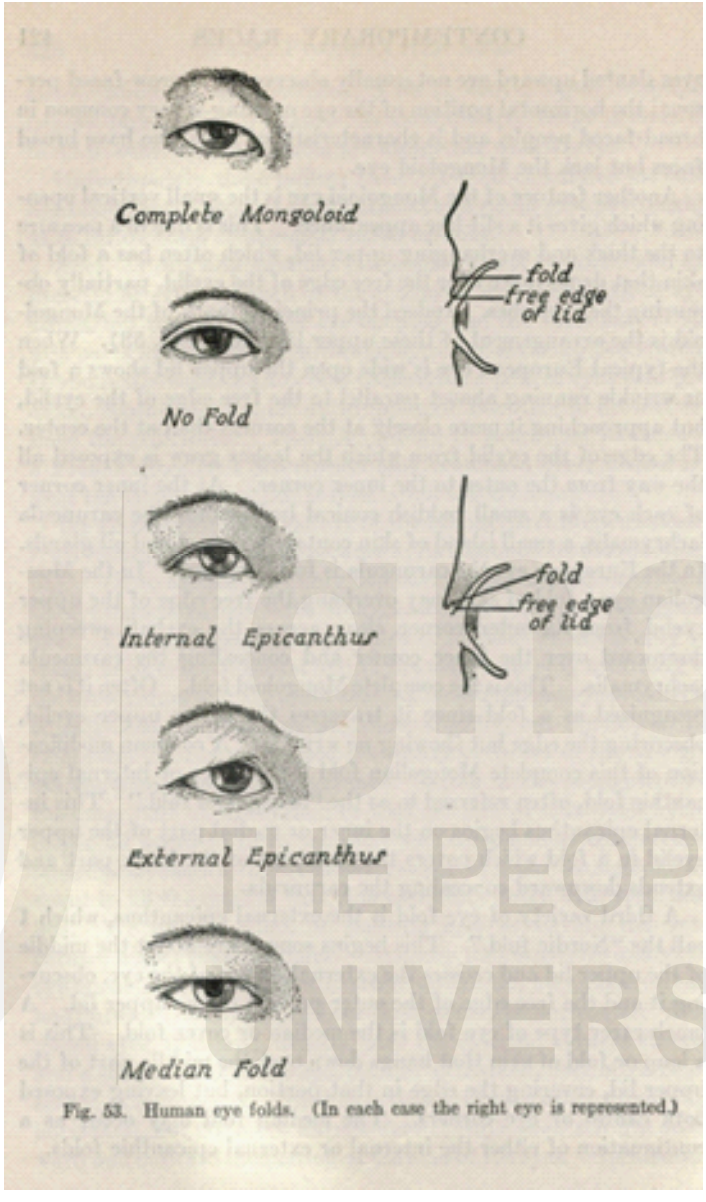

Fig. 5.2: Eye fold pattern

Source: s1.zetaboards.com

5.1.4 Nose

Different features of nose such as depression of root, nasal profile, nasal septum, nasal bridge, nasal tip, nasal wings are worth studying. The tip of the nose can be upwards or downwards and the profile could be rounded at point or fully rounded or flat. The root of the nose may be recorded as narrow, medium or broad; from the side view many appear depressed which again may be shallow, medium or deep or absent. The nasal bridge may be recorded as straight, concave (slight, medium, markedly), convex- (slight, medium, markedly) or wavy (slight, medium, markedly). The size of the nasal bridge may be narrow, medium or broad. Various types of noses in profile are shown in Figure 5.3.

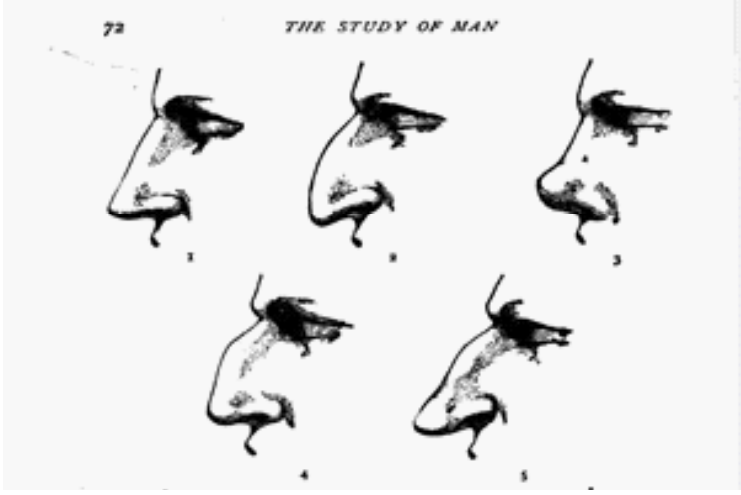

Fig. 5.3: Nose form

Source: s1.zetaboards.com

5.1.5 Lips

The thickness of the membranous lip is studied with the best observation in profile view. It may be thin, medium, thick and puffy with convex profile, above which the integument lips are deeply concave. The degree of eversion of membranous lip may be absent, moderate, or marked (as in people of African Ancestry).

5.1.6 Face

The face can be described in terms of height (long, medium or short), diameter of the face (narrow, medium, broad and very broad), its shape, malar prominence and prognathism. The shape may be oval, elliptical, round, square, quandrangular or flat. Prominence of the cheek bone (malar) is an important feature; it is described as absent, slight, moderate or marked. Alveolar protrusion of face is called prognathism. Profile view is best to ascertain it to be slight, moderate or marked.

Check Your Progress

1) What are the various Morphological Characters?

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5.2 ANTHROPOMETRIC CHARACTERS

Anthropometry is a major technique of physical anthropology. Anthropometry is a method to take measurements of human body. It is the means of quantifying variation in body size and shape. It may be defined as the systematic recording of measurements on human being both living and dead. Anthropometry can be divided into Somatometry and Osteometry.

Somatometry is the recording of measurements on living body or cadaver, including head and face. Osteometry is the measurements on skeleton, including Craniometry, which deals with measurements on skull. The somatometric measurements includes; height, sitting height, body weight, head circumference, chest circumference, abdominal circumference, head length, head breadth, skinfold thickness measurements such as triceps, biceps, subscapular, etc.

Osteometric measurements includes maximum length of radius, maximum length of ulna etc. Craniometric measurements includes, maximum cranial length, maximum cranial breadth, nasal height, nasal breadth etc.

But for the present unit, we shall study only somatometry. These somatometric measurements besides their use in understanding population variation, they are also useful in assessing the nutritional status of communities and in designing equipment for use in industry, defense purposes, spaceships, garments etc., The measurements like height vertex, and two indices cephalic index (CI) and nasal index which are used in understanding the population variation are discussed as under:

Stature (height) can broadly be classified in to three categories; tall, medium and short.

The height of the tall people ranges from 168-172cm; medium statured people ranges from 158-168cm and short statured people ranges from 148-158cm.

By measuring maximum head length and maximum head breadth, we can calculate Cephalic Index (CI) as:

$$\frac{\text{Maximum head breadth}}{\text{Maximum head length}} \times 100$$

Based on cephalic index people can be classified into:

Hyperdolicocephalic	(very long and narrow)	up to 69.9
Dolicocephalic	(long and narrow)	70.0-75.9
Mesocephalic	(medium)	76.0-80.9
Brachycephalic	(short and broad)	81.0-85.5
Hyperbrachycephalic	(very short and broad)	85.6 and over

Another important index that is being used in population variation is nasal index. It can be obtained by measuring nasal length and nasal breadth and can be calculated as below:

$$\text{Nasal Index} : \frac{\text{Nasal Breadth}}{\text{Nasal Length}} \times 100$$

By using this index, population can be categorised into the following five types:

Hyperleptorrhine	(very narrow nose)	up to 54.3
Leptorrhine	(Narrow nose)	55.0 --- 69.9
Mesorrhine	(Medium nose)	70.0 ---84.9
Platyrrhine	(broad nose)	85.0---99.9
Hyperplatyrrhine	(Very broad nose)	100.0 and over

Check Your Progress

2) What is anthropometry? What are the anthropometric characters used to classify human populations?

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5.3 DISTRIBUTION OF SOMATOMETRIC CHARACETRS

Distribution of the above somatometric characters (stature, cephalic index and nasal index) among different Indigenous peoples of India is presented in table 5.1.

Table 5.1: Distribution of Stature, Cephalic Index and Nasal Index among Indigenous people of India

Name of the Tribe	Sample	Stature	Cephalic Index	Nasal Index	Author
Balti	63	1619.10	74.58	68.38	Bowles 1970
Gujjars	14	1699.50 ±22.50[2]	-	-	
Balti	147	1622	75.70-	70.00	Eickstedt 1926
Balti	5	1614	71.82	72.90	Eickstedt 1926
Gaddi	50	1632.60	76.59+	63.74	Bowles 1970
Lahaulis	131	1677.60±3.80			Chopra & Sidhu 1907
Bhotia	90	1604.70±4.20	73.90		Bowles 1943
Tharu	65	1614		79.80	Risley 1891
Tharu	191	1633.30±3.77	76.50		Mahalanobis et al 1941
Bhil	200	1629	74.70	84.10	Risley1903
Bhil	56	1588		73.40	Weinger 1952
Bharwad	117	65.04±2.77[2,3]	77.31		Ghurye 1937
Koli	121	1608.00±5.80	75.70	75.20	Majumdar& Son 1950
Bhil	15	-	-	78.70	Kurulkar 1941.1942
Naika	103	1591.20	-	-	Sngh &Bhale 1954
Rabari	100	1685.70±7.37		-	
Siddis	37	1659.20±1.82	77.43±0.28		Haque 1984
Dafla	61	1577.10	77.31	71.90	Bhatacharya 1969
Galong Abor	90	1592.40	73.23	70.86	Bowles 1970
Garo	100	1594.90±5.50	75.17±0.28		Bowles1970
Kachari	33	1608	78.58	89.97	Waddell 1900
Rabha	100	1624.50±5.00	76.31±0.31	75.85±0.73	Das 1954-50
Mech	10	1643	79.40	90.60	Waddell 1960
Kachari Tharua	100	1632.90±6.20	79.92±0.39	70.57±0.68	Phookan 1961

Miri	100	1611.10	79.90	76.29	Sharma 1961
Deuri	100	1637.30	79.20	75.74	Sharma 1961
Riang	41	1504.08±5.63	76.67±0.42	72.71±1.06	Mitra 1953-54,56
Kaipeng	31	1571.58	74.98±0.54	75.31±1.08	Mitra 1953-54,56
Garo	70	1601.10	75.81	75.80	Bowles 1970
Lepcha	80	1563.60	80.43	65.74	Bowles 1970
Sherpa	56	1608.30±5.14	77.12±4.67	70.19±7.90	Bhasin et al
Lepcha	70	1571.27±7.13	85.04±0.50	71.93±0.90	Kumar 1980
Sunri	1	1580	76.04	70.00	Majumdar&Rao1960
Santal	24	1585.42±12.83	75.56±0.74	79.18±1.43	Majumdar& Rao 1960
Oraon	100	1621	75.40	86.10	Risley 1886-88
Birhor	16		74.95	87.13	Risley 1886-88
Santal	100	1593.00±5.40	74.00±0.32	80.70±0.79	Biswas 1956
Sauria Paharia	69	61.51±0.23	-	--	Mitra 1938-39
Ho	122	1611.43	74.89	79.55	Majumdar 1925
Mal Paharia	54	1573.60±5.31	74.54±0.26	79.10±0.76	Sarkar 1935-36
Oraons	64	1622.80±6.30	-	--	Bhatacharjee& Bhatacharjee 1986
Bhuiya	81	1577.00±3.60	77.00±0.33	77.60±0.60	Basu, 1929
Gond	51	1607.18	75.30	81.27	Karve 1949-50,54
Munda	32	1623.69	73.45	88.98	Karve 1949-50,54
Jenu Kuruba	63	1581.17	75.57	92.62	Karve 1949-50,54
Bedar	40	1654	78.10	77.50	Thurston1898, 1909
Chenchu	40	1625	74.30	81.90	Thurston 1898.1909
Chenchu	23	1649.52±9.30	72.89±0.53	81.38±0.59	Guha 1931,1933
Kurumba	25	1542	-	-	Shortt & Ouchterlony 1868, Jagor&Koerbin 1879
Kanikar	4	1573.00	70.55	82.69	Thurston 1849,1909
Paniyan	26	1574	74.00	95.10	Thurston 1849,1909
Paniyan	26	-	75.70	-	Thurston 1849,1909
Kanikar	20	1423.00±5.83	72.60±0.40	81.90±1.06	Macfarlane 1939-40
Paniyan	100	1547	73.40	87.90	Das 1955
Kannikar	14	1546.80	-	-	Gates 1960
Kannikar	113	1531.73	74.26	80.11	Kumar 1971a

Based on the above table the following observations were made.

Stature : The stature among the tribal populations ranges from 150.00-162.00 cm.

Cephalic Index: The value of cephalic index varies from Dolicocephalic (70.0- 75.9) to Mesocephalic (76.0-80.9) among the tribal groups, except a few population groups in which brachycephaly has been observed. The mean value of cephalic index is (77.31) which is Mesocephalic.

Nasal Index : It is found to be Mesorrhine (70.0- 84.9) among the tribal populations followed by Platyrrhine (85.0- 99.9).

5.4 SUMMARY

India is a multi-ethnic and multi-cultural country inhabited by large number of ethnic groups, castes, religious and linguistic groups. Both Physical anthropologists and population geneticists are continuously showing their interest in understanding the biological variation among different populations inhabiting different geographical regions with varying social, behavioural, economic and ethnic backgrounds using different kinds of methods and data. Various morphological and somatometric characters have been used to describe and classify humans into different populations groups. The present unit throws light on the morphological and somatometric characters.

5.5 REFERENCES

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5.6 ANSWERS TO CHECK YOUR PROGRESS

1) Morphological characters such as skin colour, hair colour, hair form, hair texture, hair whorl, nose form, face form are used to classify human populations. For details, please refer section 5.1.

2) Anthropometry may be defined as the systematic recording of measurements on human being both living and dead. The measurements like height vertex, and two indices cephalic index (CI) and nasal index are used in understanding the population variation.

UNIT 6 SEROLOGICAL AND BIOCHEMICAL VARIATION*

Contents

Learning Objectives

After reading this Unit, you will be able to:

- Examine various Serological Markers;
- Delineate the distribution of Serological Markers;
- Examine various Biochemical Markers; and
- Discuss the distribution of various Biochemical markers.

6.0 INTRODUCTION

In the previous unit, you have learned about what is Anthropology and different branches of Anthropology. You are also familiar with somatoscopic and somatometric characters and their distribution among Indigenous people. Besides these characters, an understanding of different markers of blood among various populations of the world plays an important role in Physical anthropology. Hence in this unit, you will be enlightened on Serological and Biochemical Markers of blood and their distribution among Indigenous people of India.

6.1 SEROLOGICAL MARKERS

The Blood group systems are a classical example for serological markers, which form a component of serology. The blood group systems have been studied by Anthropologists to understand population variation and in racial classification. A number of blood group systems were discovered. The following table depicts the list of Blood group systems.

*Contributed by Dr. Palla Venkatramana, Discipline of Anthropology, SOSS, IGNOU

Table 6.1: Major Blood Group systems

System	Year of Discovery	Discoverer
ABO	1900	Landsteiner
Rh (D)	1940	Landsteiner & Weiner
MNS	1927	Landsteiner & Levine

Besides the above three blood group systems, there are other blood group systems like P, ABH, Lutheran, Deigo, Duffy, Kidd and Kell. But ABO and Rh (D) systems were extensively investigated by Anthropologists and population biologists to understand the population variation within and between populations. The ABO and Rh (D) blood group systems are routinely being used in transfusion medicine. Before going further let us understand about ABO and Rh (D) blood group systems.

Check Your Progress

1) What are different serological markers?

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The ABO blood group system was discovered by Landsteiner in 1900. Antigens and antibodies are present in the blood (the former present on the red cells and the latter in blood plasma). Human beings are classified into four groups namely A, B, AB and O depending on the presence or absence of antigens and antibodies. The antigens are designated as A and B and the antibodies as anti-A and anti-B.

Group A person carries antigen A and antibody anti-B. Group B person carries antigen B and antibody anti-A. Group O individuals possess both the antibodies and lack any antigen while group AB individuals carry both the antigens but lack any antibody. Three genes namely A, B, and O controls the system.

The RH (rhesus) blood group system was discovered in 1940 by Landsteiner and Wiener. The two phenotypes of the system are RH D + and RH D – based on, respectively, the presence or absence of the RH D antigen. In Rh system a pair of alleles, one dominant Rh-D and one Rh-d determines the antigens of the blood group.

6.2 DISTRIBUTION OF SEROLOGICAL MARKERS

The distribution of ABO and Rh (D) blood group systems among the Indigenous peoples in different parts of India is presented in the following section.

6.2.1 Distribution of ABO System

The distribution of ABO system in various Indigenous populations of India is presented in table 6.2

Table 6.2: Distribution of ABO Blood Group system

North India					
Tribe	O (%)	A (%)	B (%)	AB	Author
Tharu	50	20	33	-	Majumdar 1943
West India					
Bhils	60%	20%	35%	-	Majumdar 1943
Koli	55%	20%	30%	-	Majumdar&Kishan 1948-49
Rabari	55%	20%	23%	-	Majumdar&Kishan 1948-49
Eastern India					
Naga	72%	255	15%	-	Bhatacharjee 1957, Mitra 1935
Khasi	70%	27%	20%	-	Das 1969, Basu 1938
Rabha	50%	30%	25%	-	Das & Deka 1985, Das et al 1980
Kachari	54%	20%	25%	-	Das and Deka 1985
Deuri	52%	31%	15%	-	Das &Deka 1985
Garo	50%	24%	25%	-	Das et al 1980
Kaipong	60%	20%	20%	-	Gupta 1958
Riang	47%	23%	30%	-	Gupta 1958
Tippua	47%	31%	20%	-	Gupta 1958
Noatia	41%	25%	33%	-	Kumar 1958
Riang	45%	21%	33%	-	Kumar & Sastry 1961
Lepcha	60%	25%	20%	-	Miki et al 1960
Oraons	68%	20%	30%	-	Sarkar 1942-44, Ray 1962, Sarkar 1949, Kirk et al 1962
Santal	55%	22%	30%	-	Chandri et al 1967, Sarkar & sons 1952, Roy Choudhri & son 1971
Kaoru	49%	23%	26%	-	Das et al 1974
Mechs	72%	11%	16%	-	Mukherjee et al 1987
Mundas	55%	24%	20%	-	Mukherjee et al 1987,Tyagi 1969
Lodhas	42%	29%	28%	-	Macfarlane 1941
Asuras	50%	37%	2%	-	Sarkar 1942
Birhors	55%	25%	40%	-	Majumdar 1951-52
Birjias	36%	15%	48%	-	Sarkar 1949
Cheros	58%	25%	18%	-	Sarkar 1949
Hos	60%	20%	18%	-	Majumdar 1951-52
Kharwas	38%	23%	37%	-	Sarkar 1949
Kisans	60%	10%	29%	-	Sarkar 1949
Korwars	40%	27%	31%	-	Sarkar 1949
Malpaharia	53%	20%	25%	-	Sarkar 1949
Khond	58%	21%	25%	-	Hargrave 1963
Poroja	62%	19%	18%	-	Sarkar et al 1960
Central India					
Bhils	42	23	35		Macfarlane 1941
Kanwar	45%	21%	35%	-	Negi 1963
Muria	55%	17.8%	31.10%	-	Negi & Ahmed 1962
Bharia	25%	28%	33%	-	Chaudhary & Sarma 2006

South India					
Chenchu	60.30%	25.77%	14%	-	Macfarlane 1940
Valmiki	68.9%	25%	20%	-	Rao 1977, Naidu et al 1980
Yerukala	73.3%	155	12%	-	Reddi et al 1980
Kondadora	73.3%	17%	12,30%	-	Rao 1977
Kondakapu	75%	10.14%	15%	-	Sarkar 1977
Adiyan	56%	11%	32%	-	Sarkar 1954
Paniyan	50%	45%	10%	-	Sarkar 1954, Das & Ghosh 1954
Kota	76.4%	1%	32%	-	Ghosh 1973
Todas	35%	18%	48.4%	-	Techmann & Cutbush 1952
Kanikkar	80%	20%	16%	-	Karunakaran 1939, Bose 1952
Mannan	55%	26.4%	18.5%	-	Roy 1955
Ulladan	55%	26%	24%	-	Bucchi 1957-58
Urali	67.93%	15.76%	16.31%	-	Bose 1952
Mala Vedan	42%	35%	23%	-	Buchi 1961

North India

In north India Tharu tribal population was studied for ABO blood system. The frequency of 'O' group is highest (50%) followed by 'B' group (33%) and then 'A' which is 20%.

Western India

In western India Bhils, Koli and Rabari tribal populations were studied. the frequency of 'O' group is found to be highest (60%) followed by 'B' group (30%). The frequency of 'A' group is 20%.

East India

In East India the tribes like Garo, Khasi, Naga, Deuri, Kachari, Rabha, Santal, Kaora, Mundas, Lodhas, Asuras, Poroja, Khond were studied. Among them the frequency of "O" group is found to be highest (70% approximately) followed by "A" group (40% approximately) then "B" group with (35%) approximately.

Central India

In central India Bhils, Kanwar, Muria tribal population were studied and among them the frequency of "O" group is found to be highest (60% approximately) followed by "B" group (40% approx) and it is followed by "A" group (30% approximately).

South India

In South India the Bhils, Chenchu, Valmiki, Konda Dora, Konda Kapu, Yerukula, Adiyan, Paniyan, Kota, Todas, Kannikars, Mannan, Ulladan, Urali, Tribal populations were studied and the frequency of "O" group is found to be highest (70% approximately) followed by "A" group (50% approximately). The frequency of "B" group was (40% approximately).

6.2.2 Distribution of Rh (D) System

The distribution of Rh (D) blood group system among different Indigenous people is presented in table 6.3.

Table 6.3: Distribution of Rh (D) Blood Group System

Tribe	D	d	Author
East India			
Garo	100.0	0.00	Das et al 1980
Rabha	91.09	8.91	Das et al 1980
Kachari	100.0	0.00	Das et al 1980
Bodo	95.0	5.00	Das et al 1980
Mech	100.0	0.00	Das et al 1980
South India			
Kondadora	87.98	12.02	Naidu et al1990
Yerukala	72.53	27.47	Reddy et al 190
Valmiki	84.30	15.7	Naidu &Veerraju 1977
Chenchu	75.74	33.00	Sirajjudin1977
Kota	86.27	13.73	Raj et al 1986
Pulayan	80.06	20.00	Banarjee et al 1988
Urali	79.15	29.85	Banarjee et al 1988
Central India			
Bharia	92	0	Dr. Ruchira Chaudhary & Gunjan Sarma, 2006

East India

In East India, Garo, Khasi, Rabha, Kachari, Bodo, Mech tribal populations were studied and the frequency of "D" gene is found to be 100% followed by "d" gene (0-10%).

South India

In south India Konda Dora, Yerukula, Valmiki, Chenchus, Kotas, Pulayan and Urali, Tribal population were studied and the frequency of "D" gene is found to be highest (100%) followed by "d" gene (0-30%).

Among the various tribal population groups, the highest frequencies is observed for Rh-D gene (100%) followed by the Rh-d gene.

6.3 BIOCHEMICAL MARKERS

Study of Biochemical variation refers to the understanding of population variation of Serum Proteins and Red Cell Enzymes. Anthropologists had studied these genetic markers with the primary aim of documenting genetic differences among various populations inhabiting different parts of the world and also for human racial classification. In this unit, our aim is to study these markers among Indigenous populations of India.

6.3.1 Serum Proteins and Their Distribution

Serum proteins are the proteins present in blood plasma. Serum proteins offer many functions which comprise transport of lipids, hormones, vitamins and metals in the circulatory system. Some of the serum protein markers such as Haptoglobins (Hp) and Transferrin (Tf) were widely investigated by anthropologists/human biologists. Three allelic genes Tfc, Tfb, Tfd controls the Tf system. The Hp system is controlled by two allelic genes Hp1 and Hp2.

The details, such as discoverer and year of year discovery, of these two markers are presented in table 6.4.

Check Your Progress

2) Write a brief note on Biochemical markers.

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Table 6.4: Serum Proteins

System	Year of Discovery	Discoverer
Transferrin (Tf)	1958	Smithies
Haptoglobin (Hp)	1955	Smithies

Distribution of Serum Proteins: The distribution of serum proteins such as Transferrins and Haptoglobins among the Indigenous people of India is presented in Tables 6.5 and 6.6, respectively.

Table 6.5: Distribution of Transferrin (Tf) System

Tribe	Tf^{c}	Tf^{B}	Tf^{D}	Author
North India				
Bodhs	100.0	0.0	0.0	Bhasin et al 1983
West India				
Bhils	100.0	0.0	0.0	Mukherjee et al 1979, Papiha et al 1978
East India				
Khasi	98.7	1.3	0.0	Goedde et al 1972
Lepcha	99.3	1.3	0.0	Goedde et al 1972
Mech	99.4	6.0	0.0	Mukherjee et al 1987
Santal	93.7	0.0	6.3	Giri et al 1981
Bhumij	95.5	0.0	4.5	Giri et al 1981
Munda	100.0	0.0	0.0	Mukherjee et al 1987
Lodha	100.0	0.0	0.0	Mukherjee et al 1987
Rabha	100.0	0.0	0.0	Mukherjee et al 1987
Garo	100.0	0.0	0.0	Mukjherjee et al 1987
Oraon	96.8	0.0	3.2	Kirk et al 1962
Khond	89.6	0.0	10.4	Sahal et al 1981
South India				
Yerukula	100.0	0.0	0.0	Gond & Rao 1977
Chenchu	99.6	0.0	0.4	Gopalam & Rao 1987
Toda	100.0	0.0	0.0	Kirk et al 1962
Kota	100.0	0.0	0.0	Ghosh et al 1977
Pardhan	100.0	0.0	0.0	Gond & Rao1980

In Tf system the gene frequency of TfC is found to be highest (100%) in almost all the tribal groups, followed by TfD gene (90%) and then TfB gene which has the least gene frequency (0%) among all the indigenous populations.

Table 6.6: Distribution of Haptoglobin (HP)

Eastern India				
Tribe	**Sample**	**Gene Frequency**		**Author**
		Hp^1	**Hp^2**	
Khasi	79	20.9	79.1	Goedde et al, 1972
Kachari	110	21.4	78.6	Walter et al, 1986
Lepcha	97	10.8	89.2	Bhasin et al, 1986
Gurungs	36	27.8	72.2	Bhasin et al ,1986
Mech	38	15.8	84.2	Mukherjee et al, 1987
Oraons	178	10.2	89.8	Saha et al, 1988
Munda	97	12.4	87.6	Mukherjee et al , 1987
Oraon	125	14.5	85.5	Kirk et al, 1962
Central India				
Bhil	136	10.3	89.7	Papiha et al, 1978
South India				
Chenchu	142	19.2	80.8	Ramesh et al, 1980
Toda	93	28.0	72.0	Saha et al, 1976
Kota	540	14.7	85.3	Ghosh et al, 1977

The frequency of allele HP1 is found to be low among the tribal population of South India. From the Western and North-eastern peninsular plateau, the frequency of the allele HP1 is also low. Among the Eastern Hmalayan region the frequency of HP1 is found to be high (0.189).

6.3.2 Red Cell Enzymes and Their Distribution

Red Cell Enzyme markers like Glucose 6 phosphate Dehydrogenase (G-6-PD), Acid Phosphatase1(ACP1) and 6-phosphogluconate Dehydrogenase (PGD) were commonly examined by anthropologists/human biologists. Two different alleles Gd+ and Gd – control the G-6- Pd system. Three autosomal allelic genes Pa , Pb , Pc controls the ACP1 system and two alleles PGDA , PGDB controls the 6-Phosphogluconate dehydrogenase system. The table 6.7 presents the details of the Red Cell Enzymes.

Table 6.7: Red Cell Enzymes

System	Year of Discovery	Discoverer
G6PD	1956	Carson et al
ACP1	1963	Hopkinson et al.
PGD	1963	Fildes & Parr

In addition to the above red cell enzymes, there are other red cell enzymes like CA I = Carbon anhydrase I, LDH B = Lactat dehydrogenase B, LDH A = Lactate dehydrogenase A, PGM 1 = Phosphoglucomutase 1, PGM 2 = Phospho-glucomutase2, AK1 = Adenylate kinase 1, SOD A = Superoxide

dismutase, PGM 3 = Phosphoglucomutase – Isomerase, GPT = Glutamat-Pyruvat-Transamisnase, anhydrase II, ESD = Esterase D, UMPK = Uridin-5 - Phosphoglycolat Phosphatase, ALADH = d-aminolevulinate dehydratase.

The distribution of Glucose 6 phosphate Dehydrogenase, Acid Phosphatase and 6-Phospho Gluconate Dehydrogenase systems among the Indigenous people is presented in tables 6.8, 6.9 and 6.10, respectively.

Table 6.8: Distribution of Glucose 6 phosphate Dehydrogenase system

Tribe	Gd^+	Gd^-	Author
Bhil	95.0	5.0	Jain et al 1981, Papiha et al 1978, Sathe et al 1987
Khasi	93.0	7.0	Flatz et al 1972
Rabha	-	-	-
Garo	-	-	Das et al 1982
Kachari	90.0	10.0	Balgir 1991
Oraons	-	-	Sathe et al 1987
Todas	100.0	0.0	Saha et al 1976

For G6PD, the frequency of Gd + among the tribal population is found to be approx (100%) among most of the tribes followed by Gd – genes. It has been observed that the gene frequency increases from Himalayan region to non-Himalayan region.

Table 6.9: Distribution of Acid Phosphatase system

Eastern India					Author
Gene Frequency					
		P^a	P^b	P^c	
Tribe	Sample				
Khasi	43	30.2	65.1	4.7	Goedde et al, 1972
Kacharis	58	25.2	74.8	0.0	Mukherjee et al, 1989
Lepcha	86	18.0	80.2	1.7	Bhasin et al, 1986
Munda	100	20.0	80.0	0.0	Mukherjee et al, 1987
Lodha	117	16.2	83.8	0.0	Mukherjee et al, 1987
Rabha	112	31.7	68.3	0.0	Mukherjee et al, 1987
Garo	70	25.0	75.0	0.0	Mukherjee et al, 1987
Oraons	127	22.8	77.2	0.0	Saha et al ,1988
Central India					
Bhil	143	19.9	80.1	0.0	Papiha et al, 1978
South India					
Chenchu	139	38.4	61.9	0.0	Ramesh et al, 1980
Yerukula	40	22.5	77.5	0.0	Blake et al, 1981
Toda	97	18.0	82.0	0.0	Saha et al, 1976
Kota	549	46.7	53.3	0.0	Ghosh et al, 1977

It has been found that the frequency of ACP1 is highest among the tribal populations from western (0.240) and South Peninsular Plateau (0.235) as

compared to North Eastern Peninsular Plateau (0.200) and among the tribes with Mongoloid affinities from Eastern Himalayan region (0.214).

Table 6.10: Distribution of 6-Phospho Gluconate Dehydrogenase system

Eastern India					**Authors**
		Gene Frequency			
		PGD^{A}	**PGD^{B}**	**PGD^{Rare}**	
Tribe	Sample				
Khasi	43	95.3	4.7	-	Goedde et al ,1972
Lepcha	81	86.4	13.6	-	Bhasin et al ,1986
Gurung	66	81.8	18.2	-	Morpurgo et al ,1983
Oraons	132	94.3	5.7	-	Saha et al, 1988
kond	113	99.1	0.9	-	Cahal ,1981
Central India					
Bhil	145	96.6	3.4	-	Papiha et al, 1978
South India					
Chenchu	139	97.8	2.2	-	Ramesh et al,1980
Chenchu	64	99.2	0.8	-	Ramesh et al,1980
Yerukula	40	98.7	1.3	-	Blake et al, 1981
Toda	98	99.5	0.5	-	Saha et al ,1976
Kota	549	99.3	0.7	-	Ghosh et al, 1977

Among the Indian tribal population the average frequency of allele PGDA is 0.959 (which varies from 0.754-1.00). It has been found that the frequency of PGDA is highest (about 0.970) among the tribes of North- east India and Southern India as compared to the tribes of Western India (0.925).

6.4 SUMMARY

This unit talks about the serological and biochemical markers and their distribution among the Indigenous peoples among different geographical zones of India. The gene frequencies of serological and biochemical markers showed variation among Indigenous populations inhabiting different geographical zones of India.; north, west, east, central and south.

6.5 REFERENCES

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6.6 ANSWERS TO CHECK YOUR PROGRESS

1) The Blood group systems are a classical example for serological markers. For details, please refer section 6.1.

2) For details, please refer section 6.3.

UNIT 7 DERMATOGLYPHICS AND OTHER BIOLOGICAL TRAITS*

Contents

Learning Objectives

After reading this Unit, you will be able to:

- Understand about Dermatoglyphics;
- Examine the biological traits like PTC and Colour Blindness; and
- Delineate the distribution of the above markers among the Indigenous people of India.

7.0 INTRODUCTION

In the previous unit you have been enlightened about the serological and biochemical markers and their distribution among the Indigenous peoples of India. In the present unit you will be introduced to the other important biological markers such as Dermatoglyphics, Phenylthiocarbamide (PTC) and Colour Blindness. Dermatoglyphics is concerned with the ridge configuration of skin of fingers, palms, soles and toes. PTC is used to understand tasters and non-tasters by using Phenylthiocarbamide solution and Colour blindness is the failure to distinguish red, green and blue colours. The distribution of Dermatoglyphics, PTC and Colour Blindness among the Indigenous populations is presented.

7.1 DERMATOGLYPHICS

Dermatoglyphics is the study of the epidermal ridge patterns of the skin of the fingers, palms, toes and soles. Dermatoglyphics is derived from two

*Contributed by Dr. Palla Venkatramana, Discipline of Anthropology, SOSS, IGNOU

Greek words ('Derma' means skin and 'Glyphe' means carve). The term Dermatoglyphics was first coined by Cummins and Midlo in the year 1926. The human body, except in palmar and planter regions, is covered with hair and sebaceous glands with an abundance of sweat glands. The skin of our palms, soles, fingers and toes is covered with epidermal ridges, which may also form patterns. Every individual possesses distinct features of ridges and their pattern in fingers, palms and soles. The ridge patterns are stable throughout life and are not modified by environmental factors. The patterns are unique to each individual. Because of these qualities these play a very important role in the personal identification, crime detection, twin diagnosis, racial variation and have applied values in various diseases and syndromes.

A brief description about the Ridge configuration: The ridge configuration present on the palm is called Palmar Dermatoglyphics and the ridge configuration present on the fingers is called Finger Dermatoglyphics. The epidermal ridges form definite local design on the terminal segment (phalanges) of digits and also on the palm and toes. Let us briefly talk about Palmar and Finger Dermatoglyphics.

Check Your Progress

1) Write a brief note on Dermatoglyphics.

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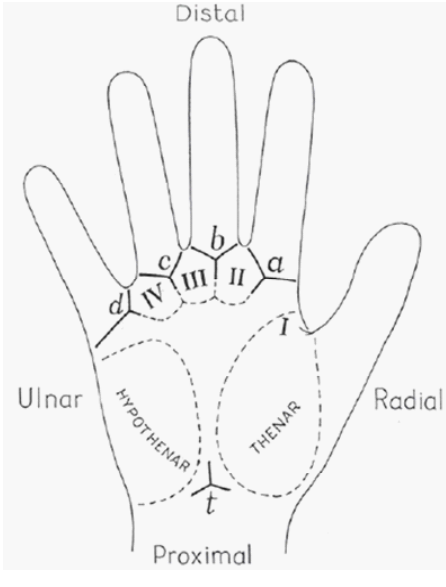
7.1.1 Palmar Dermatoglyphics

In palm, there are six elevated areas of varying prominence. These are thenar, hypothenar and four interdigital areas namely I, II, III and IV (Fig 7.1). The thenar eminence occupies a large area of the base of the thumb and the hypothenar eminence lies opposite to thenar area and is present in the ulnar portion of the palm. Generally speaking, there are four triradii normally located at the base of digits II, III, IV and V and called a,b,c, and d. A triradius is a meeting point of three opposing systems. Ideally, it subtends three angles of 120˚. In practice, the angles may range from 90˚ to 180˚ as limiting values.



The palm is divided into 13 regions. The four main lines, originating from the four digital triradii points are designated in capital letters such as, A, B, C and D (Fig. 7.2).

Fig. 7.1: Palmar Dermatoglyphics (source: medind.nic.in)

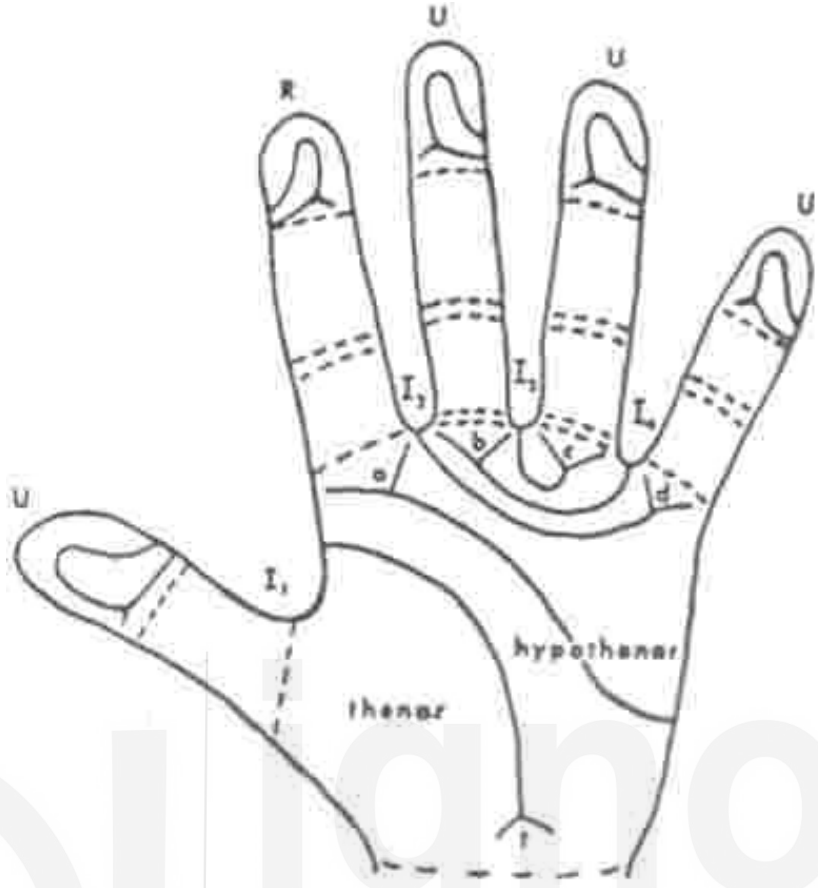


Fig. 7.2: Formulation of the Main Lines (source: www.infolank.com)

7.1.2 Finger Dermatoglyphics

It refers to the configurations present on the distal phalanges of fingers and toes. Based on the construction, Galton (1891), classified them as Arches, Loops and Whorls. Later on, Henry (1900) divided whorls into true whorls and composites.

Different types of Finger Dermatoglyphics are presented in Fig. 7.3.

Arches (A): No triradii is present in this type of configuration. Arch is of two types, plain Arch and Tented Arch.

Plain Arch: It is composed of ridges which cross the finger tip from one side to other without returning.

Tented Arch: The configuration looks like a tent. The ridges meet at a point to form a tent.

Loops (L): One or more ridges enter from one side, recurve and terminate or tend to terminate on the same side from which the ridges entered. Only one triradius is present in loops. Loops are of two types. Ulnar Loop (UL) and Radial Loop (RL).

Ulnar Loop: Loop opens to the ulnar side (side of little finger) with the triradius on the radial side.

Radial Loop: Loop opens to the radial side (side of thumb) and its triradius is on the ulnar side.

True Whorls (W): In this type of patterns two triradii are present. One triradius on the radial side and the other on the ulnar side. In this type of pattern there is single core and at times double core too. The ridges go round 180 degrees.

Composites: Composites may be classified into :

a) **Central Pocket Loop (CPL):** It is a pattern containing a loop with a small whorl (or a pocket) in the centre.

b) **Double Loop (DL):** This is comprised of two interlocking loops. Double Loop can be classified into (1) Twin Loop (TL) and (2) Lateral Pocket Loop (LPL). In twin loop, two loops open in opposite direction. But in the case of lateral pocket loop two interlocked loops open on the same margin.

c) **Accidentals:** In this type of pattern more than two triradii are present. Accidentals represent a combination of two or more basic configurations such as loop and whorl.

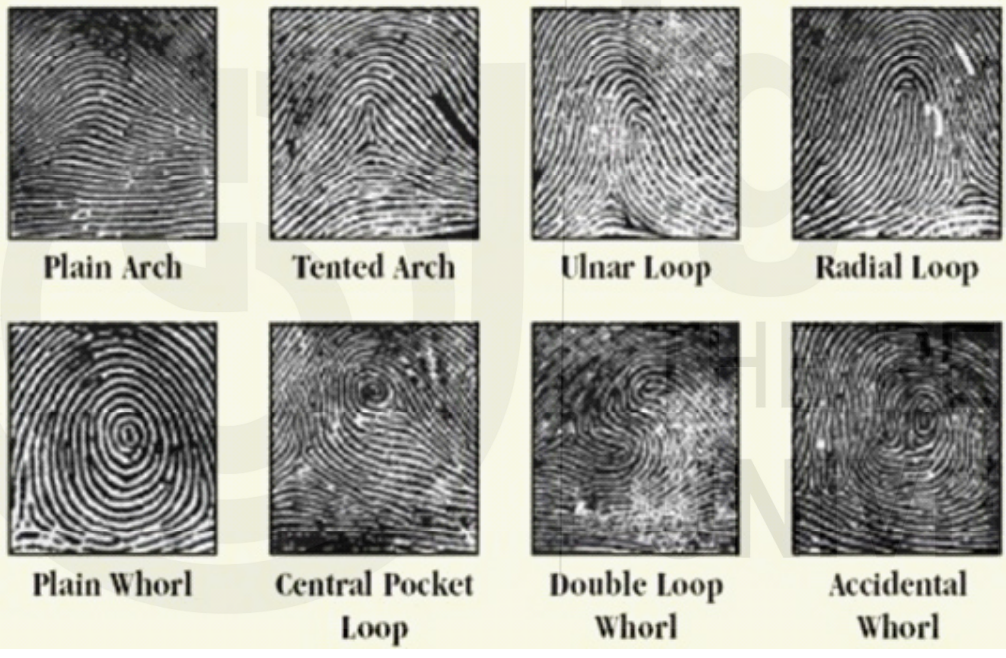


Fig. 7.3: Different types of Finger Dermatoglyphics (source: www.viewzone.com)

The Pattern Intensity Index on fingers or toes is an estimation of triradii per finger or toe. It is to be noted that a whorl consist of two triradii, a loop has one, and arch has none. "The value of pattern intensity may be stated either as the number triradii per individual or as the average number of triradii per finger"…….. "The number of triradii is approximated by adding the frequency of loops to twice the frequency of whorls, the total being divided by the number of individuals when the frequencies are in absolute numbers, or by ten for percent frequencies." (Cummins and Midlo, 1976 (1943)).

7.1.3 Distribution of Dermatoglyphics

The distribution of pattern frequency among different Indigenous people of India is presented in Table 7.1.

Table 7.1: Distribution of Dermatoglyphics

Tribe	Sample	Pattern Frequency					Author
		Whorls	Loops			Arches	
			Ulnar	Radial	Total		
Central India							
Bhils	M-100 F-100	41.40	54.60	1.80	56.40	2.20	Krishan 1987
Bhils	M-29 F-45	36.21 36.67	53.79 55.33	4.13 1.33	57.93 56.67	5.86 6.66	Srivastava 1963
West India							
Kolis	M-180	39.61	54.56	2.39	56.95	3.44	Kshatriya 1979
Korku	M-100	51.23	45.17	1.84	47.01	1.74	Basu 1969
East India							
Kachari	M=109	54.66	42.86	0.55	43.41	1.84	Das 1960
Mech	M-72	40.28	55.28	1.94	57.22	2.50	Chakravarti 1961
Lalung	M-106 F-132	51.04 38.94	45.75 55.76	1.70 2.12	47.45 57.88	1.51 3.18	Chakravarti & Mukherjee 1961
Angami Naga	M-124 F-122	52.34 45.57	45.65 50.41	1.77 1.89	47.42 52.30	0.24 2.13	Das et al 1985
Lotha Naga	M-106 F-108	53.77 49.26	41.44 48.43	1.42 1.11	42.86 49.54	3.40 1.20	Das et al 1985
Lepcha	M-112 F-42	52.86 54.42	-	-	46.42 44.63	0.72 0.95	Miki et al 1960
Oraon	M-27 F-26	50.38 57.68	43.94 40.50	3.03 0.44	46.97 40.94	2.65 1.32	Ghosh 1960
Munda	M-102	55.64	41.02	2.85	43.87	0.49	Sarkar 1969
Birhor	M-15 F-23	57.33 44.78	39.33 51.74	3.33 1.74	42.66 53.48	0.00 1.74	Gupta et al 1970
Asura	M-89 F-43	38.96 28.67	55.41 64.10	3.83 3.50	59.24 67.60	1.80 3.73	Gupta et al 1970
Oraon	M-114 F- 106	58.66 52.64	38.86 43.21	0.54 1.51	39.40 44.72	1.98 2.64	Chakravarti 1964
Gond	M-9	22.47	71.91	3.37	75.28	2.25	Sarkar & Banarjee 1957
Munda	M-6	66.67	33.33	0.00	33.33	0.00	Sarkar & Banarjee 1957
South India							
Chenchu	M-92 F-100	48.15 40.90	49.02 54.70	1.42 2.00	50.44 56.70	1.09 2.40	Nawabjam et al 1983
Paniya	M-138 F-112	60.66 53.57	36.16 43.84	1.59 1.61	37.75 45.47	1.59 0.98	Chakravarti & Mukherjee 1961
Yanadis	M-115 F-115	44.2 37.7	48.6 52.6	2.7 4.0	50.3 56.6	4.5 5.7	Jadhav S. Jaya Sankar Rao &A.B. Subhashini

From Table 7.1, it has been observed that the frequency of whorls among the tribal population is found to be highest (60%) followed by the loops and the frequency of arches is approximately 8%. The frequency of whorls among different zones is found to be highest among East India followed by Central and North India followed by West and South India.

7.2 PHENYLTHIOCARBAMIDE (PTC) TASTE TEST

The Phenylthiocarbamide taste test is popularly known as PTC. This is another significant genetic marker which has been studied by anthropologists to study differences among populations. A dimor¬phism with regard to ability to taste a chemical substance known as phenylthiourea is observed in the human populations. Some people are unable to find any taste of it while others find it very bitter. Those who are sensitive to the taste of PTC are called 'tasters' while the others who are not are called 'non tasters'. PTC tasting ability is a genetic trait controlled by a pair of alleles T and t. The T is dominant over the t.

To distinguish tasters from non-tasters a quantitative threshold method given by Harris and Kalmus (1949) is the most widely used procedure. In this protocol, a stock solution is prepared by dissolving 1.3 g of phenylthiocarbamide in 1 liter of boiled tap water and is designated as solution No. 1. From this stock solution serial dilutions are made. From stock solution (solution No.1) take 50 ml and add 50 ml of boiled tap water and mix thoroughly and label it as solution No. 2. From this solution take 50 ml and add 50 ml of boiled tap water to make solution No. 3. Likewise, a series of serially diluted solutions from solution No.1 to 14 are prepared. To segregate the subjects from taster and non-taster, the above prepared solution from solution 1 to 14 are given to taste. Based on taste, the subjects would be categorized as tasters (T) and non-tasters (t).

7.2.1 Distribution of PTC

The distribution of PTC among the Indigenous peoples of India is presented in Table 7.2.

Table 7.2: Distribution of Tasters/ Non-tasters (PTC)

Tribe	Sample	Sex	T	t	Author
West India					
Bhil	188	-	32.8	67.2	Vyas et al 1962
Dhodia	78	-	31.1	67.8	Vyas et al 1962
Dubla	207	-	32.6	67.4	Vyas et al 1962
Gamit	200	-	26.9	73.1	Vyas et al 1962
Koli	128	-	38.1	61.9	Vyas et al1962
Bhils	234	-	43.8	56.2	Mukherjee et al 1977
East India					
Khasi	209	M	59.6	40.4	Dev 1985
Adi	45	M	63.5	36.5	Srivastava 1971
Khasi	317	-	53.3	46.7	Miki et al 1960
Deuri	201	-	47.7	52.3	Das et al 1985
Mishing	200	-	60.6	39.4	Das et al 1985
Liang	401	-	59.7	40.3	Kumar & Sastry 1961
Lepchas	107	M	63.8	36.2	Bhatacharjee et al 1974
Sherpa	38	-	71.9	28.1	Bhatacharjee et al 1974

Lepcha	200	-	62.6	37.4	Bhatacharjee et al 1974
Lepcha	154	-	73.3	26.7	Miki et al 1960
Oraon	118	-	24.7	75.3	Shukla & Tyagi 1975
Munda	132	-	10.8	89.2	Shukla & Tyagi 1975
Munda	109 90	M F	34.4	65.6	Dash Sharma 1976 Dash Sharma 1976
Oraons	181	M	49.6	50.4	Dash Sharma 1976
South India					
Pardhans	202	M	28.2	71.8	Ramesh et al 1981
Paniyan	237	-	63.8	36.2	Das & Ghosh, 1954
Ulladan	339	-	47.6	52.4	Cuchhi,1957-58
Koraga	118	-	87.29	12.71	A.Chandrashekar,D. Xaviour & S.M Sirajuddin.1998

It has been observed from the table that in some indigeneous population, the frequency of tasting (T) ability is higher (Lepcha tribe), whereas some indigeneous population are having relatively higher frequency of non – tasting (t), for example (Munda tribe).

7.3 COLOUR BLINDNESS

Colour blindness is the failure to distinguish certain colours. Colour blindness can also called as colour vision deficiency because majority of the colour blind people can see colours, excepting red, green or blue. Individuals with normal colour vision can differentiate colours by the addition of the three primary colours viz., red, green and blue. Sometimes, an individual's power of perceiving one of these colours is either below normal or totally lost.

It has been established that colour vision defect is inherited as X-linked trait with the normal colour vision dominating over colour vision defect. The most popular example of sex linked inheritance is red-green (R-G) colour blindness which may be of two main types as follows.

Protan (red blind) type with subtypes

(a) Absolute/strong (Protanopia)

(b) Partial/ mild (Protanomalia)

Deutan (green blind) type with subtypes

(a) Absolute/ strong (Deuteranopia)

(b) Partial/ mild (Deuteranomalia)

In Protanopia the visible range of the spectrum is shorter at the red end compared with that of the normal, and that part of the spectrum which appears to the normal person as blue-green, appears to those with Protanopia as grey. In Deuteranopia, that part of the spectrum which appears to the normal person as green appears as grey, and the visible range of the spectrum is divided by this zone into two areas, each of which appears to be of one system of colour. The visible range of spectrum is not contracted, in contrast to protanopia. Purple-red which is the complementary colour of green appears also as grey.

A very rare congenital colour vision deficiency is Total Colour Weakness, in which colour sensitivity to red and green as well as to yellow and blue is very low and only the clear colours can be perceived but, except for the colour sensitivity, there is no abnormality in the visual functions. Another very rare group of individuals who suffer from Total Colour Weakness show a complete failure to discriminate any colour variation, usually with an associated impairment of central vision with photophobia and nystagmus. There may be extremely rare cases, who fail in the appreciation of blue and yellow who may be termed Tritanomalia (if partial) and Tritanopia (if absolute). Ishihara plates are not designed for the diagnosis of such cases.

The inheritance pattern of red-green colour blindness in man is diagrammatically presented in Fig. 7.4.

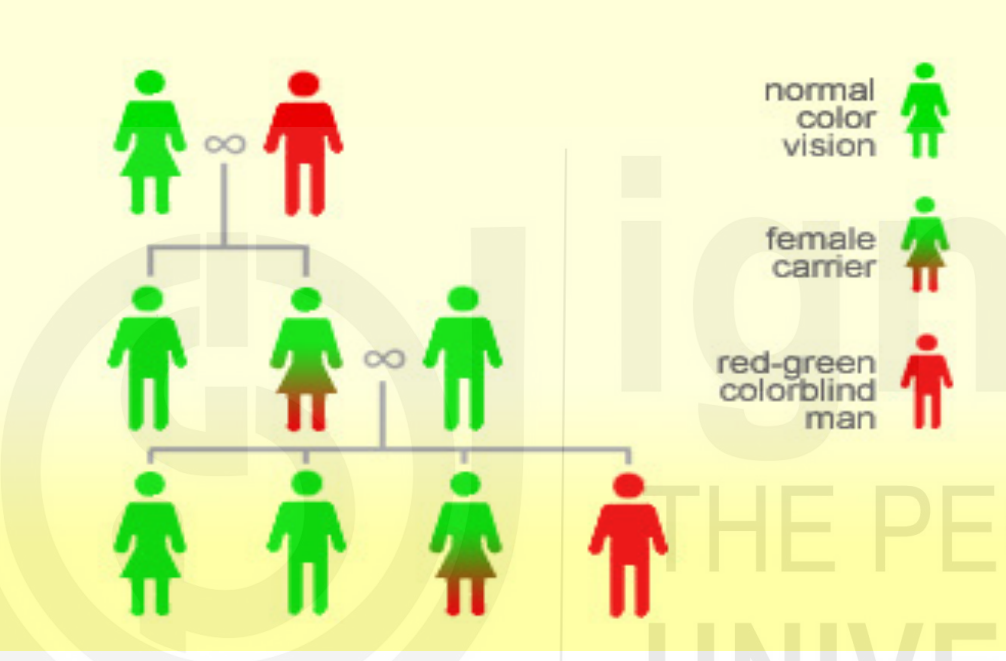


Fig. 7.4: Red-Green Colour Blindness Inheritance Pattern (Source:colblindor.com).

When a normal woman marries a colour blind man all her sons and daughters have normal colour vision. But when her daughters are married to a man with normal colour vision some colour blind sons are found. It means that a woman with normal colour vision whose father is colour blind gives birth to children of which about half of the sons are expected to be colour blind and other half to have normal colour vision.

7.3.1 Technique to Detect Colour Blindness

The test that is extensively used to distinguish colour vision deficiency is the Ishihara test. In this test the Ishihara charts are arranged as a book (Fig.7.5) which consists of a set of cards on which figures are printed in coloured dots of varying sizes against a background of dots of a different colour. The colours are so chosen that individuals with defective colour vision either misread, or are unable to read the figures. The test has a series of 38 plates (Fig. 7.6 shows some of the plates) to assess quickly and exactly colour vision deficiency. Of these plates, Nos. 1-25 are having numerals meant for literates and the remaining plates from Nos. 26-38 are having winding lines meant for illiterates.

Fig. 7.5: Ishihara-Test Book (Source: www.trishir.com)

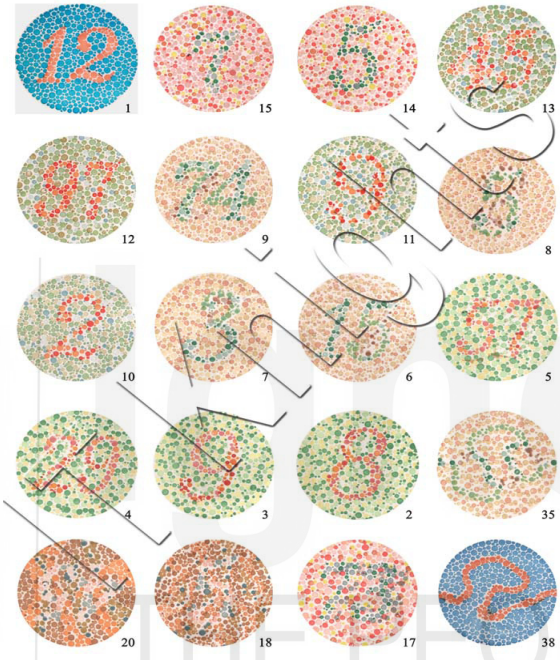


Fig.7.6: Ishihara colour blindness test plates (Source: filebuzz.com).

The first 21 plates (Nos. 1-21) in the 38 plate version of Ishihara test, charts are designed to distinguish normal colour vision individuals from red-green blind individuals. The next four plates (Nos. 22-25) are intended to separate colour vision individuals so detected into Protanopes (strong red blind) and protanomals (mild red blind) and deuteranopes (strong green blind) and deuteranomals (mild green blind).

Check Your Progress

2) Describe the technique to detect colour blindness

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7.3.2 Distribution of Colour Blindness

The distribution of colour vision deficiency among the Indigenous populations is presented in Table 7.3

Table 7.3: Distribution of Colour Blindness

Tibe	Sample	Deutan	Protan	Percentage(%)	Author
North India					
Gujjar	89	-	-	2.3	Bhasin et al 1990
Bodhs	124	-	-	3.2	Bhasin et al 1990
West India					
Bhil	142	-	-	0.7	Vyas et al 1962
Dhodia	45	-	-	0.0	Vyas et al 1962
Dubla	109	-	-	2.7	Vyas et al 1962
Gamit	147	-	-	2.7	Vyas et al 1962
Kolis	180	-	-	5.0	Kapoor et al 1983
Gond	86	-	-	5.8	Das gupta 1975
East India					
Apatani	125	13	-	10.4	Jaswal 1975
Gallong	91	-	-	1.1	Das & Choudhary 1975
Khasi	495	-	-	3.8	Mukherjee 1963
Mikir	125	-	-	0.0	Mukherjee 1963
Naga	100	-	-	0.0	Mukherjee 1963
Miri	37	-	-	0.0	Srivastava 1969
Angami Naga	85(M) 65(F)	-	-	0.0 0.0	Seth & Seth1973 Seth & Seth 1973
Tangkhul	134(M) 83(F)	-	-	6.7 0.0	Singh 1982 Singh 1982
Lushai	224	-	-	1.8	Mukherjee 1963
Riang	195	--	-	1.5	Kumar & Sastry 1961
Khasis	340	-	-	3.8	Mukherjee 1963
Lepcha	162	4	0	2.5	Bhatacharjee et al 1974
Sherpas	310	-	-	1.3	Bhasin et al 1987
Santal	114	5	-	7.9	Mukherjee et al 1977
Mundas	71	-	-	7.0	Mukherjee 1965
Oraons	126	-	-	2.4	Dash Sharma & Pal 1975
Khond	75	-	-	1.3	Deka et al 1977
Gond	100	-	-	2.0	Singh 1987
Santal	55	-	-	5.5	Singh 1987
Central India					
Bhils	86	-	-	2.3	Banarjee & Dhar 1984
South India					
Chenchu	406	2	2	1.0	Sirajuddin 1977
Pardhan	70	1	1	1.4	Goud & Rao 1979
Valmiki	130	-	-	3.8	Rao & Reddy 1973

- In this table, it has been found that the frequency of colour blindness is higher (100%) in North Indians compared to other Indigenous populations.

7.4 SUMMARY

In the beginning, anthropologists used Dermatoglyphics to study population variation. Dermatoglyphics plays an important role in personal identification

and is also associated with some diseases. PTC is a genetic character to determine the tasting ability of the population by using the threshold value. The colour blindness test is so used to determine the colour vision deficiency of the populations with the help of Ishihara charts.

7.5 REFERENCES

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7.6 ANSWERS TO CHECK YOUR PROGRES

1) Dermatoglyphics is the study of the epidermal ridge patterns of the skin of the fingers, palms, toes and soles. For more details, please refer section 7.1.

2) For details, please refer sub section 7.3.1