

HOME SCIENCE

HIGHER SECONDARY - FIRST YEAR

Untouchability is a sin

Untouchability is a crime

Untouchability is inhuman

**TAMILNADU
TEXTBOOK CORPORATION**
College Road, Chennai - 600 006.

© Government of Tamilnadu
First Edition - 2004
Reprint - 2005

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Price : Rs.

This book has been prepared by the Directorate of School Education
on behalf of the Government of Tamilnadu

This book has been printed on 60 GSM Paper

Printed by Offset at:

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1. CONCEPT OF HOME SCIENCE

1.1 INTRODUCTION

A plan of teaching Home Science must begin with an understanding of the discipline of home science. What is needed is a simple, direct explanation of the relevance and significance of home science in the modern context.

People often ask how home science is associated with the home. This question brings out the basic premises upon which the discipline of home science is built. The science of the home is concerned with the maintenance and enrichment of human relationships through the development and judicious use of all available human and material resources to achieve a maximal satisfying life for all members of the family.

Home science education prepares youth for the greatest of all vocation - Home Making. It orients young girls and boys towards preparation for several professions- teaching, nursing, dietetics, research, welfare, management, art application, extension work and communication.

There are several ways of managing homes. Men as well as women have played the roles of breadwinners and homemakers. It has become necessary for men to share housework, to enable women as professional persons to contribute to the nation.

It advocates that

1. Home is a place for development of both sexes through equal opportunities.
2. The personal and professional development of both sexes is possible within the home.
3. The roles and norms for both sexes pertain to their personal and professional lives. Therefore the imbalance between the roles of man and woman must be avoided.

4. The single dimensional role of woman as a home-maker produces constraints for women's development, society and individuals have changed and therefore the women's lopsided role of a home maker, needs to be fused with professional roles.
5. All knowledge applied are fundamental, which can be used to liberate women and men from undue pressure within and without the home, is the content of Home Science.

The goal of home science education is to help each individual to live more useful and satisfying personal, family and community life.

General education aims at the all-round development of individuals to enable them to take their places in society as effective members. In the development of their abilities, emphasis is placed on personal development for living in a social group. The functional philosophy of education calls for "Preparation for living through living".

Home science helps to fulfill these purposes in a unique way. It helps pupils to develop a point of view that challenges them to explore how to live together happily in their families, other social groups and communities.

Home science aims to achieve family happiness, raise its moral standards and improves its economic conditions and these objectives are to be achieved by fully allowing the man as well as the woman to develop personally and professionally.

Home is a place where life begins and school is the place where formal education begins. Hence what has been generated at home can be further enriched at school.

Following are the reasons for introducing Home Science at Secondary School Level.

- a) Secondary stage of education is the stage where young learners become of educable age and are sensitively aware of homes and families and are in need of emotional security, acceptance and feelings of belongingness. The study of home science can strengthen

this emotional security and develop commitment and loyalty to the family.

- b) This provides the opportunities to students to identify themselves in their own family, community and nation through identifying their responsibilities, roles and resources.
- c) The formation of habits and practices regarding eating, health, cleanliness, home making, dressing, parts of the body and sex, different stages in life etc are imparted in the school through this course.
- d) All skills required by individuals to communicate to others and be well placed in the society is possible only through home science
- e) Many boys and girls take interest in interior designing, architectural work, stitching, cooking etc and home science will help these students in fulfilling their desires.
- f) Many are compelled to terminate their formal education at the secondary stage. A course in home science ensures that students can take up many careers even at this age, since they are well equipped with information needed for this.
- g) Students with an inclination for service to the needy can do community work to the best of their abilities, since home science gives them the opportunity to use varied extension methods and audio / visual aids.
- h) Home Science in a well-expanded discipline at college and university levels, Students, passing out from Higher Secondary Levels can opt for specialization offered.

Having understood the concept of Home Science, let us look into the origin of home science in India and the beginning of the Home Science Association of India.

1.2 HISTORY OF HOME SCIENCE IN INDIA

The teaching of Home Science in India has a short history. Between 1920 to 1940, under the British administration. Home Science referred

to as domestic science, home craft or domestic economy was introduced in some schools & colleges. The Princely State of Baroda was one of the first to introduce home science in secondary school. The history of home science at College & University was made in 1932 at Delhi, in Lady Irwin College. Then in 1938 Madras University accepted home science at the degree level and the well known & pioneering home science colleges in Chennai are the **Queen Mary's College and the Women's Christian College**, which appeared in the Indian horizon in 1942.

The Avinashilingam Home Science College Coimbatore headed by Dr. Rajammal P. Devadas contributed greatly towards the expansion of this interdisciplinary course at various levels, starting from School to Ph.D.

The Agricultural Institute of Allahabad had also started a Home Science Diploma Course in 1935 and it became a University Level Department in 1945. Other outstanding home science colleges, which have developed since 1950, are Universities at Coimbatore, Luthiana, Bombay, Udaipur & Tirupathi. Then in mid 1960's to 1970's Agricultural Universities recognized the need for teaching home science.

The Home Science Association of India had taken its roots at Baroda under the guidance of **Dr. Flemmie P. Kittrell, Dr. Leela Shah and Ms. Dorothy Pearson, in 1951. The first convention of the association met at Chennai in 1952 where the constitution of the Association prepared by Ms. Pearson of Women's Christian College, Chennai, was adopted.** The broad objectives of the Association are to raise the standard of home science education in schools and colleges and to make homes and families healthier and happier. The publication of the Association is The Indian Journal Of Home Science. The Indian Home Science Association has been represented at the International Federation of Home Economics.

1.3 INTERDISCIPLINARY APPROACH

A professional home scientist requires a combination of knowledge from several specializations. This interdisciplinary approach of home

science has also increased over the years because not only have the professional roles changed their nature but also few have become possible for professional home scientists. The philosophy of home science has also changed to prepare individuals for professional roles rather than to prepare them only for home making. Today home science is aimed at preparing professional workers like teachers, nurses, dietitians, researchers, social workers, designers, administrators. etc. Therefore the interdisciplinary approach of home science has taken a new dimension.

Life Span Development or child development has interdisciplinary connectors with child psychology, pediatrics, social work, extension, family welfare, adult education and nutrition.

Physiology collaborates with physicians and specialists from different specialties like neurology, nephrology, cardiology, skin, orthopedics etc.

Food, Nutrition and Health has interdisciplinary collaboration with biochemistry, microbiology, dietetics, physicians and specialists in social medicine etc.

Home Management is concerned with housing, management, interior designing, soil, structural engineering, energy, carpentry, furnishing etc.

Fundamentals of Textiles and Clothing have interdisciplinary approaches to textiles chemistry, weaving, textile designing, fashion designing, garment production industries, and chemicals dyes etc.

Communication Skills works in collaboration with media, advertising, extension and information dissemination.

1.4. ROLE OF HOME SCIENCE IN NATIONAL DEVELOPMENT AND INTERNATIONAL INTEGRATION

National Integration is a mental attitude based on a feeling of oneness, common ideals of life and a common code of behavior. In India, one finds marked differences in the living standards, dress,

customs, religion, dietary habits, culture etc, of the various people living in different parts.

Regionalism, linguism, casteism, communalism etc. are the disruptive influences, which have divided Indian society into various groups. In this context it is the duty of the parents and teachers to inform the child to appreciate in definite and positive terms the faith, customs, manners and practices of all persons belonging to religions, language, regions other than his own.

The family is the primary socializing group in society.

It exerts the most fundamental and profound influence on every human being. Not only does it influence the child's basic personality but it also introduces him to the mores and values of the larger culture. In it lie the tremendous socio-psychological forces, which determine the behavior of the child for good or for evil. Similarly when the child enters school, the teachers and peer groups have a great influence on the child's outlook. In this context home science plays an important role in moulding the child's character and widening his thoughts, ideas, feelings etc, both at home and in school. Similarly a child gets to interact with people outside our country. This happens when she/he moves to foreign countries for studies, work etc. or after marriage or on exchange programs. Due to advancement in technology and communication, there is so much of influence and impact from other advanced countries. Media plays an important role in this. Mothers and teachers are responsible in directing the child to the right path in guiding him/her to choose the best of what is provided for him/her and ignore the rest.

Life cannot be sustained without adequate nourishment, good health, protective environment, good housing, managerial qualities/skills, empowerments, suitable resources, communication skills, high literacy levels and aspirations. All these are essential for national development. Home science is an integral course which builds an individual with all these qualities and thereby aims at development of individuals, his family, the community and the nation in large. Home science also encourages

children to participate in community extension activities and thereby make them realize their commitment to their society and less privileged and school dropouts in rural and urban areas.

One of the major roles played by Home Science in an individual's life is to make her/him to realize the need for extending the knowledge gained through formal education to the less privileged who are deprived of attending formal education. Hence we need to understand the meaning of extension education and the methods of non-formal teaching,

1.5 EXTENSION EDUCATION

Education is the production of desirable changes in human behavior changes in the social and cultural aspects of human life. The term social means anything related to human beings. **Extension education tries to develop the social behavior of the people**, their different social groups and the intra and inter relationship of these social groups.

The term culture means the socially standardized ways of feeling, thinking and acting which an individual acquires as a member of the society. The behavior of an individual is influenced, controlled and directed by culture. **Extension education helps in bringing about cultural development. The main function of extension education is to disseminate information to people who need this.**

Formal education is highly institutionalized, chronologically graded and hierarchically structured education system starting from primary school and reaching to university education. General or basic education is imparted in formal education methods in a formal atmosphere.

Non - formal education on the other hand is any organized, systematic, educational activity carried outside the framework of the formal system, to provide selected types of learning to particular subgroups in the population who cannot avail the benefits of the formal education. This will include school dropouts; young and old. For this informal methods of teaching and informal environment is used.

This non-formal system of education is referred to as adult education or extension education. It tries to bring out the following

types of changes in human behavior.

- a) Changes in knowledge and skills
- b) Changes in attitude
- c) Changes in practice

The specific objectives of the out of school system of education are

1. The fundamental objective is the development of the people.
2. To provide knowledge and help to enable the people work more effectively and efficiently.
3. To help people know the world and provide better opportunities for interaction.
4. To open up new opportunities for people to develop skills and talents and improve their standard of living.
5. To make people self-reliant and productive citizens of the society.
6. To promote better social, cultural, recreational, intellectual and spiritual aspects of the people.

1.5.1. Home Science Extension

When the concept of extension is extended to home science it is called Home Science Extension Education. Home science extension is an applied science which aims at bringing about changes in the behaviour of the less privileged through dissemination of science and technological information in the areas of home science.

The philosophy of Home Science Extension - this is based on the development of the individual, who is the most important component of the community and nation development. Every individual has the ability to solve his/her problem and in the process of solving these problems he/she learns, improves and develops. Home science extension aims at developing the human skills and abilities, disseminating suitable and important information or knowledge pertaining to the needs and problems of people and help them to bring about a change in their

practices and preconceived ideas so as to enable them to climb up the ladder towards individual and community and national development.

1.5.2 The broad objectives of Home Science Extension are

1. To promote all round development of all individuals in the home.
2. To assist individuals in the effective use of the available resources in solving their day-to-day problem.
3. To strengthen the work of the government and non governmental agencies in providing all round development of individuals through
 - a) Imparting knowledge on health, nutrition, home management, child development, their rights and responsibilities, modern technologies and other relevant information, which will lead to nutrition and social standards.
 - b) Developing functional and vocational skills like tailoring, food preservation, educational skills etc, which will help them in improving their economic status and empowerment of women especially.
 - c) Bringing about change in their attitude and practices aiming at increasing the literary levels, standard of living and ultimately community and national development.

1.5.3. Characteristics of Home Science Extension:

1. **It is a multidisciplinary approach** - It derives its body of knowledge from all sciences like physics, chemistry, physiology, nutrition and health, child development, textiles and clothing and also includes management, sociology, psychology, communication etc.,
2. **It is action oriented** - Home science extension refers to a series of activities, which impart knowledge on selected topics and help the target group to develop necessary skills for its application. Home Science extension education aims at action and results.
3. **It empowers women and youth** – In order to improve the

economic status this is essential. This technical advances are shared and they are made to work independently with better status in the community.

4. **Its results are intangible** – Change in attitude and knowledge is a slow process and results cannot be seen immediately. Sometimes it is difficult to perceive concrete results and should not be taken as a measurement for the effectiveness of a program.
5. **It is a two way process** – Home Science extension establishes a two-way communication channel by bridging the gap between centers of higher education and research and the beneficiaries. Now technology is transferred to the field through various communication media or methods and target groups are helped to realize importance of using it for improving their standard of living. Similarly the needs and problem of the people are communicated to specialists who in turn find solution to these and that is passed on through field workers.
6. **It is a need-based program** – Any home science extension program will exist or function only on needs of the people. It can be long-term or a short term need but without this no program for development can be planned.
7. **It is family oriented** – The very word home means the family and so home science extension aims at the overall development of every individual in the family young or old, men or women.
8. **It is voluntary** – There is no compulsion on the people to participate in home science extension programs. They are made to realize the need for developmental progress but accepting and participating in developmental programs is totally left to the people

.Differences between Formal and Extension Education

Formal Education	Extension Education
1. Teaching is largely confined to the premises of the institutions	Teaching is largely outside the four walls of the institutions.

2. The learners are homogenous with common goals, age, educational background experience, etc.	Are heterogeneous with diverse goals, vast difference in age, experience etc.
3. Strict adherence to institutional norms and no free choice.	Freedom and choice to learn what they want, when, how etc.
4. There is a fixed curriculum to be completed, evaluation and degree awarded. Formal teaching techniques are followed.	Curriculum is flexible, teaching is flexible and traditional methods used. Simple assessment is done. No degrees awarded.
5. Down flow of knowledge. Teacher → learners	Both downwards and upwards flow is found.
6. Starts with theoretical and includes practical work.	Practical solution converted to theoretical concepts.

1.6. GOVERNMENT AND NON-GOVERNMENT ORGANIZATIONS

A major percentage of Indian population lives in rural areas. Government and Non-governmental agencies play major role in planning and implementing programs for the development of the deprived section of our population, which constitutes mainly of women and children. Some of these programs have been discussed in the following pages.

1.6.1 Tamilnadu Corporation for Development of Women Limited (TNCDDW Ltd.)

In partnership with non-governmental organisations, banks, training institutions, and educational institutions the TNCDDW is implementing various development programs for women in Tamil Nadu since 1983.

The mission of this is **Empowerment of women** through collective action, skills upgradation for social and economic development.

This Corporation manages the following schemes:

1. Annai Bangaru Ammaiyaar Ninaivu Mahalir Thittam - a project to socially and economically empower poor women.
2. Vocational Training Programmes - women are trained in a trade and assisted in placement in a selected job subsequently.
3. Entrepreneurship Development Program - to train women in the art of entrepreneurship and starting small enterprises.
4. Empower women and adolescent girls through increased awareness to take better care of their personal and house hold health and nutrition issues.

Package of Services include

- Growth Promotion
- Selective supplementary nutrition
- Early childhood care and pre-school education
- Nutrition and health education
- Health services by health personnel
- Referral services.

Under the Nutrition Delivery Services

Supplementary food (Sathumavu) is given to selected children, mothers and pregnant women. For every 5000 population one health sub-center functioning which is looked after by a village health nurse, who in turn renders all the health services to the rural population. Communication activities have succeeded to greater extent in imparting knowledge.

Women's recreation centers provide a location for rural women to relax and exchange ideas.

1.6.2. World Bank Assisted Integrated Child Development Services III Project (ICDS)

In continuation of Tamil Nadu Integrated Nutrition Project II (TINP) government of India gave their approval to implement the ICDS scheme with effect from 1st January 1998 in all the 318 Blocks for a period of 5 years. Specific objectives of World Bank Assisted ICDS III Project are,

1. Improve nutrition, health and psycho-social status of 0-6 years of age with particular emphasis in preventing malnutrition in under 3 years and improve child care practices at the house hold level.
2. Improve nutrition and health of women particularly pregnant and lactating mothers and adolescent girls and changing attitude and creating desirable changes in several health and nutrition behavioral issues. Pre-school education is one of the major activities of this scheme. Monitoring and evaluation of the project at various levels is performed regularly.

1.6.3. Department of Social Defence

The Government of Tamil Nadu is entrusted with the task of providing services for the development of children found in difficult circumstances and the girls and women requiring care, treatment and rehabilitation. This includes institutional and non-institutional services. The Department is also involving the non-governmental organisation in all programs to ensure protection of the rights of the children and for their congenial development.

The Director of Social Defence is the coordinator for the non-governmental organization implementing programs for drug abuse control and prevention, funded by the Ministry of Social Justice and Empowerment, Government of India.

Beneficiaries of this program are

- Neglected children
- Delinquent children
- Street children
- Children abused

- Stranded girls
- Women and girls in moral danger

1.6.4 Swarna Jayanthi Gram Swarozgar Yojana (SGSY)

Integrated Rural Development Program (IRDP) was the self-employment program to start with. Over the years, a number of allied programmes were added such as Training of Rural youth for Self Employment (TRYSEM), Development of Women and Children in Rural Areas (DWCRA), etc. Due to absence of linkages among these programs Government of India decided to restructure the self-employment programmes. These programmes and the Million Wells Scheme (MWS) were merged into one comprehensive program called SGSY. This is a holistic program covering all aspects of self-employment such as organization of the poor into self-help groups, training, credit, technology, infrastructure, and marketing. The products for marketing are named “Poomalai”.

1.6.5. Solutions - Child labour

International commitments - India has accepted the Convention on The Rights of the Child, concluded by the U.N General Assembly. The International Labour Organization has been playing an important role in the process of gradual elimination of child labour and to protect the child from individual exploitation. The Government is determined to eliminate all forms of child labour by 2020. Indeed, poverty eradication combined with educational forms to provide free or-affordable access to quality education with an interesting, innovative and job-oriented curriculum for all, can effectively eliminate child labour once and for all.

1.6.6. Women’s Voluntary Service (WVS)

The main objective of this organization is to promote welfare activities for the poor. Many functional literacy centers are functioning in and around Chennai. They also have economic and developmental programs. This organization is aided by State Social Welfare Board.

1.6.7. Central Social Welfare Board (CSWB)

Under this program, voluntary institutions are extended financial assistance for a variety of welfare activities for children, women, handicapped, aged and infirm, to strengthen and improve the existing services and also to take up new services coming within the purview of the Board.

- I. Welfare Services to children includes
 1. Residential Institutions for children
 2. Short-Stay Home
 3. Creches / Balwadi etc.
- II. Welfare Services for women
 1. Institutional or residential house for destitute, widows in distress.
 2. Short stay homes
 3. Family counselling
 4. Maternity center
 5. Vocational training
 6. Literacy and recreational services
- III. Welfare for the handicapped.
 1. Institutional and Rehabilitation centers for various disabilities.
 2. Hostels for working handicapped persons.
- IV. Welfare Services in Medical Institutions.
- V. Welfare Service for the aged and infirm,

Home for the senior civilization.
- VI. Rehabilitation for the cured leprosy and T.B. Patients.

1.6.8 Special welfare measures for women and children

The main focus of programmes for women is to ensure their social and economic empowerment. The strategy comprises attitudinal change

towards girl child, education, training, employment, support services and emphasis on women's rights and law.

Indira Mahila Yojana (IMY): The IMY which aims at empowerment of women was launched during 1995-1996 in 200 blocks. Based on the findings of the Joint Study Team of the Planning Commission, to recast IMY with the awareness generation and training component has recently been approved to overcome the existing weaknesses, as a mid-term correction. The Mahila Samridhi Yojana (MSY) has been merged with IMY.

The MSY was launched in 1993. Under MSY every rural adult woman was encouraged to have her MSY account in the post office, which has jurisdiction over her village. For an amount of Rs. 300 in a year, the government contributes 25 per cent as incentive. The main aim of the programme was to promote thrift among women and to empower them with control over their household assets.

Balia Samridhi Yojana: The BSY, launched in 1997 with the specific aim of changing the community's attitude towards the girl child has been further recast in June 1999. Earlier, the mother of a girl child born on or after August 15, 1997 in a family below the poverty line in rural and urban areas was given a grant of R. 500. In the recast scheme, the post-delivery grant of Rs. 500 per child is deposited in an interest-bearing account in the name of the newborn girl child. In addition, the benefit of scholarships approved will also be deposited in the same account.

1.7 ADULT EDUCATION

The National literary Mission (NLM) launched in 1988 aims at attaining functional literacy among 100 - million persons in age group of 15-35. The goal of the NLM is to attain full literacy by 2005. Special focus is on the promotion of literacy among women SC/ST and backward classes.

After analyzing some of the programmes for women and children, let us glance through some of the statistics on population rate, literacy

levels, health status and other relevant information, which will help students to know about our country at a glance.

General features of Indian demography

1. A population too large for the area of the country.
2. An overwhelming proportion of rural population
3. High growth rate of population
4. Less production in terms of demands.
5. Low sex ratio,
6. High percentage of non-workers.
7. Low literacy levels.
8. Low nutritional status.
9. Lop sided age structure and
10. Ethnic diversity.

Population totals 2001 (india)

Persons 102, 70, 15, 247

Males 53, 12, 77, 078

Female 49, 57, 38, 169

Literates

Persons 56, 67, 14,995

Male 33, 99, 69,048

Female 22, 67, 45,947

	crude birth rate	infant mortality rate
1998	26.4%	72%
2002	23.0%	50%

Percentage of population below poverty line in Tamilnadu

	Tamil Nadu	In India
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1993 - 1994	35.03%	35.97%
1999 -2000	21.12%	26.10%

- Thirty three percent of worlds poor live in India.
- Twenty five million people in India are homeless.
- One hundred and seventy million people don't have access to clean drinking water.
- Fifty three percent children below 5 years are underweight.

Monitorable targets (tenth plan)

- Reduction of poverty ratio to 20 percent by 2007 and to 10 per cent by 2012.
- Gainful employment to the addition to the labour force over the Tenth Plan Period .
- Universal access to primary education by 2007.
- Reduction in the decadal rate of population growth between 2001 and 2011 to 16.2 per cent.
- Increase in literacy to 72 per cent by 2007 and to 80 per cent by 2012.
- Reduction of infant mortality rate (IMR) to 45 per 1,000 live births by 2007 and to 28 by 2012.
- Reduction of maternal mortality ratio (MMR) to 20 per 1,000 live births by 2007 and to 10 by 2012.
- Increase in forest and tree cover to 25 percent by 2007 and 33 percent by 2012.
- All villages to have access to potable drinking water by 2012.
- Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012.

RELATED EXPERIENCE

- 1) Visit to an ICDS centre to observe the functioning of the

programmes.

- 2) Visit to an adult education center to observe the non-formal education program.
- 3) Collect picture and photographs to understand
 1. The different disciplines of home science.
 2. Home science and national development.
 3. Home science and international integration.

QUESTIONS

Section - A

I. Fill in the blanks

- a) _____ million people in India are homeless.
- b) _____ percent of children below 5 years are underweight.
- c) The goal of NLM is to attain full literacy by _____
- d) Population of India as per 2001 census is _____
- e) In Tamilnadu the percentage of population below poverty line as per 1999-2000 census is _____

II. Expand the following

- a) IMR
- b) NLM
- c) C S W B
- d) WVS
- e) S G S Y

Section - B

1. Explain the term Extension Education.
2. What are the three behavioral changes brought about by the non-

- formal education?
3. Describe the role played by the national literacy mission.
 4. What is the function of the science of the home?
 5. Why is home science extension a two way process?
 6. Who are the beneficiaries of the programs implemented by the department of social defence?
 7. Explain the objectives of the Women's Voluntary Service.

Section - C

1. List any six targets that will be achieved by the end of the tenth plan.
2. List any six features of Indian demography.
3. Why was Bala Samriddhi yojana launched?
4. Write on the organization working towards elimination of child labour.
5. Write on SGSY.
6. Write on the activities of the department of social defence.
7. What is the package of services offered by the Tamilnadu Corporation for Development of Women?
8. Write a short note on the Home Science Association of India.
9. Highlight on the history of home science in India.
10. Give six reasons for introducing home science at the secondary school level.

Section - D

1. Write on the Central Social Welfare Board.
2. Write on the World Bank Assisted Integrated Child Development Services III project.
3. What are the differences between formal and extension education.

4. Give the characteristics of home science extension education.
5. Home science is an interdisciplinary course. Explain.
6. Discuss the role of home science in national development and international integration.
7. Describe the out-of -school system of education.

2. PHYSIOLOGY

2.1 INTRODUCTION TO HUMAN PHYSIOLOGY

Physiology is the study of different organ systems and the functions of the human body. As small children we begin to wonder what enables people to move, how it is possible for them to talk, how they can see the world and feel the objects around them, what happens to the food they eat, how they derive from food the energy needed for exercise and other types of bodily activity, by what process they reproduce so that life goes on. All these and other human activities make up life. Physiology attempts to explain them.

2.1.1 The various organs and systems of the human body

They are the skeletal system, muscular system, nervous system, circulatory system, respiratory system, the gastrointestinal system, excretory system and the reproductive system.

The skeletal system includes the bones of the skull, face, vertebral column, ribs and sternum, shoulder girdle and pelvic girdle.

Muscular system consists of various muscles that are attached to the bones with the tendons. Muscles move the limbs and other parts of the body in directions allowed by the ligaments.

The nervous system is composed of the brain, the spinal cord and the peripheral nerves that extend throughout the body. The nervous system controls many of the bodily activities, especially that of the muscles.

The nervous system is composed of two portions *-the sensory portion and the motor portion*. The sensory portion relays information to the brain through the senses of sight, hearing, smell, taste and feel. Motor portion relays information from the brain to the muscles to react accordingly.

Circulatory system is composed mainly of the heart and blood vessels. The blood acts as a transport system for carrying substances.

The circulatory system carries nutrients to the tissues and carries waste products away from the tissues. A special accessory circulatory system known as the lymphatic system takes care of dead tissues and dead bacteria.

The respiratory system consists of the air passages and the lungs. Air moves in and out of lungs by contraction and relaxation of the respiratory muscles. The exchange of gases namely O₂ and CO₂ takes place via the lungs.

The gastrointestinal system begins from the mouth where food after being swallowed enters the stomach, then the small intestine and the large intestine, finally to be excreted as feces through the anus. During the passage of food through the gastrointestinal tract, food is digested and nutrients are absorbed.

Excretory system comprises of the kidneys which help in removing unwanted substances from the blood. Kidneys also regulate concentrations of ions such as sodium and chloride, potassium, magnesium and many other substances.

The reproductive systems of the male and female are essential to provide for life's reproduction. The female provides the egg (ovum) which has to be fertilized by a sperm from the male, from which a new human being develops.

Thus it should be obvious that no single part of the human body can live by itself. The human animal is a sensing, thinking and motile organism which can adapt itself to its surroundings. In the framework of the organs and tissues, there are about 75 trillion individual cells, each one of which is a living structure. The next chapter will describe the structure and function of the cell that makes the human body possible.

2.2. CELL

The basic functional unit of the body is the cell. The cells are the building blocks of the organs and each of these organs performs its own specialized function.

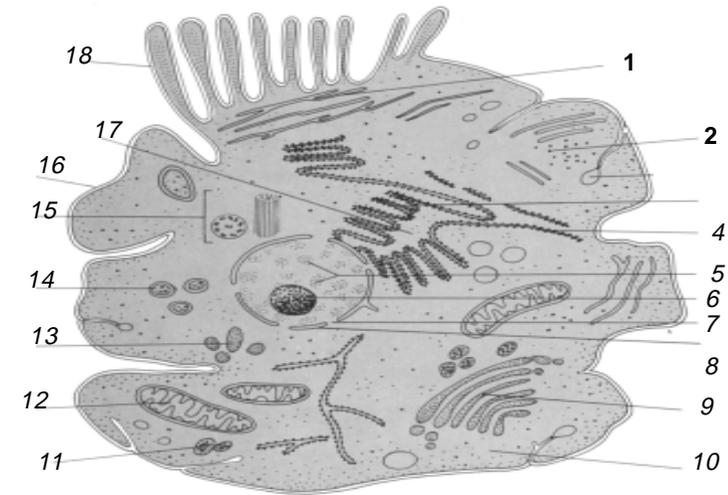


Fig. 1. Structure of the Cell

- | | |
|---|---------------------------------------|
| 1. smooth endoplasmic reticulum | 10. cytoplasm |
| 2. free ribosomes | 11. granules |
| 3. ribosomes on rough endoplasmic reticulum | 12. mitochondrion |
| 4. rough endoplasmic reticulum | 13. lysosome with digestive enzymes |
| 5. chromatin | 14. vesicle |
| 6. nucleolus | 15. centrioles with microtubules |
| 7. pore | 16. plasma membrane |
| 8. membrane | 17. cisterna of endoplasmic reticulum |
| 9. golgi apparatus | 18. microvilli |

A typical cell is composed of nucleus and various organelles. The cell is filled with a colloid type of material called **protoplasm**. This is divided between 2 separate compartments. The nuclear compartment that contains **nucleoplasm** and the compartment outside the nucleus containing **cytoplasm**. The nucleoplasm is separated from the cytoplasm

by the **nuclear membrane**. The cytoplasm is separated from the surrounding fluids by the **cell membrane**.

The protoplasm is composed mainly of 5 basic substances

- water,
- electrolytes such as potassium, magnesium, phosphate, bicarbonates and small amounts of sodium and chloride,
- proteins,
- lipids and
- carbohydrates.

The cell contains highly organized physical structures called **organelles** which are important for the functions of the cell. Some principal organelles of the cell are the cell membrane, nuclear membrane, endoplasmic reticulum, golgi complex, mitochondria and lysosomes.

Cell membrane

The cell membrane is thin and elastic, composed entirely of proteins and lipids. The structure shows a central layer of lipid covered by protein layers. The protein layer contributes to the structural strength of the membrane, also acts as carrier for transporting substances through the membrane.

Endoplasmic Reticulum (ER)

This is a network of tubular structures found in the cytoplasm. The endoplasmic reticulum is continuous with the nuclear membrane and with the inner chambers of the golgi complex. It connects directly through small openings with the exterior of the cell. The main function is transporting substances formed in different parts of the cell which enter the endoplasmic reticulum and are conducted to other parts of the cell. There are two types of ER:

a) Granular ER : This type of ER contains many small granular particles called ribosomes which are attached to the outer surface. The

ribosomes contain ribonucleic acid (RNA) which is necessary for protein synthesis.

b) Agranular ER : This type of ER contains no ribosomes attached to it. This is otherwise known as smooth ER. This helps in synthesizing lipid substances.

Golgi complex

This is a specialized derivative of the endoplasmic reticulum. It is usually composed of 4 or more layers of thin vesicles. The golgi complex is very prominent in secretory cells. It's function is believed to be temporary storage and condensation of secretory substances and preparation of these substances for final secretion. It also synthesizes carbohydrates and combines it with protein to form **glycoproteins**. eg: mucopolysaccharide ground substance of both cartilage and bone. The golgi complex is also involved in formation of lysosomes which are important for digesting intracellular substances.

Mitochondria

The mitochondria are composed of a double - layered membrane, an outer membrane and an inner membrane. Many infoldings of the inner membrane form shelves onto which oxidative enzymes of the cell are attached. The inner cavity of the mitochondrion is filled with a gelatinous matrix containing enzymes. Mitochondria are the '**power-house**' of the cell. They provide most of the energy needed for performing cellular functions.

Lysosomes

These are spherical organelles surrounded by a membrane. The lysosomes provide an intracellular digestive system that allows the cell to digest and remove unwanted substances and structures, especially foreign bodies such as bacteria.

Nucleus

The nucleus is the control center of the cell. The nucleus consists of a double walled **nuclear membrane** with pores, chromatin material

throughout the nucleoplasm which becomes **the chromosomes** during cell division, and a protein structure called nucleolus. The nucleolus contains large amounts of RNA. The nucleus controls chemical reactions of the cell and cell reproduction. The nucleus contains large amounts of DNA which are important in cell division. The chromosomes consist of DNA and protein,

2.2.1 Cell division

Each human cell contains 46 chromosomes arranged in 23 pairs. In general, the genes in the two chromosomes of each pair are almost identical with each other, except for the sex chromosomes.

Cell division or multiplication takes place by two processes - mitosis and meiosis.

Mitosis

The process by which the cell splits into two new cells is called **mitosis**. Mitosis begins once the DNA has been duplicated and each chromosome has split to form two new chromosomes.

Mitosis takes place in a series of consecutive stages beginning from prophase, metaphase, anaphase and telophase.

Prophase : In this stage the chromatin material of nucleus gets condensed. Chromosomes can be seen each made up of 2 **chromatids** joined at the **centromere**. **Centrioles**, which are small cylindrical bodies, lie in the cytoplasm and move away from each other to the opposite poles of the cell. **Microtubules, which are thick protein filaments**, form a spindle between the two centrioles and radiate to form **astral rays**. The nucleoli and nuclear membrane disappear.

Metaphase : During this phase the chromosomes are pulled by the attached microtubules to the center of the cell lining up in the equatorial plane.

Anaphase : The spindle grows further and each pair of chromosomes is now broken apart at the Centromere. All the chromosomes are grouped. Thus all 46 pairs of chromosomes are

separated, forming 46 daughter chromosomes that are pulled toward one pole by mitotic spindle and 46 chromosomes pulled to the other end.

Telophase : The spindle fibers disappear. New nuclear membrane develops around each set of chromosomes. The cell pinches in two midway between the two nuclei, thus forming two daughter cells.

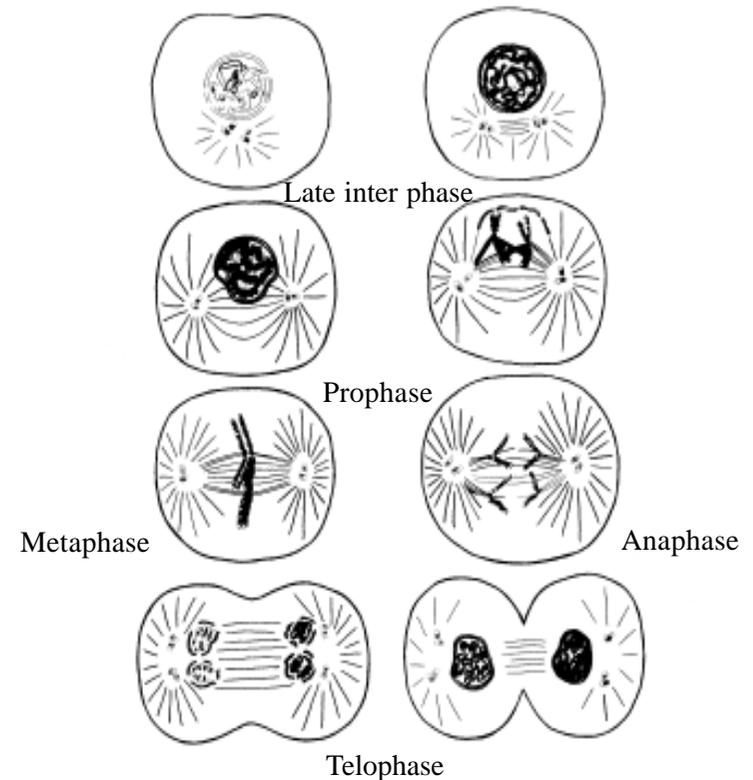


Fig. 2 - Stages of Mitosis

2.2.2. Meiosis

This is the process of cell division that occurs in the reproductive cells, i.e. ova and spermatozoa. In meiosis the chromosomes do not replicate as they do in mitosis. Instead, the pairs of chromosomes separate and one from each pair moves to the opposite poles of the parent cell. When it divides each of the daughter cells has only 23 chromosomes i.e. half the number of chromosomes or haploid number. During fertilization of the ovum with the spermatozoa, the resultant zygote will have the full complement of 46 chromosomes, half from the father and half from the mother.

2.2.3. Cancer

Cancer can occur in any tissue of the body. It results from a change in certain cells that do not follow normal growth limits and begin to multiply at an erratic rate. A **tumour** forms when the rate of cell multiplication is greater than that of cell death. The reasons for this uncontrolled cell multiplication are not known. Some factors are known to increase changes found in tumour cells. The process by which normal cell becomes cancerous in nature is called **carcinogenesis**. The agents that lead to this are called **carcinogens**.

Examples of carcinogens:

Environmental agents such as chemicals, irradiation and oncogenic viruses.

Chemical carcinogens

1. Aniline dyes
2. Arsenic compounds
3. Asbestos
4. Benzene derivatives
5. Cigarette smoke
6. Nickel compounds
7. Some fuel oils
8. Vinyl chloride.

Radiation carcinogens

X-rays, radioactive isotopes, environmental radiations and ultraviolet rays in sunlight.

Oncogenic viruses

Viruses, some consisting of DNA and some of RNA can cause mutation and thereby cancer.

2.2.4 Transport of substances through the cell membrane

Substances are transported through the cell membrane by 2 major processes.

1. Diffusion
2. Active transport.

Diffusion : This is the physical process involved in the ‘downhill’ movement of substances, i.e. from a higher concentration on one side to a lower concentration on the other, without the use of energy.

Active transport : This is the ‘uphill’ transport of substances across the membranes, i.e. from a lower concentration on one side to a region of higher concentration with the use of energy.

2.3 SKELETAL SYSTEM

Skeletal System forms the framework of the body. It provides support and protection for some of the soft organs. The adult human skeleton consists of approximately two hundred and six (206) bones grouped in two principal divisions,

1. The axial skeleton
2. The appendicular skeleton

The axial division of the skeleton consists of the bones that lie around the axis. The parts of the axial skeleton are the skull, hyoid bone, auditory ossicles, vertebral column, sternum and ribs. Appendicular skeleton consists of the bones of the girdle and the upper and lower limb.

2.3.1 Axial skeleton

The Skull

It is the bony framework of the head arranged in two parts - the cranium which consists of eight bones and the facial skeleton of fourteen bones.

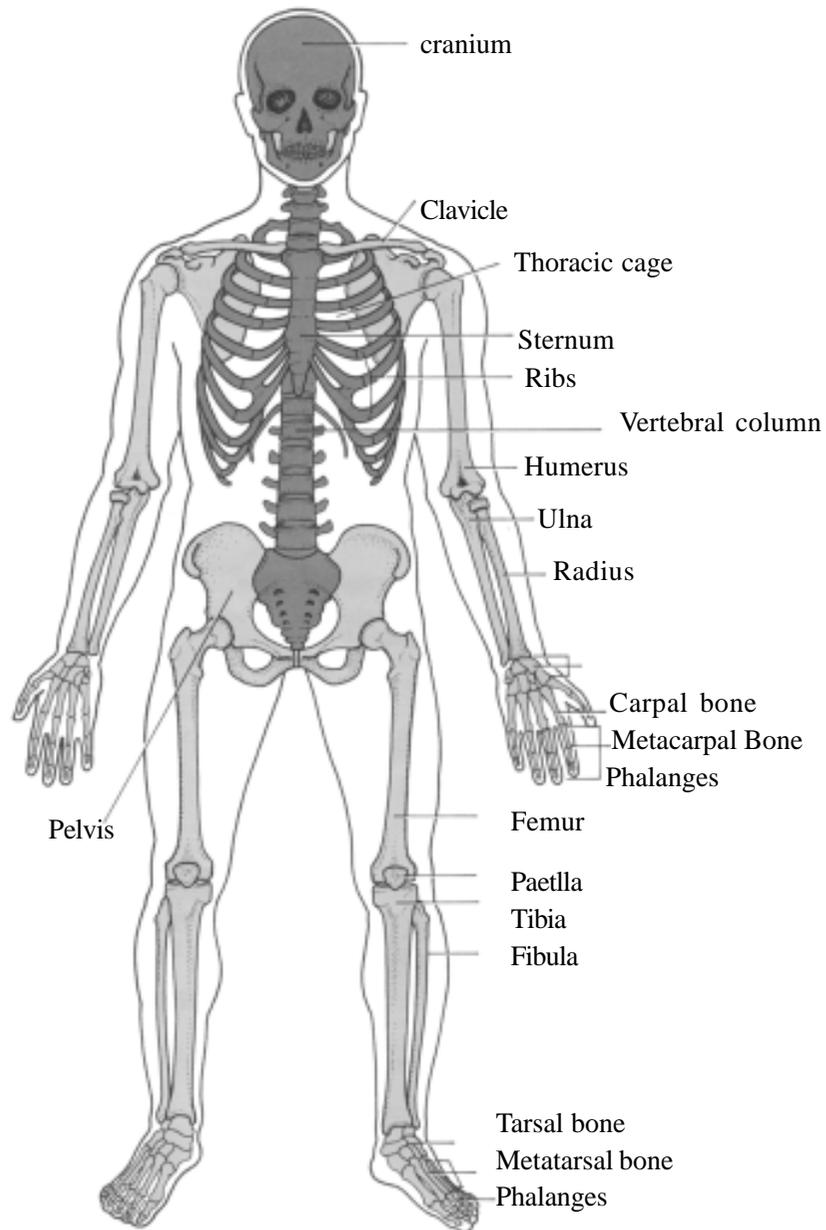


Fig. 3 - The Skeleton, Anterior view

The cavity of the cranium presents an upper surface known as the vault of the skull. This is smooth on the outer surface and marked by ridges and depressions to accommodate the brain and its blood vessels on the inner surface. The lower surface of the cavity is known as the base of the skull. It has an opening called the **foramen magnum** through which the spinal cord passes.

The bones which form the Cranium are flat bones which are immovably fixed to each other by sutures. The cranial bones enclose and protect the brain and organs of sight, hearing and balance. The 8 cranial bones are:

The frontal bone (1), Parietal bones (2), temporal bones (2), the occipital bone (1), sphenoid (1) and ethmoid (1).

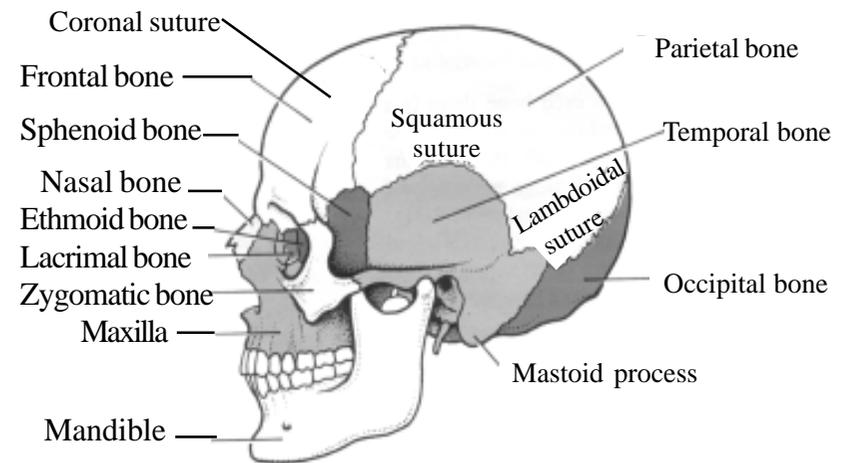


Fig. 4. Structure of the skull

The **occipital bone** is at the back and lower part of the Cranial cavity. It is pierced by the foramen magnum through which the medulla oblongata passes to join the spinal cord.

The two **parietal bones** together form the roof and sides of the skull. The outer surface is smooth. The inner surface is marked by deep furrows which lodge the Cranial arteries.

The **frontal bone** forms the forehead and the upper part of the orbital cavities.

The two **temporal bones** form the lower part of the sides of the skull.

The **ethmoid** is a light spongy bone, cubical in shape, situated at the roof of the nose wedged in between the orbits. It is the principal supporting structure of the nasal cavity.

The **sphenoid** is situated at the anterior part of the base of the skull.

Sutures : A suture is an immovable joint found only between skull bones. Very little connective tissue is found between the bones of the suture.

The four prominent skull sutures are :

1. **Coronal Suture** between the frontal bone and the two parietal bones.
2. **Sagittal Suture** between the two parietal bones.
3. **Lambdoidal suture** between the parietal and the occipital bone.
4. **Squamosal suture** between the parietal and the temporal bones.

Bones of the face

There are 14 facial bones, which are the nasal bones (2), Maxillae (2), Zygomatic bones (2), Mandible (1), Lacrimal bones (2), Palatine bones (2), Inferior nasal conchae (2) and Vomer (1).

The Vertebral Column or the spinal column is a flexible structure formed by a number of bones called **Vertebrae**. They are the back bone which forms the main axis of the body to which all other skeletal parts are attached.

The vertebral column has three functions.

1. It supports the flexible body.
2. It provides attachments for muscles which permits flexible movements.
3. It provides protection for the spinal cord.

There are 33 vertebral bones. 24 of which are separate bones and the remaining vertebrae are fused to form two bones, the sacrum and the coccyx. The vertebrae are grouped and named according to the region they occupy. There are,

1. Seven **Cervical** Vertebrae that form the neck or Cervical region.
2. Twelve **thoracic** vertebrae that form the back of the thorax or chest.
3. Five **lumbar** vertebrae that form the lumbar region or loins.
4. Five **Sacral** vertebrae that are fused to form the sacrum.
5. Four **Coccygeal** vertebrae that are fused to form the Coccyx or tail.

The vertebrae in the three upper regions that remain separate are called **movable vertebrae**.

Those in the two lower regions the Sacrum and Coccyx are united in the adult to form two bones called the fixed vertebrae.

The vertebral Column consists of primary curves (thoracic and sacral) and secondary curves (cervical and lumbar). The curves give strength, support and balance.

Fig-5 gives the detailed description of various parts of the vertebral column which includes the cervical vertebrae, thoracic vertebrae, lumbar vertebrae, the sacrum and coccyx.

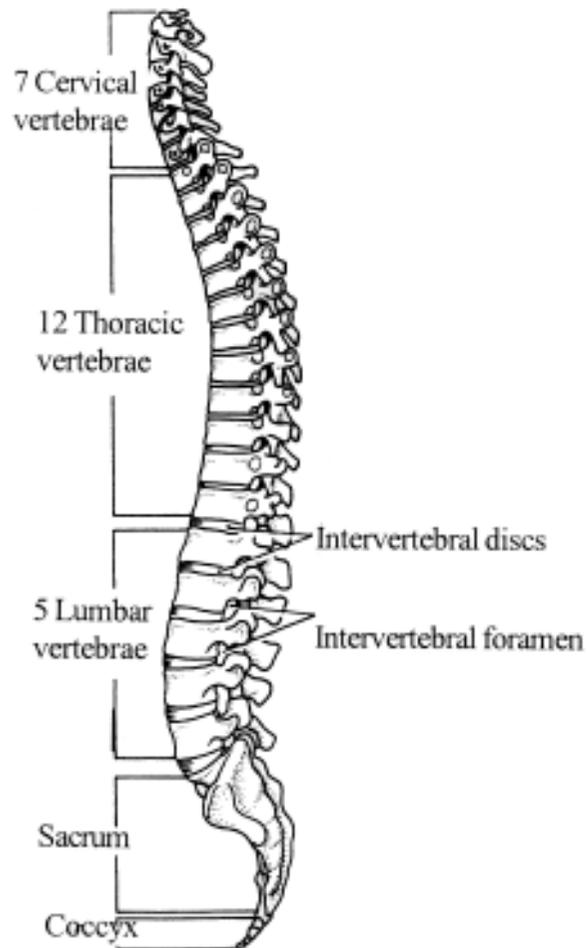


Fig. 5 - Vertebral Column

The first two cervical vertebrae are called **Atlas** or **Axis**.

The Atlas is a mere ring of bone with surface for resting the skull. The second cervical vertebra is the Axis. It has an upward projection called the **odontoid-process** which projects

through the ring of the Atlas and forms a pivot on which the head turns from side to side. The skeletal framework of the neck consists of five cervical vertebrae which are designed with shape of flat discs placed one on the other.

ANTERIOR ASPECT

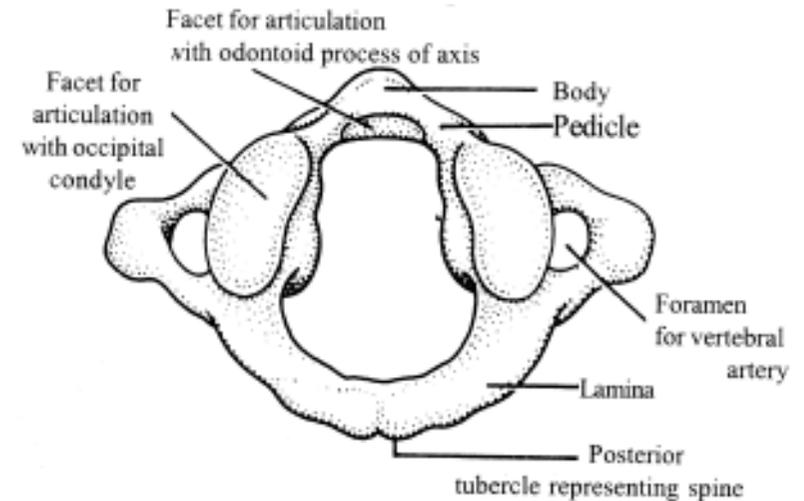


Fig. 6a - Atlas

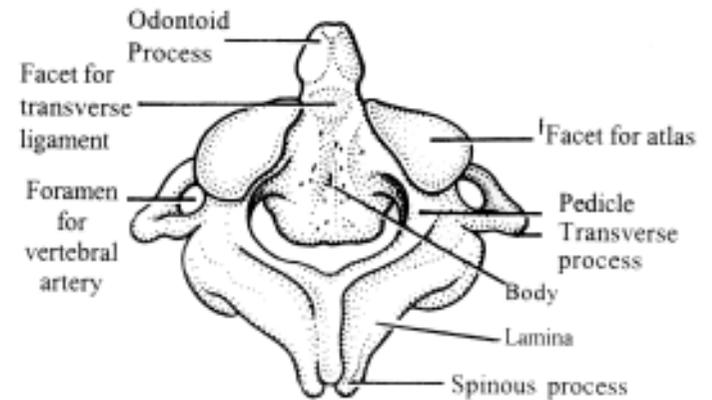


Fig. 6b - Axis

Ribs and Sternum

The thoracic vertebrae, ribs and sternum make up the thoracic basket. The skeleton of the thorax acts as a protective cage around the heart and lungs.

There are 12 pairs of movable ribs on the sides of the chest cavity. A rib is a flattened curved bone. The first upper seven pairs of ribs are the **true ribs**. These ribs articulate with the thoracic vertebrae at the back and are attached directly (separately) to the sternum by costal cartilages in front. The last five pairs of ribs are the **false ribs**. They also articulate with the thoracic vertebrae at the back, but all are not attached with the sternum in front. The 8th, 9th and 10th pairs of ribs on each side are attached with the cartilages of the rib just above to it and are joined to the sternum indirectly. The 11th and 12th pairs are free in front and do not attach to the sternum. They are called the **floating ribs**.

Sternum (or) Breast Bone

The Sternum or breast bone is a flat bone divided into three parts – the upper manubrium, the middle body gladiolus and the lower small cartilaginous xiphoid process. The collar bone articulates with the manubrium of the sternum.

2.3.2. Appendicular Skeleton

Shoulder Girdles

The shoulder or pectoral girdle attaches the bone of the upper extremities to the axial skeleton.

Structurally, each of the two shoulder girdles consists of two bones, a clavicle and a scapula. The **clavicle** or collar bones are long slender bones with a double curvature. The two bones lie horizontally in the superior and anterior part of the thorax, superior to the first rib.

Scapulae or shoulder blades are large, triangular flat bones situated in the dorsal part of the thorax between the levels of the second and seventh rib.

The upper limbs consist of 60 bones. The skeleton of the upper limb includes a humerus in each arm, an ulna and radius in each forearm,

carpals or wrist bones, meta-carpals which are the palm bones and phalanges in the fingers of each hand.

The **humerus** or arm bone is the longest and largest bone of the upper limb. **Ulna** is the medial bone of the forearm. **Radius** is the lateral bone of the forearm.

The **carpus** or wrist consists of eight small bones united to each other by ligaments. The bones are arranged in two transverse rows, with four bones in each row. The five bones of the metacarpus constitute the palm of the hand. Each metacarpal bone consists of a proximal base, a shaft and a distal head.

The **phalanges** or bones of the fingers number 14 in each hand. There are 2 phalanges in the thumb and 3 bones in each of the remaining 4 fingers.

Pelvic Girdle : It consists of two coxal bones called pelvic or hip bones. It provides a strong and stable support for the lower extremities on which the weight of the body is carried. The coxal bones are fused together and are attached to the sacrum of the vertebral column.

The pelvic girdle serves as a basis to shelter some important organs of the abdominal cavity. The basin-shaped cavity is called as pelvis which is larger in females than in males. Each hip bone is formed of three bones firmly united with one another. They are the ilium, ischium and pubis. The **ilium** is the upper flat part which is connected to sacrum. The **ischium** is the lower most part of the hip bone. The **pubis** is the front part of the hip bone. The two pubis bones meet in front by a cartilage called **pubis symphysis**. Between the pubis and ischium is a hole in each hip bone. On each outside of the hip bone where the three bones meet is a deep socket known as **acetabulum**. The head of the thigh bone (femur) fits into it and hip joint is formed.

The lower extremities are composed of 60 bones. These include the femur of each thigh, each kneecap, the fibula and tibia in each

leg, the ankle bones in each ankle, the metatarsals and phalanges of each foot.

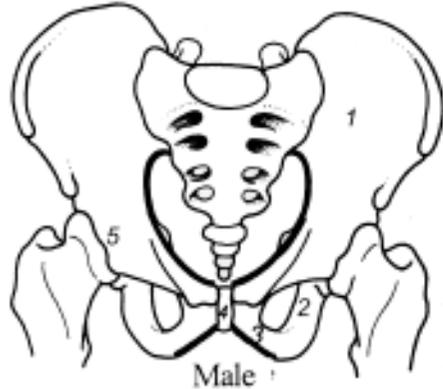
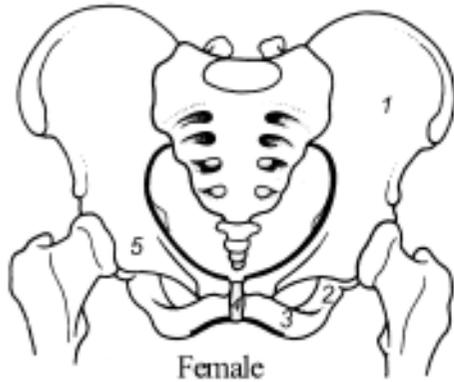


Fig. 7 - Difference in shape of Male and Female Pelvis

- | | | |
|--------------------|---------------|----------|
| 1. Ilium | 2. Ischium | 3. Pubis |
| 4. Symphysis pubis | 5. Acetabulum | |

The **femur** or thigh bone is the longest and heaviest bone in the body. Its proximal end articulates with the coxal bone. Its distal end articulates with the tibia.

Patella or knee cap is a small, triangular bone anterior to the knee joint.

Tibia and fibula : Tibia is the longer bone of the leg. It bears the major portion of the weight on the leg. The fibula is smaller than the tibia. The tarsus contain seven bones of the ankle. It has a broad, flat surface. The metatarsus consists of five metatarsal bones. It is thicker than others because it bears more weight. The phalanges of the foot resemble those of the hand both in number and arrangement.

2.3.3 Diseases of Bones

Osteoporosis

In this condition the amount of bone tissue is reduced due to low calcium intake. The bones become porous and fragile and can easily result in fractures. This is usually seen among women after menopause on a low calcium diet.

Osteomalacia

This occurs due to vitamin D deficiency in adults. The bones become soft and bowed. Vitamin D is necessary for calcification of bones and calcium absorption from the intestine.

2.3.4. The Joints of the Skeleton

The region in which two or more bones meet is known as joint. Bones are joined to one another in different ways. Some are fused together and show no movement. The union of the bones of the cranium is an example to this. The joints of the vertebrae show little movement. In some other joints like shoulder joint, hip joint etc., the bones are freely moving. In tightly fitted joints, movement is restricted. The greater the movement, the looser the fit. Unfortunately loosely fitted joints are prone to dislocation. Movement at joints is determined by the flexibility of the connective tissue that binds the bones together and by the position of ligaments, muscles and tendons.

Classification : The joints are classified into three types as

- (1) immovable joints
- (2) slightly movable joints
- (3) freely movable joints.

Fibrous joints are immovable joints in which no movement between the bone is possible. **Cartilaginous joints** are slightly movable joints in which the joint surfaces are separated by some intervening substance and slight movement only is possible. e.g. the intervertebral joints with their intervertebral discs of fibro-cartilage.

Synovial joints are freely movable joints of which there are several varieties. The ends of bones which enter into the formation of the joint are covered by hyaline cartilage. **Ligaments** are required to bind the bones together. Synovial membrane lines the joint cavity and secretes fluid to lubricate the joint.

Types of Synovial joint

Gliding : The articulating surface of bones in gliding joints are usually flat. Only side to side and back-and-forth movements are permitted. Twisting and rotation are inhibited because ligaments or adjacent bones restrict the range of movement. e.g. the joints between carpal bones, tarsal bones, the sternum and clavicle, and the scapula and clavicle.

Hinge : It is characterized by the convex surface of one bone that fits into the concave surface of another bone. The motion is similar to that of a hinged door. e.g. joints in the elbow, ankle and inter-phalangeal joints.

Pivot: Here a rounded, pointed or conical surface of one bone articulates with a shallow depression of another bone. e.g. the joints between the atlas and axis, between the proximal end of the radius and ulna, and rotation of the head from side to side.

Ball and Socket: Consists of a ball-like surface of one bone fitting into a cup-like depression of another bone. Shoulder joint and hip joint are examples.

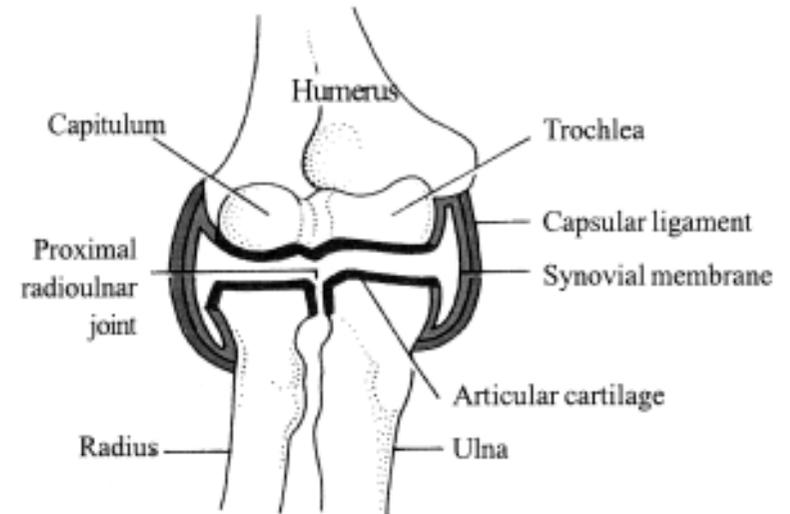


Fig. 8a - Elbow Joint - Section Viewed from Front

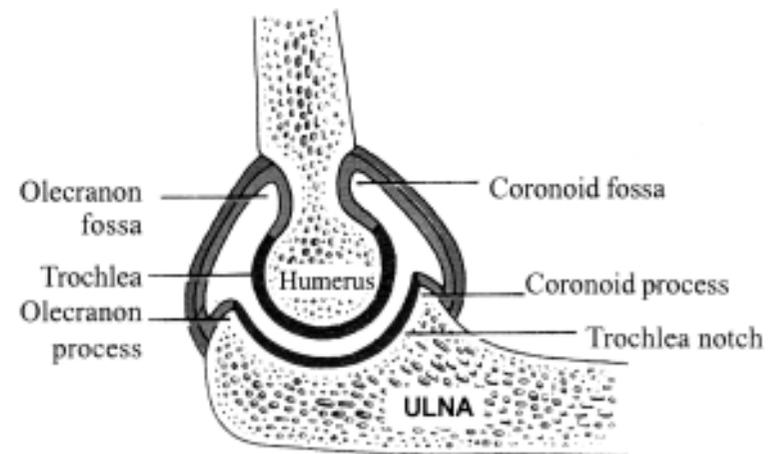


Fig. 8b - Elbow Joint - Section viewed from side

2.4 MUSCLE PHYSIOLOGY

All physical functions of the body involve muscle activity. These functions include skeletal movements, contraction of the heart, contraction of blood vessels, peristalsis in the digestive tract and many more.

There are 3 different types of muscle tissues responsible for these activities.

1. Skeletal, Voluntary or striated muscle.
2. Visceral, involuntary or smooth muscle.
3. Cardiac muscle.

Skeletal muscle tissue

This may be described as skeletal, striated, striped or voluntary muscle. It is called voluntary because contraction is under the control of the will.

When voluntary muscle is examined microscopically the cells are found to be roughly cylindrical in shape and may be as long as 35 cm. Each cell, commonly called a fiber, has several nuclei situated just under the **sarcolemma**, or cell membrane of each muscle fiber.

The muscle fibers lie parallel to one another, and when viewed under the microscope, they show well-marked transverse dark and light bands, hence the name striated or striped muscle.

A **muscle** consists of a large number of muscle fibers. In addition to the **sarcolemma** mentioned previously, each fiber is enclosed in and attached to fine fibrous tissue called **endomysium**.

Small bundles of fibers are enclosed in **perimysium**, and the whole muscle in **epimysium**.

The fibrous tissue enclosing the fibers, the bundles and the whole muscle extends beyond the muscle fibers to become the **tendon** which attaches the muscle to bone or skin.

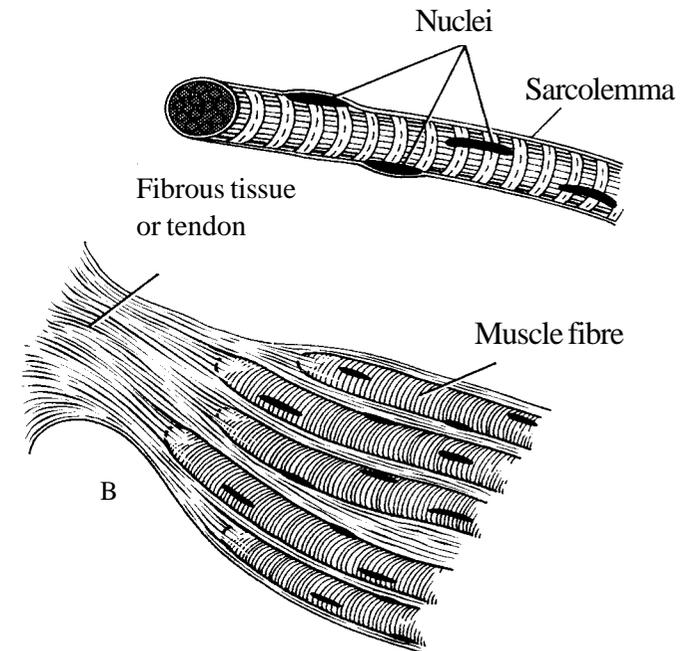


Fig. 9 - Skeletal Muscle Fibre

Visceral muscle tissue

Visceral muscle may also be described as **smooth or involuntary** (figure 10). It is not under the control of the will. It is found in the walls of blood and lymph vessels, the alimentary tract, the respiratory tract, the urinary bladder, the biliary tract and the uterus.

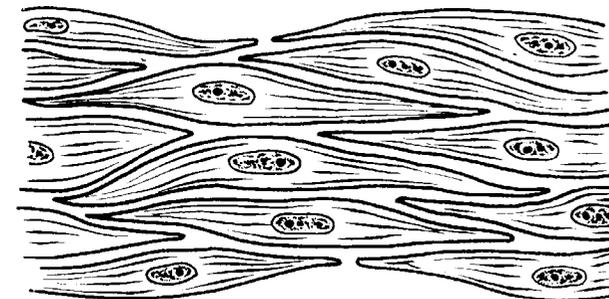


Fig. 10 - Smooth Muscle fibre

When examined under a microscope, the cells are seen to be spindle-shaped with only one central nucleus. There is no distinct sarcolemma but a very fine membrane surrounds each fiber. Bundles of fibers form sheets of muscle, such as those found in the walls of the above structures.

Cardiac muscle

This type of muscle tissue is found exclusively in the wall of the heart. It is not under the control of the will but, when viewed under a microscope, cross stripes characteristic of voluntary muscle, can be seen. Each fiber (cell) has a nucleus and one or more branches. The ends of the cells and their branches are in very close contact with the ends and branches of adjacent cells. Microscopically these 'joints', or **intercalated discs**, can be seen as lines which are thicker and darker than the ordinary cross stripes. This arrangement gives cardiac muscle the appearance of a sheet of muscle rather than a very large number of individual fibers. A wave of contraction spreads from cell to cell across the intercalated discs which means that cells need not be stimulated individually.

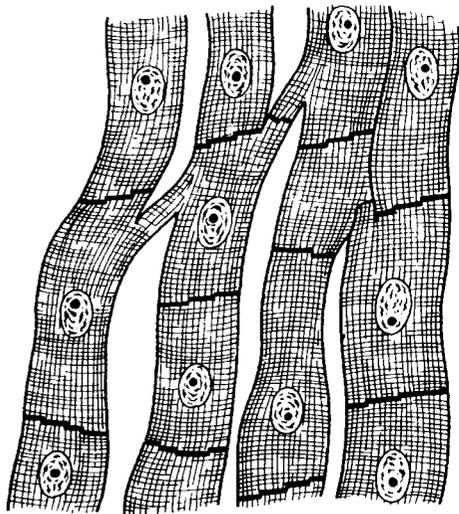


Fig.11. Cardiac muscle tissue

2.4.1 Muscle contraction

A single muscle is made up of thousands of individual muscle fibers. Every fiber extends the entire length of the muscle and is attached at each end to **muscle tendons**. When stimulated, muscle fibers contract, and the force of contraction is transmitted to the bones through the tendons.

Anatomy of skeletal muscle fiber

Each muscle fiber is between 10 and 100 microns in diameter and it varies from a few millimeters to 50 cm. in length, depending on the muscle. The longitudinal view shows dark and light bands along the fiber. This is characteristic of skeletal and cardiac muscle but not smooth muscle. The segment of fiber between each two successive bands is called a **sarcomere**.

Each muscle fiber contains several hundred to several thousand myofibrils. Each myofibril is composed of several filaments. There are two types of filaments - actin and myosin filaments which are responsible for muscle contraction. These can be seen in longitudinal view in an electron micrograph as shown below.

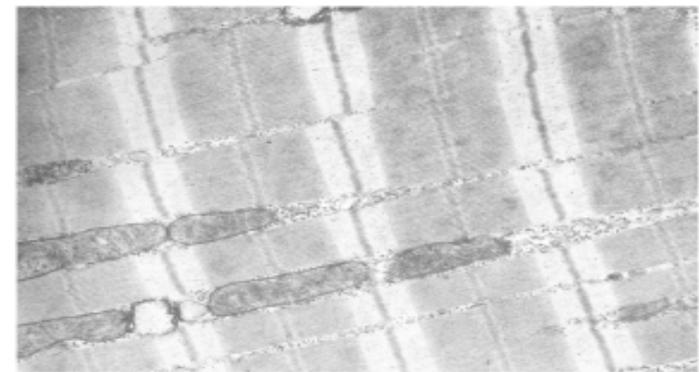


Fig. 12- Electronmicrograph of a Muscle fibre

The diagrammatic representation is as shown in figure 13.

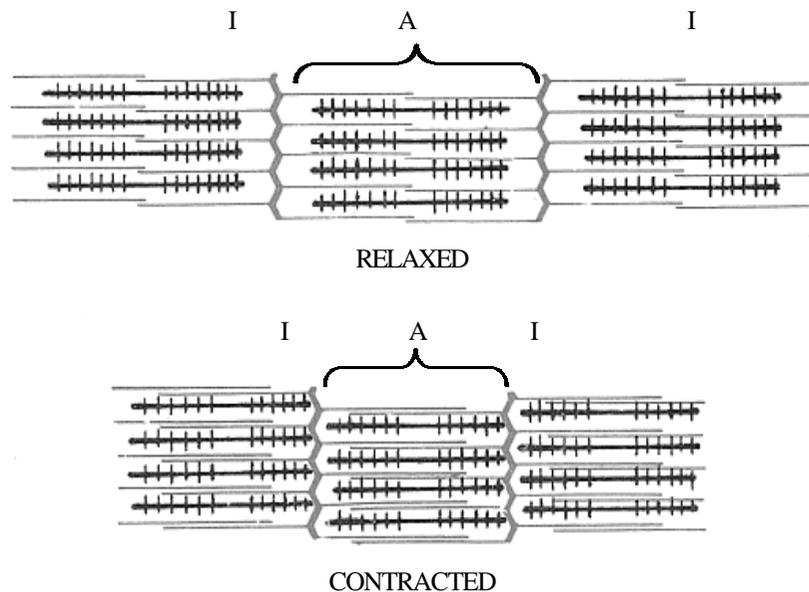


Fig. 13- The relaxed and contracted states of a myofibril

The **actin** filaments are thin filaments and form light bands called **I-bands**. The **myosin** filaments are thick filaments that form the dark bands called **A-bands**. The myosin filaments have small projections from the sides called **cross-bridges**. The actin and myosin filaments partially interdigitate and thus cause the myofibrils to have alternate light and dark bands.

The interaction between the cross-bridges and the actin filaments cause contraction of a muscle fiber. The actin filaments are attached to the Z-line. Numerous mitochondria are present which provide the energy for muscle contraction. Presence of Ca^{++} ions is necessary for activating muscle contraction. Basic mechanism of contraction involves the actin filaments to slide over the myosin filaments. Thus muscle contraction occurs by a **sliding filament mechanism**.

2.4.2 Characteristics of whole muscle contraction

Motor Unit

Several hundreds to several thousands nerve fibers enter most muscles. On an average, a single motor nerve fiber can innervate about 180 muscle fibers. Thus, stimulating one nerve fiber, can cause contraction of 180 muscle fibers all at the same time. All the muscle fibers innervated by the same nerve fiber is called a **motor unit** because they are always excited simultaneously and contract together.

Isometric and Isotonic contraction

In the human body, muscle contraction is of both isometric and isotonic types.

When a person is simply standing, he tenses his leg muscles to maintain a fixed position of the joints. This is **isometric contraction**. Isometric means '**same length**'. Here the muscle tightens but does not shorten. When a person is walking and moving his legs, or when he is lifting his arms, the contraction is **isotonic contraction**. Isotonic means '**same force**'. Here the muscle shortens in length.

2.5 NERVOUS SYSTEM

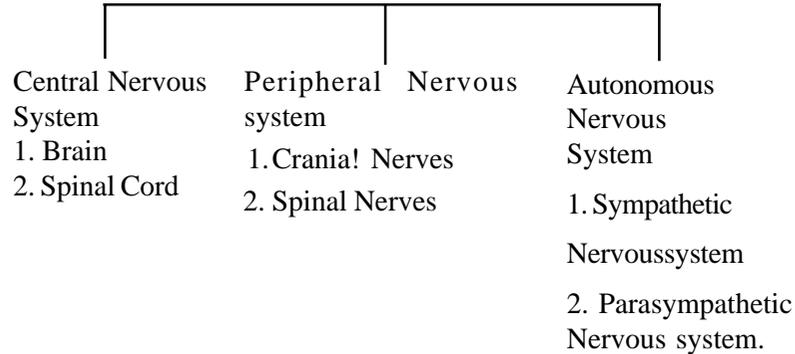
Nervous system is the most important system in our body because it is mainly concerned with the behaviour of the individual. Nervous system is essential for the reception of stimulus, and release of different responses. It also helps in initiating or controlling a particular behaviour. Many bodily functions are controlled and integrated only with the help of nervous system.

The system can be divided into,

- Central Nervous System
- Peripheral Nervous System
- Autonomous Nervous System.

The Central Nervous system includes brain and the spinal cord. Peripheral nervous system consists of cranial and spinal nerves. Autonomous nervous system consists of sympathetic and parasympathetic nervous system.

Nervous System



The nervous system consists of a vast number of units called **neurons** which are supported by a special type of connective tissue called **neuroglia**. Neurons are commonly referred to as **'nerves'**.

2.5.1 Structure of a neuron.

The structural and functional unit of the nervous system is the **neuron**. A nerve cell with all its processes is called a neuron. The processes are collectively called the nerve fibers. They are of two parts.

1. Axon or axis cylinder
2. Dendron

Neuron consists of a central body and one or more projections. One projection which does not give out branches is long and is known as **axis or axon**. The branches or the projections are termed as **Dendrons**. There are no branches near the central axis, but towards

the end of the axis there are minute branches. Sometimes there may be scattered branches at right angles to the axon. The minute branches of one axon touches the dendron of other neurons. The place where they touch each other is called **'Synapse'**.

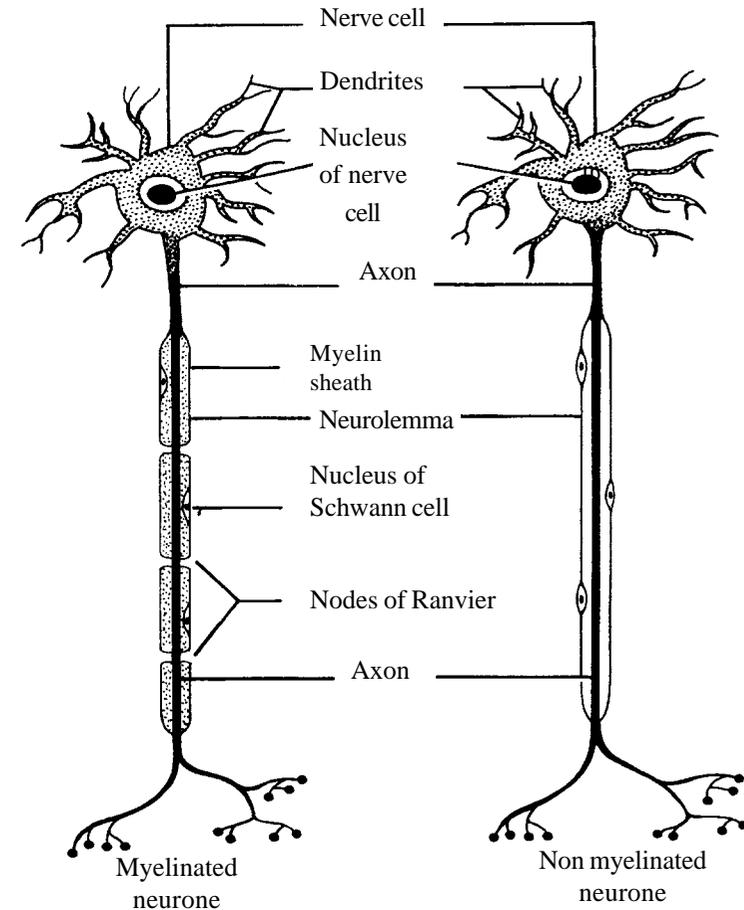


Fig. 14 - Structure of a neuron

Dendron brings messages to the neuron. This is known as the **afferent process**. Axon takes out the messages from the neuron. Axons are referred to as **efferent process**. Hence dendrons and axons can be referred to as one-way traffic.

Each nerve cell consists of a nucleus. Axon is covered by an outer membrane called **neurilemma**. The fatty sheath or the medullary sheath is interrupted by the **nodes of Ranvier**.

Types of Neurons : Neurons are classified according to their processes.

1. **Apolar** having no process.
2. **Unipolar** having only one process - the axon and fibre.
3. **Bipolar** - These are spindle-shaped cells possessing the axon at one pole and a dendrite at the other.
4. **Multipolar** - one axon and many dendrites.

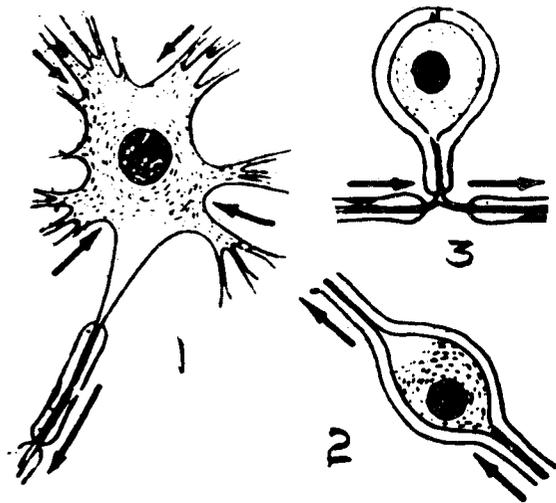


Fig.15-Types of Neurons

1. multipolar

2. bipolar

3.unipolar

Properties of Nerve tissue

Nerve tissue has the characteristics of **irritability and conductivity**.

Irritability is the ability to initiate nerve impulses in response to stimuli from:

1. Outside the body e.g. touch
2. Inside the body e.g. a change in concentration of CO_2 alters respiration.

Conductivity means the ability to transmit an impulse from :

1. One part of the brain to another.
2. The brain to voluntary muscle.
3. Muscles and joints to the brain, contributing to the maintenance of balance and posture.
4. The brain to the organs of the body resulting in smooth muscle contraction.
5. The outside world to the brain through sensory nerves in the skin stimulated by temperature, touch, pain and through the sense organs such as eye, nose, ear etc.

2.5.2 Central Nervous System

The Brain

The brain and spinal cord are surrounded by the **meninges**. The meninges are in three layers. They are the **piamater, arachnoid** and the **duramater**. The function of the meninges is to protect the delicate nerve structure by secreting a fluid called **cerebro spinal fluid (CSF)**.

The cerebrospinal fluid acts as a buffer, protecting the brain and spinal cord. It also conveys nourishment to the tissues of the central nervous system. An accumulation of excess CSF leads to enlargement of the head known as **hydrocephalus**.

The brain lies within the cranial cavity of the skull. It develops from a single tube which shows three enlargements namely fore-brain, mid brain and hind brain. The fore brain becomes the cerebral

hemispheres. The mid brain and the hind brain consists of the pons varoli, medulla oblongata and cerebellum.

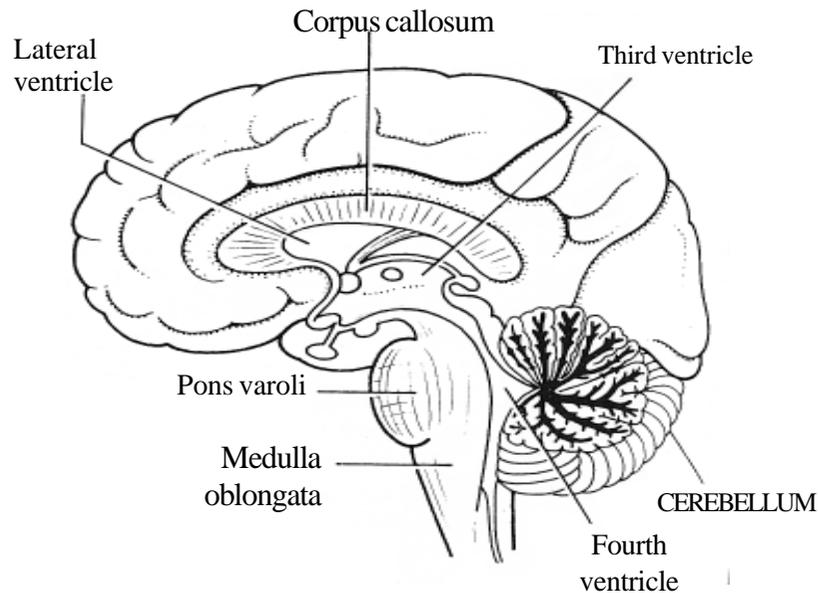


Fig. 16 - Structure of the brain

The cerebrum is the largest part of the brain. It fills the front and upper portion of the cranial cavity. It consists of two large hemispheres of nerve cells (grey matter) and nerve fibers (white matter). The outer layer of grey matter is termed as the **cortex**. The two cerebral hemispheres are separated by a deep cleft which is united at their bases by the **corpus callosum**, a mass of white matter consisting of nerve fibers. Beneath this are the islands of grey matter, the basal ganglia.

The cerebral cortex is composed of many layers of nerve cells. It is the grey matter of the cerebrum. It is arranged in irregular folds or convulsions thereby increasing the surface area of the cerebral cortex. The cerebral cortex is divided into various 'areas'. Some are motor and some are sensory in function. Each half is divided into four lobes by three fissures.

Frontal lobe : This controls the voluntary muscles. The left side of the brain governs the right side of the body and the right side of the brain governs the left side of the body.

Parietal lobe : This area is sensory in function. Here sensations of touch, warmth and coolness are perceived and interpreted.

Occipital lobe : This contains the visual area for interpreting messages from the retina of the eye.

Temporal lobe : This contains the auditory centre for interpreting impulses from the ear.

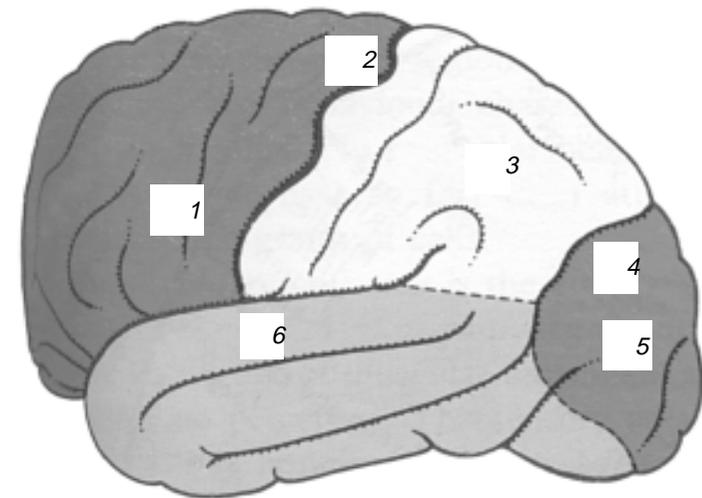


Fig. 17 - The Lobes and sulci of the cerebrum

1. Lateral sulcus 2. Central sulcus 3. Parietal lobe 4. Parieto occipital sulcus 5. Occipital lobe 6. Temporal lobe

The cerebral cortex contains the higher centres controlling mental behaviour, thought, consciousness, moral sense, will, intellect, speech, language and special senses. The cortex controls voluntary muscles.

Thalamus

The thalamus consists of two masses of nerve cells and fibers situated within the cerebral hemispheres just below the corpus callosum.

It is chiefly concerned with the reception of sensory impulses. It is the main sensory relay station of the brain. It is the centre for crude sensation. The emotional reactions are mediated through the thalamus.

Hypothalamus

It is composed of a number of group of nerve cells. This part is found under the thalamus and has got definite physiological activity. Some of them are related to autonomic nervous system. Hypothalamus also exerts control over pituitary gland of the endocrine system. Functions such as body temperature regulation, hunger and thirst are regulated by centres in the hypothalamus. It is an important reflex centre for emotional expression. It is concerned with personality of an individual. Lesions cause changes in personality and psychic disturbances.

The Brain Stem : Brain stem consists of the following parts.

The Mid Brain

The mid brain forms the upper part of the brain stem. It contains important reflex centres for sight and hearing. It also helps in the control of balance and movements of the eye.

The **Pons Varoli** is the middle portion of the brain stem. It helps in the maintenance of normal rhythm of respiration.

Medulla oblongata

The medulla oblongata extends from the pons varoli above and is continuous with the spinal cord below. It is about 2.5 cm long, and is shaped like a pyramid.

The outer aspect is composed of white matter-which passes between the brain and the spinal cord and grey matter lies centrally.

It contains **vital centres** such as :

1. Cardiac center
2. Respiratory centre
3. Vasomotor centre
4. Reflex centres of vomiting, coughing, sneezing and swallowing.

The Cerebellum

The Cerebellum is the largest part of the hind brain. It is divided into two hemispheres, right and left and joined by **vermis**. The arrangement of grey and white matter is similar to that found in the cerebrum with the grey matter arranged at the surface. The cerebellum is connected to many other parts of the nervous system namely, cerebral hemisphere of the opposite side, the brain stem, the reflex centres of sight in the roof of the mid brain, the thalamus and with auditory and acoustic nerve of hearing.

Functions of the cerebellum

The function of the cerebellum is to regulate posture and maintenance of balance. It plays an important part in muscular co-ordination.

2.5.3 Peripheral Nervous System

The Cranial Nerves

There are twelve pairs of Cranial nerves which have their origin from various parts of the brain. Some are mixed nerves, i.e. both motor and sensory, some motor only, and some sensory nerves, e.g. the nerves of the special senses. The cranial nerves are;

1. Olfactory - the nerve of smell.
2. Optic - the nerve of sight.
3. Oculo motor - the nerve of the external muscles of the eye.

4. Trochlear- innervates one muscle of the eye-ball, the external Oblique.
5. Trigeminal -innervates most of the skin of the head and face; the membranes of the mouth, nose, teeth and the muscles for mastication.
6. Abducent -innervates the muscle of the eye-ball, the lateral rectus.
7. Facial - innervates the muscles of expression of the face.
8. Auditory or Acoustic (Vestibulocochlear) - the nerve of hearing.
9. Glossopharyngeal - innervates the constrictor muscle of the pharynx, parotid gland, tongue and the soft palate.
10. Vagus - innervates most of the organs on the thoracic and abdominal cavities.
11. Accessory - innervates muscles of the neck.
12. Hypoglossal - innervates the muscle of the tongue.

Thus the Cranial nerves do their functions in various parts of the body.

Spinal Nerves

There are 31 pairs of spinal nerves which are attached to the spinal cord by two roots. viz., the dorsal root and the ventral root. Each spinal nerve is formed by the union of anterior and posterior roots. Anterior root contains motor fibers and posterior root consists of sensory fibers. The larger anterior branches interlace to form networks called plexus which then give off branches to the various parts.

The three main plexuses are

1. The cervical plexus - muscles of the neck and back of the head.
2. The brachial plexus - shoulders, arm, forearm, the wrist and the hand.
3. The lumbosacral plexus - nerves to the lower extremities.

2.5.4 The Autonomic Nervous System

This nervous system controls the activity of viscera. Its actions are generally unconscious and independent of will. Hypothalamus, thalamus and cerebrum control this system. Based on the nature of function it is classified into Sympathetic and Parasympathetic. These two are functionally opposite. The former is catabolic in nature, while the latter is anabolic.

Sympathetic and Parasympathetic system

Sympathetic Nervous system prepares the body to deal with stressful and exciting situations. It mobilizes the body for 'fight' or 'flight'.

Parasympathetic Nervous system has a tendency to slow down body processes except digestion and absorption of food and functions of the genitourinary systems. It acts in general as a 'peace maker'.

Table-1

Effects of Autonomic stimulation on the various body systems.

System	Sympathetic Stimulation	Parasympathetic stimulation
Cardiovascular System	Accelerates heart rate, raises blood pressure.	Heart rate is decreased.
Respiratory system	Dilation of bronchi allowing greater amount of air to enter lungs.	Constriction of bronchi.
Digestive system	Rate of digestion & absorption of food decreases.	Rate of digestion & absorption of food is increased.

2.5.5 Reflex action

Brain is like a very fine electronic computer receiving information from various sources, collecting and analysing it and giving appropriate stimuli for action.

There are a large number of actions which do not require the intervention of the brain and can be executed at lower levels. Examples of this are heart beat, respiratory movements and gastric secretions which are carried out automatically. Autonomous nervous system controls the above said activities.

Apart from this there is a large group of activity, many of them voluntary in nature which are also done similarly. Examples are closing of the eyelids when light falls on it, removing the hand when it touches something hot, locking a knee joint to support the body when the other joint relaxes, coughing when the throat is irritated are all examples of related activity.

Most of the voluntary activities are reflex in nature and these are the most elementary type of nervous activity.

Example of Reflex Action

Knee jerk. When the patellar tendon is tapped by a knee hammer there is a sudden unconscious tensing of the thigh muscles resulting in an upward movement of the leg.

A reflex action requires the following structures :

1. A sensory organ which receives the stimuli, e.g. the skin.
2. A sensory nerve fibre which conducts this impulse to the cells of the spinal cord.
3. Spinal Cord - where connector nerves pass impulses on to the anterior horn of the cord.
4. A motor nerve cell which receives and transmits the impulse along the motor nerve fibres.
5. A motor organ e.g., a muscle, which performs the action, when stimulated by the motor nerve impulse.

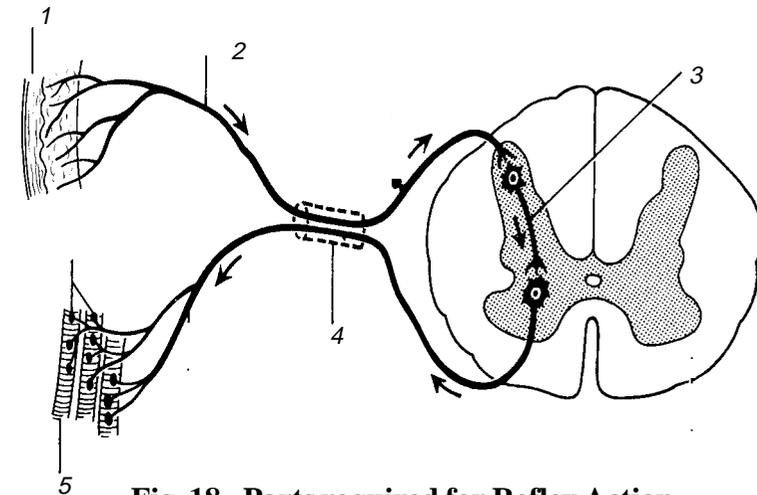


Fig. 18 - Parts required for Reflex Action

1. Sensory organ
2. Sensory nerve fibre
3. Connector nerve
4. Motor nerve fibre
5. Motor organ

Reflex action can be divided into conditioned reflex and unconditioned reflex.

Conditioned Reflex

This type of reflex is developed only with experience. A new born child will not secrete saliva if food is shown or if it smells food. On the other hand, an adult will salivate on the sight or smell of food because of the association of the special senses with food. These types of reflexes are called **Conditioned reflexes**.

Conditioned reflexes were first demonstrated by **Pavlov**, a Russian Physiologist. He conducted his experiment with a dog which salivated at the sight of the food. Then the stimulus i.e., food was associated with the ringing of the bell. The animal was fed a number of times immediately after the ringing of the bell. Then the original stimulus (food) was withdrawn and mere ringing of the bell produced salivation. This is referred to as 'Conditioned Reflex'.

Unconditioned Reflex

These actions are carried out entirely through centres situated in the spinal cord or lower levels of the brain. Unconditioned reflexes are inborn and habitual. They are not dependant on past experience, education or training. For example, while walking, the flexors of the leg contract simultaneously and the extensors relax simultaneously. When the leg is stretched these two activities namely the contraction and relaxation occur vice versa.

2.6 CIRCULATORY SYSTEM

The components of the circulatory system are the blood, the heart and the blood vessels. Blood is the principal transport system which is composed of straw-coloured fluid and the formed elements. Blood carries oxygen and nutrients to various parts of the body during the process of respiration and digestion and helps in eliminating carbon - di-oxide and the waste materials from the body.

The heart, the great pumping organ maintains the circulation throughout the body. The blood is pumped through , the blood vessels from the heart. The major blood vessels divide into smaller ones thereby giving rise to many minute branches. These are referred to as arteries and veins, which help in normal functioning of the circulatory system.

Blood

Blood is a fluid tissue found only in the higher animals. It is composed of two parts. The intracellular substance is a straw-coloured fluid called **plasma**, in which are present the blood cells or corpuscles which performs some important functions. Blood transports:

1. Oxygen from the lungs to all cells of the body and carbon dioxide from the cells to the lungs.

2. Nutrients from the digestive organs to the cells.
3. Waste products from the cells to the kidneys, lungs and sweat glands.
4. Hormones from endocrine glands to the cells.
5. Enzymes to various cells.

Some of the functions of blood are

1. Blood regulates normal body temperature because it contains a large volume of water.
2. It prevents body fluid loss through the clotting mechanism.
3. Blood protects against toxins and foreign microbes through special combat - unit cells.

Composition of blood

The total volume of blood forms about one-twelfth of the weight of the body or about 5 liters. About 55 percent, a little over half the volume is fluid, called plasma and the remaining 45 percent of the volume being made up of the blood cells.

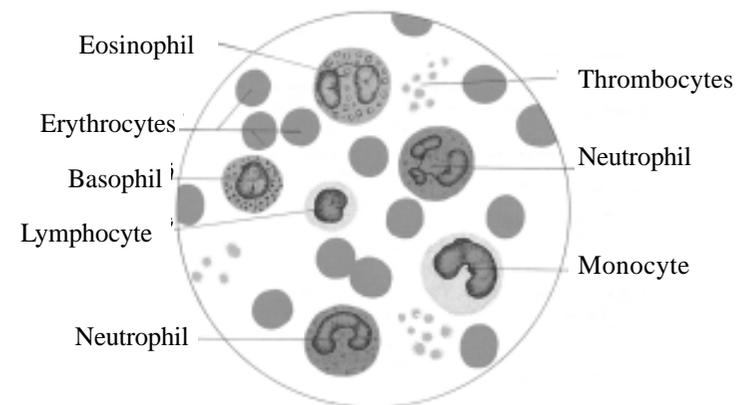


Fig. 19 - Blood cells viewed through a microscope

Plasma

Blood serum or plasma is a straw-coloured liquid. The plasma is composed mainly of water, i.e. 91 percent; and 7 percent of proteins as plasma proteins which have very important functions to perform. Plasma also contains substances like glucose, sodium chloride, sodium bicarbonate, salts of calcium, phosphorous, magnesium and iron, urea, uric acid, cholesterol and amino acids. Plasma also carries gases, oxygen and carbon-di-oxide and the internal secretions like enzymes and antigens.

Plasma proteins are albumin, globulin, prothrombin and fibrinogen. **Albumin** which constitute the majority of plasma proteins are responsible for viscosity of the blood. **Globulin**, a small component of plasma protein is able to form an antigen -antibody.

Prothrombin and **fibrinogen** take part in the blood clotting mechanism along with the platelets.

Blood Cells

These are the formed elements that float in the plasma. There are three types of blood cells namely Red blood cells, White blood cells and platelets.

Red blood cells

They are also called **erythrocytes** or R.B.C. They are circular disc-shaped cells possessing no nucleus. The central portion of the cell is much thinner than the circumference. This construction gives the cell a biconcave contour. The red cells show a tendency to adhere to one another by their flat surfaces like a pile of coins known as **Rouleaux** formation.

The R.B.C originate in bone marrow. There are about 5 million red cells in each cubic millimeter of blood. They contain a red pigment called **haemoglobin**. It constitutes about 33 percent of the cell volume and is responsible for the red colour of the blood. The haemoglobin molecules consist of protein called **globin** and a pigment called **haem**

which contains iron. It has an affinity for oxygen and combines with it forming **oxy-haemoglobin** in the red cells. By means of this function, oxygen is carried to the tissues from the lungs.

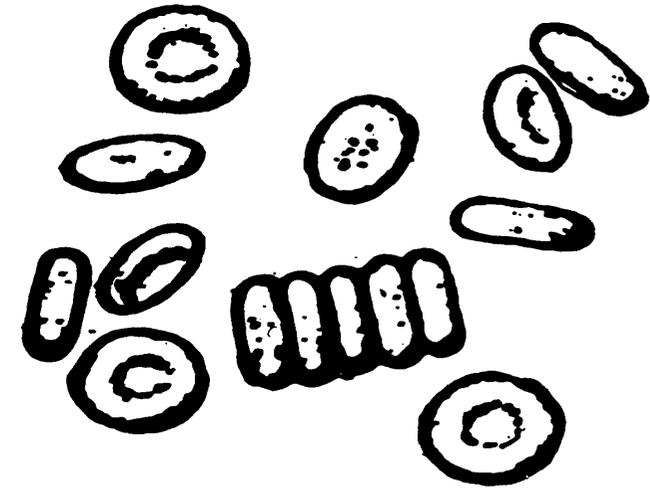


Fig. 20 - Rouleaux formation of red blood cells

The amount of haemoglobin present in normal blood is about 15 grams per 100 ml of blood. The decrease of haemoglobin in the blood results in **anaemia**.

Erythropoiesis

The formation of red blood cells is called **erythropoiesis**. The red blood cells are produced in the bone marrow and are derived from a cell known as **hemocytoblast**. The hemocytoblast passes through several stages of development, becoming first a basophil erythroblast. Then a polychromatophil erythroblast, a normoblast, a reticulocyte and finally an erythrocyte as illustrated in figure 21. During the earlier stages the cells divide many times. There is progressive formation of more hemoglobin. In the normoblastic stage, the nucleus degenerates, becomes very small and forms the reticulocyte. After the release of the reticulocyte

from the bone marrow, the cell becomes the mature red blood cell, the erythrocyte. The average life span of an erythrocyte is 120 days.

GENESIS OF RBC

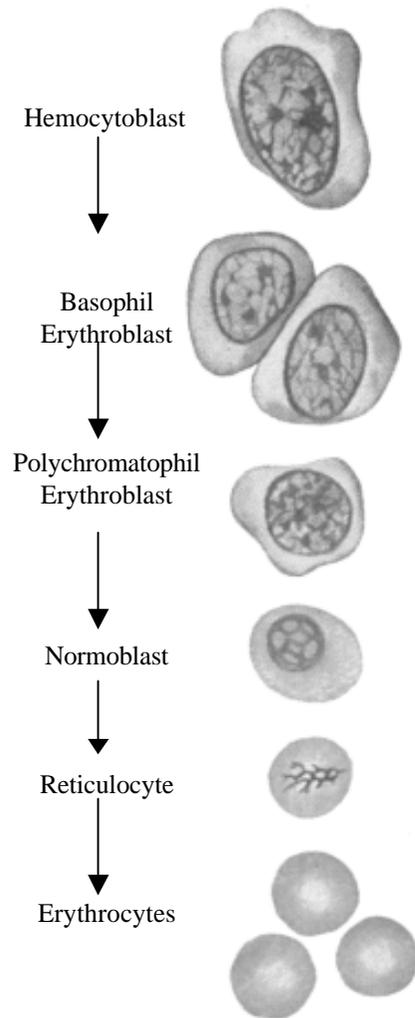


Fig. 21 - Erythropoiesis

Factors regulating RBC production

1. Anaemia.
2. High altitudes.
3. Degree of physical activity.
4. Erythropoietin - a hormone released by the kidneys in response to hypoxia or low O_2 levels acts on the bone marrow to produce more RBC.

Vitamins needed for formation of RBC

1. Vitamin B_{12} : Necessary for nuclear maturation and division. Lack of this vitamin inhibits rate of RBC production.
2. Folic Acid : Folic acid is required for formation of DNA.

Anaemia

Anaemia means a deficiency of red blood cells, which can be caused either by too rapid loss or by too slow production of red blood cells. These are often caused by blood loss, destruction of bone marrow, pernicious anemia because of lack of vitamin B_{12} or folic acid and hemolysis of red cells, that is rupture of the cells.

Polycythemia

Refers to an abnormal increase in the number of red blood cells, i.e. increase of 2 or 3 million cells per cu. mm. of blood are considered to be having polycythemia. This disorder is harmful because the viscosity of the blood is greatly increased due to the extra red blood cells. The viscosity contributes to thrombosis and haemorrhage. It also causes a rise in the blood pressure.

White blood cells

They are also called as W.B.C or **Leucocytes** These are transparent, not coloured and fewer than the red cells possessing nucleus. There are 8,000 W.B..C. in each cubic millimeter of blood.

Different types of Leucocytes are:

(a) Granular Leucocytes which includes Neutrophils, Eosinophils and Basophils. (b) Agranular Leucocytes consists of lymphocytes and monocytes cells.

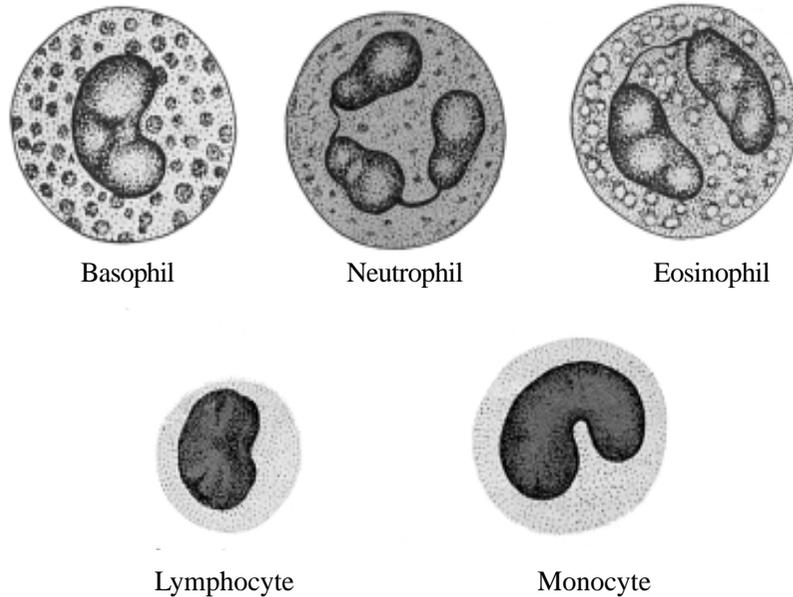


Fig. 22 - Types of White blood cells

Granulocytes and monocytes play a vital role in protecting the body from micro organisms. By their power of amoeboid movement they can move freely in and out of the blood vessels and wander about in all parts of the body. They surround any area which is infected or injured and fight against the organisms, by ingesting them by the process of **phagocytosis**. Lymphocytes make antibodies to protect against chronic infection and to maintain immunity to infections.

WBC and Inflammation

Inflammation is a series of changes in tissues in response to injury. When injury occurs due to bacteria, trauma, chemicals, heat or any other substance, several substances are released that cause local swelling around the injured area. The neutrophils also migrate to this area in increased number. They are phagocytic in action. Similarly the macrophages are released which have greater phagocytic action.

Pus formation: When neutrophils and macrophages engulf large amounts of bacteria and dead tissue they themselves eventually die. After several days a mixture of dead neutrophils, macrophages and tissue is formed. Such a mixture is known as pus.

The Reticuloendothelial system

In addition to the white blood cells, another group of cells distributed widely throughout the tissues and lining some of the blood and lymph channels helps to protect the body against foreign invaders. This group of cells are collectively called the reticuloendothelial system. These cells are mainly derived from two types of cells.

- Cells derived from monocytes that become tissue macrophages. These are phagocytic in action.
- Lymphocytic cells present in lymph nodes.

Tissue macrophages include the following.

- Macrophages of the lymph node.
- The alveolar macrophages in the lungs.
- The kupffer cells in the liver.
- The tissue macrophages of the spleen.
- The tissue macrophages of the bone marrow.

Leucocytosis

A rise in the number of white cells of the blood is called **leucocytosis**. The increase may be due to any one of the various cell types.

Leucopenia is the term applied to a reduction in the number of leucocytes below the normal.

Leukemia is a malignant disease of the bone marrow that results in uncontrolled increase in the production of leukocytes. This can lead to anaemia, thrombocytopenia and leucopenia. It is genetic in nature.

2.6.1 Immunity

Lymphocytes

Lymphocytes are associated with the protection of the body against foreign material. There are 2 types of lymphocytes that function. They are,

- a) T-lymphocytes
- b) B - lymphocytes.

These are found in lymph node and spleen.

Antigens are foreign bodies such as bacteria, virus or any toxin that enters the body.

The T-lymphocytes produce a number of chemical substances that act against antigens such as viruses, pollen, fungi and bacteria.

The B - lymphocytes produce antibodies that ingests the foreign particles.

Types of Immunity.

1. Active Immunity : Here the individual responds to an antigen and produces antibodies specific to one microbe. This can be natural or artificial.

2. Passive Immunity : Here the individual is given antibodies produced by someone else. The readymade antibodies are injected into the infected person.

Acquired Immuno Deficiency Syndrome (AIDS)

This condition is caused by the human immune deficiency virus (HIV). HIV acts mainly on T - lymphocytes. When they are infected

their number is reduced, causing suppression of T-cell immunity leading to infections such as pneumonia, tuberculosis and malignant tumors.

Platelets

They are also termed as thrombocytes. These are small disc-shaped cells without a nucleus about one third the size of the red blood cells. There are about 2 to 5 lakhs of platelets in each cu.mm. of blood. They play an important part in the control of bleeding after injury and in the clotting of blood.

2.6.2 Blood Clotting

Blood maintains its liquid state as long as it remains in the blood vessel. If it is drawn from the body, it thickens and forms a jelly. This jelly or clot contracts or shrinks and a straw-coloured fluid called serum is squeezed out from it. If shed blood is microscopically examined, very fine threads will be seen. These threads entangle the blood cells and together with them form the clot.

The process of clotting is called **blood coagulation** or **haemostasis**. Its purpose is to prevent blood loss when a blood vessel is ruptured. The normal coagulation time varies from 3 to 8 minutes.

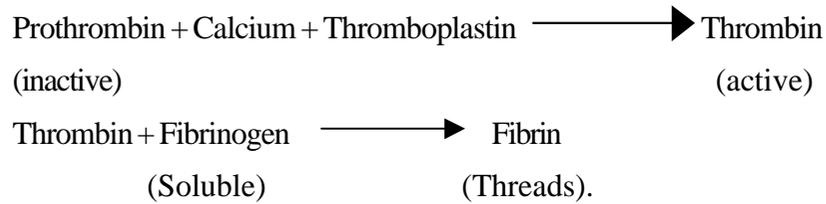
Clotting mechanism

Four substances are necessary for the coagulation of blood: prothrombin, thromboplastin, calcium and fibrinogen. Fibrinogen, prothrombin and calcium are present in the circulating blood.

Thromboplastin is present in the tissues. When the blood is shed thromboplastin is liberated from the injured tissue. The thromboplastin acting upon the prothrombin in the presence of calcium converts into active thrombin.

Thrombin acts in turn upon the soluble protein fibrinogen converting it to insoluble fibrin which is deposited as fine threads to form the framework of the clot.

The clotting mechanism can be given as follows :-



Blood Transfusion

When more than 40 percent of the blood is lost from the body over a short period of time, the body is unable to repair the loss unaided. Some artificial means of replacing the lost fluid must be resorted to. The intravenous injection of blood is called blood transfusion.

Methods of blood Transfusion

1. Direct method i.e. direct from donor's vein to that of recipient. It is however, not undertaken in practice.
2. Indirect method : In this method the blood is collected, tested and stored. For transfusion purpose, blood banks are established. The blood is used as and when needed.
3. Plasma Transfusion is given in cases of burns etc.

Body conditions which need blood transfusion are (1) major operations (2) accidents involving blood loss (3) various blood diseases i.e. leukemia, severe anaemia and agranulocytosis. (4) In case of haemophilia with severe bleeding and (5) in carbon - monoxide poisoning cases.

2.6.3 Blood groups

For a long time physicians have been waiting to give blood transfusion in order to save patients in cases of haemorrhage. Somehow or other, this was not possible as transfusion invariably tended to produce severe reactions. Blood grouping and tests of in-compatibility are carried out in order to ensure a high degree of safety before a blood transfusion is given. Karl Landsteiner introduced the ABO blood grouping system. According to him, the transfusion reactions are mostly

due to the presence of powerful agglutinogens A and B and corresponding agglutinin called alpha (α) and beta (β) present in the R.B.C, and the blood plasma respectively.

In the ABO blood grouping system blood groups are classified according to the presence or absence of agglutinin on cells. This can be made clear by the following self-explanatory table.

Table-2

ABO group	Agglutinogens	Agglutinins
O	Nil	α and β
A	A	β
B	B	α
AB	AB	Nil

All human beings can be divided into four groups namely A,B, AB and O. In considering donors of blood groups AB may give blood to AB, A to A and AB, B to B and AB. O is the universal donor for all groups. Group AB is an universal recipient. A may receive blood from A and O, B may receive blood from group B and O and O can receive blood from O only.

Rh factor

The Rh system is so named because it was first worked out in the blood of the Rhesus monkey. Like the ABO grouping the Rh system is based on the agglutinogens that lie on the surface of the red cells. Individuals whose red cells have Rh agglutinogens are designated as Rh⁺ (positive). Those who lack Rh agglutinogens are designated as Rh⁻ (negative).

Under normal circumstances human plasma does not contain anti Rh antibodies. If a Rh⁻ person receives Rh⁺ blood, the body starts to make anti Rh antibodies that will remain in the blood. If a second

transfusion of Rh⁺ blood is given later, the previously formed anti Rh antibodies will react against the donated blood and severe reaction may occur.

One of the most common problems with Rh incompatibility arises from pregnancy. During delivery some of the foetal blood may leak from the placenta into the mothers blood stream. If the foetus is Rh⁺ and mother is Rh⁻, the anti Rh antibodies will be produced in the mother's blood. If the mother gets pregnant again, her anti Rh antibodies will cross through the placenta into the blood stream of the body. If the foetus is Rh⁻ no problem will occur since Rh⁻ blood does not have Rh antigen. If the foetus is Rh⁺ an antigen-antibody response called haemolysis may occur in the foetal blood. Haemolysis means a breakage of erythrocytes resulting in the liberation of haemoglobin. The haemolysis brought on by foetal - maternal incompatibility is called **erythroblastosis foetalis**.

Several other groups like M, N and P are known. These groups have no clinical importance. But they are sometimes used as medico-legal evidence in disputed patency.

Blood Bank

Recent advances in Medicine and safety of surgical procedures like open heart surgery, transplant of kidney and heart are made possible because of improved techniques of blood grouping and safety in transfusion. Moreover the world is moving at a very fast pace and there are so many automobile accidents occurring, making it necessary for a separate department of Traumatology, where effective treatment can be done only because of the availability of blood transfusion. The place where blood is stored is called a Blood Bank and the doctor incharge is called the blood bank medical officer.

Donors can be voluntary or paid donors and they should donate blood at an interval not less than three months. The donors should be within 18 to 50 years, healthy and screened for infectious and sexually

transmitted diseases. Donors should have 80 percent hemoglobin and blood is drawn aseptically into a sterile bottle containing 3% sodium citrate. Then it is stored at four degree Centigrade.

Before bottling the donor's blood it is tested for the blood group, so that it will be easy for them to label it before storing.

Determination of blood group

Blood of the donor and the recipient must first be tested against A and B serum. Usually 'O' group serum is used as a control, as it contains both agglutinins a and b. A drop of A serum and a drop of B serum are placed separately on a slide. To each of these sera, a drop of blood diluted in 10 percent sodium citrate in normal saline is added.

If clumping of corpuscles occurs in all the sera, then the group is AB or universal recipient. If there is no agglutination in all, then the group is 'O' or universal donor. If serum A agglutinates the corpuscles, then the donor's blood is B group.

If serum B agglutinates then the donor's blood belongs to 'A' group. Similarly with Rh antigen, if the blood agglutinates then the donor is Rh positive. According to these findings the bottle filled with blood is labelled and stored.

2.6.4 Blood vessels

There are several kinds of blood vessels. Arteries and arterioles always carry oxygenated blood from the heart, the exception being the pulmonary arteries which carry venous blood.

Venules and veins carry impure blood towards the heart except the pulmonary veins which carry pure blood.

Capillaries are very minute blood vessels in which arterioles terminate and venules begin. They form a delicate network of vessels which ramify in most parts of the tissues of the body.

Arteries

They are composed of three layers, tunica adventitia, tunica media and tunica intima. The outer layer is protective in nature. The inner lining is very smooth and lined by a single layer of flat pavement cells. The middle layer is strong. It holds the vessel open and by means of contraction it exerts steady pressure on the blood. The thick walls of the larger arteries are themselves supplied with blood by a special system of tiny vessels known as the **vasa-vasorum**.

Capillaries

These are microscopic blood vessels through which materials are exchanged between blood and interstitial fluids. They unite to form venules which in turn form veins to carry blood back to heart. Capillaries branch to form an extensive capillary network throughout the tissue. The network increases the surface area allowing a rapid exchange of large quantities of materials. Capillaries are minute vessels in which the arteries terminate. As the arterioles get smaller and smaller, the three coats gradually disappear until when the fine hair-like capillary vessels are formed. These consist of one layer, the inner endothelial coat of the arteries. The extreme thinness of the vessels is highly suitable for filtration, diffusion, osmosis, etc.

Veins

Veins carry blood to heart. Each vein is made up of tunica adventitia, tunica media and tunica intima, similar to that of arteries. But the middle muscular layer is thinner, less firm and elastic than the arteries. At intervals they are thrown out into transverse folds and constitute a sort of incomplete valve. This helps to make the circulation one-way, by allowing blood to flow towards heart but not in opposite direction.

Structure of the Heart

The heart is a cone-shaped, hollow, muscular organ having the base above and the apex below. The apex inclines towards the left

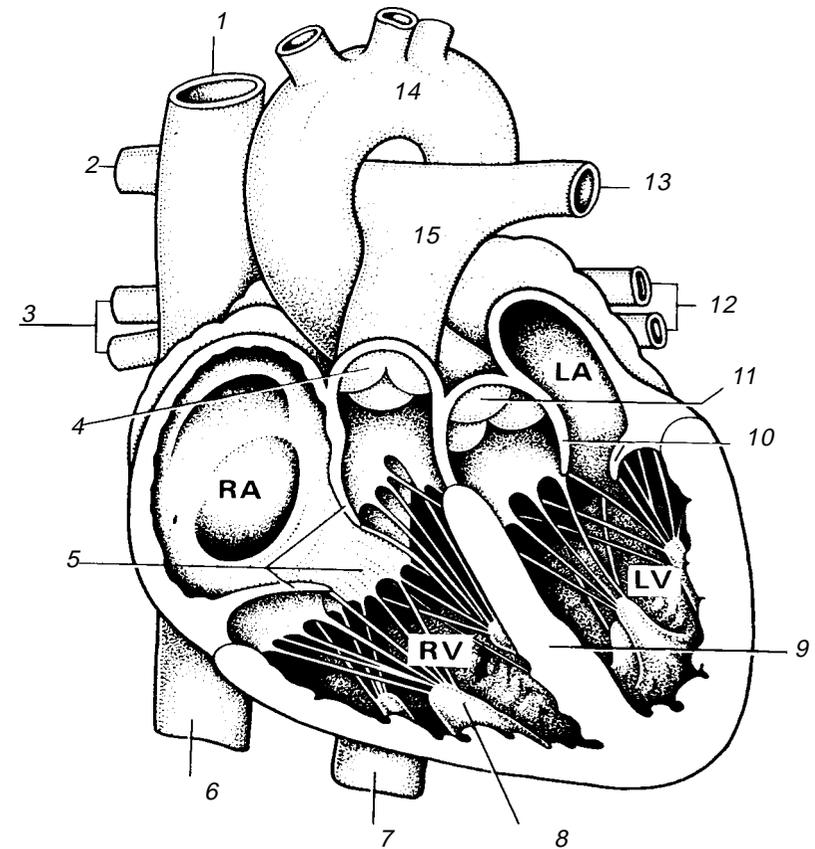


Fig. 23. Structure of the heart

- | | |
|---|-------------------------------|
| 1. superior vena cava | 9. septum |
| 2. R. pulmonary artery | 10. L. atrioventricular valve |
| 3. R. pulmonary veins | 11. aortic valve |
| 4. pulmonary valve | 12. L. pulmonary veins |
| 5. R. atrioventricular valve | 13. L. pulmonary artery |
| 6. inferior vena cava | 14. arch of aorta |
| 7. aorta | 15. pulmonary artery |
| 8. papillary muscle with chordae tendinae | |

side. The heart is about the size of a closed fist. It is divided by a **septum** into two sides, right and left. Each side is further subdivided into two chambers, an upper chamber both on the right and the left side is called an **atrium** or auricle, and a lower chamber, a **ventricle**.

The ventricles have the thickest walls. The walls of the left ventricle is thicker than that of the right as the force of contraction of the left ventricle is much greater. The walls of the auricles are composed of thinner muscles.

The auricles and the ventricles of each side communicate with one another by means of the auriculoventricular opening which are guarded by valves on the right side by the **tricuspid** valve and on the left the **mitral valve**. The auriculoventricular valves permit the passage of blood in one direction only i.e. from auricle to ventricle and they prevent the blood flowing backwards from ventricle to auricle. The interior of each ventricular wall is marked by thickened column of muscle. These project as papillae, the papillary muscles, and at the end attached with thin tendinous cords called the **chordae tendineae**. They have a second attachment to the lower borders of the auriculoventricular valves and prevents the flaps of the valves being forced up into the auricle when the ventricles contract.

The superior and inferior vena cavae empty their blood into the right auricle. The pulmonary artery carries blood away from the right ventricles to the lungs for purification. The four pulmonary veins bring blood from the lungs to the left ventricle. The openings of the aorta and the pulmonary artery are guarded by the **semilunar valves**. The valve between the left ventricle and the aorta is called aortic semilunar valve. It prevents blood flowing backwards from the aorta to the left ventricle. The valve between the right ventricle and the pulmonary artery is called pulmonary semilunar valve and prevents blood flowing backwards from the pulmonary artery into the right ventricle.

The heart is composed by a specialised cardiac muscle, surrounded by a membrane of three layers namely the **pericardium**-outer covering, the **myocardium** middle muscular layer and the **endocardium** - the inner lining.

Working of the heart

The heart is a pump and the events which occur in the heart during the circulation of blood are spoken of as the **cardiac cycle**. In a normal heart beat the two auricles contract simultaneously while the two ventricles relax and vice versa. The term **systole** refers to the phase of contraction. **Diastole** is the phase of relaxation. A cardiac cycle consists of the systole and diastole of both auricles and the ventricles.

During the auricular diastole the right auricle receives impure blood from the superior and inferior vena cavae. The left auricle receives pure blood from the pulmonary veins. When the auricle contracts both the auriculoventricular valves are opened and the semilunar valves are closed. So the blood from the right auricle passes into the right ventricle through the tricuspid valve and the pure blood from the left auricle passes into the left ventricle by means of the mitral valve.

In the ventricular systole the ventricles contract and force the blood into their respective vessels. When the ventricles contract the semilunar valves are opened and the auriculoventricular valves are closed. The impure blood from the right ventricle passes through the pulmonary artery to the lungs for purification by opening the pulmonary semilunar valves.

The pure blood from the left ventricle is taken away through the aorta to all over the body by opening the aortic semilunar valve. Thus the blood circulates through the lungs from the right ventricle to the left auricle and through the rest of the body from the left ventricle to the right auricle. The course through the lungs is called **pulmonary** or lesser circulation, that through all other parts of the body, the **systemic** or

greater circulation. The average heart beats 72 times/minute. A complete cardiac cycle requires 0.8 seconds.

Pulse

The alternate expansion and elastic recoil of an artery with each systole of the left ventricle is called the pulse. **Pulse** is strongest in the arteries which are closer to the heart. It becomes weaker as it passes over the arterial system and it disappears altogether in the capillaries. The pulse may be felt in any artery that lies near the surface of the body and over a bone or other firm tissues. The radial artery at the wrist is most commonly used.

The pulse rate is the same as the heart rate and averages between 70 and 90 beats per minute in resting state. If the pulse rate is rapid it is termed as **tachycardia**. If it is slow, **bradycardia**. Each pulse beat should be of equal strength. Irregularities in strength may indicate a lack of muscle tone in the heart or arteries.

The Heart Sounds

Heart sounds provide valuable information about the heart valves. The normal heart sounds are usually described by the two syllables 'lubb' and 'dub'. The first sound 'lubb' represents the closing of the auriculoventricular valves. The second sound 'dub' represents the closing of the semilunar valves.

If the sounds are peculiar they are called 'murmurs'. Some murmurs are caused by the noise made by a little blood bubbling back up into an auricle because of improper closure of an auriculoventricular valve. Heart sounds can be easily heard by using stethoscope.

Blood Pressure

Blood pressure is the pressure exerted by the blood on the wall of an artery. It is measured by the use of **sphygmomanometer**. Systolic blood pressure is the force of blood recorded during ventricular

contraction. Diastolic pressure is the force of blood recorded during ventricular relaxation. The average blood pressure is 120/80 mmHg. The blood pressure depends on four factors. They are

1. cardiac output or the amount of blood pumped by the heart,
2. the peripheral resistance offered by the blood vessels,
3. the viscosity of the blood and
4. the fullness of the vascular systems.

The clinical measurement of the arterial blood pressure

The blood pressure is measured by using **sphygmomanometer**. It consists of a device for applying external pressure which is attached to a mercury manometer. A rubber bag 25cm by 10cm is enclosed in a silk or cotton bag with a long silk cuff which can be tied around the upper arm. The sounds are heard on the brachial artery. The rubber bag is connected by means of rubber tubes to a pump and the mercury manometer.

The pump is used to drive in air to increase the pressure in the bag and compress the brachial artery. The manometer has a scale and a mercury reservoir incorporated within. Air is pumped into the bag and the pressure is raised rapidly well above the systolic level.

This completely stops blood flow and consequently no sound will be heard. The pressure is decreased slowly and the first appearance of the sound is recorded as the systolic point. The pressure is slowly released and the diastolic pressure is noted. The diastolic pressure cannot be detected by the palpatory method.

The normal values of blood pressure are given as 120mm of mercury which is the systolic reading and 80mm of mercury as the diastolic level.

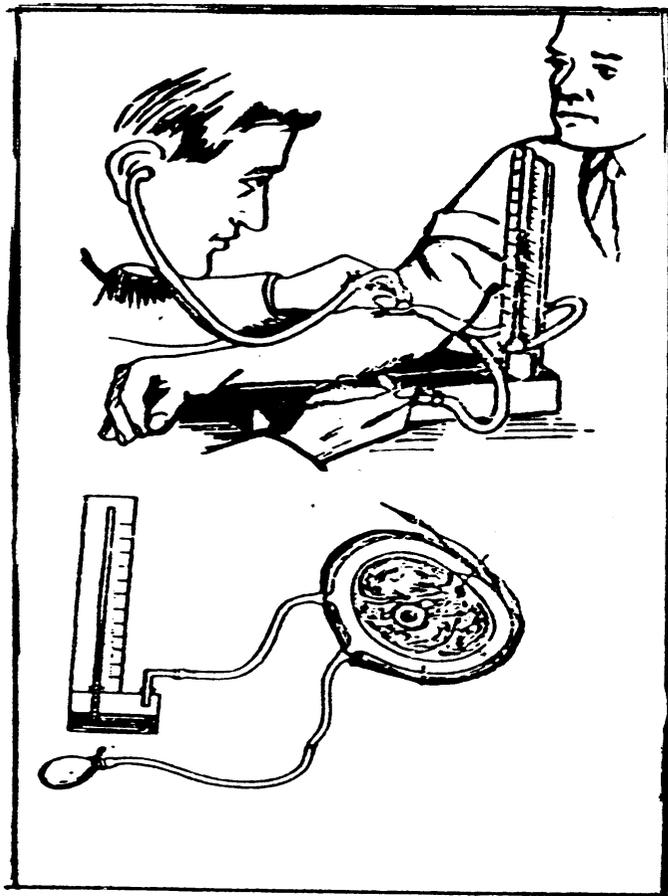


Fig.24- Sphygmomanometer

Electro Cardio-Gram (ECG)

A recording of the electrical changes that accompany the cardiac cycle is called an **electrocardiogram**. The instrument used to record the changes is ElectroCardioGraph. The ECG is invaluable in diagnosing abnormal cardiac rhythm and conduction patterns, detecting the presence of foetal life, determining the presence of several foetuses and following the course of recovery from a heart attack.

Angiogram

Recording of an image of arteries by X-ray revealed by the direct injection of dye is called **angiogram or arteriogram**. This technique is called **Angiography or arteriography**. Diagnosis is possible by means of this technique in the case of the heart disease called Atherosclerosis.

2.6.5 Diseases of Blood Vessels

Atherosclerosis

This is disease of the arteries. There is patchy changes which develop in the tunica media of arteries. There is accumulation of cholesterol compounds & calcium deposits. This makes the lumen narrower and thereby obstructing blood flow. Obesity & sedentary life style can lead to this.

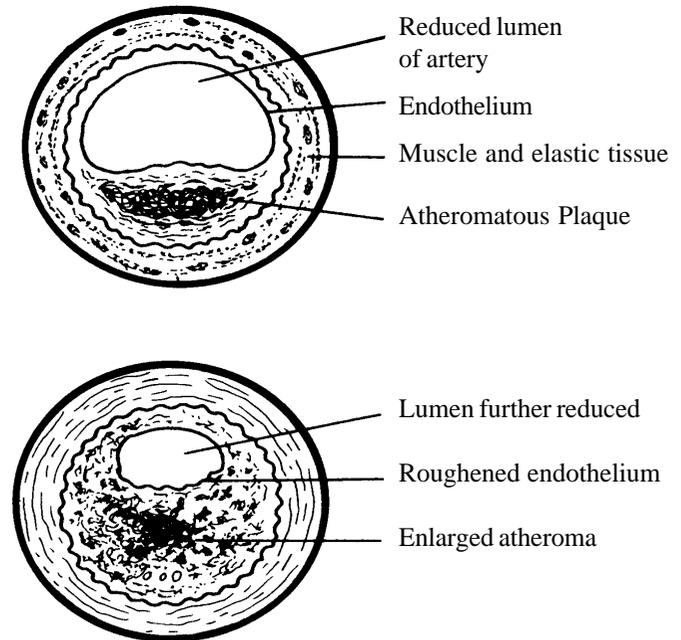


Fig. 25 - Reduced lumen of artery during atherosclerosis

Hypertension

The term hypertension is used to describe blood pressure that is sustained at a higher level than the normal level of 120/80 mmHg. The normal value differs as per age group. Prolonged hypertension affects the heart, brain & kidneys.

Cardiac failure

This is otherwise heart failure which occurs when the muscles of the ventricles are unable to maintain the circulation of sufficient blood to meet the needs of the body.

2.6.6 Lymphatic system

The Lymph, lymph vessels and a series of small masses of lymphoid tissue called lymph nodes make up the lymphatic system.

Lymph is the intracellular fluid or tissue fluid that flows through the lymphatic vessel. This tissue fluid is derived from the blood plasma. Lymph contains plasma proteins of 3 to 4 percent and variable number of leucocytes.

Lymphatic vessels originate as blind-end tubes that begin in spaces between cells. The tubes are called lymph capillaries. They are slightly larger and more permeable than the blood capillaries. Lymph capillaries unite to form larger and larger lymph vessels called **lymphatic ducts**.

The Lymph vessels are found in the skin, subcutaneous tissues and in the connective tissue of the abdominal and thoracic viscera. The lymph vessels present in the villus of the small intestines are called as **lacteals**. These lacteals help in absorbing fat from the food in to the circulation. Lymph is not present in the bone marrow and the nervous system.

The two main lymphatic vessels are the thoracic duct and the right lymphatic duct. The thoracic duct receives all the lymph of the body except that from the right side of the head, neck, arm, lungs, heart and the upper surface of the liver. The lymphatics of these parts drain into the right lymphatic duct.

These two vessels open into the subclavian vein of the corresponding side of the body. Lymphatic duct resembles vein in structure but have thinner walls, and contain lymph nodes at various intervals.

Lymph nodes : These are oval or bean-shaped structures located along the length of the lymphatics. It is also named as lymph glands. Structurally the lymph node contains a slight depression on one side called a hilum, where the blood vessels enter and leave the node. Lymph nodes give rise to lymphocytes which produce antibodies.

Functions

1. To return fluid and protein from the tissues to the circulation.
2. To transport lymphocytes from the lymphatic glands to the circulation.
3. To carry emulsified fat from the intestine to the circulation.
4. To filter out and destroy microorganisms in order to prevent infection spreading from the point where the organisms entered the tissues, to other parts of the body.
5. To produce antibodies to protect the body against subsequent infection.

2.7 RESPIRATORY SYSTEM

Respiration is the process of gaseous exchange between an organism and its environment. In the higher animals and man the gaseous exchange between the tissues and environment is termed as **internal** or **tissue respiration**. The exchange of gases between the body and the environment taking place in the lungs is termed as external respiration. The external respiration constitutes processes of inspiration and expiration. **Inspiration** is an active muscular contraction, while **expiration** is merely a passive act of the relaxation of respiratory muscles.

Structure of Human Respiratory System

The respiratory system is responsible for taking in Oxygen and giving off CO₂ and water. It is divided into the upper respiratory tract and the lower respiratory tract.

The Upper Respiratory Tract

Nose, mouth, the throat, the larynx, and numerous sinus cavities in the head.

The Lower Respiratory Tract

The trachea, the bronchi and the lungs which contain bronchial tubes, bronchioles and alveoli or air sacs.

The two lungs which are the principal organs of the respiratory system, are situated in the upper part of the thoracic cage. They are inert organs, ie., they do not work by themselves, but function with the help of a muscular wall known as the **diaphragm**.

The **pharynx** is a tube approximately 12cm in length, which is a common opening for both digestive and respiratory system. It connects the oral cavity to the oesophagus (food tube) and the nasal cavity to the larynx and wind pipe. The opening into the **larynx** is oval in shape and guarded by the leaf like **epiglottis**.

The epiglottis folds down over the opening like a trap door while food or liquid is being swallowed. It prevents the entry of foreign substances into the respiratory passage. The closure of the epiglottis, when we swallow, is a reflex action and can be interfered with, if one attempts to talk and swallow at the same time. If this happens one may choke to death in the absence of immediate assistance.

From the pharynx, air passes through the trachea, which is 12cm long and 15cm in diameter. The tract, consists of a large number of C-shaped cartilage rings. The larynx or the voice box is at the top of the trachea and it is the vocal cords inside the box which by its coming together and going away from one another produces different sounds.

The trachea branches at its lower end into the right and left bronchi which enters the lungs. Within the lungs these bronchi repeatedly divide, forming microscopic tubes called **bronchioles**. Each bronchiole ends with several clusters of microscopic elastic air sacs called **alveoli** which is the functional unit of lungs. This resembles a bunch of grapes.

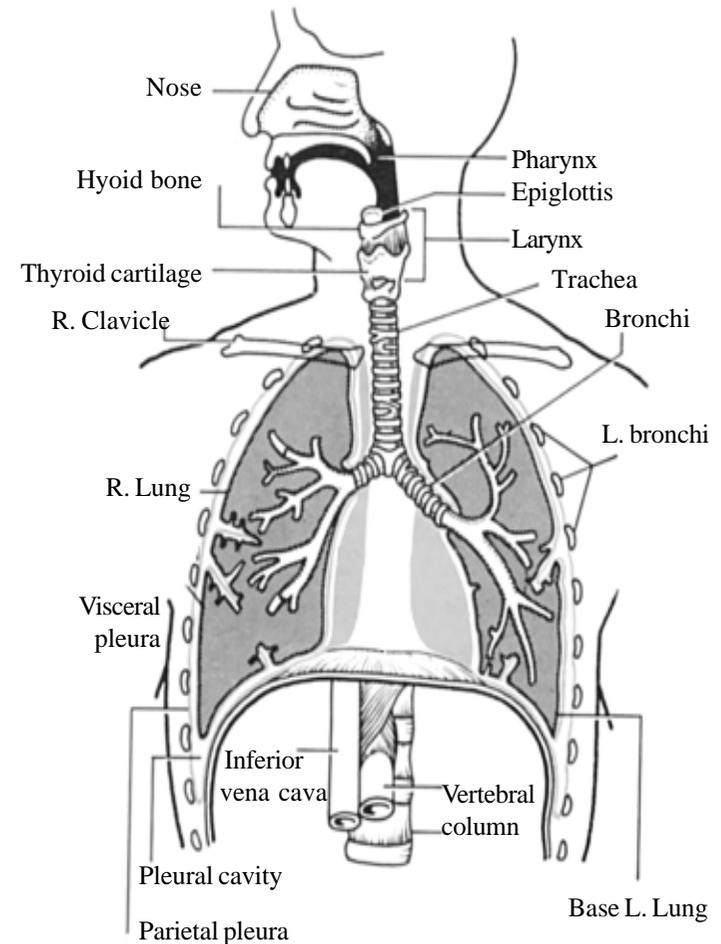


Fig. 26 - Structure of the respiratory system

The paired lungs lie within the large cavity of the chest, the thoracic cavity. The lungs are greyish in colour and are spongy in appearance. The right lung has three lobes - upper, middle and lower, and the left lung has two lobes - upper and lower. The floor of the thoracic cavity is formed by the dome-like muscular diaphragm. Each lung is enclosed by two layers of membrane called the **pleural membrane**. The chest cavity is also lined with this membrane. This layer being known as the parietal pleura, while the lung covering is called the visceral pleura. The thoracic cavity is flexible, capable of expanding and contracting along with the lungs.

2.7.1 Physiology of Respiration

We breathe continuously from birth to death, day and night, in health and disease. Respiration may be defined as the mechanical process of breathing in and out, a function which involves both the respiratory system and the muscles of the respiration. The 2 phases of breathing are (1) Inhalation - during which the air is drawn into the lungs (2) Exhalation - which refers to the expulsion of air from the alveoli.

Inhalation

The diaphragm when relaxed is a flattened dome-shaped structure pointing upwards to the lungs. During the process of inhalation it contracts, it flattens, pulls down the thorax, increases the volume of the thorax, and thus decreases the atmospheric pressure in the lungs. This causes air to rush in during inspiration.

Exhalation

During the process of exhalation, the diaphragm relaxes, the thorax is pushed up, the volume decreases and the atmospheric pressure increases and air rushes out of the lungs.

The inspired air which contains oxygen passes down into the billions of minute air chambers or air cells known as alveoli which have very thin walls. Around these walls are the capillaries of the pulmonary system.

It is at this point that the fresh air gives off its oxygen to the blood and takes carbon-dioxide from the blood by diffusion which is then expelled with the expired air.

Exchange of gases

The interchange of gases in the lungs occurs between the blood in the capillary network surrounding the alveoli & the air in the alveoli. The total pressure exerted on the walls of the alveoli by the mixture of gases is the same as atmospheric pressure i.e. 760 mm Hg. Each gas in the mixture of gases such as O₂, N₂, CO₂ & inert gases exert their individual partial pressures.

The partial pressure of oxygen in the alveoli is higher than deoxygenated blood in the capillaries of the pulmonary arteries. Since gases diffuse from an area of high concentration to one of lower concentration, the movement of oxygen is from alveoli to blood. For CO₂ the reverse occurs. The partial pressure is higher in deoxygenated blood than in alveolar air, so CO₂ passes across the walls of the capillaries and the alveoli into alveolar air.

Respiratory Rates

In adults, the respiratory rate is 14 to 18 times per minute. Children have a higher respiratory rate. Thus the respiratory rate of a new born is about 60 times per minute and that of a 6 year old child is 25 times per minute. At any age, the respiratory rate is 4.5 times lower than the heart rate. The term **hyperpnoea** means overbreathing due to abnormally rapid respiratory movement. **Apnoea** means a temporary cessation of breathing. The depth and rate of breathing are influenced by numerous factors such as emotional or mental state, changes in blood chemistry, physical fitness, metabolic rate etc., In some fevers, the respiratory rate increases in direct proportion to the increase of temperature.

Functions of Respiration

1. It supplies oxygen and eliminates carbon dioxide.

2. It excretes volatile substances like ammonia, ketone bodies, essential oils, alcohol and water vapour, etc.,
3. By adjusting the amount of carbon-di-oxide elimination, it helps to maintain the acid base balance.
4. It helps to maintain the normal body temperature.
5. It is necessary for the maintenance of optimal oxidation-reduction process in the body.

Regulation of Respiration

The respiratory centre of the brain is located in the medulla, immediately above the spinal cord. From this centre nerve fibres extend down into the spinal cord. From the neck part of the cord, these nerve fibres continue through the phrenic nerve to the diaphragm. The diaphragm does not continue to work if it is cut off from its nerve supply. If one nerve is cut, the diaphragm of that side is paralysed. This centre is governed by variations in the chemistry of the blood. If there is an increase in CO_2 in the blood, the cells of the respiratory centre are stimulated and they in turn send impulses down the phrenic nerves to the diaphragm.

2.7.2 Disorders

Asthma : This can occur due to hypersensitivity to foreign proteins such as dust, pollen, fungi etc. Here the bronchi constricts the airway and there is excessive secretion of sticky mucus resulting in obstruction to breathing.

Pneumonia : This occurs when microbes reach and colonise the lungs, especially streptococcus pneumoniae. It leads to fluid accumulation in the alveoli causing difficulty in breathing.

Tuberculosis : This is an infection caused by the mycobacterium species. It spreads through inhalation from air.

PRACTICAL

The following practical to be conducted after the completion of the respective theory portions.(Procedure as given below)

1. Draw the structure of the cell as viewed under an electron microscope.

2. Draw the structure of the human brain.
3. Estimate the clotting time of blood.
4. Estimate the hemoglobin content of blood.
5. Draw the structure of the human heart.
6. Determine the respiratory rate and discuss.
7. Draw the structure of lungs.

1.Estimation of haemoglobin concentration of blood

Haemoglobin is the main component of the red blood cells & helps in the transport of O_2 and CO_2 . Haemoglobin is a conjugated protein that consists of a basic protein, the globin and haeme. Each hemoglobin molecule consists of one molecule of globin and four molecules of haeme each containing a molecule of iron.

Aim

To measure the haemoglobin content of your blood using hemo meter.

Apparatus and reagents required

Sahli-Hellige Hemometer, N/10 HCl, distilled water, lancet, cotton swabs, alcohol, dropper.

Description of apparatus

The Sahli-Hellige Hemo meter has the following components:

a) Comparator : It accommodates a glass comparison tube which is graduated in gram percent of Hb (2-24) as well as percentage (20-140). This tube is used for holding the acid hematin. The comparator is provided with non-fading standard brown tinted glass plates.

b) Haemoglobin pipette: A pipette showing a single mark, indicating 20 cu mm. volume is provided.

c) Glass stirrer : Used for stirring the contents of the comparison tube.

Procedure

1. Add N/10 HCl to the comparison tube upto the 20% mark.

2. Prick the ball of a finger using a sterile lancet after wiping with cotton dipped in alcohol, to obtain blood.
3. Wipe off first one or two drops of blood.
4. When a good-sized blood drop forms, suck the blood into the haemoglobin pipette upto the 20 cu.mm mark.
5. Wipe away the excess of blood adhering to the tip of the pipette with cotton.
6. Immediately transfer the contents of the pipette into the tube containing HCl solution.
7. Suck a small amount of HCl acid into the pipette and blow it into the tube.
8. Mix and allow the tube to stand for 10 minutes.
9. Add a few drops of distilled water and stir the contents with a glass-stirrer.
10. Continue to add water drop-by-drop and stir the contents each time until the colour of the solution is just darker than the colour of the standard one. Note the reading, against diffused light.
11. Again, add one or two drops of distilled water & when the colour matches exactly with the standard, note the reading, against diffused light.
12. Again, add one or two drops of distilled water- so that, the colour of the solution at this time becomes lighter than the standard solution. Note this reading, against diffused light.
13. Take the average of the three readings.

Result: The haemoglobin content is _____ gms/100ml of blood.

Precautions

1. Wipe off the blood adhering to the tip of the pipette, since such a blood can give a false high value of Hb. The blood drop obtained by squeezing the finger or from a cold and cyanosed finger is likely to give high values of Hb. Hence this should be avoided.
2. The colour of the standard tinted glass should be checked periodically against the standard acid hematin solution.

3. The acid-blood mixture must be kept for atleast 10min before the dilution, to cause a complete conversion of Hb into acid hematin. The normal range of haemoglobin is as follows,
Men-13.5 - 18.0 gm/100ml.
Women - 11.5 - 16.5 gm/100ml
Infants - 13.6 - 19.6 gm/100 ml.

2.Estimation of clotting time

Clotting time of the blood is the time required for the blood to clot after it has come out of the vessel.

Slide method

Equipment

Glass slide, stop watch, pin/needle, lancet, alcohol, cotton.

Procedure

1. Wipe the ball of your finger with cotton dipped in alcohol. Allow to dry.
2. Prick your finger with the lancet.
3. Start the stop watch as soon as the flow of the blood starts.
4. Place 2-3 drops of blood on the slide.
5. At every 15 seconds, draw a pin / needle through the drop of blood until it picks up a fibrin thread.
6. Stop the watch & note the time.
7. The moment at which fibrin threads appear is the end point.
8. The time interval from the start of the blood flow to the appearance of fibrin threads denotes the clotting time.

Result: The clotting time was determined as

3.Respiration rate

Aim : To determine the respiration rate.

Apparatus : Stop clock.

Procedure

- a) The subject was allowed to read quietly for about 5 minutes. Then the observer counted the number of respirations per minute for three minutes.
- b) The subject was made to run until 'out of breath' and then was allowed to sit down. The observer then counted the number of respirations per minute for three minutes.

Observation

Respiration Rate	Respiration rate after exercise
1.	1.
2.	2.
3.	3.
Average _____	Average _____

Inference

- a) Average rate of respiration was found to be
- b) Average rate of respiration after exercise was found to be

Discussion

(To be discussed in class by the teacher)

QUESTIONS

Section -A

1. Fill in the blanks:

- 1. The _____ is also called the breast bone.
- 2. _____ are the bones of the finger.
- 3. Smooth muscle is _____ in action.

- 4. _____ of the brain regulates posture and maintains balance.
- 5. _____ pigment give blood its red colour.
- 6. Foreign bodies such as bacteria and viruses are commonly known as _____.
- 7. _____ mineral is essential for blood clotting.
- 8. _____ is a tube which is a common opening for both digestive and respiratory system.
- 9. _____ is the basic functional unit of the body.
- 10. Each human cell contains _____ chromosomes.

II. Match the following

- | | |
|---------------------------|----------------------------|
| 1. Skull | Voluntary action |
| 2. Skeletal muscle | Increase in number of WBCs |
| 3. Erythropoietin | Walking |
| 4. Polycythemia | 14 to 18 times / minute |
| 5. Leucocytosis | Kidney hormone |
| 6. Isometric contraction | Bacteria |
| 7. Adult respiratory rate | Heart |
| 8. Isotonic contraction | Axial skeleton |
| 9. Tuberculosis | Tensed muscle |
| 10. Angiogram | Increase in number of RBC |

III. Answer the following in one word :

- 1. Which blood group is the universal donor?
- 2. What are thrombocytes commonly known as?
- 3. What is the structural and functional unit of the nervous system?
- 4. Where does the RBC originate from?
- 5. How many vertebral bones are there in the human body?
- 6. What is the collar bone otherwise called?

7. What is required to bind bones together?
8. Which group is the universal recipient?
9. Which is the power house of the cell?
10. Give one example of a radioactive carcinogen?

Section-B

1. Name some of the principal organelles of the cell?
2. What are lysosomes?
3. What is diffusion?
4. What is active transport?
5. Define carcinogenesis?
6. What are sutures?
7. Name the 3 hip bones?
8. Name the facial bones?
9. Give the classification of joints?
10. Define motor unit?
11. Define AIDS?
12. What is erythroblastosis foetalis?
13. What is ECG?
14. What are lymph nodes?
15. Define atherosclerosis?
16. What is an angiogram?
17. Define osteoporosis?
18. Define osteomalacia?
19. What are the types of muscle tissue?
20. What is meiosis?

Section - C

1. Write a note on cancer.
2. Write a short note on the vertebral column.
3. Explain the types of synovial joints.
4. Write a short note on muscle contraction.
5. Write a short note on the ER.
6. List the bones which form the Cranium.
7. Describe the Autonomic Nervous System.
8. What are the properties of nerve tissue?
9. What are the functions of blood?
10. Explain the mechanism of clotting.

Section - D

1. Draw & explain the structure of the heart.
2. Explain the structure of the human respiratory system.
3. Explain the structure of the brain in detail.
4. Draw & explain various stages of mitosis.
5. Explain the appendicular skeleton in detail.
6. Draw and explain structure of a neuron.
7. Explain Reflex Action. What are the types of reflex?

3. FOOD, NUTRITION AND HEALTH

Life cannot be sustained without adequate nourishment. Man needs adequate food for growth and development and to lead an active and healthy life. **Nutrition** is the science of foods, the nutrients and other substances therein, their action, interaction and balance in relationship to health and disease. **Health** is defined by The World Health Organisation as the state of complete physical, mental and social well being and not merely the absence of diseases. Therefore **Food** plays an important role in maintaining a person's nutritional and health status.

3.1 CLASSIFICATION OF FOODS

Man must eat to live and what he eats will affect to a high degree his ability to keep well, to work and to live long. Food performs many vital functions in the body.

Foods are classified according to their functions in the body.

3.1.1. Energy Yielding Foods

This group includes foods rich in carbohydrate, fat and protein. They may be broadly divided into two groups.

1. Cereals, pulses, roots and tubers: Cereals provide in addition to energy large amounts of proteins, minerals and vitamins in the diet. Pulses also give protein and B vitamins besides giving energy to the body.
2. Fats, Oils and pure carbohydrates like sugars: Sugars provide only energy and fats provide concentrated source of energy.

3.1.2. Body Building Foods

Foods rich in protein are called body building foods. They are classified into two groups.

1. Milk, egg, meat & fish. They are rich in proteins of high biological value. These proteins have all the essential amino acids in correct proportion for the synthesis of body tissues.

2. Pulses, nuts and oilseeds: They are rich in protein but may not contain all the essential amino acids required by the human body.

3.1.3. Protective Foods

Foods rich in protein, vitamins and minerals have regulatory functions in the body like maintaining the heartbeat, water balance, temperature, etc.

Protective foods are broadly classified into two groups.

- (i) Foods rich in vitamins and minerals and proteins of high biological value (eg) milk, egg, and fish.
- (ii) Foods rich in certain vitamins and minerals only (eg) green leafy vegetables and fruits.



Fig.1-Functions of food

3.2 PRINCIPLES OF COOKING AND METHODS OF COOKING

Some foods like fruits, vegetables and nuts are eaten raw. It is good that they are consumed raw as in the uncooked condition they retain most of their nutritive value. However most foods are cooked before being consumed.

The process of subjecting foods to the action of heat is termed as cooking.

3.2.1. Objectives of cooking.

- Improves the taste and food quality.
- Cooking food to the required temperature for a required length of time can destroy all harmful microorganisms in food.
- Cooking improves digestibility.
- Cooking increases variety.

3.2.2. Methods of cooking

Moist heat methods

Boiling

Boiling is cooking foods by just immersing them in water at 100°C and maintaining the water at that temperature till the food is tender. It does not require special skill and equipment. It is time consuming.

Simmering

When foods are cooked in a pan with a well fitted lid at a temperature just below the boiling point 82°-99°C , it is known as simmering. It is a useful method when foods have to be cooked for a long time to make it tender. (eg) vegetables.

Poaching

This involves cooking in the minimum amount of liquid at a temperature of 80°-85°C. Foods generally poached are eggs and fish.

Stewing

This is a gentle method of cooking in a pan with a tight fitting lid, using small quantities of liquid to cover only half the food. The liquid is

brought to a boiling point and then the heat applied is reduced to maintain the cooking at simmering temperature i.e., 98°C. Apples can be cooked by this method.

Steaming

This method requires the food to be cooked in steam. This is generated from vigorously boiling water or liquid in a pan so that the food is completely surrounded by steam and not in contact with the water or liquid. Here the food gets cooked at 100°C.

Pressure cooking

In pressure cooking escaping steam is trapped and kept under pressure so that the temperature of the boiling water and steam can be raised above 100°C thus reducing cooking time. Foods cooked in pressure cooker are rice, dhal, vegetables and meat.

Dry heat methods

In this either air or fat is used as the medium of cooking.

Air as medium of cooking

Grilling

Grilling consists of placing the food below or above or in between a red-hot surface. This results in the browning of the food.

Pan broiling or roasting

When food is cooked uncovered on heated metal or a frying pan, the method is known as pan-broiling, (e.g) chapathis.

Baking

Here food gets cooked by hot air inside the oven. Foods baked are generally brown and crisp on the top and soft and porous in the centre, (eg) cakes and breads. The temperature that is normally maintained in the oven is between 120°C-260°C.

Fat as medium of cooking

Sauteing

This method involves cooking in just enough of oil to cover the base of the pan. Foods cooked by sauteing are generally vegetables used as side dishes in a menu.

Shallow fat frying

Here food is cooked on a tava with little oil (eg) chapathi, cutlets, etc.

Deep fat frying

Food is totally immersed in hot oil and cooked. The temperature maintained is 180° - 220°C (eg.) Samosa, Bajji, etc. The taste of the food is improved along with texture.

Other cooking methods

Braising

Braising is a combined method of roasting and stewing in a pan with a tight fitting lid. Meat is cooked by this method.

Microwave cooking

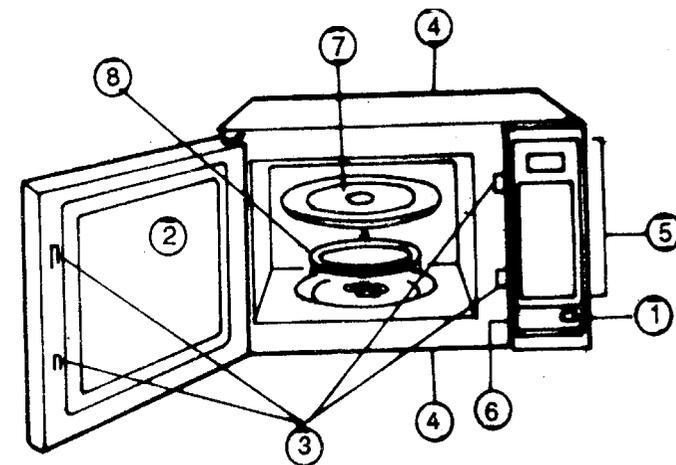


Fig.2-Microwave oven

- | | |
|----------------------------|----------------------------|
| 1. Door release button | 2. See-through oven window |
| 3. Door safety lock system | 4. External air vents |
| 5. Control panel | 6. Identification plate |
| 7. Glass tray | 8. Roller ring |

Electromagnetic waves from a power source called magnetron are absorbed by the food and food becomes hot at once. Microwave cooking enhances the flavour of food because it cooks quickly with little or no water and thus preserves the natural colour of vegetables and fruits.

SOLAR COOKING

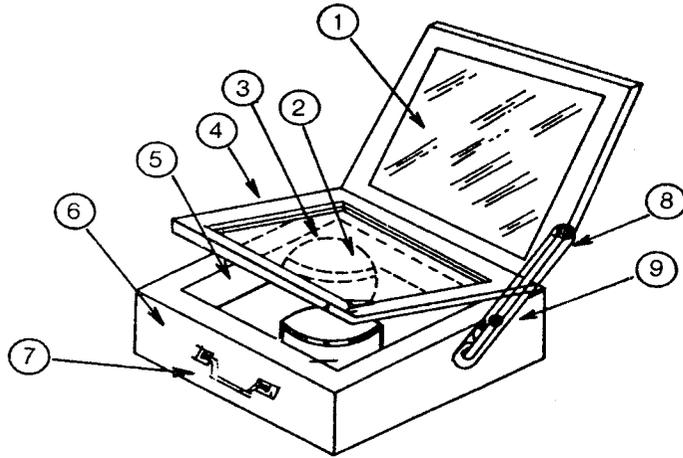


Fig.3-Parts of a Solar cooker

- | | |
|------------------------------|----------------------|
| 1. Plain mirror | 2. Cooking container |
| 3. Glass sheet | 4. Cover |
| 5. Insulation material glass | 6. Outer box |
| 7. Handle | 8. Mirror support |
| 9. Hinged adjuster and guide | |

Solar cooker works on solar energy. Solar cooker consists of well insulated box, the inside of which is painted dull black and is covered by one or more transparent covers, the purpose of which is to trap the heat inside the solar cooker. The temperature maintained is around 140°C. Cost of the cooker and the maintenance cost is low. It takes longer time and special vessels need to be used.

3.3 BASIC FOOD SCIENCE AND COOKERY.

Food is a mixture of many different chemical components. The study of food science involves an understanding of the changes that occur on these components during food preparation. Study of food science also includes understanding the nutritive value of different foods and methods of preserving them during cooking.

3.3.1. Cereals

The principle cereal crops are rice, wheat, maize, jowar, ragi and bajra.

Composition and nutritive value.

Cereals are the main source of energy. Rice provides 345 calories and 6.8 grams of protein per 100 grams and wheat provides 341 calories and 12.1 grams of protein per 100 gms. Ragi is a rich source of calcium and iron. Wheat and ragi are rich in fibre. Whole grain cereals are an important source of B vitamins in our diet.

Principles of cooking

Gelatinisation

When starch granules are mixed with water and cooked the grains absorb water and swell. This process is known as gelatinisation.

Dextrinisation

If starch is subjected to dry heat, it is converted to dextrin, giving a brown colour. This is called dextrinisation.

Gluten formation

Glutenin or glutelin and gliadin are proteins present in wheat. During the mixing of a dough the long strands of **glutenin evidently becomes aligned in the direction of mixing** and forms a film that envelopes the starch granules in the dough. In the presence of water and with mechanical agitation, the protein **fraction forms a tough elastic complex called gluten**, which is capable of retaining gases and by doing so, a leavened product is obtained. Due to its elastic property, the dough can be rolled to prepare chapathis or puris.

3.3.2. Pulses

Pulses are edible fruits or seeds of pod bearing plants. The major pulses which are used are red gram dhal, bengal gram dhal, black gram dhal and green gram dhal.

Composition and nutritive value

Pulses contain 55 to 60% starch. Every 100 grams of pulses provide about 350 calories and 22 grams of protein. Pulses are excellent source of B complex vitamins particularly thiamine, folic acid and pantothenic acid. Soyabean provides 43 grams of protein per 100 grams. Whole grams are good sources of protein, B-vitamins and fibre.

Principles of cooking

Many pulses particularly whole grams, which have hard outer covering need soaking prior to cooking. Addition of sodium bicarbonate hastens the cooking process, but is not advisable because it destroys the B vitamins.

3.3.3. Vegetables

The term vegetable is used to refer to those plants or parts of plants that are served raw or cooked as a part of the main course of a meal.

Composition and nutritive value

Nutritionally they are classified into 3 groups,

- (i) **Green Leafy Vegetables:** They are good sources of β - carotene, calcium, riboflavin, folic acid, ascorbic acid, iron and vitamin K.
- (ii) **Roots and Tubers:** They are good sources of calories and fairly good sources of Vitamin C. eg. Potato, Carrots etc.
- (iii) **Other Vegetables:** They contribute to the fibre content of the diet. Ladies finger and cluster beans are a good source of folic acid.(eg.) Brinjal, Ladies finger, etc.

Role of vegetables in cookery

- They are used in curries, salads, and in sambar.
- They are used as garnishing agents.
- They are used as stuffing in samosas and parathas.

- They are used as thickening agents in gravies and soups.
- They are used in chutneys and pickles.

3.3.4. Fruits

Fruits are the ripened ovary or ovaries of a plant together with adjacent tissues. Fruits are fleshy or pulpy in character, often juicy and usually sweet with fragrant, aromatic flavours.

Composition and nutritive value

Fruits are very poor source of protein and fat . They are good source of fibre, β - carotenes and vitamin C.

Serving of fruits

Raw, whole or cut fruits are frequently served as an appetiser, or as a salad or for dessert. Some fruits are served in the form of juices or milk shakes. Sometimes apples are served as stewed apples.

3.3.5. Milk and milk products

Milk is one food for which there seems to be no adequate substitute. The milk products include curd, butter, skimmed milk, condensed milk, khoa, paneer and cheese.

Composition

Milk is a complex mixture of lipids, carbohydrates, proteins and many other organic compounds and inorganic salts dissolved or dispersed in water. The chief carbohydrate present in milk is lactose, a disaccharide although trace amounts of glucose, galactose and other sugars are also present. The protein present in milk is caesin.

Nutritive value

Milk provides 67 calories and 3.2 grams of protein per 100ml. Milk has good quality protein. Dairy foods are a major source of calcium and riboflavin.

The ratio of calcium : phosphorus in milk is regarded as most favourable for bone development. In addition, dairy products contain

other nutrients such as vitamin D and lactose which favour calcium absorption.

Milk is not a good source of niacin, but it is an excellent source of tryptophan. Milk is a very poor source of vitamin C and iron.

Principles of cooking

- **Prevention of scorching or burning** - Too thin vessels and too high a temperature can scorch the milk at the bottom of the vessel. Use double boilers or stir constantly.
- **Prevention of scum formation** - This can be achieved by covering the pan, stirring or using milk cooker.

Pasteurization: The microorganisms present in milk are killed using a method called pasteurization, where milk is heated to 65°C for 30 minutes or 72°C for 15 seconds and cooled rapidly.

Role of milk and milk products in cookery

- Milk contributes to the nutritive value of the diet.
- It adds taste and flavour to the product.
- Milk is used in dessert.
- Curd or buttermilk is used as leavening agent and to improve the texture.
- Curd or buttermilk is given to patients with diarrhoea.

3.3.6 Eggs

Although eggs of all birds may be eaten, the egg of chicken is used more often than any other birds.

Composition

The chief protein of egg white are ovalbumin, conalbumin, ovomucin and avidin. The major proteins in egg yolk are lipoprotein which includes lipovitellins and lipovitellin. The fat in the egg yolk contains triglycerides and phospholipids (ie) lecithin.

Table 1
Nutritive value of egg / 100 g

NUTRIENT	AMOUNT
Energy (Kcal)	173
Protein (g)	13.3
Fat (g)	13.3
Calcium (mg)	60.0
Phosphorus (mg)	220.0
Iron (mg)	2.1
Retinol (mcg)	420
Thiamine (mg)	0.1
Riboflavin (mg)	0.4
Niacin (mg)	0.1
Folic acid (mcg)	78.3
Vitamin B ₁₂ (mcg)	0.2

One egg weighs between 40-50g. Egg contains good quality protein. Egg yolk is a good source of iron, vitamin A, riboflavin, folic acid and vitamin B₁₂.

Role of egg in cookery :

Eggs are used as

- boiled , scrambled or poached for table use.
- thickening agent (eg) custards.
- Emulsifying agent (eg) Mayonnaise.
- Leavening agent (eg) cakes.
- Binding and coating agent, (eg) cutlets.
- Interfering substances (eg) ice creams.
- Garnishing agents (eg) soups.
- Flavoring agents (eg) custards.
- Enriching agent (eg) egg nogs.
- Improve colour (eg) custards.

3.3.7. Flesh foods

The term flesh foods include meat, poultry and fish,

Meat

The term meat refers to the muscles of warm-blooded, four legged animals, the chief ones being cattle, sheep and pigs.

Meat provides 86 calories and 19.4 grams of protein per 100gm. Meat is an excellent source of some of the B complex vitamins. Liver is an excellent source of iron and vitamin A.

Tender cuts of beef, lamb and pork may be cooked by roasting, broiling, pan-broiling, frying, braising, stewing and pressure-cooking.

Poultry

The term poultry is applied to all birds used as food and includes chicken, duck, geese, turkey and pigeons. Of these chicken and turkey are most commonly used for their meat.

Poultry meat has high protein content and contains all the essential amino acids required for building body tissues. Poultry flesh is a good source of B vitamins and minerals.

Moist heat methods are applied to older and tougher birds and dry heat methods are applied to young tender birds.

Fish

Edible fish are categorised as either fin fish or shell fish. Fish is an excellent source of protein. They contain around 20 % protein. Fresh water fish contains n-3 fatty acids, the consumption of which reduces the incidence of heart diseases. Fish is rich in calcium. Fish liver oils are excellent source of vitamins A and D. Fish are good source of niacin and vitamin D.

Fish is usually cooked by dry heat methods of cooking like broiling, baking and frying. Moist heat method is also effectively used to protect the delicate flavour of the fish.

3.3.8. Spices

Aromatic food substances, which enhance flavour, are classified into spices, herbs and seasonings. Spices are usually dried roots, barks or seeds used whole, crushed or powdered (eg) cloves. Herbs are usually the fresh leaves (eg) coriander leaves. Seasonings are the bulbs used fresh like onion and garlic.

Role of spices in cookery

- Spices are used as flavouring agents (eg) garam masala added to pulav.
- Spices are used as colouring agents (eg) turmeric added to lime rice.
- Spices give pungency (eg) ginger.
- They act as preservatives (eg) fenugreek powder added to pickles.
- They act as souring agents (eg) dry mango powder.
- Spices act as thickening agents (eg) poppy seeds added to kurma.
- They have antibacterial and anticarcinogenic properties (eg) turmeric, garlic.
- Spices reduce blood sugar and blood cholesterol levels. (eg) fenugreek seeds.

3.3.9. Beverages

Beverages may be classified according to their functions in the body.

- Refreshing (eg) fruit juices.
- Nourishing (eg) milk shakes.
- Stimulating (eg) coffee and tea.
- Soothing (eg) warm milk and hot tea.
- Appetising (eg) soups.

Points to remember while making beverages

- Beverages should be served as soon as possible after preparation in order to retain fresh natural flavour.
- Hot beverages should be served hot and cold beverages ice cold.
- Beverages should be served in attractive glass tumblers.
- Beverages must not be diluted too much with either water or ice.

Alcoholic beverages

Beer

The principle raw materials of beer manufacture are malted barley, rice and corn, which supply carbohydrates for fermentation by yeast into ethyl alcohol and carbon dioxide.

Wine

As grapes mature, the wine yeast *saccharomyces ellipsoideus* naturally accumulates on the skin. When the crushed grape is placed at a temperature of about 27°C the juice proceeds to ferment yielding ethyl alcohol, carbon dioxide and traces of flavour compounds.

3.4. BASIC KNOWLEDGE OF IMPORTANT NUTRIENTS

Nutrients are the constituents in food that must be supplied to the body in suitable amounts. These include carbohydrates, fats, proteins, minerals and vitamins.

3.4.1 .Carbohydrates

Carbohydrates are sugars or polymers of sugars such as starch, that can be hydrolyzed to simple sugars by the action of digestive enzymes or by heating with dilute acids.

Carbohydrates are classified as monosaccharides or simple sugars (glucose, fructose), disaccharides or double sugars (sucrose, lactose) and polysaccharides which include many molecules of simple sugars (starches, dextrins).

Functions

1. The body uses carbohydrate as a source of energy. One gm of carbohydrate provides 4 kilocalories.
2. They are the major source of energy for muscular work.
3. The main source of energy for the central nervous system is glucose.
4. The body mainly uses carbohydrate as the source of energy, thus sparing the tissue protein breakdown for energy purpose. This is

called “protein sparing action of carbohydrates”.

5. In the liver, carbohydrates have special functions to perform. They include detoxifying action and a regulating influence on protein and fat metabolism.
6. The heart muscle mainly uses glucose as a source of energy.
7. Excess of calories is stored in the form of fat in the adipose tissue.
8. Consumption of indigestible polysaccharides or fibre prevents constipation and reduces the incidence of heart diseases, diabetes mellitus and colon cancer.

Table- 2
Sources of carbohydrates

FOODS	CARBOHYDRATE %
RICH SOURCES	
Sugar, jaggery,	85 - 99
Cereals and millets	63 - 79
Dried fruits	67 - 77
GOOD SOURCES	
Pulses	56 - 60
Milk powder , full fat	38 - 39
Milk powder, skimmed	54 - 55
Roots and tubers	22 - 39
FAIR SOURCES	
Fresh fruits	10 - 25
Milk	4
Nuts and oil seeds	10 - 25

3.4.2 Fats

The term lipid or fat is applied to a group of naturally occurring substances characterised by their insolubility in water. The lipids present in the diet of animal and human body includes triglycerides, phospholipids and cholesterol.

Functions

1. Fats are a concentrated source of energy. One gram of fat provides 9 calories.
2. Fat is essential for the absorption of fat soluble vitamins like vitamin A, D, E and K.
3. Fats improve the palatability and gives a satiety value (ie) feeling of fullness in the stomach.
4. Fats are deposited in adipose tissue and thus serve as a reserve source of energy during starvation and illness.
5. They protect vital organs in the body by forming a lining on top.
6. They act as insulators against heat and cold.
7. They are the essential constituent of the membrane of every cell.
8. Phospholipids are present in the plasma in combination with proteins as lipoproteins which are involved in the transport of fat and cholesterol.
9. Phospholipids are present in large amounts in the nervous system and essential for its function.
10. Cholesterol serves as a precursor for the formation of bile acids.

Table- 3
Sources of fats

FOOD	FAT%
RICH SOURCES	
Pure oils and fats	100
Ghee and vanaspathi	100
Butter	80-81
GOOD SOURCES	
Nuts and oil seeds	40-60
Milk powder, fullfat	26
Eggs	14
Meat and fish	10-15

FAIR SOURCES	
Milk, cow's	4
Milk, buffalo	7
Pulses (whole)	3-5
Cereals and millets	2-3

3.4.3. Proteins

Dietary protein performs all three functions of nutrients .It is needed for growth, maintenance, and repair of body tissues. It regulates key processes within the body and only excess protein can be used as a source of energy.

Functions

1. Proteins are required for the growth and maintenance of tissues.
2. It is needed for the formation of essential body compounds.
3. It regulates water balance in the body.
4. It helps in the transport of nutrients.
5. It is required for the maintenance of appropriate pH.
6. It is also a source of energy. One gram of protein provides 4 calories.
7. It fights the body against diseases.
8. It helps in detoxifying action.

Table- 4
Sources of proteins

FOODS	PROTEIN%
RICH SOURCES	
Meat, fish and liver	18-20
Eggs	14
Milk powder, full fat	26
Cheese	18-20
Pulses, dry	18-24
Nuts and oilseeds	18-26
Soyabean	35-40
GOOD SOURCES	
Cereals and millets	6-12

3.4.4. Minerals

1. Calcium

Calcium makes up between 1.5-2% of body weight. Almost 99% of this calcium is found in the hard tissues of the body, namely the bones and teeth.

Functions

1. It is essential for the formation of bones and teeth.
2. It is essential for clotting of blood.
3. It regulates the permeability of capillary walls.
4. It is essential for the contraction of heart and muscle.
5. It regulates the excitability of nerve fibres and nerve centres.
6. It acts as an activator for the enzymes present in the gastric juice.

Table- 5
Sources of calcium

Food stuffs	Calcium (mg/100g)
Rich sources Milk powder, sesame seeds with husk and small dried fish	1.20-1.45
Good sources Ragi, milk and green leafy vegetables and small fish eaten with bone	0.10-0.33

2. Phosphorus

Phosphorus constitutes approximately 1% of the weight of the human body, Upto 90% of this is found within calcium phosphate crystals in the bones and teeth.

Functions

1. It is necessary for the formation of bones and teeth.
2. It is essential for carbohydrate metabolism.
3. It is a constituent of certain co-enzymes.
4. It is an essential constituent of nucleic acids and nucleoproteins which are integral parts of the cell nuclei.

Table- 6
Sources of Phosphorus

Food stuffs	Phosphorus (g/100g)
Cereals, Millets, Pulses, nuts and Oilseeds	0.20 - 0.65
Dried fish	1.2 - 1.3
Milk powder	0.76 - 0.82
Meat, fish and eggs	0.31 - 0.41
Milk	0.09 - 0.11

3. Iron

Most of the iron in the body is found in the blood, but some is present in every cell bound to iron containing enzymes.

Functions

1. It is required for the transport and storage of oxygen in cells & tissues.
2. It acts as co-factors of enzymes and other proteins.
3. It is required for the formation of red blood cells.

Table- 7
Sources of iron

Food stuffs	Iron (mg/100g)
Rich sources Sesame seeds, jaggery and green leafy vegetables.	10-20
Good sources Cereals and millets	3-8
Liver	7-9
Meat and egg	2-3

4. Iodine

Functions

Iodine is a constituent of thyroxine, the active principle of the thyroid gland. The thyroid gland plays an important role in energy metabolism and in the growth of the body.

Sources

Iodine is present only in small amounts in common foods, the quantity of iodine present depending on the iodine content of the soil. Iodised salt and seafood are good sources of iodine.

3.4.5. Vitamins

Vitamins may be defined as organic compounds occurring in small quantities in the different natural foods and necessary for the growth and maintenance of good health in human beings.

I. Fat soluble vitamins

1. Vitamin A

Functions

1. Vitamin A plays a critical role in vision in dim light.
2. Vitamin A is essential for the integrity of the mucous secreting cells of epithelial tissues.
3. It is essential for normal bone formation.
4. Vitamin A deficiency causes degeneration of the myelin sheath.
5. Vitamin A is essential for the synthesis of mucoproteins and glycoproteins.
6. It is essential for normal reproduction.

Sources

Vitamin A is present only in foods of animal origin, such as liver, eggs, milk and fatty fish. All plant foods contain only carotenoids which is converted to vitamin A in the body. Papaya, mango, carrots, green leafy vegetables and other yellow, orange coloured fruits and vegetables are good sources of β -carotene.

2. Vitamin D

Functions

1. Vitamin D promotes the absorption of calcium and phosphate from the small intestines.

2. This also acts on the bones directly promoting calcification.
3. It regulates the concentration of calcium in blood plasma.

Sources

The good sources of vitamin D includes sunlight, fish liver oils, butter, cheese, ghee and milk.

3. Vitamin E

Functions

1. It is essential for normal reproduction in man.
2. It is required for the normal functioning of the immune system.
3. It is an antioxidant, which reduces the incidence of heart diseases.

Sources

Vegetable oils and fats, nuts and oilseeds and whole grains are the richest natural sources of vitamin E.

4. Vitamin K

Functions

Vitamin K is essential for blood coagulation. It is required for the synthesis of various substances needed for blood clotting.

Sources

The concentration of vitamin K is highest in dark green leafy vegetables, but it is also found in liver, pulses, cereals and some tubers.

II. Water soluble vitamins.

1. Vitamin C or Ascorbic acid

Functions

Vitamin C is essential for

1. Formation of collagens and intercellular cement substances.
2. Absorption of iron and incorporation of plasma iron in ferritin.
3. Bone formation.
4. Adrenal cortex function.

5. Neuro transmitter synthesis.
6. Aids in calcium absorption.
7. Drug detoxification.
8. Activation of hormones.

Sources

The rich sources of vitamin C includes amla, guava and other citrus fruits. Good sources include green leafy vegetables and fruits like papaya and tomato.

B Complex Vitamins

2. Thiamine or Vitamin B₁

Functions

1. Thiamine is essential for growth.
2. It is essential for maintaining the nerves in normal condition.
3. It plays an important role in carbohydrate metabolism.

Sources

Diets based on whole wheat, millets, raw hand pounded rice or parboiled rice usually supplies thiamine in the diet. Organ meats, pork, liver, eggs and whole grams are fair sources of thiamine.

3. Riboflavin or Vitamin B₂

Functions

1. Riboflavin is involved in the regulatory functions of some hormones involved in carbohydrate metabolism.
2. The retina contains free riboflavin, which is converted by light to a compound involved in stimulation of the optic nerve.
3. Riboflavin plays, an important role in many enzyme systems involved in the metabolism of carbohydrates, fats and proteins.
4. It is involved in the formation of red blood cells in the bone marrow.

Sources

Rich sources of riboflavin include milk and milk products, eggs, liver, and dried yeast. Good sources are green leafy vegetables, whole

cereals and millets, meat and fish. Fair sources include milled cereals, cereal products and roots and tubers.

4. Niacin or Nicotinic Acid

1. Nicotinic acid is essential for the normal functioning of the skin, intestinal tract and the nervous system.
2. Nicotinic acid is a component of two coenzymes NAD and NADP, which take part in several enzymatic reactions.

Sources

The rich sources of niacin are groundnuts, dried yeast and liver. Good sources are whole cereals, legumes, meat and fish. The fair sources include milled cereals, maize, milk and eggs.

5. Pyridoxine or Vitamin B₆

Functions

1. Pyridoxine like other vitamins functions as a co-enzyme.
2. It is essential for growth of infants and prevention of macrocytic anemia.

Sources

Meat, pulses, wheat and dried yeast are good sources while green leafy vegetables and other cereals are fair sources of this vitamin.

6. Folic acid

Functions

1. It is essential for the maturation of red blood cells.
2. It is required for the normal growth and division of all cells.
3. It plays a role in the metabolism of some amino acids.
4. It prevents megaloblastic anaemia.

Sources

Fresh green leafy vegetables, yeast, liver and eggs are rich sources of this vitamin. Cereals, pulses, nuts, oilseeds and other vegetables like ladies finger and cluster beans are good sources of this vitamin.

7. Vitamin B₁₂

Functions

1. It promotes the maturation of erythroid cells.
2. It is involved in biochemical-processes essential for DNA synthesis and division of cells.
3. It is required for the synthesis of myelin, the white sheath that covers the nerve fibers.
4. It stimulates appetite and improves the general health of the patient.
5. It cures the neurological symptoms of pernicious anemia.

Sources

Vitamin B₁₂ is normally present only in animal foods like liver, egg, mutton and milk.

8. Pantothenic Acid.

Functions

It is involved in the synthesis of amino acids, B₁₂ and hemoglobin.

Sources

The best sources of pantothenic acid are liver, kidney, egg yolk, yeast and fresh vegetables. Milk and meat are fairly good sources.

9. Biotin

Functions

Biotin takes part as a coenzyme in several metabolic functions of carbohydrate and lipid metabolism.

Sources

Liver, kidney and yeast extracts are good sources. Pulses, nuts and chocolate are fair sources of this vitamin.

3.5 BASIC FIVE FOOD GROUPS AND BALANCED DIET

Menu planning is the process of planning and scheduling intake of meals for a general or specific individual requirements.

3.5.1. Basic Five Food Group : The five food group suggested by ICMR given in the following table, permits an individual to plan a menu

to achieve nutrient intake as specified by recommended dietary allowances.

Health professionals can use the basic five-food group for the following purposes.

1. Tool for nutritional assessment and screenings.
2. Tool for nutritional counselling.
3. Explain therapeutic diets to the patient.

Table - 8

The five food groups and their major nutrients

Group	Food Group	Main Nutrients
1.	Cereal grains and products: Rice, Wheat, Ragi, Bajra, Maize Jowar, Barley, Rice flakes, wheat flour.	Energy, Protein, invisible fat, vitamin B ₁ Vitamin B ₂ , Folic acid, Iron, Fibre.
2.	Pulses and Legumes Bengalgram, Blackgram, Greengram, Redgram, Lentil (whole as well as dhals) Cowpea, Peas, Rajmah, Soyabean, Beans	Energy, Protein, invisible fat, vitamin B ₁ Vitamin B ₂ , Calcium, Iron, Fibre, Folic acid.
3.	Milk and Meat Products Milk, Curd, Skimmed Milk, Cheese, Chicken, Liver, Fish, Egg, Meat. Fruits and Vegetables	Protein, fat, Vitamin B ₂ , Calcium.
4.	Fruits : Mango, Guava, Tomato, Papaya, Orange, Sweet lime, Water melon, Vegetables : (Green leafy) amaranth, Spinach, Gogu, Drumstick, Leaves, Coriander leaves, Fenugreek, leavesl. Other vegetables : Carrots, Brinjal, Ladies finger, Beans capsicum, Onion, Drmstick, Cauliflower.	Carotenoids, Vitamin C, Fibre, invisible fat, Vitamin B ₂ , Folic acid, Iron. Carotenoids, Vitamin B2, Folic acid, Cal- cium, Iron, Fibre. Carotenoids, Folic acid, Calcium Fibre.

5.	Fats and Sugar Fats : Butter, Ghee, Hydrogenated fat, Cooking oils like Groundnut, Mustard, Coconut, Sugar and Jaggery	Energy Fat, Essential Fatty acids
----	--	--------------------------------------

3.5.2. Principles of Planning Menus.

1. A good menu plan should meet the nutritional requirements of each member of the family.
2. Meal pattern must fulfill family needs.
3. Meal planning should save time and energy.
4. Meal planning should satisfy the budget of the family.
5. Meal plan should give maximum nutrients.
6. The meal planned should consider individual likes and dislikes.
7. Planned meals should provide variety.
8. Meals should give satiety.
9. Menus should include available foods.

Steps Involved in Planning a Menu

Balanced diet is one which contains different types of foods in such quantities and proportions so that the need for calories, proteins, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand short duration of leanness.

A balanced diet should provide around 60-70% of total calories from carbohydrate, 10-12% from protein and 20-25% of total calories from fat.

There are three steps involved in planning a menu.

STEP I - RECOMMENDED DIETARY ALLOWANCES

To calculate balanced diet, as a first step, there is a need to know Recommended Dietary Allowances for different age groups prescribed by Nutrition Expert committee of Indian Council of Medical Research (ICMR).

Table - 9
Recommended dietary allowances for Indians - 1989

Group Particulars	Body wt	Net energy	Protein	Fat	Calcium	Iron	Vitamin A	
							Retional	β-carotene
	kg	kcal/d	g/d	g/d	mg/d	mg/d	μg/d	μg/d
Man								
Sedentary work		2425						
Moderate work	60	2875	60	20	400	28	600	200
Heavy work		3800						
Woman								
Sedentary work		1875						
Moderate work	50	2225	50	20	400	30	600	2400
Heavy work		2925						
Pregnant woman		+300	+15	30	1000	38	600	2400

Source : Dietary guidelines for Indians, a Manual, National Institute of Nutrition, ICMR, Hyderabad 500 007

Table-11

Balanced diet for adults - sedentary/moderate/heavy activity

(number of portions)

Food Group	Portion g	Type of work					
		Sedentary		Moderate		Heavy	
		Man	Woman	Man	Woman	Man	Woman
Cereals and millets	30	14	10	16	12	23	16
Pulses	30	2	2	3	2.5	3	3
Milk	100ml	3	3	3	3	3	3
Roots & tubers	100	2	1	2	1	2	2
Green leafy vegetables	100	1	1	1	1	1	1
Other vegetables	100	1	1	1	1	1	1
Fruits	100	1	1	1	1	1	1
Sugar	5	5	4	8	5	11	9
Fats and Oils (visible)	5	4	4	7	6	11	8

For non-vegetarians substitute one pulse portion with one portion of egg/meat/chicken/fish.

Source

Dietary guidelines for Indians - A manual, National Institute of Nutrition, ICMR Hyderabad, 500 007.

Table - 12

**Balanced diet for infants, children and adolescents
(number of portions)**

Food Groups	Portion g	Infants g 6-12 months		Years					
				1-3		4-6	7-9	10-12	13-18
				Girls	Boys	Girls	Boys	Girls	Boys
Cereals and Millets	30	1.5	4	7	9	9	11	10	14
Pulses	30	0.5	1	1.5	2	2	2	2	2
Milk (ml)	100	5	5	5	5	5	5	5	5
Roots and tubers	100	0.5	0.5	1	1	1	1	1	2
Green leafy vegetables	100	0.25	0.5	0.5	1	1	1	1	1
Other vegetables	100	0.25	0.5	0.5	1	1	1	1	1
Fruits	100	1	1	1	1	1	1	1	1
Sugar	5	5	5	6	6	6	7	6	7
Fats / Oils (visible)	5	2	4	5	5	5	5	5	5

Quantity indicates top milk. For breast fed infants, 200 ml top milk is required.

One portion of pulse may be exchanged with one portion (50 g) of egg/meat/chicken/fish.

For infants introduce egg/meat/chicken/fish around 9 months.

Specific recommendations as compared to a sedentary woman:

Children

- 1 -6 years : ½ to ¾ the amount of cereals, pulses and vegetables and extra cup of milk
- 7-12 years : Extra cup of milk
- Adolescent girls : Extra cup of milk
- Adolescent boys : Diet of sedentary man with extra cup of milk.

Source : Dietary guidelines for Indians - A manual, National Institute of Nutrition, ICMR. Hyderabad 500 007.

STEP III -PLANNING THE MENU

The foods that are listed in step II are converted into the actual recipes and distributed in different meals like breakfast, lunch, evening tea and dinner. The food pyramid given below shows the dietary guidelines in the easily understood graphic format.

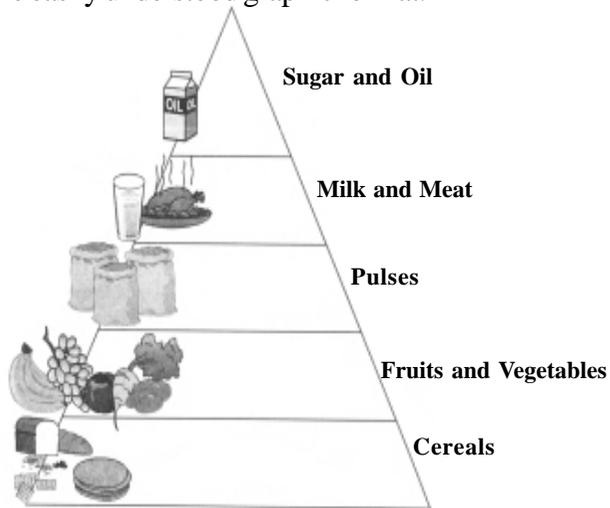


Fig. 4. Food Pyramid

The food pyramid given above shows the dietary guidelines in the easily understood graphic format.

3.5.3. Principles of planning menus for different age groups.

INFANCY (0-12 MONTHS)

Breast milk is not only the best but it is a must for the infant, only breast milk should be given to the infant upto the age of 6 months.

The advantages of breast-feeding are as follows.

1. Breast milk protects the baby against several diseases like diphtheria, poliomyelitis, influenza and other bacterial diseases.
2. The composition of human milk is best suited to the infants, aiding in easy digestibility.
3. Breast feeding is associated with reduced need for hospitalization and improved child survival.
4. An infant derives a sense of security and belonging in being held.
5. It is economical to breast feed an infant.
6. Breast feeding is an important birth control method.
7. Breast feeding enables the mother to shed extra weight accumulated during pregnancy and the uterus comes back to normal size faster when the mother breastfeeds the infant.
8. Human milk is always fresh and at the right temperature.
9. Low danger of incorrect formula and overfeeding.
10. There is evidence to suggest that breast fed babies have better IQ scores later in life and their mental ability is improved.

World Alliance for Breast feeding Action (WABA) has designated August 1st – 7th as the World Breast Feeding Week.

Weaning

Weaning begins from the moment supplementary food is started and continues till the child is taken off the breast completely. The types of supplementary foods include liquid supplements (fresh fruit juices, soup from green leafy vegetables), solid supplements mashed well (cereal and starchy gruels) and solid supplements unmashed (cooked cereals, pulses and vegetables).

Preschool Children (1-6 Years)

1. The diet should include a variety of foods.
2. The food should be interesting and attractive (eg) chapathis and puris can be made into different shapes.
3. Child should never be forced to eat more than he can take.
4. Food preferences of the child should be taken into consideration.
5. Flavour or color of the milk can be changed to encourage the child to drink more milk.
6. Milk can be given in other forms like milk shakes, ice creams etc.,
7. Regularity of meal times is essential.
8. The person feeding the child should not show any dislike of that food in front of the child.
9. The child should never be hurried while taking the food.
10. Different cooking methods and new attractive combinations encourage the child to eat more.

Some suggested recipes include noodles, tricolor sandwiches, milk shakes and ice creams.

School Children (6-12 Years)

1. Menus need to provide variety in colour, texture, taste and flavour.
2. Children do not like to spend too much time at the table for eating. So menus have to provide dishes that are quick to eat and yet satisfying nutritionally.
3. Nutritional requirement should meet their increasing activity and growth.

4. Children have varying appetites and often prefer snacky meals at frequent intervals to a few large ones.
5. New foods are likely to be accepted if it is given in a form, which can be easily handled, and they should be offered at regular intervals until the child learns to accept it.
6. The young child should be encouraged to eat with the rest of the family to help him to learn good eating habits.

Adolescence (13-18 Years)

1. Adequate well balanced nutritious foods should be taken to prevent obesity or under nutrition.
2. An adolescent girl should take enough calcium rich foods in her diet to increase bone density, which delays the onset of osteoporosis.
3. No meal of the day should be missed.
4. Avoid empty calorie foods such as carbonated beverages and junk foods.
5. Iron rich foods may be included in the diet to prevent anemia.
6. Calorie and protein rich foods should be taken to support the growth spurt.
7. Include fruits and vegetables in the diet to meet the vitamins, minerals and fibre requirement.
8. Eating habits should be independent of emotions.

ADULTS

1. Foods from all five food groups should be included in every menu.
2. It is better to include two cereals in one meal.
3. To improve the cereal and pulse protein quality, minimum ratio of cereal protein to pulse protein should be 4:1.
4. Foods rich in fiber should be included in the diet.
5. Every diet should contain atleast one medium size fruit.
6. Inclusion of salads or raitha not only helps in meeting the vitamin requirements, but the meals would be attractive and have high satiety value due to the fiber content.

7. One-third of calories and protein requirement should be met by lunch or dinner.
8. Processed foods contain a variety of food additives. They may not be nutritionally balanced unless fortified.
9. Fried foods cannot be planned, if oil allowance is less or low in calorie diets.
10. At least five servings of fruits and vegetables should be included in a day's diet.

OLD AGE

After the age of 35, the basal metabolic rate decreases due to reduced muscle mass and other metabolically active tissue mass. Also there is reduction in physical activity which affects the energy needs.

The ICMR energy requirements of adults of different ages are given in the following table.

Table -13

Energy requirement at different ages of adults males and females with different body weights (Kcal/24 hr)

		Age 30+ to 59 + yrs				Age 60 + yrs.	
		Activity				Activity	
Sex	Body Weights kg	BMR	Seden tary	Moderate	Heavy	BMR	Seden tary
Male	45	1325	2120	2518	3333	1040	1664
	50	1380	2208	2622	3450	1105	1768
	55	1435	2296	2727	3588	1170	1872
	60	1485	2376	2822	3713	1235	1976
	65	1540	2464	2926	3850	1295	2072
	70	1595	2552	3031	3988	1360	2176
Female	75	1650	2640	3135	4125	1425	2280
	40	1120	1792	2128	2800	0965	1544
	45	1160	1856	2204	2900	1015	1624
	50	1200	1920	2280	3000	1065	1704
	55	1240	1984	2356	3100	1115	1784
	60	1285	2056	2442	3213	1165	1864
	65	1325	2120	2518	3313	1215	1944
	70	1365	2184	2594	3413	1265	2024

Source : A report of the expert group of The Indian Council of Medical Research, 2000, Nutrient requirements and recommended dietary allowances for Indians ICMR. New Delhi. 110 029.

Dietary modification

The dietary modification to be made in old people's diet and the reason for modification is given in the following table.

Table- 14

Modification of diet during old age

Dietary modification	Reason
Foods must be soft, easily chewable.	Problems of dentition, fallen teeth or dentures.
Foods should be easily digestible.	Decreased production of digestive enzymes.
Restricted fat in the diet, inclusion of PUFA.	Susceptible to heart disease.
Foods rich in fibre should be given.	To prevent constipation and reduce cholesterol level. Also to prevent colon cancer.
Coffee, tea and cola beverages should be restricted.	May result in insomnia due to over stimulation.
Foods rich in calcium like milk should be given.	To compensate the bone loss and reduce the incidence of osteoporosis.
Green leafy vegetables can be given liberally.	Source of nutrients like carotene, calcium, iron, riboflavin, folic acid and vitamin C, besides supplying fibre, Rich in antioxidants.
Foods of the elderly should consist of familiar	Unfamiliar or changes in the food pattern may lead to

foods. New foods are difficult to accept.	psychological problem like depression.
Clear soup at the beginning of meal.	Aids digestion.
Small and frequent meals instead of three heavy ones.	Favour more complete digestion and free from distress.
A glass of hot milk just before going to bed.	May induce sleep.
Heavy meal at noon and light evening meal.	Sleep is less likely to be disturbed.
Too many sweets with lot of fats and sugar should be avoided.	Too much of sugar may cause fermentation, discomfort due to indigestion and cause tooth ache and may increase cholesterol level. May lead to obesity.
Plenty of fluid	To prevent constipation and dehydration.

Pregnant women

A women who has been well nourished before her pregnancy with reserves of several nutrients so that the needs of the growing foetus can be met without affecting her health. Infants who are well nourished in the womb, have an enhanced chance of entering life in good physical and mental health. Mother's diet should produce adequate nutrients, so that maternal stores do not get depleted and produce sufficient milk to nourish her child after birth.

Dietary modification.

1. Nutrient dense foods are those that give the most nutrients per calorie consumed. This type of foods should be included in a pregnant women's diet.
2. Each meal should contain foods from all five food groups.

3. Small and frequent meals at regular intervals should be planned.
4. Usually a daily diet containing 3 cups of milk or its equivalent, two servings of meat, fish, poultry, eggs or a source of complete protein, a dark green or yellow vegetables and a generous serving of citrus fruits will provide a foundation for a nutritionally adequate diet.
5. Plenty of water at least four to six glasses in addition to what is contained in the form of milk and other beverages should be taken daily throughout pregnancy. This will help keep the bowels regular.

Lactating mothers

The nutritional link between the mother and the child continues even after birth. The newborn baby depends for some period solely on breast milk for his existence.

Lactating mother's nutritional requirements should meet her own daily needs, provide enough nutrients for the growing infant and furnish the energy for the mechanics of milk production. Diet of lactating mother and her nutritional status during pregnancy affect to a certain extent the quality and quantity of breast milk.

Dietary guidelines

1. Nutritional requirements are maximum during lactation compared to any other age group in a woman's life. Hence the diet should be balanced and meet the nutritional requirement.
2. Number of meals can be increased.
3. The diet can include lactogogues like garlic, nuts, etc which stimulate the production of milk.
4. It is better to control constipation by including raw and cooked fruits and vegetables, whole grains and adequate amount of water.
5. No food need to be withheld from the mother unless it causes distress to the infant.

- If the mother loses rapid weight while breast feeding, her calorie intake is to be increased. Some suggested recipes include badam kheer, garlic chutney, fried snacks and custards.

Nutritional deficiency diseases and diet in different diseases will be dealt in class XII.

PRACTICALS

- Collection and preparation of recipes to match various methods of cooking (at least 2 recipes for each method)
- Preparation of recipes choosing foods from different food groups - 2 each from cereal, pulses, vegetables, fruits, eggs, meat, fish, milk and beverages.
- Making charts showing sources of carbohydrates, proteins, fats, vitamins and minerals.
- Planning and preparation of full day's menu and calculation of nutritive value for different age groups - preschool, school going, adolescents, adults, old age, pregnant and lactating mothers.

QUESTIONS

Section - A

I. Fill in the Blanks

- When food is cooked uncovered on heated metal or frying pan, the method is known as _____
- _____ helps in proper thyroxin function.
- In yellow orange vegetables vitamin _____ is present .
- Green leafy vegetables is an example of _____ food.
- For normal reproduction in man, vitamin _____ is essential.

- _____ is cooking foods by just immersing them in water at 100°C.
- Samosas are cooked by _____
- Soyabean provides _____ grams of protein per 100 grams.
- The recommended calories intake for a person doing sedentary work is _____ calories.
- The recommended protein for a 15 year old adolescent girl is _____ grams.

II. True Or False

- Simmering slowly in a covered pan with sufficient water is called stewing.
- Lactogogues helps in increasing milk production.
- Milk is a good a source of calcium.
- Braising is an example of combination method of cooking.
- Fish is a good source of n-3 fatty acids.
- When foods cooked in a pan with a well fitting lid at temperature just below the boiling point, it is called simmering.
- One gram of carbohydrate provides 4 calories.
- Calcium and phosphorous are essential for the formation of bones and teeth.

III. Choose the correct answer

- This is a moist heat method.
a) steaming b) sauteing c) baking.
- This is an appetising beverage
a) soup b) milk shakes c) coffee
- This is an example of moist heat method
a) baking b) braising c) pressure cooking

4. Cooking in a minimum amount of liquid at a temperature of 80°-85°C is called as
a) steaming b) poaching c) simmering.
5. When food is cooked uncovered on heated metal or frying pan this method is known as
a) panboiling b) grilling c) frying
6. Idlis are made by this method of cooking
a) pressure cooking b) frying c) steaming
7. This contains fibre and B vitamins.
a) green leafy vegetables b) potato c) carrot
8. This is a rich source of protein
a) meat b) vegetables c) fruits.

IV. Match the following

- | | |
|-------------------------|----------------------------------|
| 1. Nourishing beverage | dry heat |
| 2. Stimulating beverage | combination
method of cooking |
| 3. Steaming | soup |
| 4. Grilling | milk shake |
| 5. Braising | infants |
| 6. Weaning | lactogogues |
| 7. Garlic | coffee |
| 8. Appetising | moist heat method of cooking |

V. Answer in one/two words

1. Name 2 protective foods.
2. Name any 2 functions of spices.
3. Give 2 sources of vitamin C.

4. Give any one advantage of solar cookery.
5. Give an example of refreshing beverage.

Section-B

1. What is dextrinisation?
2. Define balanced diet.
3. What are the functions of spices?
4. What is gelatinisation?
5. What is gluten formation?

Section-C

1. How do you classify foods according to functions ?
2. What are the objectives of cooking food?
3. Classify beverages. Give examples.
4. Explain basic five food groups.
5. Write short notes on microwave cooking.
6. What are the advantages of breast feeding?
7. Explain the role of egg in cookery.
8. Give the nutritive value of milk, egg and meat.
9. What are the factors to be considered in planning menus for pregnant and lactating mothers?
10. What are the functions of different fat soluble vitamins?

Section - D

1. What are the factors to be considered in planning menus for preschool children, school going children and adolescents?
2. Explain the functions and sources of water soluble vitamins.
3. Explain the functions and sources of different minerals.
4. Explain the different cooking methods .
5. Explain the different steps in planning menus.

4. LIFE SPAN DEVELOPMENT

Studying and learning about children leads the way to a better understanding of what they are all about, their growth and development, behavioral changes, sex role typing and hazards, throughout the life span. In this chapter on Life Span Development we get to understand the meaning of developmental changes, stages in the life span, developmental tasks in different stages and major characteristics in periods starting from prenatal stage to late childhood. This also includes a glimpse into childhood diseases and substitute child - care.

4.1 MEANING OF DEVELOPMENTAL CHANGES

The term **development** means a progressive series of changes that occur as a result of maturation and experience. To understand the pattern of development, certain fundamental and predictable facts must be taken into consideration. They are

a. Early foundation are critical:

Attitude, habits and patterns of behaviour established during the early years of age, determine to a large extent how individuals will be able to adjust to life as they grow older. The foundations laid during the first two years of life are the most critical.

b. Role of maturation and learning in development

Maturation & learning play important roles in development. Maturation is the unfolding of the individual's interest traits -functions which are common to the human race such as crawling, sitting, walking, etc.

Learning is development that comes from exercise and efforts on the individual's part- these are specific to the individual like writing, driving, swimming, etc.

c. Development follows a definite and predictable pattern

These are orderly pattern of physical, motor, speech, intellectual development eg: laws of developmental direction -the “cephalocaudal law” which maintains that development spreads over the body from head to feet and the “proximodistal law” which maintains that development spreads outward from the central axis of the body to the extremities.

d. All individuals are different

Every person is biologically and genetically different from every other, even in case of identical twins and there is evidence that differences increase rather than decrease as children grow from childhood into adolescence and eventually to old age.

e. Each phase of development has characteristic behaviour

During the growing up years, the patterns are marked by period of equilibrium, when individuals adapt or adjust easily to environmental demands and as a result, make good personal and social adjustments. The other is periods of disequilibrium, when they experience difficulties in adaptation and as a result make poor personal and social adjustments.

f. Each phase of development has hazards

There is evidence that each period in the life span has associated with it certain developmental hazards or problems, Which can be physical, psychological, social or environmental in origin and these inevitably involve adjustment problems. Awareness of these hazards will help people to cope with these and adjust better.

g. Development is aided by stimulations

Stimulation in the form of support and encouragement given to children by parents and elders will aid development in children in the desired direction.

h. Development is affected by cultural changes

Individual’s development and behaviour is moulded to conform to cultural standard and ideals and life style. Changes in these standards affect the development pattern.

i. Social expectation for every stage of development

Every cultural group expects its members to master certain essential skills and acquire certain approved pattern. These are referred to as “developmental tasks” - a task which arises at or about a certain period in the life of the individual. Successful achievement of these tasks will lead to happiness and to success with later tasks.

j. Traditional beliefs about people of old ages

These beliefs about physical and psychological characteristics affect the judgment of others as well as their self evaluation. This is true of the traditional beliefs about sex differences and the cultural stereotype of males & females at all ages. So long as they persist, they have a profound influence on the developmental pattern.

After a brief note on the meaning of development and pattern of development of let us try to understand the different stages in the life span and the developmental tasks during the life span.

4.1.1 Stages in the life span

- | | |
|------------------------------|---|
| a) Prenatal period | - conception to birth |
| b) Infancy | - birth to the end of the second week |
| c) Babyhood | - end of the second week to end of the second year. |
| d) Early childhood | - two to six years |
| e) Late childhood | - Six to ten years or twelve years |
| f) Puberty or preadolescence | - Ten or twelve to thirteen or fourteen years |
| g) Early adulthood | - eighteen to forty years |
| h) Middle age | - forty to sixty years |
| i) Old age | - sixty to death. |

4.1.2. Havighurst's developmental tasks during the life span

Babyhood and early childhood

- Learning to take solid foods
- Learning to walk
- Learning to talk
- Learning to control the elimination of body wastes
- Learning sex differences and sexual modesty
- Getting ready to read
- Learning to distinguish right and wrong and beginning to develop a conscience

Late childhood

- Learning physical skills necessary for ordinary games
- Building a wholesome attitude toward oneself as growing organism
- Learning to get along with age-mates
- Beginning to develop appropriate masculine or feminine social roles
- Developing fundamental skills in reading, writing, and calculating
- Developing concepts necessary for everyday living
- Developing a conscience, a sense of morality, and a scale of values
- Developing attitudes toward social groups and institution
- Achieving personal independence

Adolescence

- Achieving new and more mature relations with agemates of both sexes
- Achieving a masculine or feminine social role
- Accepting one's physique and using one's body effectively
- Desiring, accepting, and achieving socially responsible behavior
- Achieving emotional independence from parents and other adults

- Preparing for an economic career
- Preparing for marriage and family life
- Acquiring a set of values and an ethical system as a guide to behavior - developing an ideology

Early adulthood

- Getting started in an occupation
- Selecting a mate
- Learning to live with a marriage partner
- Starting a family
- Rearing children
- Managing a home
- Taking on civic responsibility
- Finding a congenial social group

Middle age

- Achieving adult civic and social responsibility
- Assisting teenage children to become responsible and happy adults
- Developing adult leisure-time activities
- Relating oneself to one's spouse as a person
- Accepting and adjusting to the physiological changes of middle age
- Reaching and maintaining satisfactory performance in one's occupational career
- Adjusting to aging parents

Old age

- Adjusting to decreasing physical strength and health
- Adjusting to retirement and reduced income
- Adjusting to death of spouse
- Establishing an explicit affiliation with members of one's age group
- Establishing satisfactory physical living arrangements
- Adapting to social roles in a flexible way

Having learnt the pattern of development, stages in the life span and developmental tasks during the life span, let us go into details of each

stage, starting from prenatal period, which is the first stage in the life span to late childhood.

4.2. CHARACTERISTICS OF THE PRENATAL PERIOD

This is the first developmental period in the life span, though the period is short it is in many respects one of the most important period. It begins at conception and ends at birth approximately 270 to 280 days in length or of calendar 9 months. This has six important characteristics.

Although it is relatively short, the prenatal period has six important characteristics, each of which has a lasting effect on development during the life span. They are

1. The hereditary endowment which serves as the foundation for later development is fixed once and for all, at this time. While favourable or unfavourable conditions both before and after birth may and probably will affect to some extent the physical and psychological traits that make up this hereditary endowment, that changes will be quantitative and not qualitative.
2. Favourable condition in the mother's body can foster the development of hereditary potentials while unfavourable conditions can stunt their development.
3. The sex of the newly created individual is fixed at the time of conception and conditions within the mother's body will not affect it.
4. Proportionally greater growth and development take place during the prenatal period than at any other time throughout the individual's entire life. During these nine months, the individual grows from a microscopically small cell to an infant who measures approximately twenty inches in length and weigh on an average 3-3.5 kg. Development is rapid.
5. The prenatal period is a time of many hazards, both physical and psychological. This can have a marked effect on the pattern of later development or may even bring development to an end.

6. How life begins - New life begins with the union of a male sex cell and a female sex cell. These sex, cells are developed in the reproductive organs. There are twenty three pairs of chromosomes in each mature sex cell and each chromosome contains genes - the true carriers of heredity. At the time of conception four important conditions are determined that influence the individual's later development.

4.2.1. The four important conditions are

1. Hereditary endowment is the determination of the newly created individual's hereditary. Hereditary places limits beyond which individuals cannot go and it is entirely a matter of chance in the number of chromosomes from the maternal or paternal side that will be passed on to the child.
2. Sex - Determination of sex is the second important happening at the time of conception. Sex depends on the kind of spermatozoon that unites with the ovum.
3. Number of offsprings - when a ripe ovum is fertilized by one spermatozoon, the result will be a singleton, unless the fertilized ovum splits into two or more distinct parts during the early stages of cell cleavage, when this happens, the result will be identical twins, triplets or other multiple births. When two or more ova are released simultaneously and are fertilized by different spermatozoa, the result will be non identical twins, triplets or other multiple births.
4. Ordinal position - The fourth thing happening at the time of conception is the establishment, of the new child's ordinal position among siblings, such as the role the individual plays in the family and the treatment received from significant family members and their attitudes.

4.2.2. Some common characteristics of twins

Developmental Lag in physical, mental, motor, and speech development. Twins tend to lag behind singletons of the same age. Lag

in motor and speech development is also seen. This lag may be due to brain damage or to prematurity but it is more likely to be due to parental over protectiveness.

Physical Development

Twins tend to be smaller, age for age, than singletons. This is generally due to the fact that they are premature. They also suffer from brain damage and other physical defects more often than singletons.

Mental Development

Mental similarities between identical twins are much greater than between nonidentical twins and this persists into old age. Identical twins also show strong similarities in terms of special abilities, such as musical and artistic aptitudes.

Social Development

Twins tend to compete for adult attention, to imitate each other's speech and behavior, and to depend on each other for companionship during the preschool years. As they grow older, sibling rivalry and competition develop. One twin usually takes on the role of leader, forcing the other into the role of follower. This affects their relationships with other family members and with outsiders.

Personality Development

Many twins have difficulty in developing a sense of personal identity. This is especially true of identical twins and of nonidentical twins of the same sex. Others enjoy the close relationship of twinship and the attention they receive as a result by their similarity in appearance. This leads to self-satisfaction and self-confidence.

Behavior Problems

Behavior problems have been reported to be more common among twins than among singletons of the same ages. It is thought that this is a result of the way twins are treated, both at home and outside the home. Behavior problems have also been reported to be more common among nonidentical than among identical twins. It has been

suggested that this is because rivalry is stronger between nonidentical than identical twins.

It was interesting to read on the common characteristics of twins. Now let us analyse the three periods of prenatal development.

4.2.3. Periods of Prenatal Development

The prenatal period is ten lunar months of twenty eight days each in length or nine calendar months. This can vary from 180 to 334 days. Because prenatal development is orderly and predictable, it is possible to give a timetable of the important development taking place during this period. This period is divided into three stages.

Timetable of prenatal development

Period of the Zygote (fertilization to end of second week)

- The size of the zygote - that of a pinhead – remains unchanged because it has no outside source of nourishment; it is kept alive by yolk in the ovum.
- As the zygote passes down the fallopian tube to the uterus, it divides many times and separates into an outer and an inner layer.
- The outer layer later develops into the placenta, the umbilical cord, and the amniotic sac, and the inner layer develops into a new human being.
- About ten days after fertilization, the zygote becomes implanted in the uterine wall.

Period of the Embryo (end of the second week to end of the second lunar month)

- The embryo develops into a miniature human being.
- Major development occurs, in the head region first and in the extremities last.
- All the essential features of the body, both external and internal, are established.
- The embryo begins to turn in the uterus, and there is spontaneous movement of the limbs.

- The placenta, the umbilical cord, and the amniotic sac develop; these protect and nourish the embryo.
- At the end of the second prenatal month, the embryo weighs, on an average, 33 gm ($1^{1/4}$ ounces) and measures in length $1^{1/2}$ inches.

Period of the Fetus (end of the second lunar month to birth)

- Changes occur in the actual or relative size of the parts already formed and in their functioning. No new features appear at this time.
- By the end of the third lunar month, some internal organs are well enough developed to begin to function. Fetal heartbeat can be detected by about the fifteenth week.
- By the end of the fifth lunar month, the different internal organs have assumed positions nearly like the ones they will have in the adult body.
- Nerve cells, present from the third week, increase rapidly in number during the second, third, and fourth lunar months. Whether or not this rapid increase will continue and depend upon conditions within the mother's body such as malnutrition, which adversely affects nerve cell development - especially during the latter months of the prenatal period.
- Fetal movements usually appear first between eighteen and twenty-two weeks and then increase rapidly up to the end of the ninth lunar month when they slow down because of crowding in the amniotic sac and pressure on the fetal brain as the fetus takes a head-down position in the pelvic region in preparation for birth. These fetal movements are of different kinds - rolling and kicking and short or quick movements.
- By the end of the seventh lunar month, the fetus is well enough developed to survive, should it be born prematurely.
- By the end of the eighth lunar month the fetal body is completely formed, though smaller than that of a normal, full-term infant.

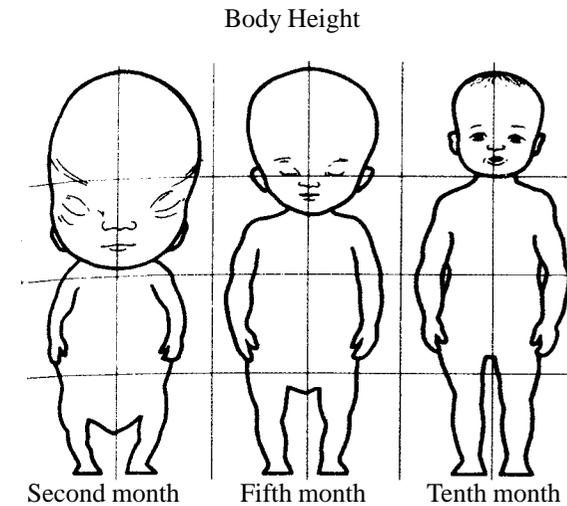


Fig. 1 - Body proportions at the end of different lunar months during the prenatal period

4.2.4. Hazards during the prenatal period

At no other time during the life span are there more serious hazards to development or hazards of a more serious nature, than during the relatively short period before birth. These may be physical or psychological.

Common physical hazards

Period of the Zygote

a) Starvation

The zygote will die of starvation if it has too little yolk to keep it alive until it can lodge itself in the uterine wall or if it remains too long in the tube.

b) Lack of Uterine Preparation

Implantation cannot occur if, as a result of glandular imbalance, the uterine walls are not prepared in time to receive the zygote.

c) Implantation in the Wrong place

If the zygote becomes attached to a small fibroid tissue in the uterine wall or to the wall of the Fallopian tube, it cannot get nourishment and will die.

Period of the Embryo

a) Miscarriages

Falls, emotional shocks, malnutrition, glandular disturbances, vitamin deficiency, and serious diseases such as pneumonia and diabetes, can cause the embryo to become dislodged from its place in the uterine wall, resulting in a miscarriage. Miscarriages that are due to unfavourable conditions in the prenatal environment are likely to occur between the tenth and eleventh week after conception.

b) Developmental Irregularities

Maternal malnutrition, vitamin and glandular deficiencies; excessive use of drugs, alcohol, and tobacco; and diseases, such as diabetes and German measles, interfere with normal development, especially that of the embryonic brain.

Period of the Fetus

a) Miscarriages

Miscarriages are always possible upto the fifth month of pregnancy; the most vulnerable time is when the woman's menstrual period would normally occur.

b) Prematurity

Fetuses which weigh less than 1 kg have less chance of surviving than heavier fetuses and a greater chance of developing malformations.

c) Complications of Delivery

Maternal stress affects uterine contractions and is likely to lead to complications during birth.

d) Developmental Irregularities

Any of the unfavorable environmental conditions present during the period of the embryo will also affect the development of fetal features and retard the whole pattern of fetal development. Psychological Hazards -Like the physical hazards associated with the prenatal period, the psychological hazards can have persistent effects on the individual's development and can influence the postnatal environment and the treatment the child receives from significant people during the early

formative years. The three important psychological hazards are traditional beliefs about prenatal development, maternal stress during the period and unfavourable attitude towards the unborn child on the part of people who will play significant roles in the child's life.

Traditional belief include-how one can predict the sex of an unborn child from heart-beat test or sliva test.

Twins were believed to be caused by evil spirits and thus were feared and rejected by the social group. Stress can be the result of fear, anger, grief, jealousy etc. Maternal stress can start from not wanting a child to any disturbance in the feelings and thought of the child unfavourable on others on the part of the father to be who blames his wife for being careless and make her feel guilty about not preventing the pregnancy or attitude toward children of multiple birth and many such unfavorable attitudes have far reaching influence on development.

The second and important stage in the life span is "infancy". This stage will deal with characteristics of infancy, adjustments, kinds of birth and activities.

4.3. INFANCY

Characteristics of Infancy

1. Infancy is the shortest of all Developmental period - Infancy begins with birth and ends when the infant is approximately two weeks old. This period is divided into two namely
 - a) **Period of the Parturate** - from birth to fifteen to thirty minutes after birth. The infant continues to be a parasite until the umbilical cord has been cut and tied.
 - b) **Period of the Neonate** - from cutting and tying of the umbilical cord to approximately the end of the second week of postnatal life. Now the infant is an independent individual and not a parasite. During this period, the infant must make adjustments to the new environment.

2. Infancy is a time of radical adjustment - although the human life span legally begins at the moment of birth, birth is merely an interruption of the developmental pattern that started at the moment of conception. It is the graduation from an internal to external environment.
3. Infancy is a plateau in development - The rapid growth and development which took place during the prenatal period suddenly comes to a stop with birth. The halt in growth and development, characteristic of this plateau is due to the necessity for making radical adjustment to the postnatal environment. Once these adjustments have been made, infants resume their growth and development.
4. Infancy is a preview of later development. It is not possible to predict with even reasonable accuracy what the individual's future development will be on the basis of the development at birth.
5. Infancy is a hazardous period - physically it is hazardous because of the difficulties of making the necessary radical adjustment to the totally new and different environment. Psychologically infancy is hazardous because it is the time when the attitudes of significant people towards the infant are crystallized and change radically after the infant is born or can remain unchanged depending on conditions at birth and on how the parents adjust.

4.3.1. Adjustments of infancy

Temperature Changes

There is a constant temperature of 100°F in the uterine sac, while temperature in the hospital or home may vary from 60 to 70°F.

Breathing

When the umbilical cord is cut, infants must begin to breathe on their own.

Sucking and Swallowing

Infant must now get nourishment by sucking and swallowing, instead of receiving it through the umbilical cord.

These reflexes are perfectly developed at birth and the infant soon gets less nourishment than is needed and so loses weight.

Elimination

The infant's organs of elimination begin to work soon after birth; formerly, waste products were eliminated through the umbilical cord.

4.3.2. Kinds of birth

Natural, or Spontaneous Birth

In a natural birth, the position of the fetus and its size in relation to the mother's reproductive organs allow it to emerge in the normal, head first position.



Fig. 2 - Kinds of Birth

Breech Birth

In a breech birth, the buttocks appear first, followed by the legs and finally the head.

Transverse Birth

In a transverse presentation, the fetus is positioned crosswise in the mother's uterus. Instruments must be used for delivery unless the position can be changed before the birth process begins.

Instrument Birth

When the fetus is too large to emerge spontaneously or when its position makes normal birth impossible, instruments must be used to aid delivery.

Caesarean Section

If x-rays taken during the latter part of pregnancy indicate that complications may result if the infant emerges through the birth canal, the baby is brought into the world through a slit made surgically in the mother's abdominal wall.

Physical Development

Infants differ greatly in appearance and physiological functions at birth and in their early adjustments after birth.

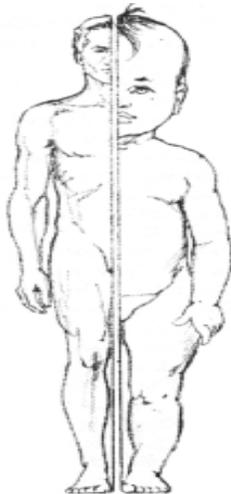


Fig. 3 - The body proportions of the new born and the adult

Size

At birth the average infant weighs 3 to 3.5 kg and measures 19-20 inches in length. Weight in relation to height is less at birth. The muscles of the newborn are soft, small and uncontrolled. Bones are also soft & flexible. Skin is soft. The flesh is firm and elastic. Eyes change from bluish grey to their permanent colour. The new born is not a miniature adult.

The head is approximately one - fourth of the body length. The cranial region, the area over the eyes is much larger while the chin is much too small. The nose is small and flat. The neck is short, almost invisible.

The shoulders are narrow, while the abdomen is large and bulging. Hands and feet are miniature. With the birth cry, the lungs are inflated and respiration begins. Neonatal heart beat is more rapid. Hunger demands are irregular. Elimination of waste products begin a few hours after birth.

4.3.3. Activities of the infant

Mass activity - occurs throughout the entire body when any area is stimulated, though the activity is most pronounced in the stimulated area.

Specific activities - involve certain limited areas of the body. They include reflexes, which are definite responses to specific sensory stimuli and generalized responses, which use larger groups of muscles that are involved in reflexes and may be aroused by external or internal stimuli.

4.3.4. Hazards of infancy

Some of the physical hazards of infancy are of only temporary significance while others can affect the individual's entire life pattern. The more serious ones are

- a) **Unfavorable prenatal Environment** - may lead to difficulties in adjusting to postnatal life, like mother being stressed during pregnancy.
- b) **Difficult and complicated birth** - can cause brain damage. Birth requiring instruments or the fetus lies in a foot first, or a transverse position or a caesarean all these can cause problems.
- c) **Multiple births** - are usually smaller and weaker than singletons. These babies tend to be born prematurely, which adds to their adjustment problems.
- d) **Post maturity** - This arises only when the fetus become so large that the birth requires the use of instruments or surgery.

- e) **Premature** - Causes more neonatal deaths than any other conditions. Brain damages can occur. Anoxia is common since the premature baby's respiratory mechanism is not fully developed, and hence needs three times as much oxygen as full - term infants. Sucking and swallowing reflexes are underdeveloped & hence may require special feeding. Premature affects adjustments not only during infancy but also for many years thereafter.

4.4. BABYHOOD

After infancy the next important stage in the life span is babyhood. This stage occupies the first two years of life after infancy and will be discussed under the headings-characteristics, pattern of development and hazards in babyhood.

Characteristics of Babyhood

1. Babyhood is the true foundation age- Because at this time, many behavior patterns, attitudes and emotional experience are being established. It is found that personality maladjustment in adulthood had their origin in unfavorable childhood experience. The first two years are critical in setting the pattern for personal and social adjustment, providing a rich social life for a twelve to fifteen month old child is the best thing you can do to guarantee a good mind .
2. Babyhood is a age of rapid growth & change - Babies grow rapidly both physically & psychologically. There is change in appearance and capacities. Limbs develop. Body proportions change. Intellectual growth takes place and baby's ability to recognize & respond to people and objects become visible. They understand and communicate their needs.
3. Babyhood is an age of decreasing dependency – Results from the rapid development of body control to sit, stand and walk. Negativism is one of the outstanding characteristics of the closing months of babyhood.

4. Babyhood is the age of increased individuality - Individuality is shown in appearance and in pattern of behaviour and then leads to treating them as individuals.
5. Babyhood is the beginning of socialization- They learn to be a part of the social group by attachment behaviour. They win the attention of others and develop strong emotional ties.
6. Babyhood is the beginning of sex-role typing – Indirectly girls are sex - role typed in babyhood by being permitted to cry and show other signs of “Female Weakness” which are discouraged in boy babies.
7. Babyhood is an appealing age - They are attracted by many especially when they are dressed well.
8. Babyhood is the beginning of creativity - This is the age when they are learning to develop interest and attitudes that will lay the foundation for creativity.
9. Babyhood is a hazardous age - among the physical hazards, illness and accidents are the most serious because they often lead to permanent disabilities or to death. Since behaviour patterns, interests and attitude are established during babyhood, serious psychological hazards can result if poor foundations are laid at this time.

4.4.1. Pattern of development during babyhood weight

At the age of four months, the baby's weight has normally doubled. At one year, babies weigh, on the average, three times as much as they did at birth, or approximately 10 kgs. Increase in weight during the babyhood comes mainly from an increase in fat tissue.

Height

At 4 months, the baby measures between 23 and 24 inches, at one year, between 28 and 30 inches and at two years between 32 and 34 inches.

Physical Proportions

Head growth slows down in babyhood while trunk and limb growth increases. Thus the baby gradually becomes less

top-heavy and appears more slender and less chubby by the end of babyhood.

Bones

The number of bones increases during babyhood. Calcifications begins in the early part of the first year but is not completed until puberty. The soft spot on the skull or fontanel has closed in approximately 50% of all babies by the age of 19 months and almost all babies by the age of two years.

Muscles and fat

Muscle fibres are present at birth but in very under developed forms. They grow slowly during babyhood and are weak. By contrast, fat tissue develops rapidly during babyhood, due partly to the high fat content of milk, the main ingredient in a baby's diet.

Body builds

During the second year of life, as body proportions change, babies begin to show tendencies toward characteristic body builds. The three most common forms of body build are **ectomorphic**, which tends to be long and slender, **endomorph**, which tends to be round and fat, and **mesomorphic** which tends to be heavy, hard and rectangular.

Teeth

The average baby has four to six of the twenty temporary teeth by age of one and sixteen by the age of two. The first teeth to cut through are those in the front, the last to appear are the molars. The last four of the temporary teeth usually erupt during the first year of early childhood.

Nervous system

At birth, brain weight is one-eighth of the baby's total weight. Gain in brain weight is greatest during the first two years of life, thus accounting for the baby's top-heavy appearance. The cerebellum, which plays an important role in body balance and postural control, triples in weight during the first year of postnatal life. This is true also for the cerebrum.

Immature cells, present at birth, continue to develop after birth but relatively few new cells are formed.

Sense organ development

By the age of three months, the eye muscles are well-enough coordinated to enable babies to see things clearly and distinctly and the cones are well-enough developed to enable them to see colors. Hearing develops rapidly during this time. Smell and taste, which are well developed at birth, continue to improve during babyhood. Babies are highly responsive to all skin stimuli because of the thin texture of their skin and because all sense organs relating to touch, pressure, pain, and temperature are present in well-developed forms.

4.4.2. Physiological Function

Babyhood is the time when the fundamental physiological patterns of eating, sleeping and elimination should be established, even though the habit formation may not be completed when babyhood ends.

Speech development - Both aspects of communication - comprehension of what others are trying to communicate and the ability to communicate is improved. One's thought and feelings to others in terms they can understand - are difficult and not mastered quickly. Foundation for both are laid during babyhood years. The speaker's facial expression, tone of voice & gesture help babies to understand what is being said to them. Babbling is the most important because real speech eventually develops from it. Crying is one of the first ways in which a baby is able to communicate to others.

Emotional behaviour - Babyhood emotions differ from those of other age groups. They are brief in duration, though intense while they last. They appear frequently but give way to other emotions when baby's attention is distracted. Emotions are more easily conditioned during babyhood than at later age. This is because their intellectual abilities are limited.

There are certain emotional patterns that are common. But since they are susceptible to conditioning, there are variations in these patterns

as well as common emotional patterns in babyhood are anger, fear, curiosity, joy, affection etc.

Development in socialization - The social experiences play a dominant role in developing the baby's future social relationships and patterns of behaviour towards others. Foundation for later social behaviour is laid in the home. During the first year of babyhood babies are in a state of equilibrium which makes them friendly, easy to handle and pleasant to be with. This changes soon and they become fussy, noncooperative and difficult to handle.

Throughout babyhood, play is often solitary than social. They derive a lot enjoyment through play and it aids in overall development of the child.

Beginning of sex-role typing - This starts literally at birth. Babies are identified as male or female by the colours of their dress and other things used including toys. The foundation for sex-appropriate behaviour is laid at home by parents and others and this continues as they move to day care centers or nursery schools.

Personality development - The potentials for personality development are present at birth. Since no two individuals have the same physical or mental endowment or the same environmental experiences, no two persons will ever develop identical personality patterns. Babyhood is often referred to as a 'critical period' in the development of personality because at this time the foundations are laid upon which the adult personality structure will be built. Factors like constant companion to the child (mother quite often), unfavourable occurrence in the environment (over protection), sex differences, will influence the personality development.

4.4.3. Hazards in Babyhood

In the first year of babyhood, physical hazards tend to be more numerous and more serious than psychological ones, while the reverse is true during second year.

Physical Hazards - Are serious for all babies but more for those who are born prematurely, suffer from brain damage or other birth defects and those whose physical development and general conditions at birth are poor. Children can have gastrointestinal or respiratory complications. Minor illnesses such as cold, digestive upsets, can occur. Accidents are frequent, when babies start to move around. Malnutrition can affect physical and mental development. On the other hand obesity is a great problem.

Psychological Hazards - Serious hazards arise either directly or indirectly due to failure to master developmental tasks of babyhood like hazards in motor development, speech hazards, emotional, social play and hazards in personality development.

4.5. EARLY CHILDHOOD

Most people think of childhood as a fairly long period in the life span - a time when the individual is relatively helpless and dependent on others. To children, childhood often seems endless as they wait impatiently for magic time to come when society will regard them as grown ups and no longer as children. Childhood begins when the relative dependency of babyhood is over, at the age of two years, and extends to the time when the child becomes sexually mature at thirteen years for girls and fourteen for boys. Childhood period is now divided into - early and late childhood. Early childhood extends from two to six years and late childhood from six to the time when the child becomes sexually mature.

4.5.1. Pattern of Development in Early Childhood

Growth during early childhood proceeds at a slow rate as compared with the rapid rate of growth in babyhood.

Physical development in early childhood

Height

The average annual increase in height is 3 inches. By the age of six, the average child measures 46.6 inches.

Weight

The average annual increase in weight is around 2-3 kgms. At age six, children should weigh approximately 7 times as much as they did at birth.

Average girl weighs 25-30 kgms.

Average Boy weighs 30-32 kgms.

Body Proportions

Body proportions change markedly.

- “Baby look” disappears.
- Facial features remain small, but chin becomes more pronounced.
- Neck elongates.
- Gradual decrease in stockiness of the trunk.
- Body tends to become cone shaped with flattened abdomen.
- Chest becomes broader and flatter.
- Arms and legs strengthen.
- Hands and feet grow bigger.

Body Build

Some children have an endomorphic or flabby, fat body build. Some have mesomorphic or sturdy muscular body build and some have endomorphic or relatively thin body build.

Bones and Muscles

The bones calcify at different rates in different parts of the body.

- The muscles become larger, stronger and heavier, with the result that children look thinner as early childhood progresses, even though they weigh more.

Fat

Endomorphy - more adipose than muscular tissue.

Mesomorphy - have more muscular than adipose tissue.

Ectomorphy - have both small muscles and little adipose tissue.

Teeth

In the first 4 to 6 months of early childhood the last four baby teeth erupts till the back molars. In the last half year of early childhood the

baby teeth begins to be replaced by permanent teeth. The first to come out are the front central incisors, the first baby teeth to appear. When early childhood ends the child has one or two permanent teeth in front and some gaps where permanent teeth will eventually erupt.

Physiological Habits - Habits laid in babyhood becomes well established. Children no longer need specially prepared food, fall into regular meal pattern. Depending on their activities their sleep pattern will change. Bowel and bladder control is well established. Hand skills and leg skills are improved. They start eating on their own, brush their teeth & bathe and dress themselves. Similarly, they are able to hop, skip, jump, climb, swim, cycle, balance and dance.

Improvement in Speech - Learning to speak is an essential tool in socialization and in achieving independence. So there is a strong motivation to learn to speak. The way they pick up speech, the words used, pronunciation etc depends on time spent by family members and encouragement given and the contact with peer groups.

4.5.2. Emotions of Early Childhood

Anger

The most common causes of anger in young children are conflicts over playthings, the thwarting of wishes, and vigorous attacks from another child. Children express anger through temper tantrums, characterized by crying, screaming, stamping, kicking, jumping up and down, or striking.

Fear

Conditioning, imitation and memories of unpleasant experiences play important roles in arousing fears, as do stories, pictures, radio and television programs and movies with frightening elements.

At first, a child’s response to fear is panic; later, responses become more specific and include running away and hiding, crying, and avoiding frightening situations.

Jealousy

Young children become jealous when they think parental interest and attention are shifting towards someone else in the family, usually a new sibling. Young children may openly express their jealousy or they may show it by reverting to infantile behavior generally trying to be naughty. All such behavior is a bid for attention.

Curiosity

Children are curious about anything new that they see and also about their own bodies and the bodies of others. Their first responses to curiosity take the form of sensory motor exploration; later, as a result of social pressures and punishment, they respond by asking questions.

Envy

Young children often become envious of the abilities or material possessions of another child. They express their envy in different ways. The most common of which is complaining about what they themselves have, by verbalizing wishes to have what the other has or by appropriating the objects they envy.

Joy

Young children derive joy from such things as a sense of physical well-being, incongruous situations, sudden or unexpected noises, slight calamities, playing pranks on others, and accomplishing what seem to them to be difficult tasks. They express their joy by smiling and laughing, clapping their hands, jumping up and down, or hugging the object or person that has made them happy.

Grief

Young children are saddened by the loss of anything they love or that is important to them, whether it be a person, a pet, or an inanimate object, such as a toy. Typically, they express their grief by crying and by losing interest in their normal activities, including eating.

Affection

Young children learn to love the things - people, pets, or objects - that give them pleasure. They express their affection verbally as they grow older but, while they are still young, they express it physically by hugging, patting, and kissing the object of their affection.

Pattern of Early Socialization

Between the ages of two and three years, children show interest in watching other children play and they make social contacts, this is known as parallel play. Following this comes associative play, in which children engage in similar or identical activities with other children. As social contacts increase, they engage in cooperative play. Some of the social patterns followed are imitation, rivalry, cooperation, sympathy, empathy, social approval, sharing and attachment behavior.

They also have some unsocial patterns like negativism, aggressiveness, selfishness, destructiveness, etc.

Play in Early Childhood - Early childhood is often called the toy stage because most play, makes use of toy in one form or another. Children become aware of the fact that certain kinds of play and toys are considered more appropriate for one use than for the others. The amount of play equipment, space provided for this and the interest and involvement is directly related to the socio-economic status of the family.

Sex-Role Typing in Early Childhood - In early childhood, parents and family members are the main agencies of sex-role typing and when they go to pre school or day care centres, the teachers take over. Another important agency for sex role typing comes from the mass media. The stories read to children, TV shows, comics, commercials etc. By the time early childhood draws to a close most children are well typed, especially the boys.

Personality Development- The child self-concept is “formed within the womb of family relationship”, because parents, siblings and other relatives constitute the social world first.

Later young children have more and more contacts with peers in neighborhood or preschool. This will have an effect in their self concept and may have negative or positive influences. Some of the factors that affect self concept are parental attitudes, child training methods, parents expectations, ordinal position, environment and appropriate sex-role identification.

4.5.3. Hazards of Early Childhood

Physical hazards - Young children are highly susceptible to all kinds of illness, especially, when they play out. Most children experiences cuts, bruises, infections, burns, broken bones, etc. and a few have more serious problems that can lead to temporary or permanent disability. Obesity is a major problem.

Psychological Hazards - The most common of these are speech, emotional, social, play, concept development, sex-role typing, personality etc. Early childhood can & should be a happy period in life.

4.6. LATE CHILDHOOD

Late childhood extends from the age of six years to the time the individual becomes sexually mature. This period is marked by conditions that profoundly affect a child's personal and social adjustment. The child enters school and has a major change in life pattern. No longer is the mastery of developmental tasks the role responsibility of parents, it now becomes the responsibility of the teachers and to a lesser extent, the peer group.

4.6.1. Pattern of Development

Late childhood is a period of slow and uniform growth period until changes of puberty begins.

Good health and good nutrition are important, since boys begin their puberty growth spurt approximately a year later than girls, they tend to be slightly shorter and lighter in weight than girls of the same age until they too become sexually mature.

Marked sex differences exist-not only in play skills at their age but also in the level of perfection of these skills. Girls surpass boys in skills involving finer muscles like painting, sewing etc. Boys are superior to girls in skills involving the grosser muscles, like kicking, playing basket ball etc.

Areas of improvement - Throughout late childhood, children's general vocabularies grow by leaps and bounds. From their studies in school, reading, conversation with others, exposure to radio, T.V, newspaper, they build up vocabularies which they use in their speech and writing. Errors in pronunciation are less common at this age than earlier. There is improvement in comprehension and communication.

Content of Speech - Their speech will depend on their personalities, social contacts and satisfaction from these contacts. They like to criticize and make fun of others. Children who are popular have a strong incentive to improve the quality of their speech.

Chatterbox stage characteristics of early childhood is gradually replaced by more control and selection of speech. Normally as childhood draws to a close, children talk increasingly less and this is part of the withdrawal syndrome that is characteristics of the puberty period.

Emotions in late childhood - Older children soon discover that expressions of emotions, especially of the unpleasant emotions is socially unacceptable to their age-mates. Hence they learn to control the outward expressions of their emotions. Heightened emotions may come from physical or environmental causes or from both. When they are ill or tired, sex organs begin to function, heightened emotionality is normally at its peak.

Social behavior in late childhood - This age is often referred to as the "gang age". From the time children enter school until puberty, the desire to be with and to be accepted by the gang becomes increasingly strong.

Play activities in late childhood - They indulge in a lot of constructive activities which includes drawing, painting, singing, working

with models, exploring, collecting etc. They also do lot of reading, watching movies, T.V, playing games and participating in sports. Children who are lonely at home and who have few friends often amuse themselves by daydreaming.

Sex - Role Typing in late Childhood- Unquestionably the most important force in sex - role typing during these years come from peer pressure. If they have to be accepted by members of children's gangs, children must conform whole heartedly to the beliefs, values, pattern of behaviour of the peer group. In clothing, appearance and in mannerisms, children try to create the impression of sex-appropriateness.

Personality changes in late childhood - As childhood draws to a close, children begin to hero-worship characters in history, fiction, on screen, world of sports or teachers. They then form concept of the ideal self, the kind of person they would like to be.

4.6.2. Hazards of Late Childhood

Physical Hazards - Illness, Obesity, accidents and disabilities due to this are common hazards as in earlier age. Other than that sex - inappropriate body build are likely to be ridiculed by their peers and pitied by adults, (girls with masculine body builds and boys with girlish physique or voice) Same way awkwardness and clumsiness prevent them from doing what their playmates do.

Psychological Hazards - Most of psychological hazards are in relation to speech, emotional, social, play, sex-role typing and hazards in personality development.

Types of discipline used in early and late childhood

Authoritarian Discipline

This is the traditional form of discipline and is based on the old saying that "to spare the rod means spoiling the child." In authoritarian discipline, parents and other caretakers establish rules and inform children that they are expected to abide by them. No attempt is made to explain to the children why they must conform nor are children given opportunities to express their opinions about their fairness or the

reasonableness of the rules. If children fail to conform to the rules, they are subjected to act as a deterrent in future rule breaking. Their reason for breaking the rule is not taken into consideration. It is assured that they knew the rule and willfully violated it. Nor is it considered necessary to reward them for complying with a rule. This is regarded as their duty and any reward given, it is believed, might encourage children to expect to be bribed to do what society regards as their duty.

Permissive Discipline

Permissive discipline developed as a revolt against the authoritarian discipline, many adults had been subjected to during their own childhoods. The philosophy behind this type of disciplinary technique is that children would learn from the consequences of their acts how to behave in a socially approved way. Consequently, they were not taught rules, they were not punished for willful breaking of rules, nor were they rewarded for behaving in a socially approved way. There is a tendency on the part of many adults today to abandon this form of discipline on the grounds that it fails to fulfill all three of the essential elements of discipline.

Democratic Discipline

Today there is a growing tendency to favor discipline based on democratic principles. These principles emphasize the rights of the child to know why rules are made and to have an opportunity to express their opinions, if they believe a rule is unfair. Blind obedience is not expected even when children are very young. Attempts are made to have children understand the meaning of the rules and the reasons the social group expects them to abide by them. Instead of corporal punishment, in democratic discipline an attempt is made to make the punishment "fit the crime" in the sense that the punishment is related to the misdeed. Appreciation for attempts to conform to social expectations as spelled out in rules is shown by rewards, mainly in the form of praise and social recognition.

4.6.3 Factors influencing how much young children talk

Intelligence

The brighter the child, the more quickly speech skills will be mastered and consequently the ability to talk.

Type of Discipline

Children who grow up in homes where discipline tends to be permissive talk more than those whose parents are authoritarian and who believe that “children should be seen but not heard.”

Ordinal Position

Firstborn children are encouraged to talk more than their later-born siblings and their parents have more time to talk to them.

Family Size

Only-children are encouraged to talk more than children from large families and their parents have more time to talk to them. In large families, the discipline is likely to be authoritarian and this prevents children from talking as much as they would like to.

Socioeconomic Status

In lower-class families, family activities tend to be less organized than those in middle and upper class families. There is also less conversation among the family member and less encouragement for the child to talk.

Racial Status

The poorer quality of speech and conventional skills of many young children may be due in part to the fact that they have grown in homes where the father is absent, or where family life is disorganized because there are many children, or because the mother must work outside home.

Bilingualism

While young children from bilingual homes can talk as much at home as children from monolingual homes, their speech is usually very limited when they are with members of their peer group or with adults outside the home.

Sex-Role Typing

As early as the preschool years, there are effective sex-role typing on children's speech. Boys are expected to talk less than girls, but what they say and how they say it, is expected to be different. Boasting and criticizing others, for example are considered more appropriate for boys than the girls, while the reverse is true of tattling.

4.6.4 Common hazards in establishing physiological habits

Eating Habits

Babies who suck for long periods show signs of tenseness. They engage in more non nutritive sucking (such as thumb-sucking), have more sleep difficulties, and are more restless than those whose sucking periods are shorter. If weaning is delayed, babies are likely to resist new kinds of food and substitute thumb-sucking for the nipple. They will also resist semi-solid foods. If such foods are introduced too early, not because of their taste but because of their texture.

Sleep Habits

Crying, strenuous play with an adult or noise can make babies tense and keep them from falling asleep. Sleep schedules that do not meet the requirements of the individual babies make them tense and resistant to sleep.

Habits of Elimination

These habits cannot be established until the nerves and muscles have developed adequately. Trying to toilet train babies too early will make them uncooperative about establishing these habits when they are maturationally ready. Delay in toilet training, on the other hand, results in habits of irregularity and lack of motivation on the baby's part. Enuresis - bed-wetting is common when training is not timed according to the baby's developmental readiness.

4.6.5. Conditions that affect parental attitudes towards the infant

Preparation for Parental Duties

Parents who have had experience in caring for earlier-born children, taken courses given in prenatal clinics or babysat for older siblings or neighbors' children have more confidence in assuming the parental role than to those who have lacked any such experiences.

The childhood experiences

The mother's attitude toward the infant is more favourable when the childbirth experience has been relatively easy than when it is prolonged, difficult, and followed by physical complications. The father's attitude is also colored by his wife's childbirth experience.

The Mother's Physical Condition after Childbirth

The more quickly a mother recovers after childbirth, the more favorable her attitude toward the infant will be and the more confident she will be of her ability to fulfill her maternal role satisfactorily.

Concern about Expenses

When complication arise at childbirth, such as a caesarean operation, prematurity which necessitates special nursing care and a prolonged stay in the hospital, or some defect brought on at birth or apparent at birth, parental attitudes will be unfavorably affected by concern about the unexpected expenses involved.

Evidence of Defects

If there is a suspicion or actual evidence that the infant is defective in some respect, parental attitudes will be colored by disappointment, concern about the future normality of the infant, and the added expense the defect will cost.

The Infant's Postnatal Adjustments

The faster and the better the infant adjusts to postnatal environment, the more favorable parents' attitudes will be.

Infantile Crying

Infants who cry excessively and without apparent reason encourage the development of unfavorable attitudes not only on the part of parents but also on the part of all family members. Parental Resentments against Work, Privations, and Expenses.

When parents find that the care of the infant requires more work, privations and expenses than they had anticipated, their attitudes toward the infant will be far less favorable than they would have been had they prepared themselves for the conditions that parenthood normally imposes.

Concern about normality

If an infant must remain in the hospital longer than the usual stay, as a result of prematurity, some defect, or poor postnatal adjustments, parents are not only concerned about the infants normality, but also about their ability to care for the infant after leaving the hospital.

Concern about survival

When an infant must remain in the hospital longer than the usual time and be given special attention, parents become concerned about the infant's survival. If the infant does survive, parents tend to be over protective when they assume responsibility for its care.

4.7. CHILDHOOD DISEASES

Diseases are of two types. They are communicable and non communicable diseases. The common diseases spread rapidly through the medium of air, food, water, contact and insect bite. They are caused by agents/pathogens, which include bacteria, virus and worms. These diseases can be prevented and controlled by - immunity, good nutrition and sanitation.

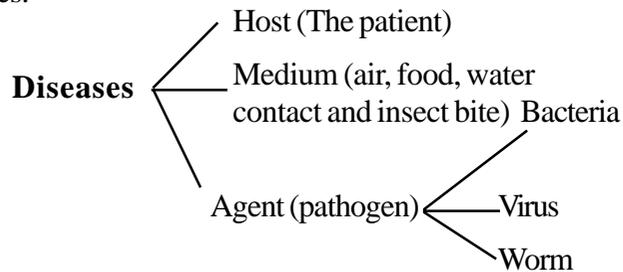
4.7.1. Barriers against disease germs

1. Skin - The germs cannot enter unless the skin is damaged. Mucin secreted by mucous membranes repel bacteria.
2. Saliva. The antiseptic quality of the saliva is well-known.

3. Tear glands. Produce secretion containing “lysozyme” which has a potential of filling and washing away germs.
4. Nasal opening have cilia that sweep out germs to some extent.
5. Urine and faeces, besides excreting body waste also gets rid of some of the pathogens.
6. Stomach secretes ‘pepsin hydrochloric acid’ that burns away some of the germs.
7. Blood contains WBCs which engulf the bacteria and release a ferment to liquefy bacteria.
8. Lymph nodes engulf the disease germs and kill them.

4.7.2. How diseases spread

Diseases are of two main types. They are communicable diseases and non communicable diseases. The communicable diseases spread rapidly through the medium of air, food, and water contact and insect bites.

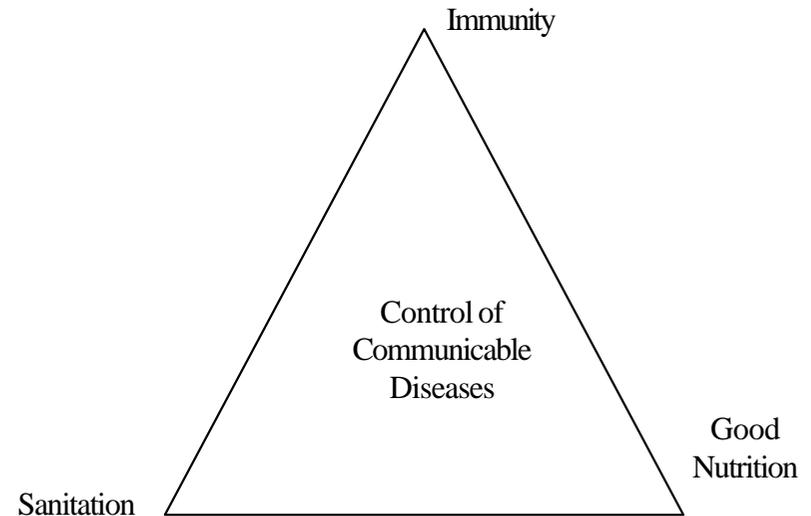


Communicable diseases are caused by agents/pathogens. These include micro-organisms like bacteria, virus and worms. The child/individual who gets disease is commonly called a ‘host’. The time of pathogen entry to the appearance of disease symptoms is called “incubation period of the disease”.

A disease is known to be communicable when it spreads from one person to another. Non-communicable disease does not spread from one person to another. The former spreads at a very fast rate and needs to be controlled before it proves serious/fatal.

4.7.3. Prevention and control of communicable diseases

Communicable diseases can be prevented and controlled by the following three factors:



You are very well-acquainted with the importance of good nutrition and its relation to the strength and well being of the child/individual.

4.7.4. Mode of spread of children’s diseases and their control measures

A brief account of some important childhood diseases is given below:

Table 1

Medium of Disease Spread	Childhood Diseases	Control Measures
Air gets polluted when individuals cough and sneeze without covering their mouth and nose.	Influenza, Tuberculosis, Whooping cough, Measles, Chicken pox	i) Mouth and nose should be covered while coughing and sneezing ii) Paper tissue could be used to clean children’s nose and mouth. iii) Sanitary disposal of tissue is essential

<p>Water and food can be polluted by</p> <p>i) Unhygienic conditions while storing, cooking, serving and eating.</p> <p>ii) Low level of personal hygiene.</p> <p>iii) Use of dirty vessels and serving dishes, etc.</p> <p>iv) Consuming food exposed to flies and dirt.</p> <p>v) Consumption of unsafe water.</p>	<p>Diarrhoea, Dysentery, Cholera, Jaundice, Polio, etc.</p>	<p>i) If in doubt boil water to make it safe.</p> <p>ii) Keep food covered to protect contamination by flies.</p> <p>iii) Avoid licking food with dirty fingers.</p> <p>iv) Wash hands before and after eating food.</p>
<p>Insect Bites</p> <p>The disease causing germ gets transferred from sick person to a healthy person through bite of the insect - that is an intermediary host.</p>	<p>Malaria, Filaria</p>	<p>i) Keep environment clean to check insect multiplication</p> <p>ii) Protect house by having wiremesh on doors and windows.</p> <p>iii) Protect yourself by wearing full sleeve dresses from dusk to dawn.</p>

		<p>iv) Sleep under mosquito nets or use modes of repelling mosquitoes to avoid being bitten by them.</p>
<p>Soil gets polluted when the wastes are not properly disposed off.</p>	<p>Tetanus, worms</p>	<p>i) Have proper footwear for protection from soil borne infections.</p> <p>ii) Clean wound properly with antiseptic solution.</p> <p>iii) Ensure that toddlers and children</p>
<p>Diseases spread directly and indirectly by contact. Direct contact means the disease germs is picked up by touching the sick child/person.</p> <p>While indirect contact means the germ gets transferred from a sick child to another child through play</p>	<p>Scabies, Eczema</p> <p>Diphtheria</p>	<p>i) Avoid contact with sick persons or attend to the sick by taking all personal protection measures.</p> <p>ii) Healthy children should not be allowed to play</p>

materials.		or use the toys of sick children and provide good nursing care.
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4.8. DAY-CARE CENTERS AND PRE SCHOOLS FOR CHILDREN

The first five or six years of childhood are said to be a critical or sensitive period in the development of children. The damage done in early childhood cannot be fully compensated in the later period of life. Proper stimulation of all areas of development is necessary for a child reaching his maximum growth potential. With the necessity for women to take a part time or full time job, mothers need a place where their children will be given custodial care.

With growing number of children entering child-care centers at a very young age, parents, psychologists, educators, and nutritionists are becoming concerned about the potential effects of child care centers on the development of the child.

4.8.1. Needs of infants and small children

The parents look forward to have their own children to love and to cherish. Having a child at home means that one should be prepared for all the basic needs of the baby. Every child needs to:

- Be loved and feel physically, mentally and socially secure.
- Have food for optimum growth and development.
- Be clothed for protection against all possible weather conditions. Clothes also contribute to one's personality in any social set up.
- Have a shelter/home that will provide protection against natural calamities. Shelter also provides the much needed physical security against thieves, burglars and bad elements.



Fig. 4 - Care of Infants and children

4.8.2. What is substitute child care?

You are now familiar with the needs of small children. These are generally fulfilled by parents in the family. Economic factors often force the mothers to take up jobs. Consequently young ones need to be taken care of by older siblings, neighbours or relatives etc. What role are the siblings, relatives and neighbour playing in bringing up the children? They are mother substitutes while she is at work.

Hence substitute child care can be defined as “the care rendered to the child to meet the basic needs in the absence of mother/parent.” Substitute care can be made available both at home (siblings, relatives) and outside (creche/day care centres).

4.8.3 Kinds of substitute child care

Substitute child care is provided by the following:

- a) Older siblings
- b) Relatives/neighbours

- c) Hired help
- d) Creche/day care centres
- e) Pre-nursery/nursery school/Balwadi.

You will now study about the effectiveness of each of these parent substitute care facilities.

Sibling Care is very common among families in low income group. Infants and children are left under the care of a slightly older child. You might find a 6 years old child looking after two to three smaller siblings. How effective or safe can this child care be? Not very effective, because a six years old is not equipped with skills required for the usual child rearing. Slightly older children are not mature enough to care for the young ones. Hence it might be a better idea to find an alternative yet safe substitute child care centre.

Relations and Neighbours can and do play important role in the upbringing of small children in the home itself. Presence of elders in a family with small children is a big boon. Grand parents in a family provide very loving and safe child care.

Neighbours can be a family away from your own family. In the absence of suitable mother substitute, neighbours can provide the much needed substitute child care. This sort of child care is generally of a short duration. In case the neighbour has time and is willing to provide support on a regular basis it would be advisable to speak frankly with the neighbour. After discussion you should arrive at an understanding where by you can provide suitable compensation for the neighbour's help.

Hired Help is a common feature in affluent urban families. One should carefully interview the hired help (Ayah/maid servant) as regards their reliability and experience of being able to provide for all the basic needs of the young one. Have you heard about the importance of police verification before hiring the services of the 'Ayah/maid servant'? Parents should keep a strict vigil on the hired help for the safety of their child.

Creche : Do you know what a creche is? “ It a safe place where small children can be left and looked after while the parent is working.”

Creche is a day care centre. Parents take their children home after the working hours are over. Have you ever visited a creche?

Creches take care of children upto 3 years of age. Here the children are left under the expert care of qualified and responsible staff/adults. Hence the mothers can carry on with their jobs without anxiety as regards their child.

4.8.4. What Parents Should Think About When Choosing Day-Care centers

Is the center licensed and regularly checked by government authorities? What is the cost for each child? How old is the child? Are there other children of the same age for companionship? Is the center near enough to the parents' place of work, so it could be quickly reached in an emergency? Is it well equipped for activities? Do those who manage and work at the center like the jobs? Do they act as though their task is just to baby-sit, or do they encourage the physical and psychological development of the children? Are there enough teachers and aides to give child individual attention? Is there careful supervision of all children at all times? Is the food well prepared, of good quality, and suited to the age of the children? Is the environment relaxed and happy or do the children seem bored and irritable?

4.8.5. Specific needs of children upto three years of age

These can be listed as below :

- Feeding the child according to his/her needs.
- Keeping the child clean.
- Providing facilities for rest and sleep.
- Availability of toys to play with.
- Providing the facility of exercise.
- Clean and safe environment.

4.8.6. Facilities provided by an ideal creche

A creche should fulfil all the above needs of the small children. Well-organised creches also have the facility of medical check ups for the small children.

a) **Feeding of children :** Very small children are fed by the staff of the creche. All possible care is taken to observe the rules of hygiene while feeding these children.

(i) The milk/food is fed to the child at appropriate time and temperature.

(ii) Older children are made to wash their hands before and after the meal timings.

b) They are made to sit and eat in company. This is how they learn the table manners.

c) Keeping the child clean. Creches will have certain number of children who are toilet trained. Hence special care is taken to keep these children clean and dry.

Children should be encouraged to relieve themselves. They should learn to keep toilet clean and also wash their hands with soap and water.

d) **Providing the child with rest and sleeping facilities :** Little children need to sleep and rest a while in a comfortable bed. The creche should provide individual care to small babies. Older children can make use of floor mats to sleep on. Little children enjoy having their own small pillow and small toy to sleep with.

e) Toys for playing help the children to play in a happy atmosphere. There should be toys to suit the children of different ages. Some useful appliances help child to exercise and explore his/her environment. Walkers, tricycles, small monkey-ladders etc. can be kept in small barricaded play area in the creche.

f) Clean and safe creche environment ensures safety of little children against diseases and accidents. Trained and healthy staff are the strength of every efficient creche.

g) Medical and first aid facilities should be available in each creche. Wherever needed skilled nursing staff could help in emergencies. Availability of a doctor once in a fortnight/month is an added health promotional requirement of a good creche. A first aid kit should be available at each creche.

Some large organisations are extending the creche facilities to the children of their own employees only.

4.8.7. Role of nursery schools/balwadis

Pre-school children between the age of 3-5 years go to nursery schools in urban areas. Nursery schools fulfill the basic needs of small children. These schools have an added responsibility of preparing the child for the schooling ahead. The children are initiated into the learning processes in play-way methods. For example, they play and dance to nursery rhymes. Can you recall some of these nursery rhymes you learnt in your childhood?

The privately run nursery schools are relatively more expensive than the usual nursery sections attached to the main schools.

Balwadis provide education to the children in rural areas. They are similar to the nursery schools in towns.

Children learn to draw and paint. They learn to make things with sand, plasticine/mud. They also learn to identify different shapes and colours.

Nursery schools/balwadis promote the social development in children as they learn to share things and communicate in a social group. The environment in these places helps in the development of language among children. Teachers in these schools often check the hair, nails and clothing of children to make the little ones conscious of personal hygiene and grooming. Do you remember your teacher narrating a story

to you in your childhood? It developed your listening skills, memory and comprehension. Children learn to fantasize and have flights of imagination during such story-telling sessions. It enhances their mental development.

The Ways Day-Care Centers and Preschools Help the Young Child's Development :

Good Health : By balancing activity, rest and making sure that all children have medical checkups and are immunized against certain diseases.

Skills : By improving skilled already formed and teaching new once under the teacher's guidance and supervision.

Speech : By making children's vocabularies larger and widening their interest.

Emotions : By teaching children to express their emotion in socially approved ways.

Social Behaviour: By teaching socially approved behaviour patterns.

Social Attitudes : By teaching children to be tolerant of those who are different to add to the group and to be good sports, good followers, and good leaders.

Creativity : By encouraging children to express their creativity in ways that will please them.

Discipline : By teaching children, through consistent and fair discipline, to obey rules and respect those in authority.

Self-concept : By stressing self-confidence, and feelings of self-worth.

Easier Adjustment to school by teaching skills that are basic to school work.

4.8.8. Integrated Child Development Scheme (ICDS)

Integrated Child Development Scheme was launched in 1975 with the main assumption that a package of multiple services is more effective than providing these facilities one at a time. Initially ICDS was extended to a small population. Today the expansion of ICDS projects has increased considerably.

Objectives of ICDS

- (a) Improvement of health and nutritional status of children of 0-6 years of age.
- (b) Laying foundation for psychological, social and physical development of the child.
- (c) Reduction in the incidence of malnutrition, morbidity, mortality and school drop out rates among children.
- (d) Effective coordination of the policy and implementation among different departments in order to promote ICDS.
- (e) Enhancing capabilities of mothers to look after normal health and nutritional needs of the children.

TARGET GROUP

Integrated Child Development Scheme targets at reaching out the package facilities to the following age-groups:

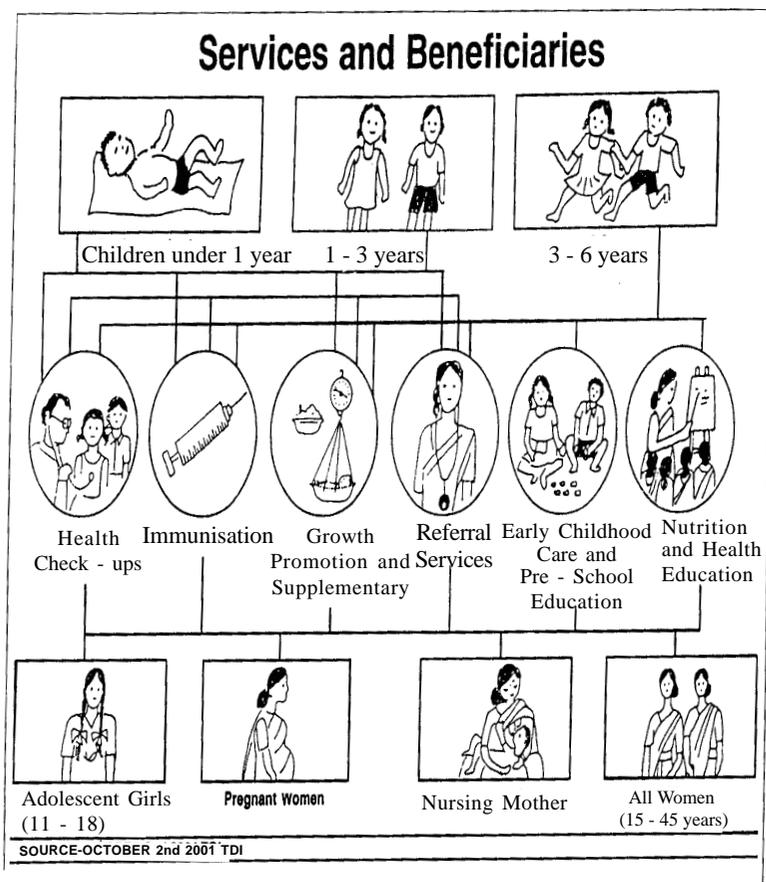
- (a) Children 0-6 years of age
- (b) Adolescent girls between 11-18 years.
- (c) Women between 15-45 years of age.
- (d) All pregnant and lactating women.

PACKAGE OF SERVICES RENDERED BY ICDS

It includes :

- (a) Supplement Nutrition,
- (b) Immunization,
- (c) Health check ups and Referral Services,
- (d) Nutrition and Health Education,
- (e) Non-formal Education.

The scheme has successfully reached almost 40% of the deprived children. Double amounts of supplements are given to children below 50-60% of the lowered nutritional standards. ICDS provides nutritional supplements through the schools/and primary health centres. Have you heard of mid-day meals? It is one venue for providing children with cheap yet nourishing protein and carbohydrate supplements. Roasted channa and milk powder are the usual food supplements.



Services and Beneficiaries

Fig. 6 - Services and Beneficiaries

All children should be immunized within the first year against the six killer diseases of early childhood. Can you name these diseases studied in the earlier chapters?

The facilities of health check ups and referral services are provided in the Government hospitals and municipal dispensaries. Prenatal and postnatal facilities are provided to mothers and new born babies. The rural as well as the tribal areas are also provided with these medical

facilities on regular basis. The medical facilities are fully funded under the Government's five year plans except for the cost of supplements which is borne by the states.

The mother in the productive years of life are made aware of the importance of spacing, and restricting the size of the family. The relationship between maternal status and healthy child is highlighted. Mothers with poor maternal status and low weight gain during pregnancy period give birth to children weighing less than 2.5 kgs. (normal weight at birth for Indian children). Such children remain shorter and lighter than their counterparts. They often rate low in their performance throughout life.

ICDS contributes not only to the achievements of women and child goals related to health, nutrition and early child development but also to other primary health care goals and the goals of universal elementary education, as enunciated in the National Plan of Action for children 1992.

ICDS facilities are provided to the rural population through Anganwadis. All possible efforts are being made to impart formal as well as informal health and nutrition education. Radio, TV and movies carry these messages to a large section of the population living in urban as well as rural areas.

4.8.9 To highlight on the quality of child care services

- The location of the centers to be easily reached from all sides.
- Safe, clean and spacious environment. Both covered and open space for indoor and outdoor activities.

The amount of space should be adequate in relation to the number of children to move about freely at 1.5 square meter per child. A minimum area of two square meter of play space per child is desirable.

- The building should be strong and sturdy, bright and attractively painted, with good lighting and adequate ventilation.
- Potable water supply and proper drainage is a must.

- Toilets should be well maintained and free from contamination.
- Proper storage is necessary to prevent pilferage, infestation and maintain quality of food.
- Good menu planning and cooking is essential to provide good nutrition to the children.
- Food service is equally important to make the children eat well and enjoy meal time. This also includes the place, furniture and how food is served.
- Food safety and sanitation is important to protect the health and safety of children.
- Play materials must facilitate the all round development of children.

RELATED EXPERIENCE

1. Visits to
 - a. ICDS projects
 - b. Balwadies, Creches and Nursery schools

QUESTIONS

Section – A

I. Fill in the blanks

1. Fetal movement usually appears first between _____ and _____ weeks.
2. Infancy is a _____ in development.
3. Prenatal period starts from _____ and extends up to _____
4. There are _____ chromosomes in each mature sex cell.
5. At the end of the second prenatal month, the embryo weighs on an average _____ and measures in length.
6. In a _____ birth, the buttocks appear first followed by the legs and finally the head.
7. At birth the average infant weights _____ to _____ kg.
8. _____ is common in premature babies since the respiratory mechanism is not fully developed.

9. _____ is the beginning of sex-role typing.
10. _____ diseases spread rapidly through the medium of air, food and water.

II. Match the Following

- | | |
|-------------------|-------------------------------------|
| 1. Insect bite | 1. First development period |
| 2. Babyhood | 2. Control of communicable diseases |
| 3. Late childhood | 3. Malaria |
| 4. Prenatal | 4. First two years of life. |
| 5. Immunity | 5. Achieving period of independence |

III. True Or False

1. The term development means a progressive series of changes that occurs as a result of maturation and experience.
2. There is no definite developmental pattern or predictable pattern followed during the life span.
3. Prenatal period is short but most important period in the life span.
4. Sex of the newborn depends on the kind of spermatozoon that unites with ovum.
5. Prenatal period is ten calendar months.
6. End of second lunar month to birth is the period of the fetus.
7. There is rapid growth and development taking place during infancy.
8. Obesity is a major problem in child-hood.
9. Creche is different from a day -care centre.
10. Space is not an important criteria for a good creche, only the type of building is taken into consideration.

Section -B

Explain the following terms:

- a. Substitute child care
- b. Period of neonate
- c. Mass and specific activities of infants

- d. Cooperative play
- e. Incubation period
- f. Sex-role typing
- g. Balwadis
- h. Prenatal development
- i. Miscarriage
- j. Prematurity
- k. Development
- i. Infancy
- m. Natural birth
- n. Socialization
- o. Emotions in the early childhood

Section - C

1. Mention three developmental tasks in early childhood.
2. List four happenings at the time of conception.
3. Why is infancy a plateau in development?
4. Write the three patterns of socialization in early childhood.
5. What are the two types of activities in infants?
6. Explain the two periods in infancy.
7. What are the three factors that control communicable diseases?
8. What is sex-role typing in childhood?
9. Write on the common hazards during fetal growth.
10. Mention the four areas of adjustments in infancy.

Section - D

1. Discuss the stages in life span development.
2. Write on the major barriers against diseases caused by germs.
3. What are some of the common characteristics of twins?
4. List some of the childhood diseases and write on the measures taken to overcome these.
5. Enumerate on the five kinds of birth.
6. Explain the different emotions expressed by children.

5. HOME MANAGEMENT

5.1 HOUSING

The house is the first unit of society and it is the primary unit of human habitation. The housing, next to food and clothing, satisfies one of the basic needs of man. According to National Building Organization a **house** is a **pucca or semi-pucca unit** of dwelling that can accommodate an average household. With advancement in science and technology man has created newer designs of shelter to provide greater comfort, convenience and facilities.

5.1.1. Importance of House:

1. A house is a physical structure consisting of walls, doors, windows, roofs, etc. in which human being live and seek refuge from tensions and worries of the outside world.
2. The house protects the family members from excessive cold and heat, wind and rain and from all external anti social elements.
3. The house forms the center of family life. It is a place where family members are bound together by love and affection and enjoy group living.
4. The house provides space for group and individual activities for the members of the family such as cooking, serving, washing, storage, disposal of waste, recreation, reading and hospitality.
5. The house offers facilities for self-expression and a degree of freedom of action.
6. A good house provides a healthy environment for its members to develop their personality, attitudes, values and a sense of security in addition to rest and privacy.
7. Only in the house an individual acquires customs, traditions, habits and culture of the family.

8. A house is the place where some family members who cannot support themselves for reasons of sickness, unemployment, old age, widow-hood or other handicaps get shelter and care.
9. A house and its surrounding is a status symbol of a family.
10. Housing is the determining factor for the standard of living of a family.
11. The housing condition is a measure of nation's progress.
12. Housing contributes to national income, national wealth and national employment.

The residential buildings may broadly be classified into five categories as follows

1. **Detached house:** This is an independent house surrounded by its own land on all the sides.
2. **Semi-detached house:** A common boundary wall to form a structural barrier and divides an independent plot into two units. This helps in achieving economy by sharing expenses on amenities such as water lines, drainage lines, electric cables etc.
3. **Row of houses:** This is preferred for low-income group of families. These rows of houses, having a common wall between two houses, with minimum requirements such as living room, and kitchen.
4. **Apartments or flats:** This consists of three to seven storeys and each floor or storey may accommodate two or four tenements. The land and other amenities are shared by all the occupants.
5. **Skyscrapers:** These are multi-storeyed building. This is common in big cities where the price of the land is very high.

5.1.2 Factors affecting choice of house

The following points should be kept in mind while looking out for a house.

1. **Physiological needs :** The house should have adequate ventilation and proper orientation so that there is proper temperature balance, adequate fresh air circulation and light.
2. **Psychological needs :** The house should provide privacy and safety.
3. **Family size :** A large family with more than six members have to go for a larger house than a small family with four members.
4. **Family type :** Families can be classified as nuclear, extended or joint families. The size of the house will vary according to the type of family.
5. **Stage of family life cycle :** The stage in which the family is, should be considered. A family in the expanding stage will need a larger house than a family in the beginning or contracting stage.
6. **Family Structure :** This indicates the build up of the family with regard to the age, sex and their relationship of one member to another.
7. **Family Values and Standards :** The standard of living that a family wants to maintain, the family values and priorities in life should be considered while selecting a house.
8. **Permanence of residence :** There are two types of family in this regard.
 1. **Transient family** - which has to move from place to place, because of occupational or other needs.
 2. **A Permanent family** - which is reasonably sure of staying in the same place for a long time. This factor should be considered while making decision to rent or own a house.
9. **Cost of living :** The cost of living in a particular area should be taken into account while deciding on the locality of the house.

10. Cost of building : The financial status of the family should be considered while selecting a house.

5.1.3 Owning or renting a house

Owning : This is buying a house outright in order to secure its services.

Advantages of owning

- 1) People who own a house will feel secure and have a feeling of belongingness.
- 2) Can stay in a house for a long period.
- 3) Become a means of compulsory saving.
- 4) Changes or improvement in the house can be made whenever needed.
- 5) Gives a feeling of happiness, pride and sense of security during old age .
- 6) Credit can be acquired easily.
- 7) Can develop longstanding friendship with neighbours.
- 8) It is a good investment.
- 9) Have tax benefits.
- 10) Better furniture and furnishing can be purchased.

Renting: Renting is the compensation that is paid to the owner, generally in terms of money, by the user for the services of a house, from month to month.

Advantages of Renting

1. Freedom of mobility.
2. Can take advantage of different occupational opportunities.
3. Can change the house according to the needs and income of the family.
4. No responsibility of maintaining the property.
5. No need to invest on furnishings and furniture as furnished house can be rented.
6. Renting is cheaper.
7. Higher living standards can be achieved.

8. The family will not get affected if the property value decreases.
9. Money spent on buying the house can be invested in other business to get more money returns.
10. Gives financial freedom.

In general, many families feel that owning a house is far better than renting.

5.1.4 Site Selection

Each family attempts to meet its housing needs through the selection of a dwelling unit. The house is probably the largest single investment you will make in your life. One cannot change one's residence often. Hence it becomes essential for each one of us to have adequate knowledge about selection of a site and house planning. A site in a good locality should be selected.

Now let us see the factors to be considered while selecting a site for the construction of a house.

i. Physical Features

1. The site should be regular in shape and should have exact boundaries marked on the land.
2. A low lying ground is unhealthy because it is likely to cause dampness during rainy season and it becomes a breeding place for flies and mosquitoes.
3. The site should be on an elevated ground for drainage of water especially during rainy season.
4. A site on an elevated ground affords wider and brighter view of the house.
5. Site which faces South/North direction is preferable.

ii. Soil Conditions

1. The best soil is one where soft soil is at the surface and hard soil beneath 3 or 4 ft.
2. A mixture of sand and gravel is good.
3. Rocky surfaces afford good foundation, but poses difficulty while leveling or excavating the ground due to its hardness. On rocky

surface, laying drainage pipe is very costly. Besides, it is not-suitable for growing plants.

4. Clay and sandy soils are unsuitable because clay surface holds water for a long time and sandy soil absorbs water.

iii. Sanitary Facilities

1. There should be no stagnant pools or water tanks and unused wells around the site.
2. The site should never be surrounded by public drainage and toilet.
3. The site should not be selected near cattle sheds, poultry farm and factories for health reasons.
4. Reclaimed land filled with debris and refuse is unhealthy for building purposes, as it will give out obnoxious gases. During rainy season it becomes a good breeding place for flies and mosquitoes.
5. The site should be such as to command fresh air, ample lighting and good water supply.
6. A site in a busy locality may not be suitable for health reasons because of dust and the constant smoke from vehicles.
7. A site with modern sanitary facilities is the most suitable.

iv. Practical Convenience

The value of the site depends upon the convenience available around.

The site should be within easy reach to school, market, bank, hospital or nursing home, railway station, bus terminus and post office.

v. Good Neighbourhood

1. The site should be selected near a developed area for safety.
2. Good neighbourhood adds to the permanent happiness of the family.

3. The economic and social status of the neighbourhood should be on par with the occupants.
4. The area should be pleasant and charming.
5. The site in the neighbourhood of a sea commands pleasant sea breeze. But one disadvantage is that sea breeze carries with it a thin spray of salty water, which corrodes all iron articles.

vi. Legal Characteristics

1. The legal description of the plot and the exact location of the plot must be known.
2. The site should be a freehold land without encumbrance.
3. A legal advisor should be consulted, the place surveyed and the boundaries marked on.

5.1.5 Activities in the house and space allocation

The house and its grounds can be divided into three major areas based on the various activities of the house.

- 1) **Social or public area** - The rooms allotted are, verandah, living room, reception, dining, music, reception and games room.
- 2) **Service or Work area** - The rooms allotted are kitchen, serving, laundry, drying yard, ironing room, garage, storage areas, office and study room.
- 3) **Rest or private area** - Bedroom, dressing room, bathrooms, prayer room etc.

It is not possible to allot room for each and every activity separately, but it is important to allot spaces for the more important ones.

Rooms in the house

A **verandah** serves many purposes. It is a place for stranger or a visitor to wait. It is a place for keeping shoes, walking sticks, umbrellas and a place to store vehicles. It provides place for business, the postman, the newspaper boy, milkman, and the vendors to call on the family members at the entrance. It serves as a passage to other rooms of the

house. It is a place for sitting in the evening or at night after dinner enjoying light reading, or conversation with family members and neighbours. In small houses, it is the main sitting room. It protects the walls of the house from the direct rays of the sun. It is a place for pets and also a place for growing plants.

The Back Verandah

It serves different functions such as grinding, drying clothes etc. A verandah more than 3.6 m wide is not economical. A verandah facing south or west is comfortable.

Living Room

Living room is placed adjacent to verandah. The living room should provide place for many of the family activities as reading, conversation, get together, indoor games and light music. It is a place to receive friends and also to hold social functions. In a small house, it can serve as a study room for children, sleeping area for one or two members. It can be a dining room during special occasions. At times it can accommodate guests. Thus it may serve multi various functions, depending upon the type of the family.

A living room should express cordial welcome to the friends of the family. The living room should be well lighted and well ventilated and should provide maximum comfort for the family members. The living room should be situated on one side with an entrance from front verandah.

The minimum size for a living room should be 4.5m by 3.6m(15 ft. by 12 ft). The size of the door should be 90cms as minimum width and should be at one side of the wall. A coating of oil painting on tiles fixed on walls for a distance of 1.5 m from the floor is good from the sanitary point of view. The furniture and furnishing that are used in the living room must be comfortable and suitable for the room.

For example,

For **conversation**- sofa, chairs,

For **hospitality**- a center coffee table

For **reading**- table, chairs and bookcase

For **recreation**- radio and television cabinet, table and chairs

The living room should be simple in design. There should be enough wall space for hanging pictures and for display of decorative articles. Flower arrangements add beauty to the room. A shelf may be provided for art objects.

Bed Room

One spends more than 1/3 of his/her lifetime at rest and instead of in sleep here. It can provide place for dressing and storage of clothes. Practically 4.5m by 3.5m has been found to be a good size for a bedroom. A rectangular room is more convenient than a square one. No room should have less than 3sq.m. of the floor area.

Ventilation is of utmost importance in bedroom. It should be on the side of the direction of prevailing wind. The door of the bedroom should be located in such a way that when opened the bed is not visible fully. Bathroom attached to a bedroom would add to the convenience of the family members.

Some storage space should be provided in the bedroom. Built-in cupboards for clothes and bed linen save space. A chest of drawers could also be provided. A small table and a chair may find a place to keep some of the books for light reading, table lamp, flower arrangements etc.

It is better that parents have a separate master bedroom and children above ten years have separate bedrooms.

Kitchen

Kitchen is aptly described as the **home maker's workshop**. It is the nerve centre of the house, a place where we cook food, store our food, utensils and provisions. It can provide space for eating too. The comfort, health and happiness of the family mainly depends on the activities carried out in the kitchen.

Homemakers in India spend 70% of their time in the kitchen. Kitchen should never be a suffocating chamber of pungent smoke

irritating the eyes, nose, lungs and also the temper of the housewife. The apartments pose some of the problems such as lack of space and uncomfortable arrangements. It is very essential that one gives enough thought to the kitchen arrangements.

Location

The best location will be eastern or north-eastern corner of the house. This is helpful in having purified air and also warmth in the morning and coolness during the other part of the day.

Size and shape

For actual efficiency the kitchen should be neither too small nor too large. A rectangular kitchen is step saving. The size can vary from 3m by 2.4m or 3m by 3m.

Activities and work centers

The main activities in the kitchen are food preparation, cooking and cleaning of food items and equipment. The work area for these three activities should be carefully planned. The kitchen should have the preparation, cooking and washing centers adjoining each other at comfortable heights to form a triangle. This work triangle ensures convenience and safety.

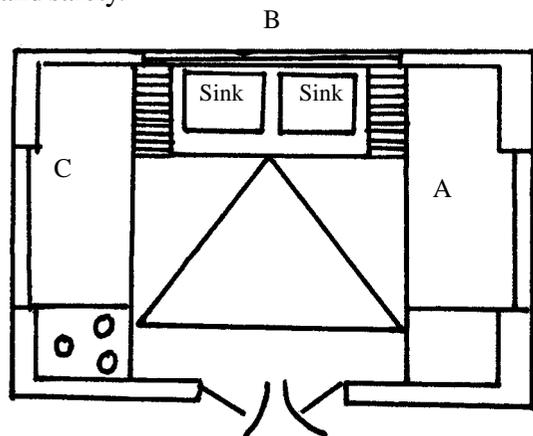
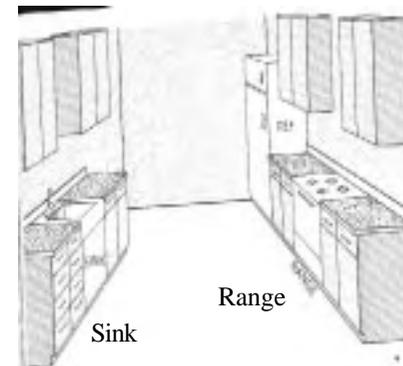


Fig. 1 - Work triangle

- A. Preparation centre
- B. Washing center
- C. Cooking centre

The various shapes in which the major work centers can be arranged are 'U' shaped, 'L' shaped, one wall and parallel walls. The ideal shape for the kitchen arrangement is 'U'. It consists of preparation and cooking centers on either side and the cleaning center in the middle. This is a compact arrangement and labour saving too.

In the 'L' shaped kitchen arrangement of the work centers are placed on two adjoining walls. The one wall arrangement is suitable for small kitchen.



1

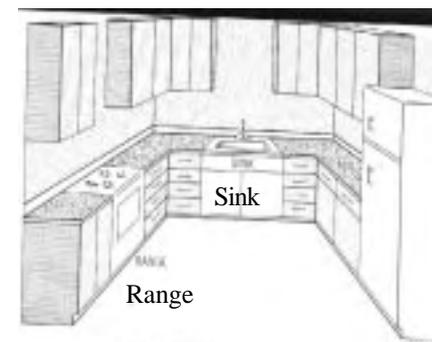
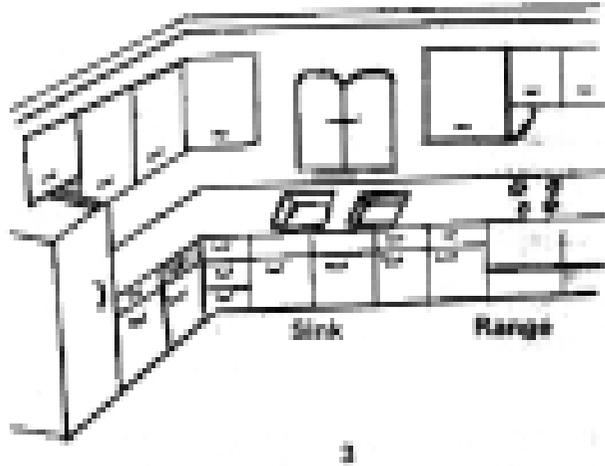


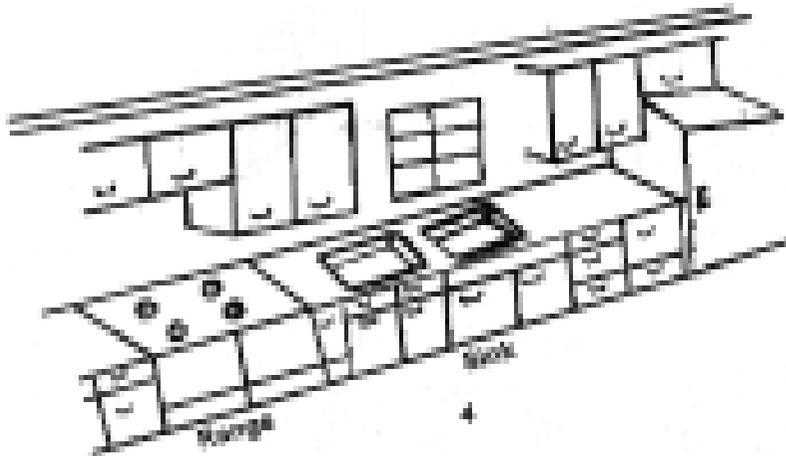
Fig. 2. Types of kitchen

1. Parallel wall

2. U - shape



3



4

Fig. 2a - Types of kitchen

3. L shape

4. Single wall

Cooking centre

The range with the storage of utensils needed for cooking occupied an important place in the kitchen. A peg board for frying pans and

sauce pans, a holder for knives and spoons and all the food items and equipment must be placed within easy reach in the cooking center.

Washing centre

Storage cupboard for dishcloth and brushes can be hung in convenient place provided there. Sink should always be placed in front of a window. Garbage pail should be kept near or under the sink.

Preparation centre

Placement of a refrigerator in the preparation center facilitates easy handling of vegetable, milk, egg and fruits during preparation. The equipment like blenders, beaters, sifters, saucepans, measuring cups, spoons, knives, spatula should be stored here.

Height of the working center

It can be 80 to 90cms depending upon the height of the person working in the kitchen.

Storage facilities in the kitchen

Built-in cupboard or cupboard with drawers and rack can be provided. Care should be taken to avoid insects. The wall area above and below the counter should be made full use of.

Bathroom

The purpose of a bathroom is to provide facilities for bathing, washing and dressing too. The main bathroom should be in the ground floor not far away from the main rooms. It can be attached to the bedroom for convenience. A bathroom with 1.5m by 1.8m in size is necessary. If area for keeping water boiler and washing clothes are to be provided the size may be 1.8m by 3m.

There should be good ventilation in the bathroom. A window at the usual level with frosted glass shutters, admitting light but keeping privacy, is good. A ventilator at the height of 180 cm. above the ground level is helpful. Loft can be provided to store things if necessary. Small built-in shelf may be used for keeping oil, soap, brush, paste, etc. The

flooring finish should be easy to clean. It should never be slippery. The wall should have a polished surface to a height of 90cms from the floor. There should be good drainage facilities for removal of waste water from the bathroom.

Water closet or latrine

Water closet can be near the house or even inside the house. Now a days they can be flushed with the water. The latrine on basket system is not sanitary. Earth closets can be used in rural areas. The minimum space needed is 1.2m by 1.8m in width and length. Strictest privacy is required in these rooms in respect of light and sound.

The lavatory should be kept clean. The basin should be cleaned daily with a reagent. The room should be washed with disinfectant like phenol/dettol. If bath section and water closet are combined, more space is needed. The room may be equipped with mirror, washbasin, closed storage for toilet articles, a rack to keep clothes and towels, tub, mug, etc. There should be tap connection for running water. Facilities for shower bath add to the convenience and pleasure.

One Room Apartment

The acute housing shortage and low-income levels in India have compelled many to live in one room apartment. One room apartment is a single room where daily activities of family are carried on. Hence enough thought should be given for the proper planning and use of one room apartment. One should learn to make the best use of their single room.

1. The single room is divided into various areas as cooking, dining, sleeping, studying, entertaining areas and so on.
2. The division of space is possible by means of room divider, screen, wooden screen, plywood, wooden cupboard and other types of partitions.
3. The front area can be used as living room and the area behind can be used as cooking cum dining room.
4. The living room can be partitioned from the dining by a large wooden partition with shelves on either side. Curioes, flower arrangements

could be placed on the shelf facing the living room, where as crockery, tumblers and other dining utensils could be stored on the shelves of the dining room side.

5. The kitchen section should be large enough to play the part of a kitchen as well as an eating-place.
6. The living room can be converted into bedroom at night. The dining room can serve as a study room.
7. In the kitchen, built-in-cupboards for storage help to save space.
8. Furniture should be kept to a minimum .
9. Multipurpose furniture save space. For example sofa-cum-bed, which is convertible as sofa in the morning and as bed at night.
10. Folding chairs, tables, movable modas are helpful to keep the place compact.
11. If wooden partitions take too much space, cloth screens can be used as room divider.

By carefully planning the one room apartment a family can enjoy a comfortable life.

5.1.6 House plans

House plans are important and it is the initial stage towards construction of a house.

Importance of House Plan

1. For a owner or builder to have clear idea about the construction.
2. To estimate the cost of the proposed building.
3. To estimate the building materials requirement.
4. To get sanction for construction from the authorities.

The plans usually required in connection with the building are site plan, elevation, perspective view, cross-sectional plan, land scape plan and floor plan.

Site Plan: This consists of a drawing, which shows the location of the particular building in a plot with reference to the surroundings. This includes,

1. The length of the boundary of the plots.
2. The adjoining plots on all sides with numbers.
3. The nearest street.
4. The north direction indicated by an arrow with the letter 'N' at its head.
5. The exact location of the proposed building and other structures and margin around the house.
6. The drainage line
7. The public water line.
8. The direction of the prevailing wind.
9. The direction and amount of the downward surface slope.
10. Results of the type of soil in the plot.

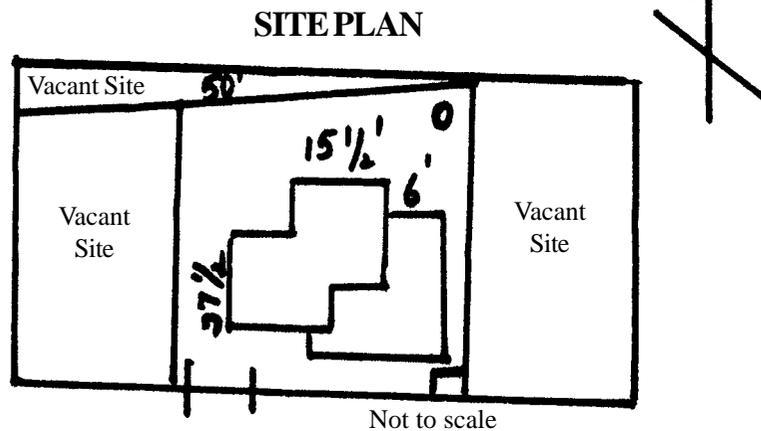


Fig. 3 - Site Plan

Elevation: This shows the type and location of the windows, doors, balconies, and roof lines which will enhance the outside appearance of the house.

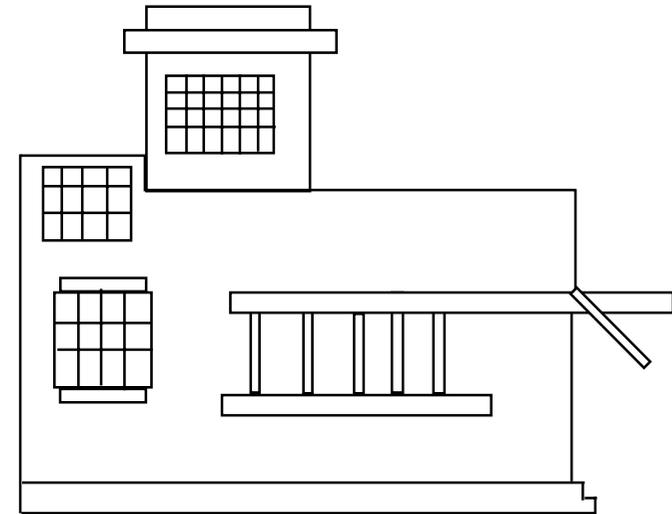


Fig. 4 - Front view elevation

Perspective view: This represents the photographic view with three dimensional effect resembling the true image of the proposed house.

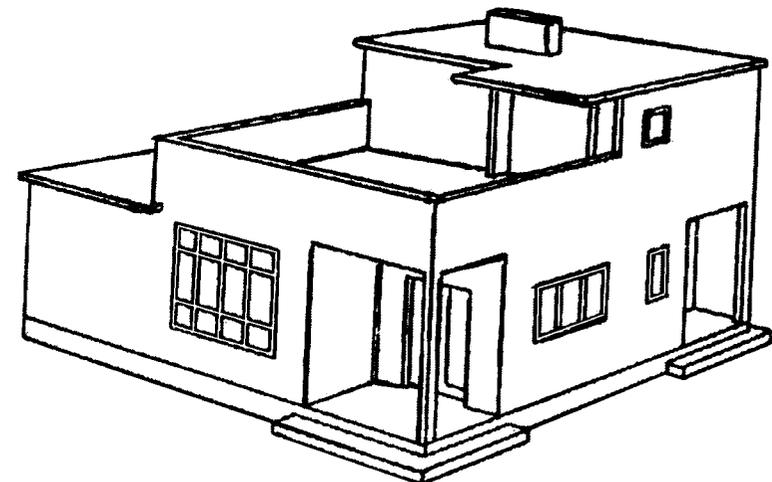


Fig.5-Perspective View

Cross sectional plan: This explains fully the details from the roof to the foundation, in a vertical position. This indicates the heights of the windows, doors, built in cupboards, ceiling, thickness of the floor, walls and depth of foundation.

Land scape plan: This shows the positions of plants, shrubs, lawns, paths, etc. in the plot through which the beauty of the building can be enhanced.

Floor plan: This is a horizontal plan which shows the general arrangements of the various rooms, its length and breadth, thickness of walls, positions of the doors, windows, cupboards, furniture and fittings.

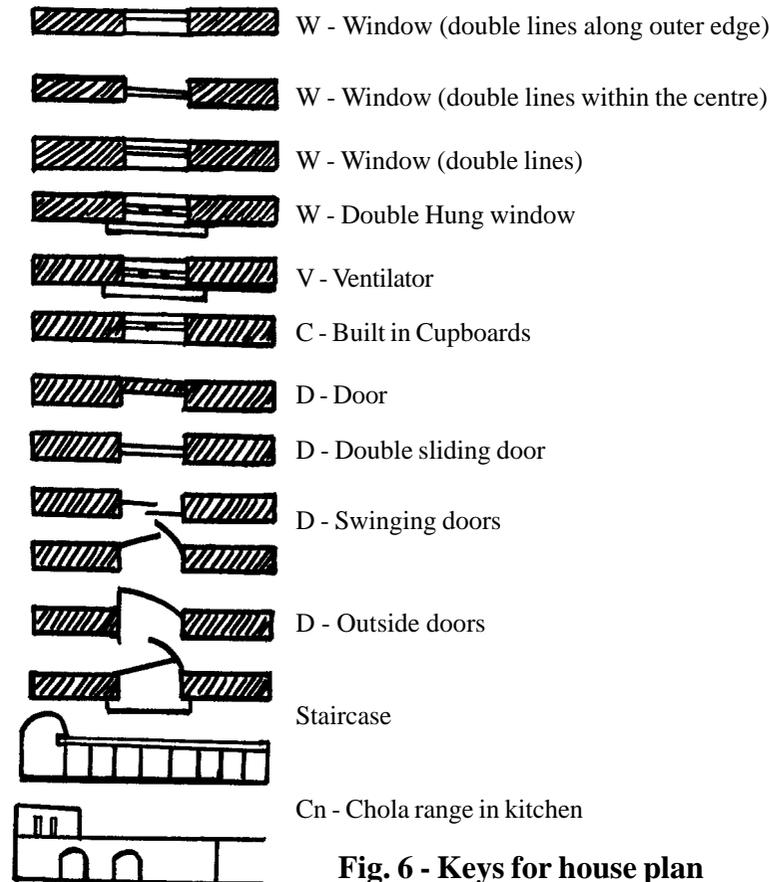


Fig. 6 - Keys for house plan

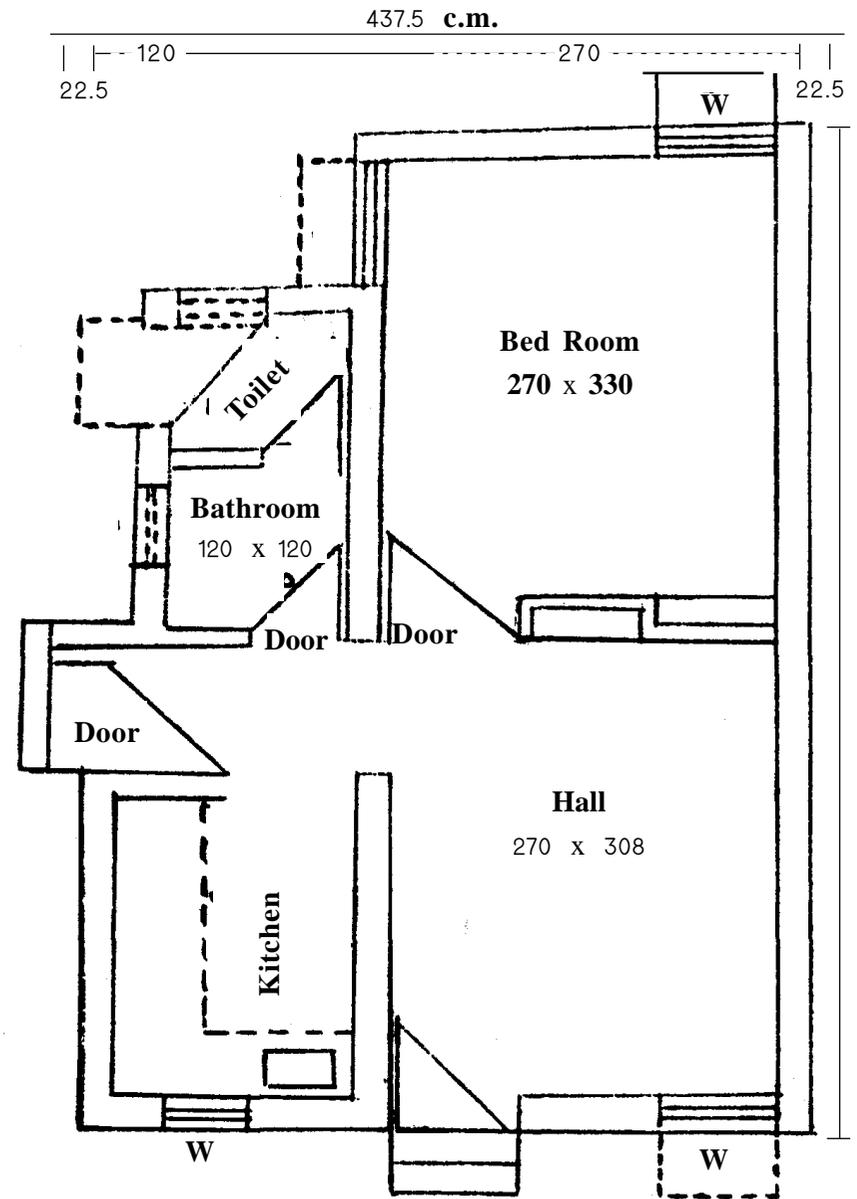


Fig. 7- Low income group house plan Plinth area 386 sq.ft

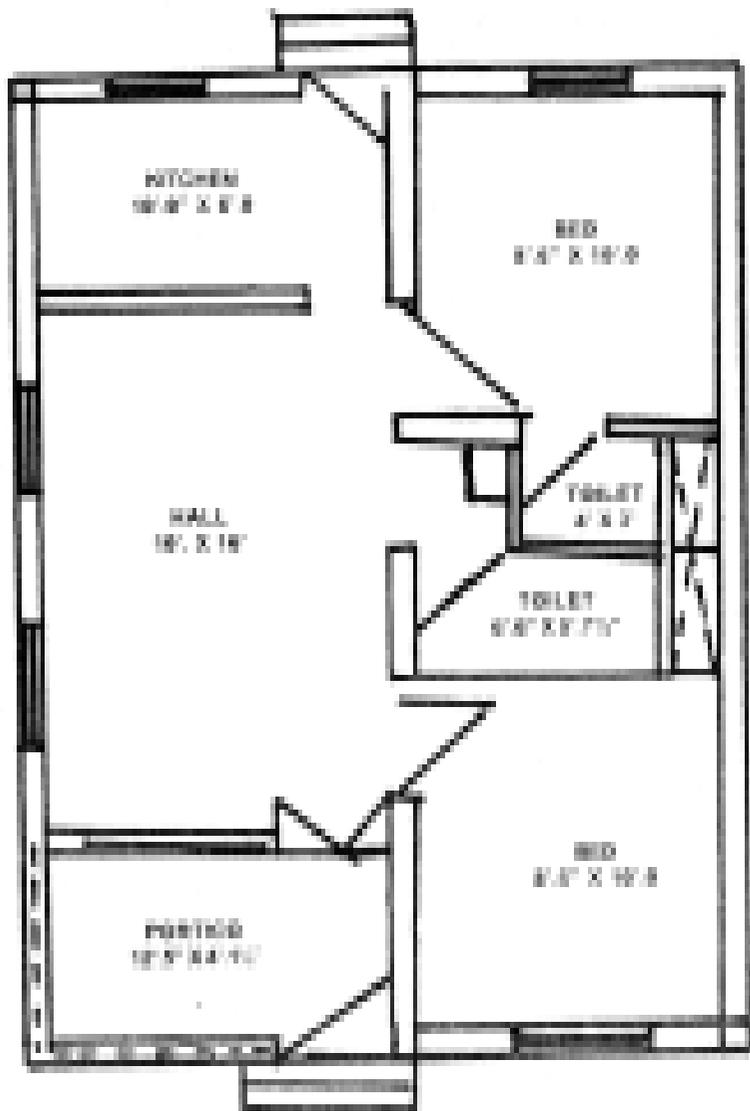


Fig. 8- Middle income group house plan Plinth area 593 sq.ft

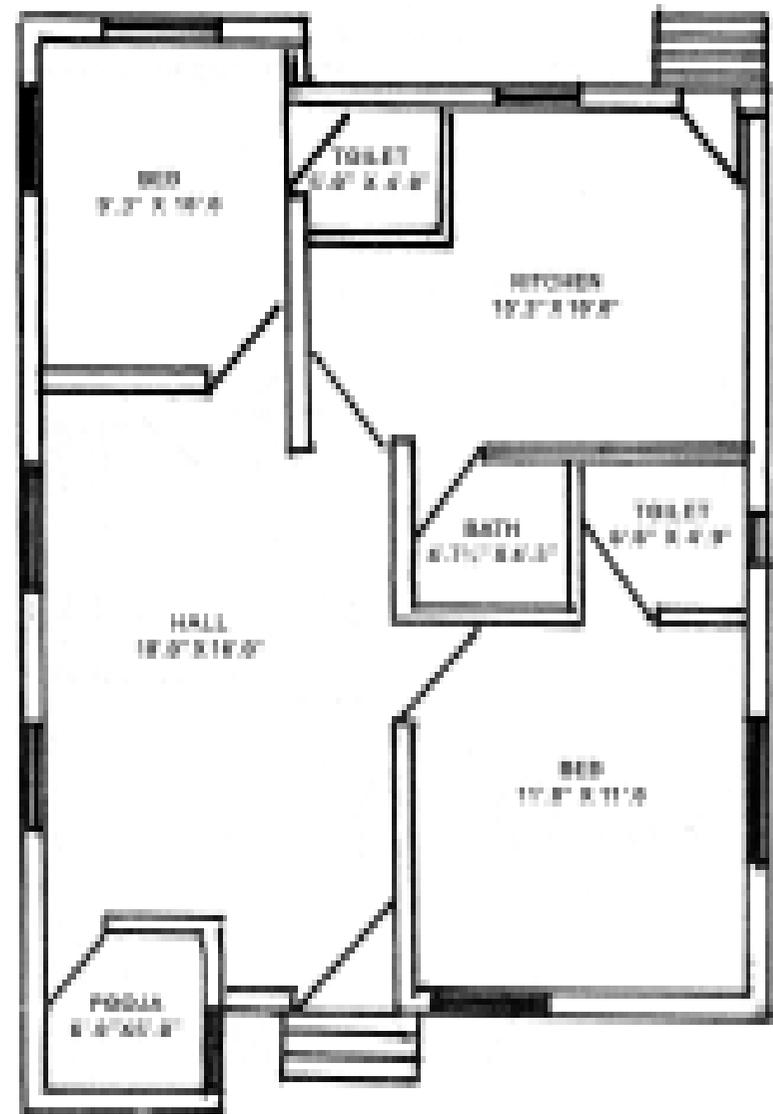


Fig. 9- High income group house plan Plinth area 798 sq.ft

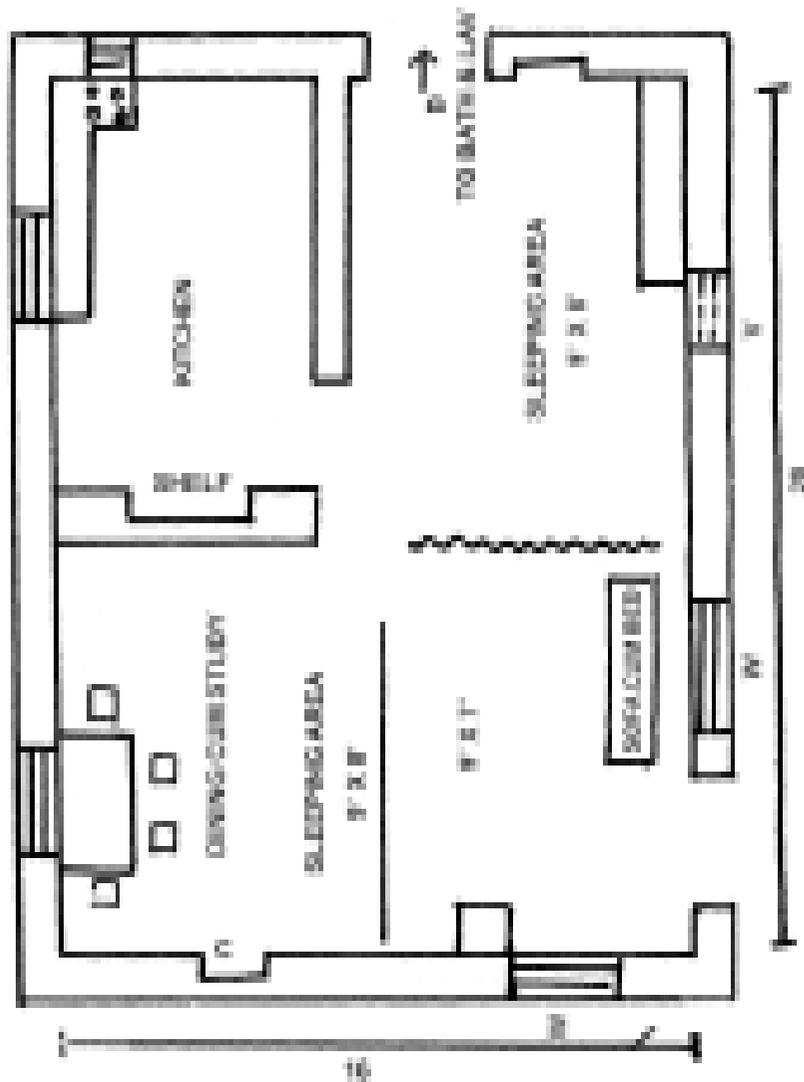


Fig. 10 - One room apartment

5.1.7 Principles of Organising a House

The factors to be considered while planning a house are aspect, prospect, privacy, grouping, roominess, furniture requirements, circulation, flexibility, sanitation and practical consideration.

i. Aspect

Aspect is the arrangement of doors and windows on the outside walls of a house which allows good breeze, sunshine and a good view of the nature. Aspect is also needed from hygienic point of view. With careful placement of windows, it is possible to admit sun's rays into any desired room. For example, kitchen should face the eastern side so that the morning sun's rays can purify air. Bed rooms should have southern aspect- either southeast or south west to facilitate enjoyment of good breeze. The living room can be north-east or south-east in its aspect.

ii. Prospect

It is the impression that the house creates on a person who views it from outside. It must be attractive in appearance, modern, cheerful and comfortable. A beautiful window, carved pillars, modern design on the walls and roof may add to the charm of the house.

iii. Privacy

Privacy is of two kinds-privacy of the entire house from the road side; privacy of each room from other rooms and from the entrance. Privacy from outside can be gained by planting trees and growing creepers or having a compound wall. Privacy within the house can be obtained by proper arrangement of doors and windows. Privacy to bedrooms, toilets, water closets and dressing room is of utmost importance.

iv. Grouping

It is the arrangement of rooms in the house in respect to their relative positions and activities towards each other. The dining room

close to the kitchen and living room, the living room near verandah, the toilet near bed room and so on. Grouping is based on convenience.

v. Roominess

It is the spacious effect a room gives to those who live in. The available space should be fully made use of. One can have built in wall cupboard, shelves and storage area so that the floor of the room is left free for various activities. The same way the space under the staircase, window sill, area below the ceiling (attic) can be made use of for storage. In addition the size and shape of the room, the furniture arrangement as well as the colour scheme used, have a bearing over the roominess of the house.

vi. Furniture Requirement

The rooms must be planned with due thought to the furniture to be placed there. The type, the position, size and the number must be planned earlier in respect to the size and placement of doors, windows and built-ins in the room.

vii. Circulation

The circulation from room to room must be good. Good circulation means independent entry to each living space through a common space. It should provide privacy to the members and not to disturb any member doing his/her work in the room. Straight, short, direct passages must be provided. Circulation can be achieved by proper placement of the doors, grouping of the rooms and furniture arrangement.

viii. Flexibility

This means making use of a room originally designed for one purpose, for different purposes at various occasions. e.g. converting a living room to a dining hall during function, a back verandah near the kitchen to be used as play center for children, a dining room converted as child's study center or play center. Screens, cupboards, folding partitions may help to make a room flexible and serve more than one purpose.

ix. Sanitation

It includes provision of light and ventilation and attention to general cleanliness and sanitary conveniences. There should not be any room in a house without enough light. Ventilation must be adequate. It means supplying fresh air and evacuating polluted air. Opposite windows and doors as well as ventilators must be provided for easy movement of air. Sanitary conveniences as provision for drainage of waste water, disposal of refuse and human waste must be planned ahead.

x. Practical Considerations

One may have to take into consideration, while planning the house, the following practical points as **strength, convenience, comfort, simplicity, beauty, possibilities of extending** the house in future and above all economy.

5.1.8 Storage

Successful housing needs the provision of adequate storage facilities through out the various parts of the house. Good storage facility is needed for the following reasons.

1. Gives a neat and orderly background for a family living.
2. Avoids unnecessary waste of time and energy.
3. To have easy access to things.
4. To have maximum use of space allotted.
5. To preserve and protect the things against mice, flies, ants etc.
6. To keep things away from dust, sunlight, moisture, abnoxious gases and adverse temperature.
7. To prevent pilferages.
8. To keep things out of reach of children.

Some of the things in the house that need to be stored are clothing, bedding, food supplies, kitchen equipment, sports equipment, garden and yard tools, cleaning agents, cleaning equipment, books, medicines, disinfectants, recreational equipment, etc.

Provision for storage in a house can be made in **attics, basements, garage, shelves and built in cupboards.**

The following points should be kept in mind when planning storage.

1. Store materials and equipment near the place of work.
2. Store materials at proper heights to avoid unnecessary stooping and stretching.
3. Arrange articles properly.
4. Group articles of similar nature together.
5. Label the items stored.

5.1.9 Safety

Safety in the home refers to **prevention of accidents** so that a hazard free environment can be provided to the family members. One of the main reasons for the cause of accidents, is the manner of house construction. The following points should be kept in mind while constructing the house to avoid accidents.

1. Avoid bumpy and insecure flooring.
2. Avoid slippery and highly polished flooring.
3. Plan for storage cabinets at proper heights.
4. Avoid shelves and corners jutting into traffic lanes.
5. Light switches should be placed in proper places.
6. Electrical wiring should be done properly.
7. Stairs should have handrail.
8. The slope for stairs should be between 30-36 degrees and should not be very steep.
9. There should be sufficient landing space and head room at each flight of stairs.
10. The house should be well ventilated and well lit.
11. The terrace should have parapet walls of sufficient height
12. Use non-combustible building materials.

5.1.10 Building materials

The beauty, utility, economy, comfort and convenience of the houses generally depend to a larger extent on the selection, use and care of the

building materials. The cost of building materials alone works out to more than forty percent of the total cost of the house. The materials available in our country are **natural materials and man made materials.**

- a. Natural materials : Mud, stone, sand, wood, lime, asbestos and leaves.
- b. Man-made materials: Cement, brick, tiles, metal, glass and plastic.

a. Natural materials

Mud

It is the most commonly used material in the house construction. Ever since man felt the necessity of a house, mud is widely used.

Its main features are as follows.

1. Abundantly available natural material.
2. Cost is cheap.
3. Easily made and repaired.
4. Sufficiently lasting.
5. Maintain equitable temperature both in winter and summer.
6. Highly useful for low-income people. The use of mud mixed with chopped straw and cow dung helps for coating the inner and outer walls of the house. A thin coating of mud and cement maintain the surface in a good condition.

Stone

Stone is a natural material of construction and is obtained from quarries. Since prehistoric days, it has been used for constructing different components of buildings like foundation, walls, lintels, floors, roofs etc.

The stones used for foundation and walls should be sound and free from cracks and decay. Stones of different forms such as granite,

marble, slate, sandstone and limestone are commonly used as building materials. Waxing and polishing make them more attractive. Gravel which are stones not larger than 2cms is essentially needed for building. Care should be taken in using proper sizes of stones and correct inter locking in the width of walls.

Sand

It consists of small grains of silica and is formed by the disintegration of rocks caused by weather. Sand should have the following qualities.

1. It is hard, durable, clean, free from organic matter and does not contain appreciable amount of clay.
2. It does not contain harmful impurities such as iron pyrites, salts, coal, mica, alkaline or other materials, which will affect hardening.

Wood

Wood is the nature's most abundant useful building material. It is comparatively inexpensive, strong, durable and easy to work. Mainly wood is used for paneling, ceiling, roofing, partitions, doors, windows and for making veneers and plywood.

Plywood is made of odd number of woodpiles or layers laminated with plastic resins under high temperature and pressure. It is used for doors, cupboards and decorative paneling.

Deodar, teak, mango, jack, toon, mahogany and bamboo are some of the common Indian timber trees used for building purposes.

Lime

Lime has been used as a cementing material since time immemorial. In India till recently, lime has been extensively used for all types of construction purposes. Big palaces, forts, monuments, temples, bridges that were constructed centuries back and that are still existing in good condition substantiate that the use of lime for constructional purposes had reached perfection in the past. Egyptian and Romans made extensive use of lime. Even though cement has replaced the use of lime. Lime

mortars have some advantageous properties like good workability, plasticity, less shrinkage on drying and durability. Lime is cheaper and easily available.

Asbestos

It is available in nature as a mineral in Marwar , Garhwal (Uttar pradesh) and Bhandra in Madhyapradesh. It is silicate of calcium and magnesium found in the form of very thin fibres which are elastic and capable of being woven into fabrics. It can withstand high temperature and acids without any change. It is used for roof, bathroom doors and partitions. However it is not advisable to use asbestos as a roofing material essentially in our country since they transfer heat.

Leaves

Grass, palm leaves and palmyrah leaves are used for roof structure. They are temporary and highly inflammable.

b. Man-made Materials

Cement

Cement should be used for the purpose of **durability** and **strength** of buildings. It has the quality to bind together loose particles of gravel, broken stones or other aggregates.

Its quick setting property, strength and ease with which it can be used under variety of conditions has revolutionized the concept of construction. Hence it has become the most popular cementing material. **Concrete** is a building material made by mixing cement, sand, gravel and water, which becomes rockhard, when dry and set. It is fire proof, sturdy and can withstand high pressure. Because of these qualities, almost all huge structures are moulded by concrete.

Brick

It is the **most extensively** used construction material because it is locally available, cheap, strong, and durable and it has the good insulating property against heat and sound. It can be moulded to any shape or size.

Tiles

Tiles used for construction are of different types such as **flooring tiles, country tiles and marble tiles**. The **Country tiles** and **Mangalore tiles** are generally used for roofing in rural areas. Floor tiles consists of terrazzo, which are polished tiles made out of marble chips mixed with coloured sand. Mosaic tiles are cement tiles polished with a portable machine after laying. Though they are expensive, they are easy to maintain.

Metals

Metals and their alloys are the backbones of all engineering products used for construction. Metals used for construction can be classified in to two categories.

(i) **Ferrous metals** wherein iron is the main constituent. (e.g.) Cast iron, wrought iron and steel.

(ii) **Non-Ferrous metals** wherein iron is not the main constituent. (e.g.) Aluminium, Copper, zinc, lead and tin.

Iron and steel occupy the most important place in the construction of huge structures. Steel is produced by combining iron and carbon chemically, heating it to red-hot and cooling it suddenly. Steel is used as reinforcement in reinforced cement concrete.

Metal have great tensile strength and are lighter than wood. Metals are both malleable (Capable of being beaten into any shape or rolled into sheets) and ductile (Capable of being drawn into wires of variable thickness).

Glass

Glass has been extensively used for **glazing doors and windows**, for **insulation and for decoration**. Rapid advances in glass technology have opened up new avenues for its use.

Glass plate is heated and then suddenly cooled to temper it. This tempered glass is much stronger and is used for glazing entrance doors, or in making table tops, shelves, counters, etc. Glasses are also used for sound proof partitions.

Plastics

Plastic have become a versatile material of modern times. Plastics are available in a variety of forms to suit varied requirements. It is fast replacing many conventional materials like timber, aluminium etc. Plastics are used in electric and sanitary fittings like electric points, switches, holders, insulators, water closet seats and domestic furniture.

While selecting the building materials, the following factors are to be considered:

1. Utility
2. Ease of maintenance
3. Durability
4. Availability
5. Process of installation
6. Cost
7. Family's taste and preference
8. Fashions of the present day.

Prefabrication

Architects have long been aware of the need for less expensive ways of building and have recognized the potentialities in prefabrication. Prefabrication is the process of assembling the different architectural structures like roof, walls, floors, windows etc., from standardized factory-built components.

Reasons for prefabrication in houses are

1. Prefabrication reduces the cost of construction, shortens construction time and assures a specified degree of quality.
2. Inadequate housing for millions of people.
3. At the present rate of population growth millions and millions of new dwelling unit will be needed within the next few years. Enormous social problems can be solved only if satisfactory housing at realistic costs can be provided which is possible by prefabrication.

5.2 CARE OF THE HOUSE

Proper care and maintenance of the house is important to keep our living environment clean, healthy and livable.

To clean means, to remove dust that has settled, dirt or foreign matters that has adhered to various surfaces and discoloration of various surfaces.

Dust

These are both **organic and inorganic loose particles** deposited from the air.

Examples: powdered earth, sand, hair, pollen etc. As these are light in weight it floats above in the air and settles on any surface. As it is easily disturbed, careful attention should be given in the removal of dust.

Dirt

These are dust held firmly by moisture, or grease on rough surfaces.

Foreign matter

These include chemical compounds formed due to the reaction of air or food with metals. Example : rust.

Cleaning involves various kinds of operation, knowledge, abilities and skills and hence it is important to know the reasons, types of cleaning and the different types of cleaning implements used in the upkeep of the house.

5.2.1. Reasons for cleaning

1. To make the house look neat and tidy.
2. To keep the environment clean.
3. To protect things from destruction.

5.2.2. Types of cleaning

Cleaning can be classified into three types. They are

1. **Daily cleaning:** This includes sweeping and mopping of floors, dusting of various surfaces, removing superficial dust from carpets, shaking of curtains and making beds.
2. **Weekly cleaning:** This needs more attention and time. This includes removing dust or dirt by scrubbing, vacuum cleaning of

carpets, cleaning of shelves and cupboards, cleaning of toilets, bathrooms and washbasins. This sort of cleaning is usually done during weekends.

3. **Periodical cleaning:** This involves more amount of time and work. This includes airing the mattresses, getting rid of insects, pests, washing heavy draperies and carpets, polishing the floor and furniture etc. This sort of cleaning is done occasionally or before certain festivals.

5.2.3 Cleaning implements

Cleaning method depends upon the amount of soiling, the nature of the substance to be cleaned and the purpose for which the article is used.

1. **Dusters:** They are made of cotton fabrics and are used to wipe dust from hard surfaces.
2. **Mop cloths:** These are a kind of dusters used for mopping floors, stairs, ledges and shelves. They are of different types namely impregnated mop, static mop and disposable mop. They have a handle with polyester or cotton head.
3. **Rag:** These are used for applying polish which are thrown away when dirty.
4. **Chamois leather:** This is supple thin leather used for wiping windows and glass.
5. **Scrim:** This is loosely woven linen material which has high absorbency and does not leave lint. It is often used to clean windows, glass and mirrors.
6. **Brushes:** They are available in various sizes and shapes. The bristles are made of plastic, nylon and coconut fibers. They are used to clean toilet pans, carpets, clothes and furniture.
7. **Brooms:** Brooms are either soft or hard depending on the type of material used. They are available in different varieties. They are used to clean interior floors. Yard brooms are stiff and are used to clean exterior floors.
8. **Dust pan:** This is used for collecting dust and dirt. They are available in different shapes and colours, sizes and materials.

9. **Buckets and basins:** They are used for carrying water for cleaning. They are available in different shapes, sizes, colours and materials.
10. **Stools and Ladders:** These are used for reaching high places in the house for removing cobwebs, clean lamps and fans.
11. **Vacuum cleaner:** This is a motorized cleaner used for sucking dust. This has a disposable dust bag, brushes and tube nozzles. The suction created by a revolving fan helps in drawing the dust from the article into the dust bag. They are used to collect dust from carpets, upholstery and are used in high dusting and to collect dust from inaccessible areas.

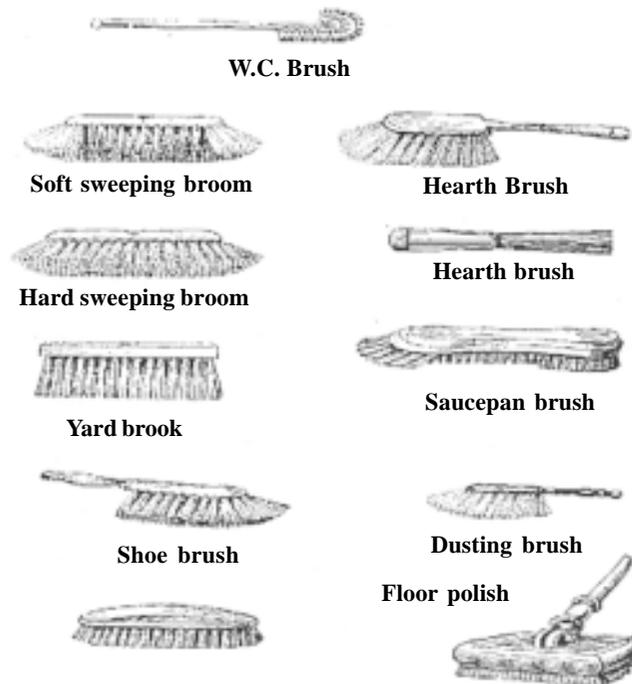


Fig. 1 la - Types of Brushes

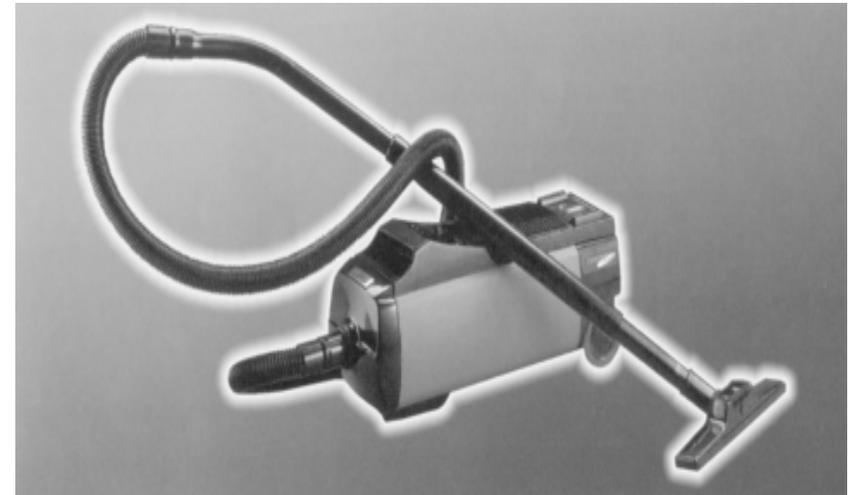


Fig.11b-Vacuum cleaner

5.2.4 Cleaning agents

1. **Soaps:** These are alkaline salts of fatty acids. They emulsify the grease on the articles.
2. **Detergents:** Detergents are effective in all types of water. They are non-soapy, synthetic materials.
3. **Abrasives:** They are used to remove dirt by scrubbing and cleaning the surface. Examples of abrasives are saw dust, nylon mesh, steel wool, ash and brick powder.
4. **Disinfectants:** These are used after cleaning to get rid of microorganisms.
5. **Grease solvents:** These are used to remove grease. Eg. Petrol, kerosene, spirit.
6. **Lemon, vinegar and salt** are used for removing tarnishes from metals.
7. **Bleaches:** These are used to remove stains from toilets, sinks and mosaic floors. They are obtained in liquid and powder forms.
8. **Linseed oil, varnish and wax polishes** are used to polish unpainted wood.

9. **Polishes:** Jeweller's rouge and silvo are used for polishing silver and brasso for polishing Brass. These are commercially available in the market.

10. **Shikakai:** This is used for cleaning tarnishes, metals.

5.2.5 House Hold Pest

Control of pests in the house is an integral part of home management. Some insects do good, but most insects do harm. Some are the direct causes of disease while others are indirect forms. These pests can be divided into three types based on their tendencies- bloodsuckers, polluters of food and destroyers of property.

Ants: They live in colonies in soil and in garbage. They can be controlled by

1. Poisoning with sodium chloride by spraying it into cracks where they abide.
2. Keep the legs of food safes standing in vessels of water with a little oil.
3. Dust borax in their haunts.

White ants: These are **most destructive** of all household pests. They cause damage to wood and wooden articles. They can be controlled by

1. Wooden post erected on earth should have cement foundation.
2. If they are planted into the earth directly, the sunken part can be coated with thick tar.
3. Boiling water or kerosene may be used to kill them.
4. Cracks should be filled up with cement.

Bed Bugs: These are round flat insects reddish brown in colour. They live on **human blood**. They breed on crevices of walls, floors, beds and other furniture. They can be controlled by

1. Plastering crevices on ceilings, walls and floors.
2. Sun dry bed sheets, cloths and hangings at least once a week.
3. Spraying pyrethrum in crevices.
4. Fumigation with ethylene oxide.

Book lice: These pests devour the paste used for binding books and framing pictures. They sometime breed on mattresses and upholstered furniture. These can be controlled by airing the rooms every day.

Cockroaches: The colours vary from dark brown to black. They feed on leather, books, starchy fabrics and all kinds of food. They live in drains and pipes. They are found mostly in kitchen and dining rooms. The control measures are

1. Do not keep any food item open.
2. Using repellents like borax or pyrethrum powder.
3. Thorough cleaning to remove unpleasant odour.

Crickets: They cause a **lot of damage to wood**. The way of controlling them is to keep the areas clean or spray borax.

Houseflies: Flies are very dangerous insects as they play a major role in **spreading diseases** like typhoid, cholera, tuberculosis, dysentery and diarrhoea. They can be controlled by

1. Cover all garbage items.
2. All food items should be covered.
3. Destroy the eggs with kerosene or borax.
4. Use flypapers made of 5 parts of castor oil and 8 parts of resin powder, to which flies will get stuck and die.

Mosquito: They suck blood, inject germs. There are different types of mosquitoes namely **anopheles** which causes malaria, **culex** which causes filaria and **qedes** which causes yellow fever. The control measures are

1. Stagnation of water should be avoided.
2. Wells and tanks should be covered properly.
3. D.D.T powder suspended in water can be sprayed.
4. Mosquito nets can be used over beds and windows to prevent entry of mosquitoes.
5. Kerosene can be sprayed in open drains to destroy larva.
6. Incense and other repellants like neem leaves, tobacco and camphor can be burnt.
7. Eucalyptus oil or lavender oil can be rubbed on the skin.

Silver fish: They attack paste used for bookbinding, framing pictures and starched clothes. The control measures are

1. Clean pictures, photograph and glass frequently.
2. Use D.D.T powder or pyrethrum powder.

Mice: They get attracted by the warmth of the building and the food in the house. They destroy clothes and newspapers. They can be controlled by blocking all possible points of entry and placing rodenticides.

Pests : This could be controlled to a greater extent if the house is kept clean. To keep the house clean, it is important to know the various ways of collecting and disposing waste in a hygienic manner.

5.2.6 Waste disposal

The wastes that are produced in the house should be collected and disposed off in a proper manner. There are two types of household waste. They are

1. **Refuse:** This is made up of solid organic waste in a decomposing or non-decomposing state, excluding body wastes. Examples are garbage and rubbish.
2. **Sewage:** This is waste water containing solid and liquid excreta.

Reasons for waste disposal

1. To avoid contamination of soil
2. To prevent ground water from getting polluted.
3. To prevent breeding of flies and other harmful microorganisms that spread diseases.
4. To keep the surroundings clean.
5. To protect the surroundings from obnoxious odour.

The domestic refuse should be collected in a container or bin which has a tight-fitting cover. The bins must be kept away from cooking area.

Methods of refuse disposal

Dumping: This is filling up empty pits with refuse or reclaiming low-lying lands. If dumping is done under proper supervision and during dry season it is called “**Controlled dumping**”.

Sanitary land fill: This is dumping the refuse material in a trench and covering it with 15cm layer of earth.

Compost formations: This method is used mainly where refuse is to be disposed off with night soil and to convert the waste into humus.

Sorting: This method consists of sorting the refuse into soft core which consists of animal and vegetable organic matter which can be used as manure and hardcore which consists of broken bottle, crockery^ tiles, etc. which can be used for metalling roads.

Incineration: This is one of the best methods of refuse disposal. In this method, the refuse is burnt in incinerator and reduced to ashes,

Sewage disposal: The best method of disposing sewage is through water carriage system. In big cities, this system leads to the sewer systems and in small towns it may lead to septic tank. **Dilution** is a method in which the sewage is disposed into water sources such as rivers, streams and sea, after having been suitably treated. The solid part obtained from this treated sewage is used as manure in fields.

A well-maintained house will create a healthy and safe environment to live in. But one should also know to add beauty to the house, by decorating its interiors in a pleasant way.

5.3 INTERIOR DECORATION

A simple house can be made to look attractive by decorating its interior tastefully. When our home looks beautiful, we feel happy and proud. **According to Keats, “A thing of beauty is a joy forever”.** One’s imagination, good taste and aesthetic sense are very much needed to have a good interior. Interior decoration is a creative art of adjusting the space and equipment to suit the fundamental and cultural needs of the dwellers.

5.3.1. Importance of good taste

Taste differs from person to person. The taste is reflected by the things a person buys. A thing may or may not be appreciated by all individuals equally. Certain arrangements attract the viewers for longer periods while some arrangements attract for shorter periods. Whatever the care may be, taste of the person who has created that particular piece of work is reflected through his or her creation.

Art and good taste go together like the jasmine and its fragrance. There are general characteristics found in beautiful things that establish certain principles. Any piece of art that satisfies the principles is always admired by all. One should have the knowledge of the principles fundamental to good taste. Based on this, he can identify and appreciate beauty. Now let us deal with the elements of art.

In formulating a design, two groups namely **the elements of art and principles of design emerge. Design is defined as any arrangement of lines, forms, colours and textures.** It involves the problem of choosing these forms and colours and then arranging them. **A good design shows an orderly arrangement of the materials and creates beauty in the finished product.**

5.3.2. Elements of Art

Line: Line is the basic element. Line has three dimensions. They are **length, thickness and direction.** Lines can be classified into straight, curved lines or combination of these as zig zag line, scalloped lines. Straight lines give a rigid, formal appearance where as curved line indicates femininity and flexibility. They also give gracious look.

Lines can take vertical, horizontal, diagonal directions or a combination of these. **Vertical lines** suggest dignity and create the illusion of height to the room. **Horizontal lines** give a restful effect and make the room look lengthier and reduces height. **Diagonal lines** are dynamic and create the impression of restlessness if used in excess.

Form: Form is referred to as **area, mass and shape.** When lines are drawn in different directions, they meet at common points to form different shapes. A solid has three dimensions and the flat forms have two dimensions of length and width. Too many varieties in form create confusion. A rectangular and square form can be obtained by combining horizontal and vertical lines. A triangular form can be produced by combining vertical or horizontal and diagonal lines.

Size: Size is the dimension of objects. It may vary from small, smaller, smallest or large, larger and largest.

Texture: Texture is the surface quality of the material. This can be classified into **actual and visual** texture. Actual texture is the one that can be felt when we touch and visual texture is the one that can be identified through visual examination. A rough texture absorbs more light and smooth texture reflects light. Texture in home may refer to wall finish, rugs, woodwork, an oil painting, a ceramic urn or wood used for furniture.

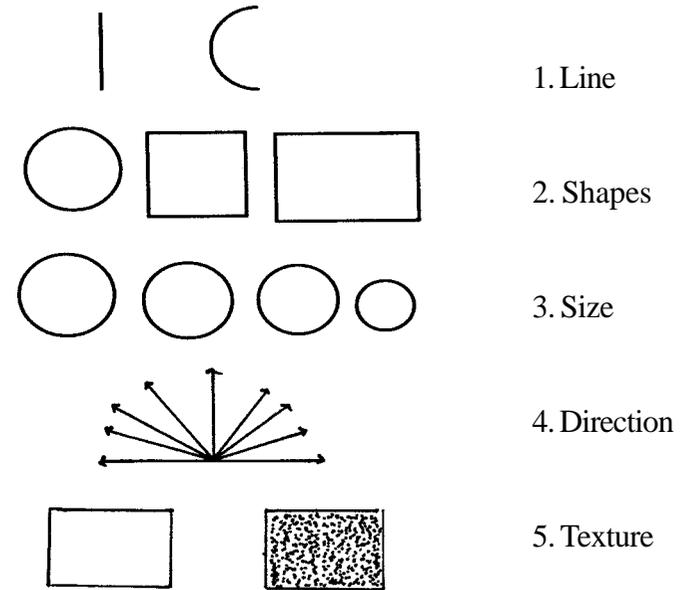


Fig.12-Elements of art

Colour: Colour adds beauty to any expression of art. Colour can bring about warm or cool effect, light or dark effect, bright or dull effect in the articles and different areas of the house.

Design: A good design shows an orderly arrangement of **lines, forms, colours and textures**. It involves the problem of choosing these forms and colours and then arranging them. It can be **structural and decorative**.

5.3.3 Structural design

Structural design is the design made by the size, form, colour and texture of an object. Structural design is essential to every object.

Requirements of a good structural design

1. It should be simple and beautiful.
2. It should be suited to its purpose.
3. It should be well proportioned.
4. It should be suited to the material of which it is made.
5. It should have originality.

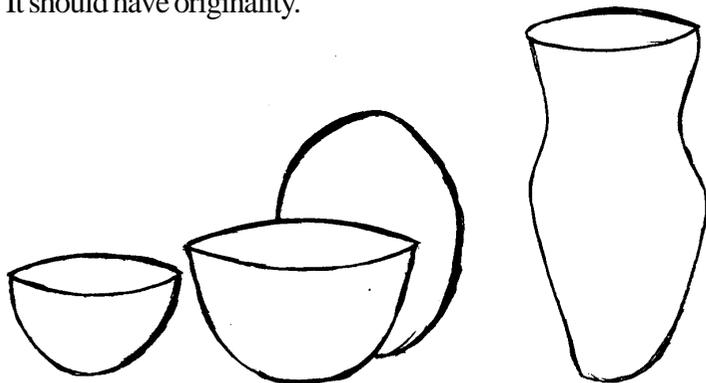


Fig. 13 - Structural Design

5.3.4. Decorative design: Decorative design is the surface enrichment of a structural design. This adds luxury to a design.

Requirements of a good decorative design

1. The decoration should be in moderation.
2. The decoration should be placed at structural points.

3. It should strengthen the shape of the object.
4. There should be enough background space to give an effect of simplicity and dignity to the design.
5. Surface patterns should cover the surface quality.

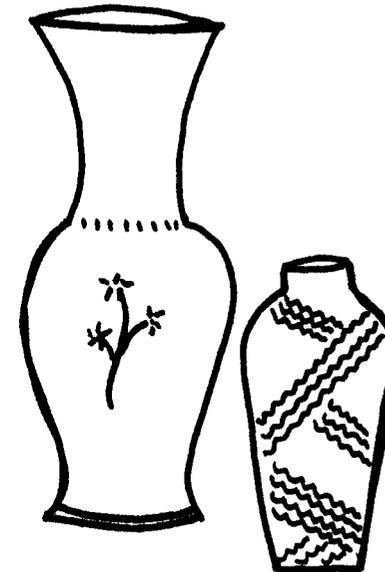


Fig.14-Decorative Design

Designs, based on their source can be classified into natural,conventional, geometric and abstract designs.

5.3.5 Colour and colour combinations

The appeal of colour is universal. It enhances the beauty of objects and gives satisfaction to the mankind. Each colour has got its own characteristic such as irritating, charming, boring, welcoming or repelling. Because of these effects, colour affect the atmosphere of the home and we react emotionally to different colours.

Prang colour chart

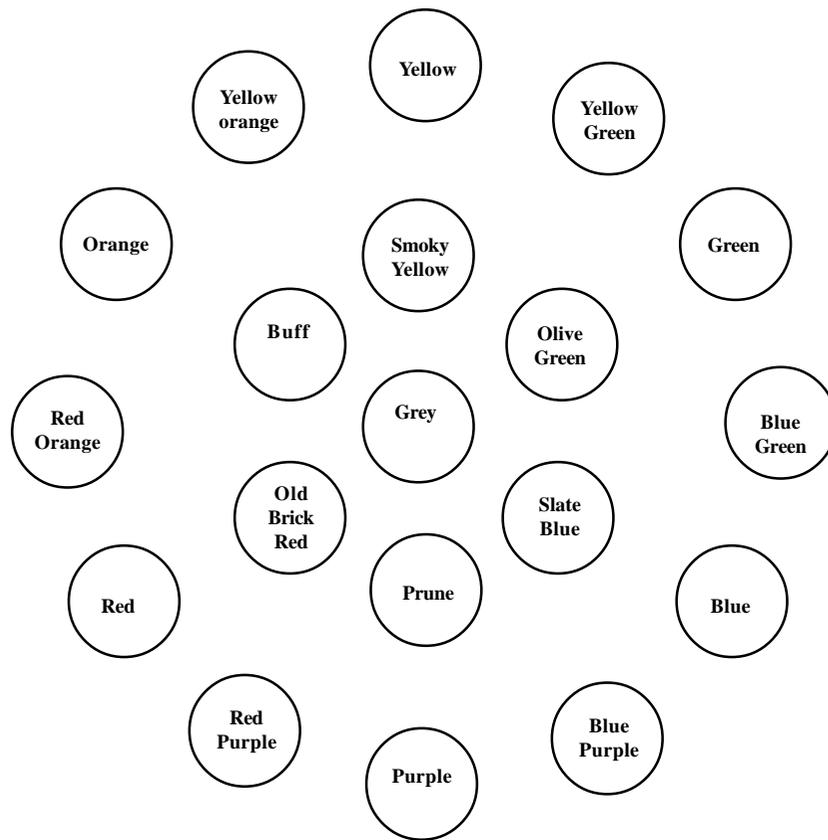


Fig.15- Prang colour chart

Dimensions of colour

Colour has three qualities or dimensions. They are hue, value and intensity.

Hue: hue indicates the **name** of the colour. Examples are red, yellow, blue etc.

Value: Value indicates the **lightness or darkness** of a colour. The value of the colour can be changed by adding white or black to make it lighter and black or more colour to make it darker than the normal colour. A value that is lighter than the normal hue is termed as **tint** and a value darker than the normal hue is termed **shade**.

Example: Red is a normal hue. Pink is tint of red and maroon is shade of red.

Dr. Denman W. Ross has given nine degrees of value scales ranging from white to black. **White is the highest** of all values and no colour can be as light as white. **Black is the lowest** of all values and no colour can be as dark as black. When black and white are mixed, we get seven different scales of grey namely highlight, light, lowlight, middle, light dark, dark and low dark, based on the amount of black and white present in the grey colour.

White
High Light
Light
Low Light
Middle
High Dark
Dark
Low Dark
Black

Fig. 16 - Ross Value Scale

Intensity

This indicates the brightness or dullness of a colour. It indicates the purity or strength of a colour.

Classification of colours

Prang colour chart: According to Prang colour chart, there are three primary colours. They are **yellow, blue and red**. They are called

primary colours because these colours cannot be produced by mixing other colours.

When two primary colours are mixed in equal proportions, we get secondary colours.

Yellow + Blue = Green.
Blue + Red = Violet or Purple.
Red + Yellow = Orange

The primary and secondary colours together are called **basic colours**.

When a primary and an adjacent secondary colour is mixed an intermediate colour is produced. There are six intermediate colours. They are

Yellow + Green = Yellow Green.
Blue + Green = Blue Green.
Blue + Violet = Blue Violet
Red + Violet = Red Violet
Red + Orange = Red Orange
Yellow + Orange = Yellow Orange.

The three primary colours, three secondary colours and six intermediate colours form the outer circle of the Prang colour chart.

When two binary colours are mixed a tertiary colour is produced. There are three tertiary colours. They are

Green + Orange = Grey Yellow or Smoky Yellow.
Orange + Violet = Grey Red or Old brick Red.
Green + Violet = Grey Blue or Slate Blue.

When two tertiary colours are mixed a quaternary colour is produced. There are three quaternary colours.

They are
Smoky Yellow + Old Brick Red = Grey Orange or Buff.
Smoky Yellow + Slate Blue = Grey Green or Olive Green
Old Brick Red + Slate Blue = Grey Violet or Prune.

The three tertiary and three quaternary colours form the inner circle of the prang colour chart. Grey colour is in the centre of the Prang colour chart.

When we draw an imaginary vertical line in the centre of the Prang colour chart, the colours will be divided into two large groups. The colours on the right side of the prang colour chart closer to blue are cool colours and the ones on the left side, closer to red and orange are warm colours. **Red and Orange are the warmest colours and Blue and Blue Green are the coolest colours.**

Warm colours make the objects appear bigger and closer where as cool colours make the objects appear smaller and far away. Warm colours are cheerful and stimulating where as cool colours are calm and restful. Light values increase the size of the objects and dark values reduce the size.

Colour combination or colour harmonies

Colours should be combined effectively to create beauty, pleasure and satisfaction. They produce a sense of unity in colour combinations. Colour combination or colour harmonies can be classified into related and contrasting colour harmonies.

Related colour Harmony: They are obtained by using colours which are similar. They are classified into **monochromatic and analogous** colour harmony.

Monochromatic colour harmony: This is also known as one hue or one mode harmony. In this only one colour in different values and intensities is used. Example. Dark blue and light blue. In a monochromatic colour scheme, charming effects can be obtained through contrast in textures of the materials used.

Analogous colour harmony: In this colour scheme the colours which are lying adjacent to each other in the prang colour chart are used. They provide interesting variety than monochromatic harmony. The colours should be of different intensities and values.

Examples: Yellow, Yellow Green, Red, Red Orange, Orange.

Contrasting colour harmonies

Complementary colour scheme: Two colours that are directly opposite in the Prang colour chart are combined. Example: Yellow and Violet, Blue and Orange.

Double complementary colour harmony: Two adjacent colours and their opposite colours in the Prang colour chart are combined. For example: Yellow, Yellow Green, Violet and Red Violet.

Split complementary colour harmony: In this a primary or an intermediate colour and the two colours that lie on either side of its complementary colour are combined. For example: Yellow, Blue Purple and Red Purple.

Triad: In this, three colours which are at equal distance in the Prang colour chart are combined. We get four triads namely primary, secondary and two intermediate triads.

Primary Triad - Yellow, Blue and Red.

Secondary Triad - Green, Orange and Violet.

Intermediate Triad -

- a) Blue Green, Red Purple and Yellow Orange
- b) Yellow Green, Blue Purple and Red Orange.

Tetrad: This is formed by any four hues equidistant on the Prang colour chart. Example : Green, Yellow Orange, Red and Blue Purple.

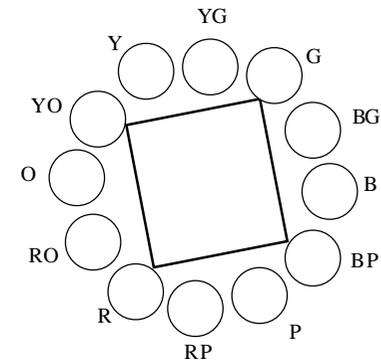
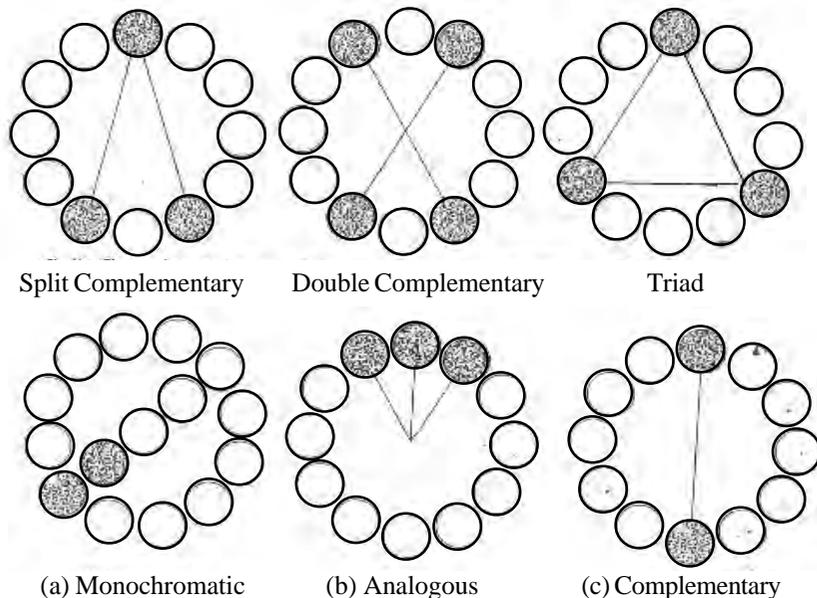


Fig. 17 - Colour Harmonies

Factors to be considered while planning colour scheme:

1. The expected effect in size, shape and direction of the room.
2. The mood to be created in the room. Example: Masculine, feminine, traditional, formal, etc.
3. Individual preference of the family members.
4. The activities to be carried out in each room.
5. Colours of other existing furniture and furnishings in the house.
6. Only one colour should dominate.
7. The basic colour should occupy atleast 60-70% of the whole colour scheme. Second hue should be used in lesser quantity and if a third colour is used, it should be used in least quantity.
8. Follow 'Law of areas' that is, larger the area lighter the colour and smaller the area brighter the colour.
9. The current trends and fashions.

5.3.6 Principles of Design

In our daily life, we meet with a number of designs. It is always important to remember that beauty is the goal toward which we are striving for. Utility also plays a major role in forming a good design. The

following art principles are the bases for judging good design. They are Harmony, Balance, Proportion, Rhythm, and Emphasis.

Harmony

Harmony is the fundamental requirement of any piece of work. It means **unity or a single idea or impression**. It produces an impression of unity through its selection and arrangement of consistent objects and ideas. Forms, lines, textures and colours should be harmonious.

For example, In a formal dinner arrangement, a table should have table mats, plates, knives, spoons, forks, cups, hand towels etc., arranged in order so as to achieve harmony of ideas. In a round plate, a round design will be more apt than a square design.

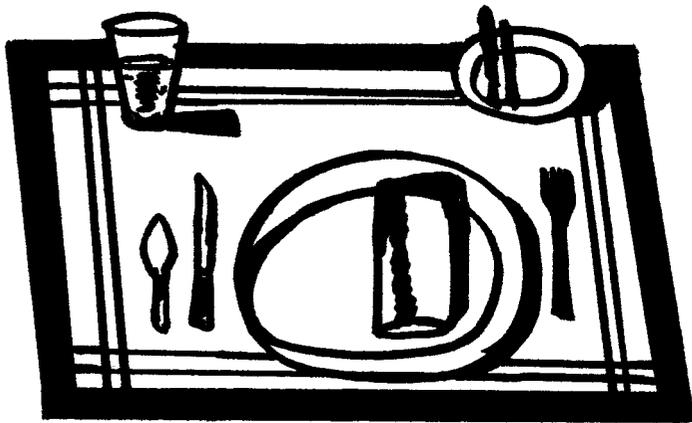


Fig.18-Harmony

Balance

Balance is **equalization of attraction on both sides of the center**. It is rest or repose. This effect is obtained by grouping shapes and colours around a center in such a way that there are equal attractions on each side of that center.

Balance is of two types

They are formal and informal balance.

Symmetrical or formal balance results when articles are kept at equal distance. If objects are similar in appearance, they will attract the same amount of attraction and therefore should be equidistant from the center.

A design which has formal balance gives a feeling of dignity and stateliness. **Asymmetrical or informal** can have many variations. If the objects do not have the same amount of attraction they must be placed at different distances from the center.

This type of the balance is just like see-saw, in which to balance off a heavier person, the lighter one moves away from the centre and the former towards the centre.

Informal balance is more creative and require much more effort than the formal one. It gives an impression of spontaneity, freedom of movement and casualness.

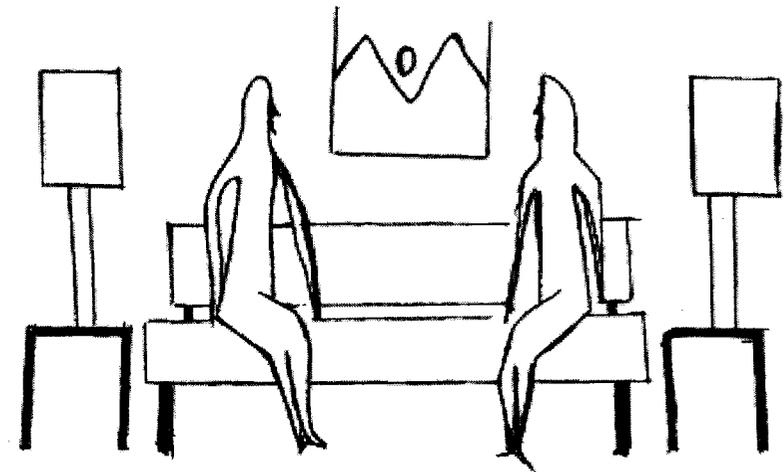


Fig. 19A Symmetrical balance seems formal and static

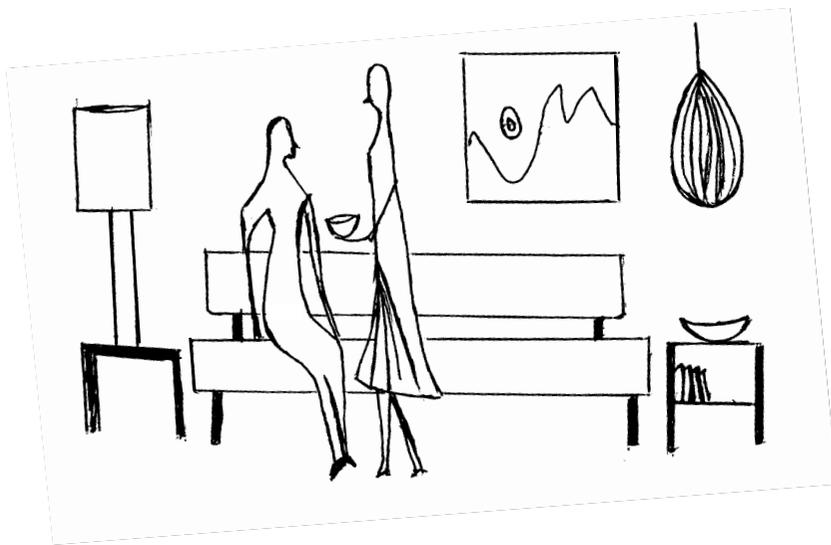


Fig. 19-B Asymmetrical balance suggests informality and movements

Proportion

Proportion means **the relationship of sizes or areas to one another or to a whole**. Whenever two or more things are put together, good, or bad proportions are established. Proportion is achieved when the different sizes of objects are successfully grouped in an arrangement the elements making up the structure having a pleasing relationship for the whole and to one another. For example, a very small chair next to a very massive one would be 'out of scale'.

Greek oblong or Golden Oblong is a good proportion, which can be used for division of space interestingly. This oblong uses the ratio of 2:3 or 3:5 in case of flat surfaces and 5:7:11 in case of solids. In the figures, three rectangles are given where the entire area is divided into two portions. The division of the area can either be interesting or uninteresting proportions. In A, the division is too

simple to be interesting. In C, the proportion is too unlike. In B, the divisions are pleasantly related because they are little alike. The difference in the division makes it interesting.

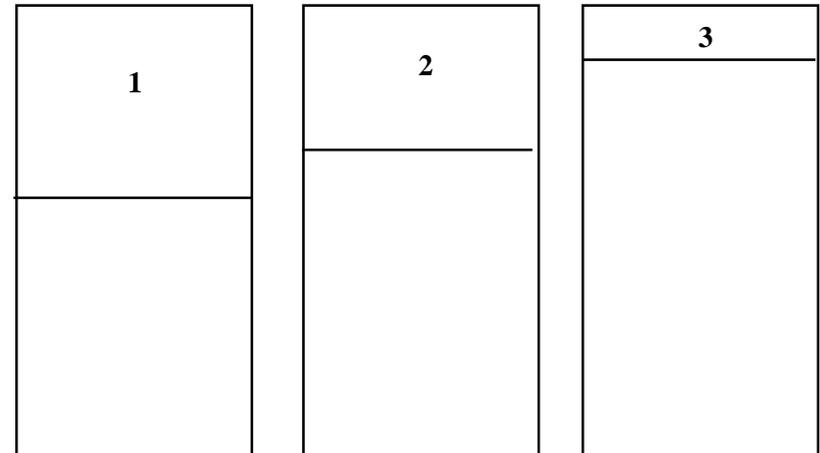


Fig. 20- Division of Space

Rhythm

Rhythm is the **movement of the eyes across a design**. It is a kind of organised and related movement in continuity. Rhythm means an easy connected path along which the eye may travel in any arrangement of line, form or colour. In a perfectly plain surface, there is absolutely no movement of the eye and it remains quiet. Some line movements create rhythm and others create a feeling of confusion.

Rhythm can be achieved in many ways :

Through the repetition of shapes

When a shape is regularly repeated at proper intervals, a movement is created which carries the eye from one unit to the next.

Through a progression of sizes

Progressing sizes create a rapid movement and at the same time interesting.

Through an easily connected, or a continuous line movement.

The eye is led along the design by the continuous line movement.

Radiation

Radiation is the plan for many geometric design. From a central point, line radiate. Radiation is a type of movement that grows out of a central point or axis. It is used very commonly in designs like Ashoka Chakra in the national flag, and flower arrangements.

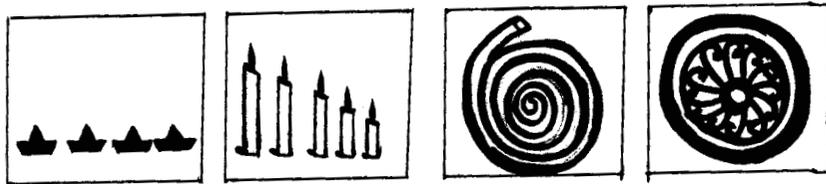


Fig. 21-Rhythm

Emphasis

Emphasis is the art principle by which the eye is carried first to the most important thing in any arrangement and from that point to every other detail in order of importance.

Emphasis can be achieved by the following ways

1. By placing or grouping of objects.
2. By the use of contrast of colour.
3. By using decoration.
4. By having sufficient background space around objects.
5. By contrasting or unusual lines, shapes or sizes.
6. By unusual texture.

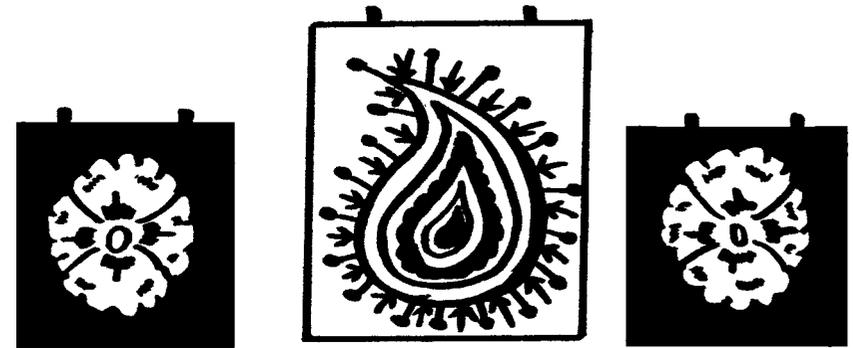


Fig. 22-Emphasis

So far we have learnt about the use of art principles in decorating the interiors. Now we will learn about the different ways of furnishing the house.

5.3.7 Furniture for the House

Furniture are pieces intended for comfort, rest and relaxation, storage or articles of beauty. Furniture in all houses, are indispensable and they provide for a harmonious living. While selecting furniture the following points are to be borne in mind.

1. Furniture used should be in proportion to the size of the room.
2. The design should be simple, plain, well constructed and provide comfort to the user.
3. The furniture we select should be easy to maintain.
4. The furniture should not occupy too much space.
5. It should be light weighted.
6. Children's furniture should be of adjustable height (legs).
7. The furniture should be movable.

8. The furniture should be functional and not too decorative.
9. The furniture should stand firmly.

General Rules

1. Select, a centre of interest and subordinate all other interests to it.
2. Observe balance in arrangement. Formal balance gives dignified, restful effect, but too much of formal balance in a room will give a monotonous appearance.
3. Retain good proportion while arranging. Place all large pieces on large wall area and small pieces on small wall area.
4. Avoid using too many furniture in a room.
5. Scatter upholstered pieces among wooden pieces.
6. Avoid letting furniture hide the walls. But at the same time avoid filling too much of the centre floor area. Keep the traffic lines in the room very clear while arranging. Arrange all furniture with purpose and function in mind, grouping those, which are needed for a particular activity in one place.

In the distribution of furniture, the housewife should exercise three policies: **elimination, re-arrangement, and concealment**. If one can afford, broken and unwanted furniture may be discarded and fresh ones replaced. Furniture in a room may be reorganised so as to achieve satisfaction. Unsightly and jarring object must be concealed by the use of slipcovers. Defective and unattractive furniture can be concealed by the use of good attractive covers.

Furniture Needed in Different Rooms

Drawing Room: One comfortable sofa and few chairs. Teapoy which is a bit lower than the seat of the sofa, television, video cassette recorder, radio and record player cabinets to keep record albums.

Dining Room: Dining table and chairs, folding chair, if needed a trolley.

Bed Room: A double bed, bedside table and a lamp, dressing table, bed time table with lamp, place for suitcases, chairs.

Children's Room: A study table, a bed, book shelf.

Guest Room: Sofas which can be converted to bed. Dressing table, bed side table with lamp, place for suitcases, chairs.

Kitchen: Built in storage space (appliances), stools, shelves, plate rack.

5.3.8 Window treatment

Treating the windows with fabrics and other materials is the easiest and most common way of furnishing the house. Window treatment can be classified into **soft and hard**. Soft window treatment is furnishing the windows with curtains and draperies. **Curtains** are thin fabrics which are used to cover the windows. They provide more light and less privacy to a house. **Draperies** are the thick fabrics which are used to cover the windows and they provide less light and more privacy.

Selection Of Curtains

1. Curtains should control light, heat and noise.
2. It should provide privacy.
3. The material purchased should be easy to wash and maintain and should not collect dirt easily.
4. It should neither be too light nor too heavy.
5. Curtains should add to the width of the windows.
5. It should suit the colour scheme of the house.

Curtains with large designs suit only large rooms, while those small designs are fit for use in small rooms.

Hard window treatment is treating the windows with blinds, shades, shutters, thoranams, beads, leaves etc.

5.3.9 Cushions

Cushions are available in many sizes and shapes. We can select the cushions according to the size of the furniture on which they are

placed. Cushions are used for comfort and relaxation. They are luxury and charm to the room.

5.3.10 Floor Coverings

Floor coverings are used to **enhance the beauty of an ugly floor surface**. Floor covering may be hard floor covering, which include wood, stone, marble, slate, brick, tile and concrete; Resilient floor coverings which are smooth surface materials like asphalt tile, rubber tile, vinyls, cork and varieties of linoleum and soft floor coverings are carpets and rugs which represent the major house furnishing.

The floor covering should be selected on the basis of function, wear, cost design; and the effect of covering on the overall decoration.

5.3.11 Carpets And Rugs

A carpet covers the entire floor area of the house. They create an **illusion of space**. Wall to wall carpets produce a feeling of warmth, quiet and luxury. A rug is single piece of floor covering made with a floor pattern or a border with fringe. Plain rugs add unity and warmth.

Points to be considered while buying Carpets and Rugs

1. Their design and colour should be in harmony with the general colour scheme.
2. They should be of durable material.
3. The edges of rugs should be well finished and clear.
4. They should prevent the floor surface noise.
5. Carpets should provide safe fitting and prevent slipping.
6. Maintenance of carpets and rugs should be easy.
7. Cost, character of the room, purpose, quality, design, utility, resiliency and abrasiveness are also the factors to be borne in mind.

5.3.12 Wall finishes

Wall finishes play an important role in changing the appearance of the room. A room can be made to look larger or smaller, noisy or quite,

formal or informal, light or dark, cluttered or empty, festive or serious, depending on the finish that is given to the walls. It is also important to give an easily cleaned and hygienic surface. It is easy to bring various colours, patterns, textures and light inside the interior using various types of wall finishes. Wall finishes can be classified into **structural and applied** wall finishes. Structural wall finishes are the finishes that are given to the walls while the construction of the building is on. Examples for structural wall finishes are brick finish, cement plastered finish, tiled finish, stone finish with granite, marble, black stone, etc., rubble finish etc. Applied wall finishes are those, which are applied to the structural unfinished walls. Examples for applied wall finishes are lime and colour wash, paints, wall paper, fabric wall covering, wood paneling, glass wall covering, metal wall covering, leather wall covering etc.

It is possible to introduce more than one type of wall covering into a room and colours, designs or materials can be used for focal points to add interest.

5.3.13 Lights

Sunlight has a cheerful and happy effect on everybody in the home. House should be built in such a way as to admit maximum sunlight. Sunlight is also germicidal in action. Other than electricity, gas light, candle and oil lamps can be used. The amount of light from these sources prove to be sufficient. Electric lamps are powerful and lessen the strain to the eye. Electric tubes are better than filament bulb. Careful choice and colour of light in a room adds to the decorative appearance of the home. Good lighting means providing an even diffused light throughout the rooms, as well as providing spot lighting for concentrated work.

Besides a central light in a room, local lighting as table lamps, dining table spot lamps, bedside lamp or work spot light near stove etc. are needed. There are many decorative lampshades available in the market. The lampshades should not collect dust. Adequate lighting helps

in reducing eyestrain and provides more comfortable working conditions. Lighting in all parts of the house is considered to be essential, for the sake of convenience and safety.

5.3.14 Accessories

Accessories are **small art objects**, which are used in completing the interior decoration. It contributes much to the loveable and comfortable atmosphere of a room. They enhance the beauty of the room. They serve as means of self-expression, originality and personality of the homemaker. Accessories may be classified as **functional or decorative**. Paper weight, timepiece, pin tray, penholder etc. are functional. Carvings, pictures, ornamental objects, flower arrangement etc. are decorative. Some other accessories are books, gifts, candle stick, book ends, strip covers, shells, wall hanging, feathers, stones, twigs, beads, metal objects etc. Likewise you can have a list of other accessories you have come across.

Pictures

Pictures are integral part of wall decoration. It reveals **the aesthetic sense** of the viewers. They have the power to stir one's imagination. They can establish the mood or theme of a room.

The various types of pictures are landscape, seascape, still life, architectural portraits, photographs, religious, abstract modern pictures etc.

Selection of Pictures

1. The picture must coincide with the idea of the room.
2. Pictures should have the natural colours.
3. It should satisfy the principles of design.
4. It should fit in with the general decor of the house.
5. The frame should suit the picture. It should be plain and not too decorative.

6. Pictures should find a central place on the wall, directly above the furniture and should not be hung too high or too low.
7. Sufficient light should be focused on the picture.
8. Cost of the picture, availability and the personal taste of the user must be considered.

Hanging of pictures

Hanging picture is itself an art. Pictures should be hung in such a way that the center of interest comes at above eye level. They should be hung flat against the wall and not tipped forward. Avoid using visible wires. Light pictures are best hung on fairly light walls and dark pictures on dark walls or in dark corners. Tall pictures should be hung on vertical wall spaces and broad pictures on horizontal space. Small pictures will be out of place on large wall spaces. **Proportion** is an important consideration while hanging pictures. Principle of **emphasis** plays an important part. There must be plain space which will add to the brightness. Pictures should carry the eye towards it and not away from it.

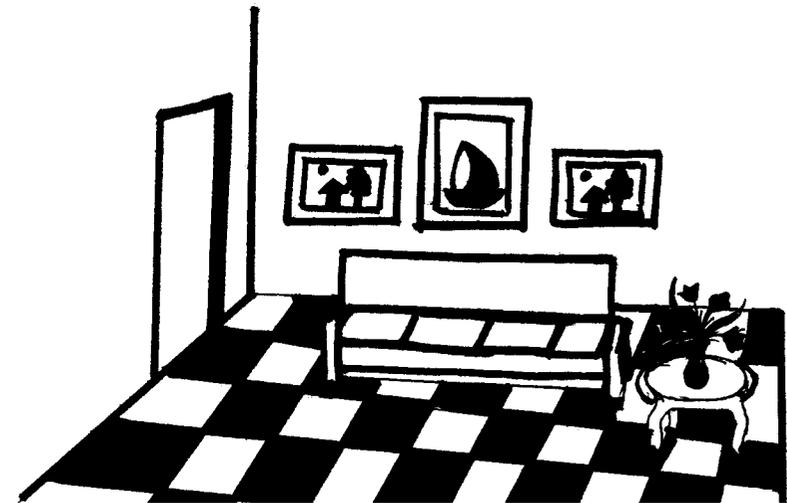


Fig. 23- Hanging of pictures

The following rooms can have the pictures as suggested below:

Living room - portraits, photographs of personalities, abstract paintings, landscapes, marine life, flower and figure compositions.

Bed room - photos of close relatives and babies.

Dining room - still life paintings of fruits, vegetables, landscape etc.

Children's room - picture of animals, flowers, cartoons, . photos of leaders, scientists, great men of the nation etc.

Kitchen - pictures of fruits and vegetables.

5.3.15 Using plants and flowers

Flowers delight everyone. Interior decoration is complete only with the presence of few flowers in a room. Flowers suit any room in the house and provide variety and interest. Flowers are universally admired and loved. Apart from the beauty and charm they possess, plants also help to purify the air during the day time. Plants inside the house create a pleasant, fresh and cheerful atmosphere. It alleviates feelings of depression and objection. Today arranging flowers has become the fascinating hobby of many housewives. Now we shall discuss flower arrangement in detail.

Selection of Vases

The main function of the vases or container is to support the flowers and foliage. The container should be subordinate to the flower arrangement. It should be of the right size, shape, colour and material.

Types of vases or containers

1. Jars, attractive bottles, tins.
2. Tall cylinders, narrow necked vases, flat round dishes, deep trays, low round bowls.
3. Bottles of different colours.
4. Block of wood or bamboo baskets.
5. Household pots, vessels, tumblers, shallow dishes.

Selection and preservation of flowers

1. Flowers should be collected either early morning or evening.
2. Select buds or flowers just blossoming than flowers in full bloom. These flowers are liable to shed their petals or droop and wither fast in a short period.
3. The stems should not be broken with the hand. It should be cut with scissors or a sharp knife. The stem should be as long as possible.
4. The cut portion of the stem should be immersed in water. Only the petals of the flowers should be exposed.
5. The leaves close to the base of the stem should be removed.
6. The flowers should be wrapped either in a piece of paper or a broad leaf, such as the banana leaf, above the stem ends and stored in dark corner of a room in a bucket of water, to protect them from sunlight. If they are not going to be used soon, polythene covers may also be used to cover the cut flowers.
7. The container or the vase should be filled with warm water. The water should be changed every day. Add sugar or salt to enable the flower to last.

Flower Holder

A flower holder is one which has sharp spikes upon which the stems can be firmly placed. This is known as pin type holder. Other than this we also have crumpled wire, split twigs etc. Flower holders must be strong and flexible, so that any type of stem can be easily fixed.

It should also be rust proof. Pin holders can be fixed to the bottom by clay or candle. This fixing must be done when the vase as well as the holders are dry. Large flowers and foliage can be arranged at the bottom so that the holders are concealed.

Styles in flower arrangement

1. **The traditional style:** Where a mass of flowers of all kinds, colours and size are used together. This produces a multicolored mass effect.
2. **Oriental style:** This is Japanese mode of flower arrangement. It gives an impression of a natural growing plant. The stems are so arranged that their lines form an attractive pattern. The flowers are placed in such a way so as to produce balance. The flowers are always in odd numbers, three, five, seven or eleven. The arrangement has three main branches representing heaven, man and earth.
3. **The modern style:** A combination of traditional and oriental style.
4. **Floating arrangement:** This arrangement can be made in shallow bowls and trays with short stemmed flowers. The largest, highest and most attractive flower can be allowed to float in the centre and others grouped around. Flowers should not completely cover up the water.

Points to be Considered While Arranging Flowers

1. Have an idea about the arrangement.
2. Arrange the flowers first and then fill up with leaves and twigs.
3. Have big bright flowers at the bottom and small light coloured flowers on higher levels.
4. Make the levels start and deviate from one point in the arrangement.
5. Fill the flower vase with enough water to dip the stem ends.
6. Sprinkle salt, sugar or suitable preservative to keep up the freshness of flower for long.
7. Display the flower arrangement beautifully in a place to be seen and enjoyed. Select suitable accessories to go in with the arrangement.

8. All the principles of design should be followed for pleasing effects.

Types of Flower Arrangements

1. **Mass Arrangement:** A group of flowers of all kinds, colours, size and textures are combined in a container. Usually decorative container is used.



Fig. 24 -Mass arrangements

2. **Line arrangement:** This arrangement is simple, meaningful, beautiful and informal. The Japanese oriental style usually follows. This arrangement gives an impression of natural, free growing plant.

Odd numbers of flowers are used at three levels. The **highest** level signifies heaven, the **middle** refers to the man and **lowest** indicates the earth.

Heaven- $1\frac{1}{2}$ times to 2 times the height or width of the vase

Man - $\frac{3}{4}$ th the height of heaven.

Earth - $\frac{1}{2}$ the height of man.

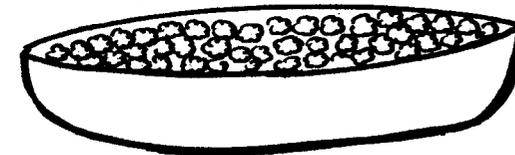


Fig.25-Floating arrangement

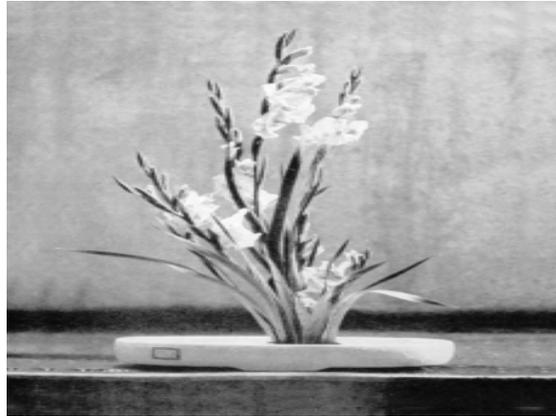


Fig. 26 -Ikebana arrangement

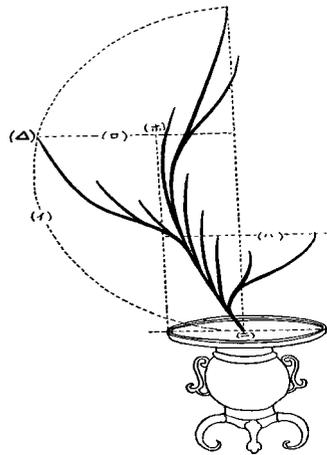


Fig. 27 -Ikebana arrangement - basic style.

3. **Combination arrangement:** A combination of line and mass arrangement gives rise to geometric shapes as cone, crescent, circle, triangle, 'L' shape and so on.
4. **Foliage arrangement:** Arrangements using leaves or branches of plants are foliage arrangements, (e.g.) ferns, crotens, cannas, cactus, weeds can also be arranged effectively with a touch of imagination.

5. **Diminutive arrangement:** They are small arrangements usually within four inches in height arranged in small containers like egg shell, small bottles, lids, etc.

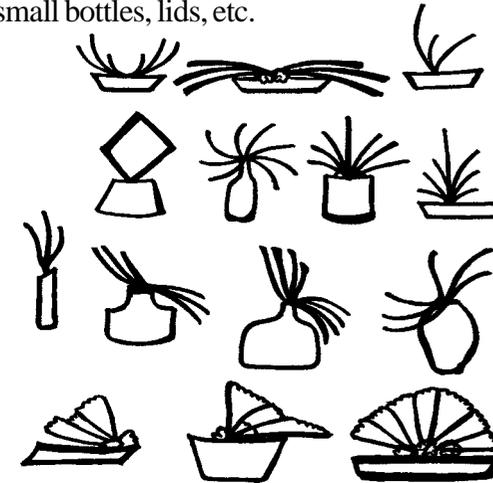


Fig. 28 - Arrangements of Different Shapes

Dry Arrangement

These are particularly useful during rainy season when there are very few flowers, Dry arrangements with fruits, vegetables, seed pods, bare branches, flower plumes of tall grasses, sugar cane, roots, stems of money plant, a small dead tree, the clustering, especially peacock feathers if well arranged presents a novel appearance and are suitable for interior decoration. Dry arrangements with wood can be painted in silver, white or gold for variation in style.

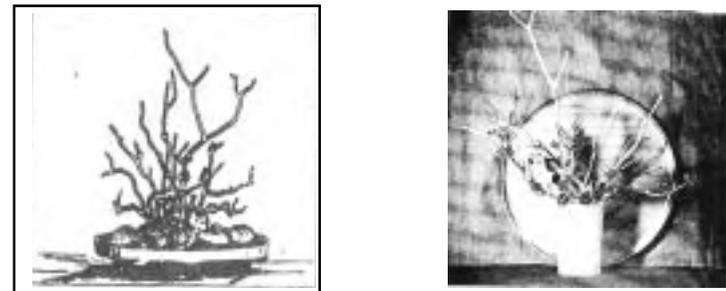


Fig. 29 - Dry arrangements

Fruit and Vegetable Arrangement

A great amount of foliage should be added in fruit or vegetable arrangement. Containers should be sturdy and large sized. Even baskets and trays will be attractive. The cuts and carving should be made in such a way so that a pine apple may look like a peacock, an onion a lotus and beet root, red rose, melon - a. lamp shade etc.

5.3.16 Floor decorations

The various types of floor decorations are

1. Kolam: Kolam is a free hand drawing of various designs. It can be either dotted or in various designs. For drawing kolams, either white stone or chalk powder, enamel paint, white or Coloured salt, sand or powders and solutions prepared by mixing ice flour and water is used. Red mud solution is used as painting to give added brightness. In rural areas, people spray cowdung mixed with water as base on floors before putting Kolam.

2. Rangoli: Coloured dry powder which are usually made from kolam powders are used. They are mixed with either sand or salt.

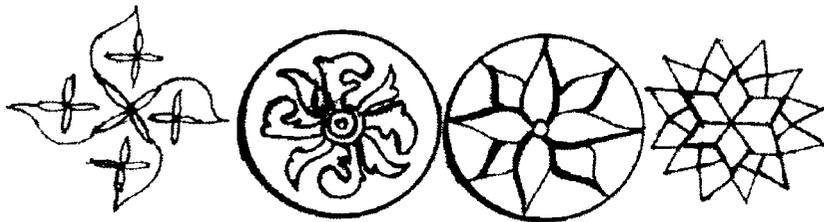


Fig. 30 -Rangoli

3 Alpana: Alpana is a traditional art where the design is painted with white paint. Usually zinc oxide and gum are mixed to keep it for a longer duration.

4. Flower Carpet: Different coloured flowers, petals and leaves are arranged over the design. Wet sand may be evenly spread beneath the flower carpet to have a raised effect.

PRACTICALS

1. Learn to draw floor plans for low, middle and high- income group houses to scale.
2. Learn to read blue prints.
3. To visit buildings under construction.
4. To learn various methods of cleaning.
5. Learn to clean, polish and varnish various surfaces.
6. To do market survey on pesticides.
7. Analyse art objects for good structural and decorative design.
8. Collect pictures for various elements of design.
9. Make Prang colour chart.
10. Ross value scale..
11. Tints and shades for the basic colours.
12. Try out various colour harmonies.
13. Collect pictures on principles of design.
14. Collect pictures of different types of furniture.
15. Collect pictures of furniture in various rooms.
16. Visit shops to see different furniture, furnishings and accessories.
17. Learn to do various styles of flower arrangements.
18. Learn to do various floor decorations.
19. Make students arrange a corner table, center table, study table, etc.,

QUESTIONS

Section –A

I. Fill in the blanks

1. _____ shape is good for kitchen.
2. _____ aspect is most favoured for kitchen.
3. _____ line suggests repose.

4. _____ line suggests movement.
5. The surface feel of the object is called _____
6. Burning refuse is called _____
7. The plan which shows the outside appearance of the building is called _____
8. The dust firmly held to surface are called _____
9. The best method for sewage disposal is _____
10. The Greek oblong ratio for solid is _____

II. Match the following

- | | |
|--------------------|----------------------------|
| 1. Common Wall | work triangle |
| 2. Privacy | row hours |
| 3. Kitchen | staircase |
| 4. 30° - 60° | draperies |
| 5. Asbestos | loose particles |
| 6. Cement | cleaning glass |
| 7. Dust | DDT |
| 8. Chamois leather | 2:3 |
| 9. Mosquito | man-made building material |
| 10. Golden oblong | natural building material |

III. One word answer

1. What is the land which is filled with debris called?
2. Name a private area in the house.
3. Name a multipurpose furniture.
4. What is the plan that gives the details from roof to foundation called?
5. Name a leaf that is used for house construction.
6. Name a man-made building material.
7. Name the leather used for cleaning glass.
8. Name a functional accessory.
9. Name a resilient floor covering.

Section-B

1. What is a semi-detached house?
2. What is row of houses?
3. Which type of soil is good for constructing houses?
4. What is a reclaimed land? Is it good for constructing house. Why?
5. Classify the areas of a house based on the activities ?
6. List the importance of house plan.
7. What is a cross sectional plan?
8. What is a landscape plan?
9. Define floor plan.
10. Define prefabrications.
11. List the factors to be considered while selecting building materials for a house.
12. Explain the types of cleaning.
13. List any six cleaning implements.
14. How can cockroaches be controlled?
15. How can you control mosquitoes?
16. What is incineration?
17. List the characteristics of a good structural design.
18. What are the requirements of a good decorative design?
19. What are tints and shades?
20. Give an analogous cool colour scheme?
21. Define harmony.
22. How would you select curtains for your house?
23. What are carpets and rugs?
24. Classify floor coverings with examples.
25. State the importance of wall finishes.
26. What are the points would you consider while buying carpets?
27. What are accessories? Classify.
28. List the various types of flower containers.
29. What is a floating arrangement?
30. What is a dry arrangement?

Section-C

1. List the importance of a house.
2. Explain the factors to be considered while selecting a house.
3. Which shape is ideal for a kitchen? Why?
4. List the details that should be there in a site plan.
5. List the reasons to have good storage facility in a house.
6. Give the advantages of any three man-made building materials.
7. Explain the factors to be considered while planning colour scheme for the house.
8. Define Balance and classify.
9. Define rhythm and explain the ways of achieving it.
10. Define Emphasis. How can this be achieved?
11. List the points to be borne in mind while selecting furniture of the house.
12. How would you select and preserve flowers for arranging them?

Section -D

1. Explain the factors to be considered while selecting a site.
2. Explain the features of a good kitchen.
3. Draw a low-income group house plan keeping in mind the various activities to be carried out in a house.
4. Draw a middle-income group house plan and explain how you have made provision for the various activities.
5. Draw the floor plan and explain how you would make provisions for various activities in a one-room apartment.
6. Explain the principles of planning a house.
7. Explain the role of elements of design in interior.
8. Explain the dimension of colours.
9. Explain in detail the various colour harmonies giving examples.
10. Explain the role of principles of design in interiors.
11. Explain with diagrams the various styles of flower arrangements.
12. Explain the different types of floor decorations with diagrams.

6.FUNDAMENTALS OF TEXTILES AND CLOTHING

Clothing is one of the basic needs for mankind. It protects the body from heat and cold, but also brings out one's personality, enhances beauty, gives comfort and expresses the status of living. Thus the need to study about fiber, fabric and clothing in this chapter. Fundamentals of Textiles and clothing.

6.1 FIBERS

Fibers are very small visible units from which fabrics are made by one process or another. Take a yarn or thread and untwist until it comes apart, or pull a single strand from an opened cotton ball or from a bunch of wool. The small fine, individual hair-like strands are fibers. Thus, a fiber may be partly described as being a slender filament or fine strand of sufficient length, pliability and strength, to be spun into yarns and formed into cloth.

6.1.1 Fiber properties:

The fibers possess certain essential properties. These are the **primary** and **secondary** properties.

The primary properties include :

- a) High length to breadth (width) ratio
- b) Tenacity or Fiber strength
- c) Flexibility or Pliability.
- d) Cohesiveness or spinning quality of fibers, and
- e) Uniformity

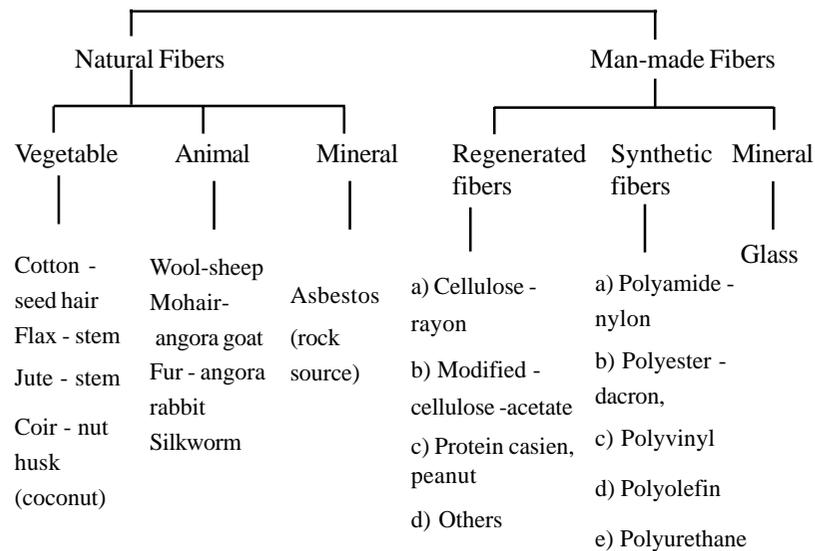
Secondary properties of fibers are not essential but desirable for consumer satisfaction. These include :

- a) Physical shape
- b) Specific gravity
- c) Luster

- d) Moisture regain
- e) Elastic recovery
- f) Elongation
- g) Resilience
- h) Thermal behavior
- i) Resistance to biological organisms
- j) Resistance to chemical and other environmental conditions.

6.1.2 Broad classification of fibers

Table-1



6.2 NATURAL FIBERS

These include cotton, silk and wool.

6.2.1. Cotton

Cotton referred to as the “**King of fibers**” is most important textile fibre in the world. Cotton fabrics were made by the ancient Egyptian, Chinese and of course Indian civilizations.

The cotton fiber is a long cell made up of countless cellulose molecules. Cotton is removed mechanically from the seed balls by the cotton gin. The ginned cotton is then pressed into bales and sent to the factories to be spun into yarns.

Manufacture: The main processes are bale breaking and cleaning, carding, combing, spinning, weaving, scouring, bleaching and dyeing.

Bale breaking and cleaning

The tightly pressed cotton fibers from the bales are loosened in a machine, the impurities falling out. Another machine removes more impurities until sheets of loose fiber like cotton wool emerge ready for carding.

Carding: The shorter fibers are further removed in this process and the fibers are made to lie flat called **slivers**.

Combing: removes more short hairs and makes fibers more parallel.

Spinning: The combed sliver is now converted into yarn by spinning. Scouring and Bleaching is usually done after weaving to enable the cloth to be dyed easily.

Properties of cotton: Cotton fiber is a single cell and varies in length from ½ to 2½ inches. The width varies between 12 to 20 microns.

Microscopic Appearance : Cotton appears as a flat tube with spiral twists in longitudinal view, under cross section it is bean shaped with lumen.

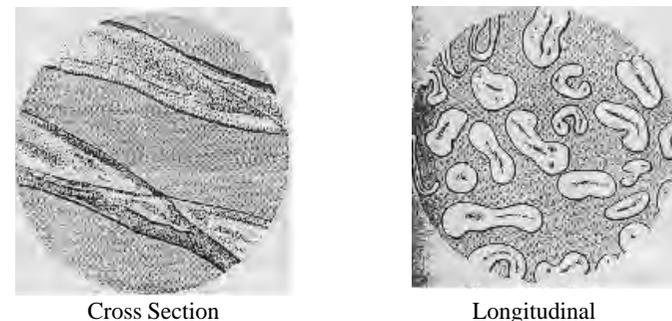


Fig. 1 - Microscopic Appearance of Cotton

Physical properties:

1. The cotton fibers vary in colour (i.e) white to cream.
2. Cotton has low luster, elasticity & resilience.
3. It is 25% stronger when wet than dry and absorbs moisture.
4. Cotton fabrics shrink and hence they are made shrink resistant.

Thermal properties:

1. Cotton burns quickly and readily with a smell of burning paper.
2. It is a good conductor of heat.
3. It will scorch when ironed with too-high temperatures.

Chemical Properties:

1. Cotton is resistant to alkali.
2. Strong acids disintegrates cotton.
3. It is resistant to organic solvents.
4. Mercerized cotton can be dyed easily.

Biological Properties :

1. Cotton is damaged by fungi such as mildew and bacteria.
2. Silverfish lives on cellulose, so it damages cotton fibers.
3. Moths and beetles do not attack or damage cotton.

Uses of cotton:

Cotton is the most widely used fiber because it is inexpensive, easy-care, high absorbency, excellent launder ability and good colourfastness. It is not only used for apparel but also for household and industrial applications.

6.2.2 Silk

Silk has been considered as one of the most elegant and luxurious of fibers. It is popularly known as the **Queen of fabrics**. The method of raising silk worms and removing the silk filaments from the cocoons, and of using the silk in weaving for garments was discovered by **Hsi-Ling-Chi**, a little Empress of China.

Commercial silk is produced by the cultivated silkworm, *Bombyx mori*, a caterpillar, that feeds on mulberry leaves. The eggs laid by the moth are stored in winter and spread out on trays to hatch in a warm shed. Mulberry leaves are placed as soon as the worms appear, for them to eat.

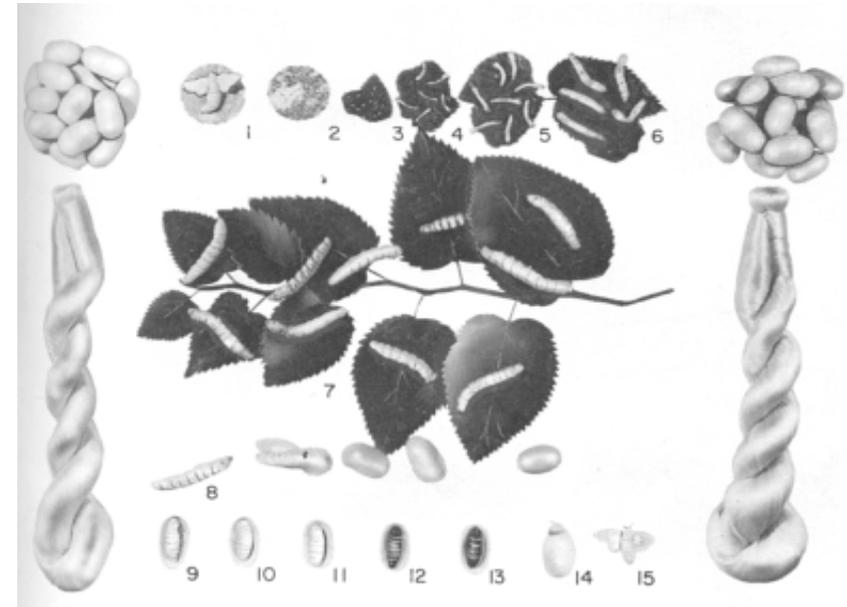


Fig. 2- The life Cycle of Silkworm

- | | |
|--|-----------------------------|
| 1. Laying of eggs | 2. Hatching |
| 3. First age | 4. Second age |
| 5. Third age | 6. Fourth age |
| 7. Fifth age silkworm feeding on mulberry leaves | |
| 8. Spinning cocoons | |
| 9, 10, 11, 12 - Stages of pupa | 13, 14, 15 - Stages of moth |

(Courtesy International Silk Guild, Inc)

When the worm is fully grown, it starts spinning its cocoon on straw placed on the trays. The silk fluid from special glands issues from two holes, one on either side of the head, called **spinnerets**.

The fluid hardens as it comes in contact with the air and two long fibers which are stuck together with silk gum are formed. The cocoons are heated to kill the pupa inside, otherwise the moths would destroy some of the silk. Some are allowed to become moths to provide eggs.

Manufacture

The manufacturing process involves Reeling, Throwing, Degumming, Weaving, Dyeing and sometimes Weighting.

Reeling: This is a process of unwinding the silk filament from the cocoon. The cocoons are boiled in water to soften the gum so as to unwind the filaments

Throwing: Throwing is a process of combining several reeled strands to make a yarn. The number of strands are twisted together to form a strong yarn.

Degumming : The gum left on the fibers to protect them are now removed by boiling in soap and water. Sometimes degumming is left until the fabric is woven. Weaving is carried out the same way as for other fibers.

Weighting: Weighting is the process of treating silk with certain metallic salts to give weight and body to the product.

Properties

Microscopic appearance

Longitudinally, degummed silk appears as a smooth, lustrous, translucent filament like a glass rod. In cross-section silk show triangular fibers with no markings.

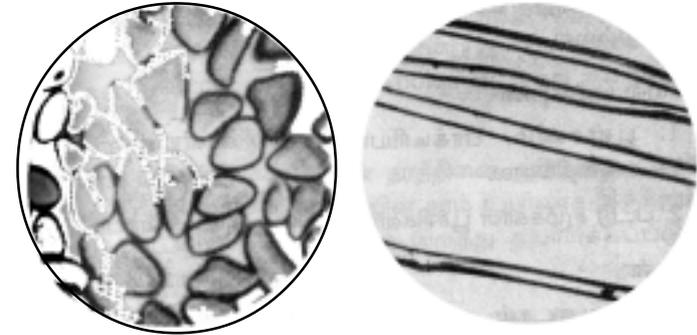


Fig.3 - Microscopic appearance of silk

Physical

1. Silk filaments are very fine and long.
2. It is one of the strongest fibers.
3. It has good elasticity and moderate elongation and resilience.
4. Silk fabrics have good resistance to stretch & shrinkage when dry-cleaned.

Thermal

1. Silk burns directly in the path of flame.
2. It extinguishes itself when removed from flame and gives an odour of burning hair.
3. Silk scorches if ironed at too high temperatures.

Chemical

1. Silk is damaged by strong acids and alkalis.
2. Silk is not affected by cleaning solvents.

Biological

1. Silk is resistant to attack by mild dew, bacteria and fungi.
2. Carpet beetles will eat it.

Use

Silk fabrics are noted for their soft, luxurious handle, rich luster, warmth, resilience, and crease resistance, strength and excellent draping quality. A wide range of fabrics are made ranging from sheer chiffon to

firmer dress and suiting material, to heavy brocades to the rich pile velvet. Silk serves best for ceremonial occasions, evening or day wear and lingerie.

6.2.3 Wool

Wool is a natural protein fiber and considered as Man's **best friend**. Sheepskin, including the hair, was probably used long before it was discovered that fibers could be spun into yarns or even felted into fabric. The earliest fragments of wool fabric have been found in Egypt but **Mesopotamia** is the birth place of wool.

Wool can be sheared from the living animal or pulled from the hide after the animal has been slaughtered for its meat. Sheared wool is called **fleece** or **clipwool** and wool taken from the hides of slaughtered animal is called **pulled wool** which is inferior in quality to fleece or clip wool.

The quality of wool is expressed by numbers. The higher the numbers, the finer the wool and better the quality. The finest wool is from young sheep. Very fine wool of excellent quality is shorn from lambs when eight months old .

Manufacture

Once the raw wool reaches the mills, it has to pass through many processes before it finally emerges as woolen cloth. Sorting, Scouring, Carbonizing, Carding, Spinning, Bleaching, Dyeing, Weaving, Knitting and Finishing.

Sorting : When the bales are opened, the fleece is graded. It may be separated into sections such as shoulders, sides etc.

Scouring : The raw wool is washed in successive troughs of soapy alkaline water of decreasing strength to remove dirt and grease.

Carbonizing : Straw, burrs and other vegetable matter are removed by treatment with acid, heat and pressure of rollers.

Carding: The wool is passed through machine rollers with sharp steel wires which separate the fibers and mix them thoroughly.

Spinning: The mass of carded wool is drawn out and twisted or spun into woolen yarn which is soft and fluffy thread.

Properties

Microscopic Appearance

Wool appears in longitudinal as solid rod with its surface covered with horny scales. The cross- section reveals the cellular internal structure with spindle like cells in the cortex, which are smaller than those in the medulla

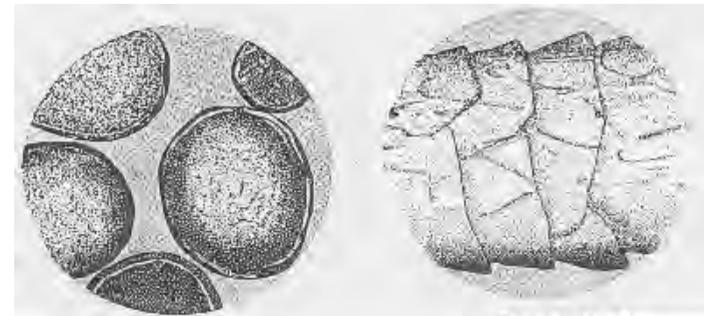


Fig. 4 - Microscopic Appearance of wool

Physical

1. Wool fibers varies in length from 1½ -15 inches
2. Wool after scouring is yellowish - white or ivory in colour. Other wool may be grey, black, tan or brown.
3. Fine & medium wool have more luster than coarse wool.
4. Wool has a natural crimp. The crimp increases the elasticity and elongation properties of the fiber.
5. Wool is weak but has exceptionally good resilience and moisture absorption.

Thermal

1. Wool burns slowly with a slight sputtering and is self extinguishing.

2. A crisp, black, bead-shaped residue is formed and gives a burning hair smell when removed from flame.
3. Wool scorches easily.

Chemical

1. Wool is susceptible to damage by alkaline solution. Even 5% of NaOH will dissolve wool.
2. It is resistant to mild acid but strong concentrated sulphuric acid decomposes wool fibers.
3. Solvents have no damaging effect on wool fibers.

Biological

1. Wool is resistant to bacteria and mildew but if moisture is present both may destroy wool fiber.
2. Wool being protein fiber is a good food source for carpet beetle and the larvae of clothes moth.

Uses

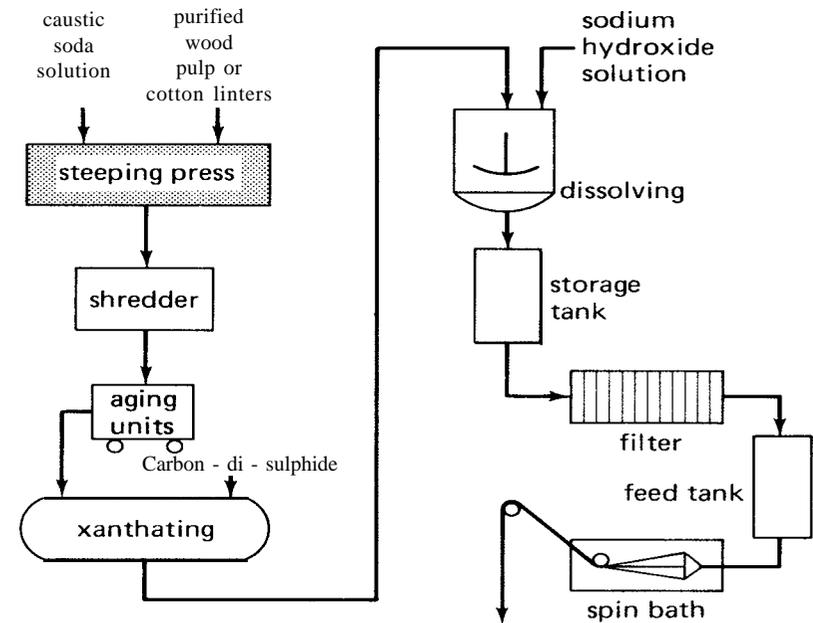
Woolen and worsted fabrics are used throughout the world. They are crease resistant, flexible, elastic, absorbent, warm and comfortable. A major problem with wool fabric is the tendency to shrink. Crimp decreases when wet and increases when dry. Wool can be dry-cleaned but laundering is difficult. Wool can be dyed and has good colourfastness property.

6.3 MAN-MADE FIBERS

These include viscose rayon, polyester and nylon.

6.3.1. Viscose Rayon

Viscose Rayon - The Versatile Fiber is the result of the work of Cross, Bevan and Beadle of England, who in 1892 made the first viscose solution.



to desulfurizing, bleaching, washing, drying, twisting, skeining and combing.

Fig. 5 -Flow Diagram Showing Processes in Viscose Rayon Manufacture

Manufacture

There are three main steps in making rayons. They are,

1. To obtain pure cellulose from the raw material.
2. To form a thick, thread - like liquid from the cellulose.
3. To spin the liquid into hardened filaments of regenerated cellulose.

For viscose, **spruce wood** or **cotton linters**, which yield the cellulose, are used as raw materials. They are treated with caustic soda and carbon bi sulphide to form a thick liquid.

Spinning: The liquid is forced through a spinneret into an acid bath to harden the long filaments, which are stretched and twisted to form the yarn. This is called **wet stretch spinning**. The stretching makes the fibers stronger and the acid and other chemicals in the bath cause the cellulose to re-form or to be regenerated.

Delustering : The filaments have metallic luster, if not treated. They are delustered by putting a white pigment in powder form into the spinning solution.

Dyeing may be carried out after the yarn is spun or pigments may be added to the spinning solution.

Properties:

Microscopic Appearance

The longitudinal appearance of regular viscose rayon exhibits uniform diameter and interior parallel lines called striations.

In cross section viscose fiber shows highly irregular or serrated edges. The presence of delusterants is indicated by spotted effect.

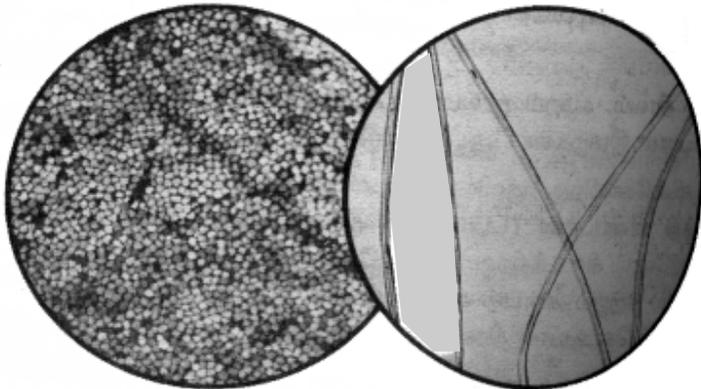


Fig. 6 - Microscopic Appearance of Viscose Rayon

Physical

1. Viscose rayon though resembles silk in appearance, its physical and chemical properties are quite different. However, some properties are like those of cotton.
2. Viscose is absorbent, burns rapidly, is not elastic, it has low dry strength, much reduced strength when wet and greater stretch.

Thermal

1. Rayon fibers burn rapidly with a yellow flame and give a light grey residue.
2. Afterglow results after extinguishing the flame.
3. Very high temperatures disintegrate the fibers.

Chemical

1. Rayon fibers disintegrate in acids.
2. Strong alkali solution causes rayon to swell and produce a loss of strength.

Biological

1. Mildew and bacteria damage the fibers.
2. Silverfish also destroys rayon fibers.

Uses

Rayon fibers are used extensively in apparel and home furnishing fabrics. It is also used in automobile tyres and various industrial applications. Simple, complex and textured yarns can be made from rayon fibers.

6.3.2 Polyester

During the early stages of fundamental research for Du Pont was done by the Carothers team on polyester fibers. In 1941, J.R. Whinfield and J.T. Dickson of Calico Printers Association introduced a successful

polyester fiber. Dacron polyester has become one of the most used of all synthesized fibers.

Manufacture

Polyester are the product of the reaction between a **dihydric alcohol** and **dicarboxylic acid**. Ethylene glycol and terephthalic acid polymerize by condensation reaction to form the polyester polymer. Dimethyl terephthalate is more frequently used than terephthalic acid because it is easily obtained in pure form. The resultant molten polymer is forced through spinneret and then cooled where it solidifies. It is later cut into small chips, dried and stored until needed for filament formation. The fibers can be used for weaving or knitting.

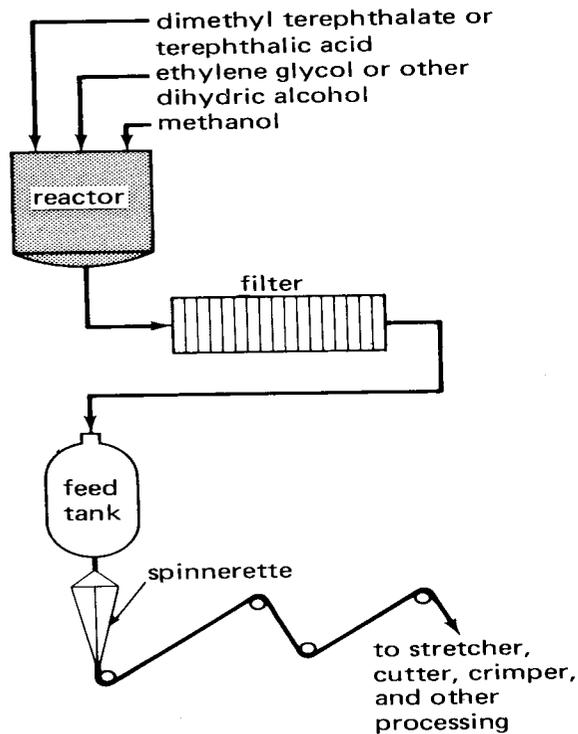


Fig. 7- Flow diagram Showing Processes in Polyester manufacture

Properties

Microscopic Appearance

The longitudinal view of polyester exhibits uniform diameter, smooth surface and a rod-like appearance. The cross-section of regular polyester is round.

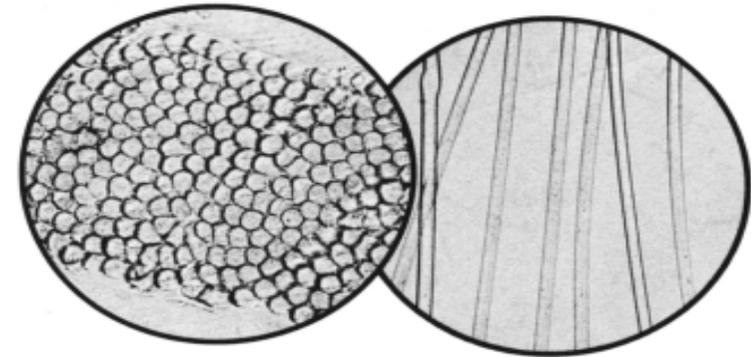


Fig. 8 - Microscopic appearance of polyester

Physical

1. Polyester is transparent and white or off - white in colour. The fiber strength varies due to differences in the formulation of the polymer.
2. There is no loss of strength when the fiber is wet.
3. Polyester has good elasticity, resilience and wrinkle resistance.
4. The fibers are heat-set to prevent shrink and stretch during use.
5. Polyester like cotton and linen has high degree of wickability. This wicking property carries exterior moisture through to the inside, or body perspiration through to the outside.

Thermal

1. Polyester will burn and produce a dark smoke and an aromatic odour.

2. It forms a grey colored bead.
3. Heat setting is essential if polyester fabrics are to possess the easy-care, wrinkle free properties.

Chemical

1. Polyester has good resistance to weak than strong alkalis.
2. It is not affected by acids, but prolonged exposure to strong acids at high temperature may destroy the fiber.
3. It is resistant to organic solvents.
4. Polyester exhibits good resistance to sunlight when behind glass, but prolonged exposure to sunlight weakens the fiber.

Biological

1. Beetles and other insects cut their way through the fabric.
2. Microorganisms will attack fabrics that have been applied with finishes.

Uses

Polyester fibers have immediate consumer acceptance because of their easy-care and wrinkle-free properties. They require no-ironing, easy to launder and quick to dry. Polyesters are not only used as apparel but also in industrial use items such as laundry bags, calendar sheeting, press covers, conveyor belts, fire hoses, fish netting, ropes and protective clothing. An important use of polyester is for surgical implants.

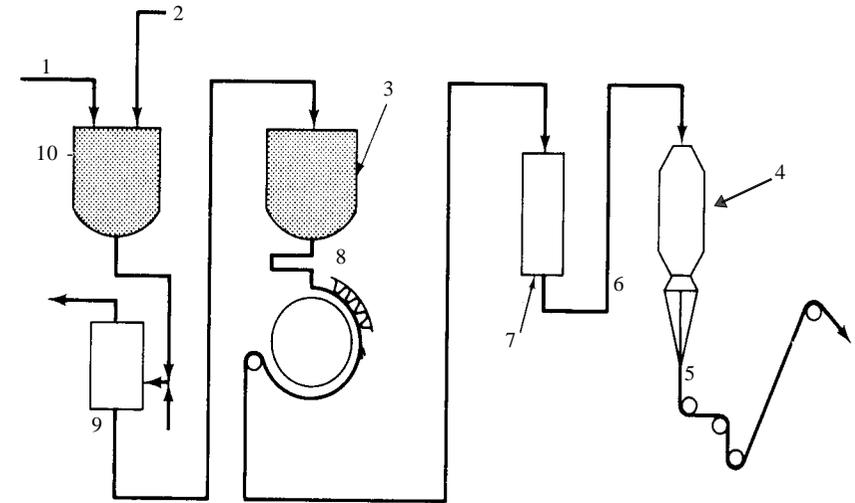
6.3.3 Nylon

Nylon is a man-made fiber developed by Du-Pont company in 1927-29. It was discovered that when a glass rod came in contact with some viscous material in a beaker was pulled away slowly, the substance adhered to the rod and a fine filament was formed which hardened when exposed to cool air. It had excellent stretchability producing a flexible and strong fiber.

Manufacture:

Nylon 6,6 means it has six carbon atoms per individual molecule. Nylon is made by **linear condensation polymerization** process of

the two chemicals, **hexamethylene diamine** and **adipic acid**. After polymerization it is extruded in a ribbon form and chipped into small flakes or pellets. The polymer is melted and extruded through a spinnerette into cool air. Thus the nylon filaments are formed which are stretched to give strength and fineness.



- | | |
|----------------|--------------------------|
| 1. Adipic acid | 2. Hexamethylene diamine |
| 3. Autoclave | 4. Pressure chamber |
| 5. Spinneret | 6. Air |
| 7. Chipper | 8. Water |
| 9. Water | 10. Reactor |

Fig. 9 - Flow diagram showing process in nylon manufacture

Properties

Microscopic Appearance

Longitudinal appearance of nylon are transparent fibers of uniform diameter. Cross-sectional view of nylon fibers is perfectly round.

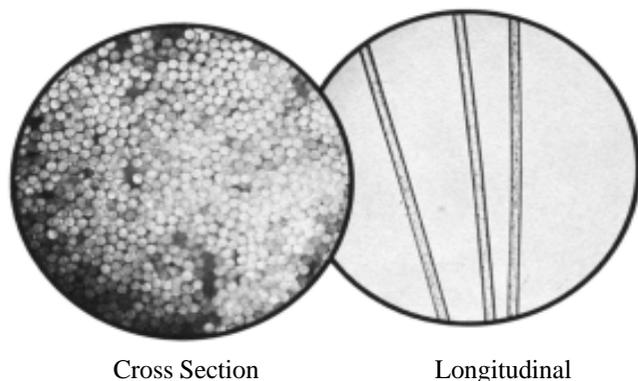


Fig. 10. Microscopic appearance of nylon

Physical

1. Nylon is transparent and can be made bright or dull.
2. It is the strongest of man-made fibers.
3. It has good elasticity, good recovery from creasing and wrinkling.
4. It has low moisture absorbency and resistance to perspiration.

Thermal

1. Nylon melts away from flame and forms a gummy grey residue that hardens as it cools.
2. Nylon is heat set but very high temperatures discolour the fabric.

Chemical

1. Nylon is unaffected by alkalis.
2. Acids disintegrate nylon fibers.
3. Except phenol all other solvents are harmless.
4. Prolonged exposure to sunlight has a destructive effect on nylon and weakens the fabric.

Biological

1. Ants, crickets, and cockroaches will eat nylon fabrics if trapped in creases or folds.
2. Mildew has no effect on the fiber.

Uses

Nylon is widely used for apparel, home furnishing and industry. It is a leading fiber in the manufacture of hosiery and lingerie for it wears well, has good elastic recovery, dimensional stability, shape retention and abrasion resistance. It is also used as carpeting materials and upholstery fabrics.

To weave or knit a fabric, it is necessary to have yarns. Thus now we move on to the manufacture of yarns from these fibres.

6.4 FABRIC CONSTRUCTION

The quality of cloth, its suitability for different purposes, and its performance in wear and cleaning cannot be assumed entirely from a knowledge of its fibers. The method by which the fibers have been combined to form yarns, and the ways in which the yarns have been interlaced to form the material are very important.

Yarns are composed of textile fibers. Yarns play an important role in determining the characteristics of the great variety of fabrics. Much of the beauty, variety and texture of fabrics is due to yarn differences.

Yarn as defined by ASTM (American Society of Testing Materials) is “**A generic term for continuous strand of textile fibers or filaments in a form suitable for knitting, weaving or otherwise intertwining to form a textile fabric**”.

Yarns are of two types

- 1) Short staple fibers are derived from natural fibers that are short in length or they may be composed of man-made fibers or silk fibers that have been cut short.

- 2) Long filament fibers obtained by extruding the chemical liquid through fine jets in the spinnerette.

6.4.1 Classification of yarns

Yarns are classified as simple, complex and textured yarns.

- A simple yarn is composed of two or more simple single yarns plied or twisted together. A ply yarn consists of two or more singles twisted together and a cord yarn consists of two or more ply yarns twisted together.

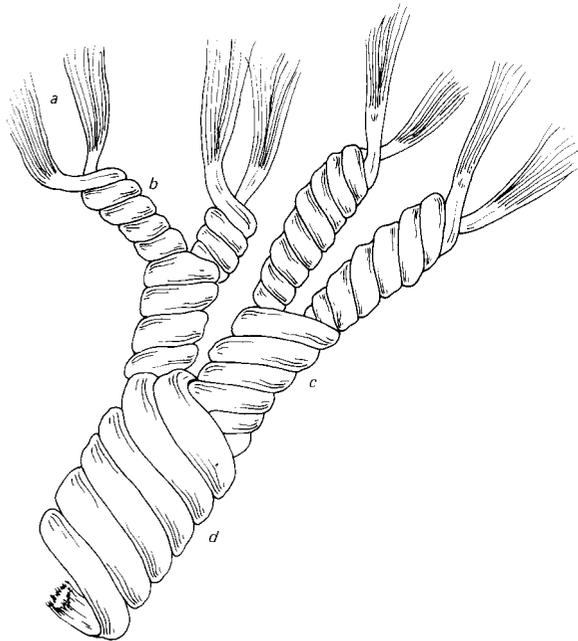


Fig 11 - Yarn Structure

a) fibres b) singles c) ply yarn(s) d) cord yarn(s)

- Complex or Novelty yarns are different from simple yarns in structure, size, twist and effect. Complex yarn may be composed of single or ply. Complex ply yarns are composed of a base or

core, an effect and tie or binder yarn. The base yarn controls the length and stability of the end product. The effect yarn forms the design and the tie or binder yarn holds the effect yarn so that it will remain in position.

- Textured yarns have greater apparent volume than other yarns of similar fiber count and linear density. The yarns have a relatively low elastic stretch and the greater volume is achieved by physical, chemical or heat treatment.

6.4.2. Processing of yarns

Yarns are made from fibers by two processes - General which is common to many yarns and texturizing to obtain special textured effects such as extra bulk, stretch or a combination of these properties in the fabrics made from them.

The **General** processes include opening, picking, cleaning, blending, degumming, scouring, carbonizing, carding, combing, drawing, spinning, throwing, slashing, rewinding as discussed in the earlier chapters in the manufacture of natural fibers. No fiber goes through all these processes. Texturing process are primarily applicable to man-made fibers and particularly to thermoplastic fibers.

Texturizing imparts a permanent **curl, loop or crimp** to the individual filaments, so that when they are recombined, the yarns are more or less fuzzy - appearing and have stretch, bulk or both. Textured yarns do not have free fiber ends to pull out, roll up, or pill. They are more opaque, have a different appearance, feel, warmth and more absorbent.

Yarns thus formed are now used in the manufacture of fabrics. Woven fabrics consists of sets of yarns interlaced at right angles in established sequences. One of the process of fabric manufacture is **weaving**.

6.4.3 Weaving of Fabrics

Weaving is the process most used for the manufacture of textile fabrics (John Hoye, 1942) In weaving two or more set of yarns are

interlaced at right angles to each other. The warp yarns run in the lengthwise direction in a woven fabric also called as **ends**. The filling yarns run in the crosswise direction also called as **picks**. Extra warps yarns at each side form a selvedge which is parallel to the warp yarns.

The machine for weaving is a **loom**. Loom are of different types varying in their complexity from the most primitive to the most modern, operate on the same principles. A diagram of a simple loom is shown in figure-12.

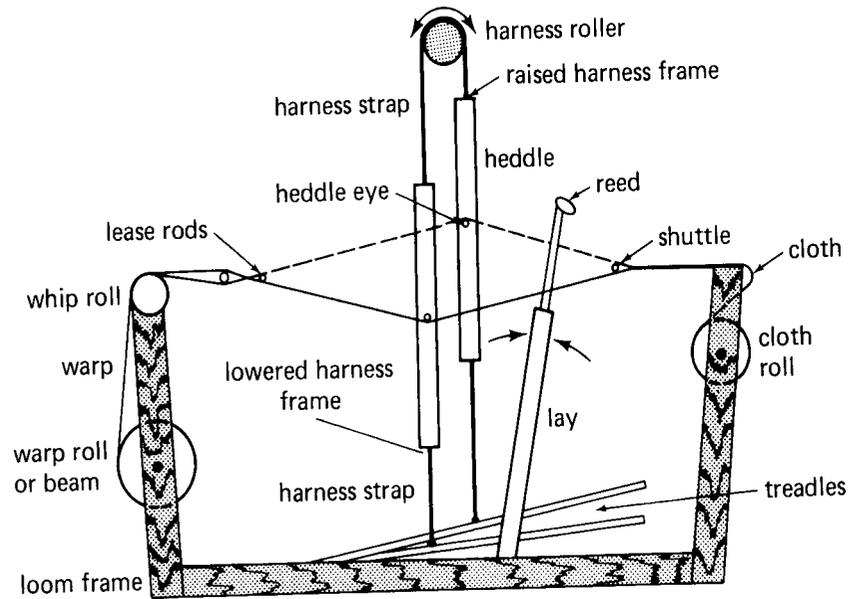


Fig.12-Simple loom

The essential parts of the loom are - the warp beam which holds the lengthwise yarns is located at the back of the loom and release yarns as needed. The harness is the frame which holds the heddles in position. The heddles are the wire or metal strips with an eye at the centre through which individual yarns are threaded. The harness can be raised or lowered to produce the shed. The reed is a comb-like device which determines the cloth width and acts as a beater bar. The filling

yarns are carried by shuttles or bobbins across from side to side. The cloth beam is present at the front of the loom which rolls the fabric as it is woven.

The basic weaving operation includes :

Shedding : The harness can be raised or lowered which has the warp yarns by means of heddles to form the shed. The filling yarns pass from one side of the loom to the other through the openings of the warp yarns.

Picking : The filling yarns are carried by the shuttle across the shed, laying the filling in position.

Battening or Beating consists of evenly packing the filling yarns into position in the fabric with the reed.

Taking up involves the taking up of the newly made fabric on the cloth beam and **Letting off** involves releasing thread from the warp beam for the weaving operation.

6.4.4. Different types of Weaves

Weaves are classified according to the interlacing of warp and weft yarns and the number of warp and weft yarn used. Variety can be achieved by using the basic weaves plain twill and sateen by varying the number of warp and weft yarns used.

The different types of weaves are :

Plain Weave

This is a simplest form of weaving. The weft yarn passes over one warp yarn and under the next alternately across the entire width of the fabric. Plain weave has no wrong side unless coloured finish is applied to differentiate right or wrong side. Attractive fabrics can be obtained by varying the number of warp yarns and filling yarns. Most fabrics are made using plain weave. It produces strong and durable fabrics.

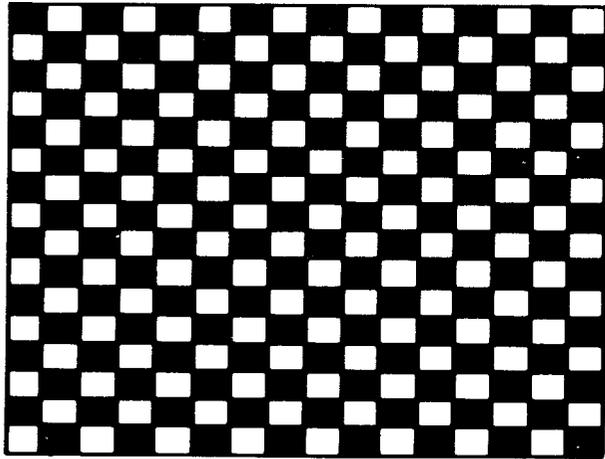


Fig.13-Plain weave

Rib Weave:

The rib appearance is produced by using heavy yarns in the warp or filling direction, by grouping yarns in specific areas, or by having more number of yarns in warp than filling. Examples are poplin, broadcloth and grosgrain.

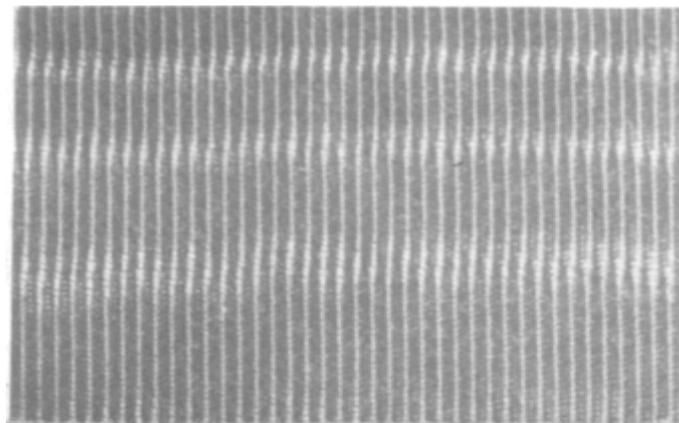


Fig. 14 - Rib weave

Basket Weave

Two or more weft yarns pass alternately over and under two or more warp yarns. In this construction the fabrics are not durable, but are more decorative. Examples are coat and suit fabrics, hopsock.

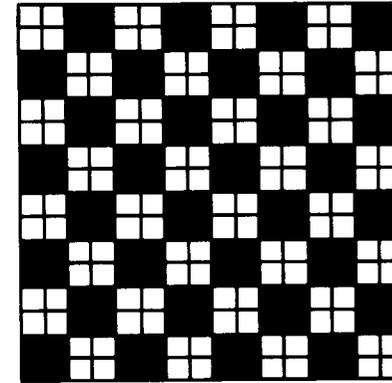


Fig. 15 -Basket weave

Twill weave

The second basic weave pattern is the twill weave. A twill weave always shows diagonal ridges across the fabric. The twill or diagonal weave may run from left to right, or from right to left, both on the face and back of the cloth. The simplest twill weave uses three warp yarns and three weft. Twill weave has increased strength and warmth but more easily worn by abrasion. Examples are denim, drill, jean, some flannel and suitings.

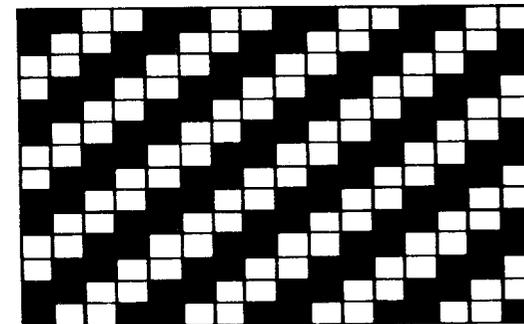


Fig. 16 - Twill weave

Satin Weave

This weave makes use of low-twist floating warp yarns of lustrous man-made or silk filaments. The warp yarns pass over a number of weft yarns and under one alternately, so that the warp floats are on the surface along the length of the fabric. The weft yarns are hardly noticeable. A variation of the satin weave in which the filling yarns float on the surface of the fabric is **satin** weave. Example damask, sateen, ticking and Venetian

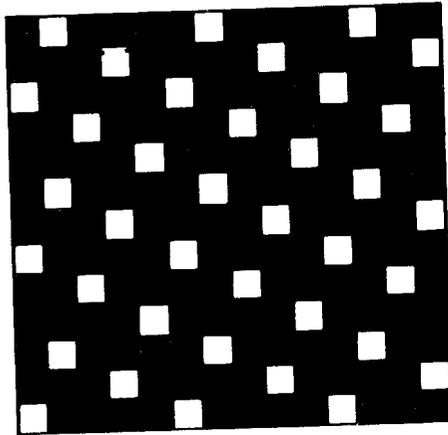


Fig. 17 -Satin weave

6.4.5 Novelty Weaves

Novelty Weaves are also called as decorative, fancy, figure and design weaves. They are formed by predetermined changes in the interlacing of warp and filling yarns. The different weaves include dobby, jacquard, leno, pile and double cloth.

Dobby Weave

Dobby designs have small figures such as dots, geometric designs and floral patterns woven into the fabric. The design is produced by a combination of two or more basic weaves and the loom may have upto thirty two harnesses. Examples of dobby weave are shirting madras, pique, huck towelling.

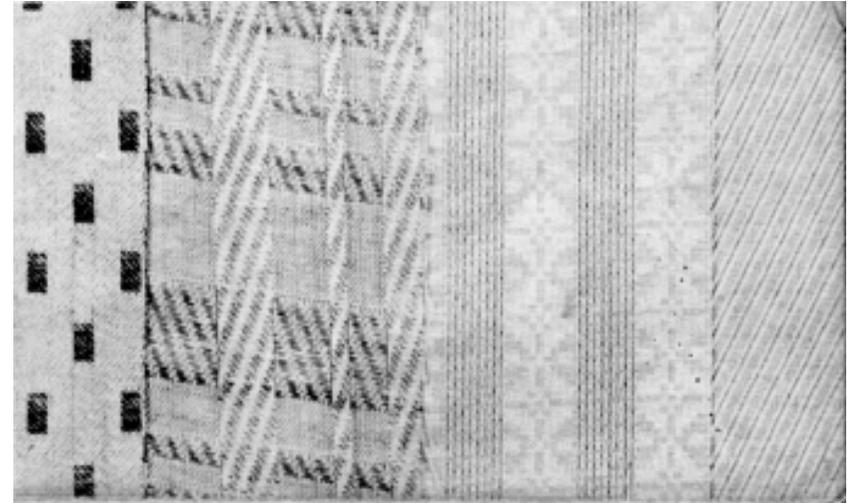


Fig. 18 - Dobby weave

Jacquard designs

Fabrics with elaborate designs are woven using the Jacquard loom attachment. It was introduced by Joseph Marie Jacquard in 1801. The Jacquard mechanism has the ability to control every warp yarn instead of a series as in regular harness looms. The machine is very big and very expensive. The pattern for the Jacquard loom is transferred to a series of perforated cards, one for each filling pick in the pattern.

The card is punched so as to permit the needles on the machine to be raised to pass through the card. The shed is formed and the pick passes through each card stops on the cylinder for its particular pick, moves on, and new card takes its place. This process continues until all the cards are used. Thus when pattern is over the cards start for the next till the entire cloth is woven. Thus extremely complicated and decorative woven designs are produced using jacquard loom attachment. Examples include brocade, damask, tapestry, terry-cloth towels.

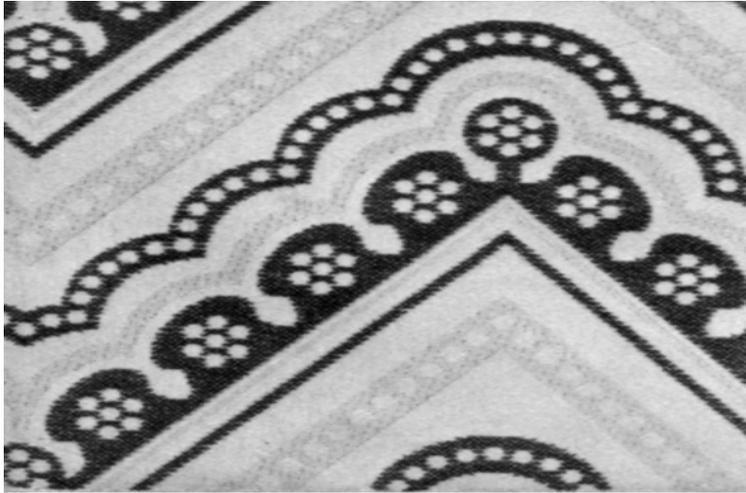


Fig. 19 - Jacquard weave

Leno Weave

The leno weave produces an open-textured fabric that may be sheer or heavy. It is produced by the doup attachment to the basic loom. The doup attachment controls the warp threads horizontally as well as vertically and the unusual warp interlacing prevents slippage of the filling and reduces shrinkage. Examples include mosquito nets, household bags and curtains.

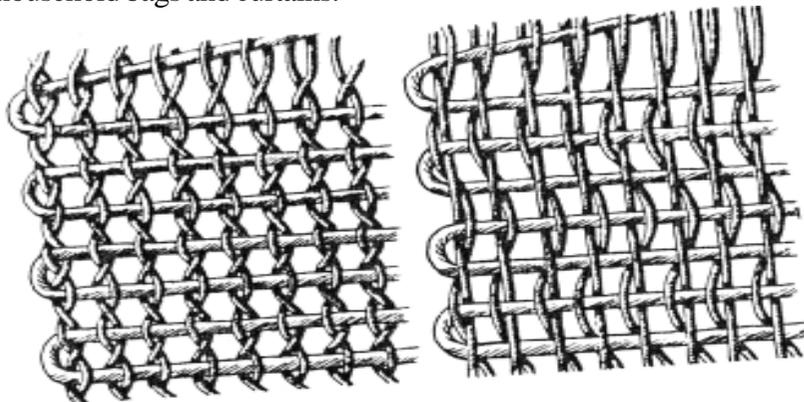


Fig. 20. Leno weave

6.4.6 Surface Figure Weaves

Extra warp or filling yarns can be interlaced on the basic weaves to produce different designs. These include

Lappet Weave

In lappet weave an extra warp yarn is introduced in a manner so as to create design on the base, fabric. Patterns are woven in the fabric by an attachment to the loom. Long floats formed on the back of the fabric are cut away, if floats are small they are usually left. Example: fancy sarees.

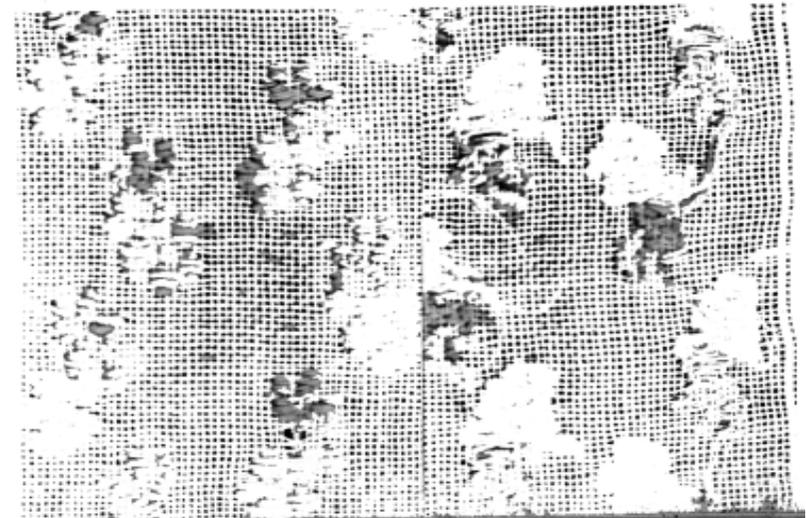


Fig.21 -Lappet weave

Swivel Weave

The Swivel weave differs from lappet in that designs are produced by extra filling yarns. Separate shuttles are placed at each point where the design has to be made. The shed is formed by the pattern, where the shuttle carries the yarn through the shed, the distance of the pattern. The extra filling floats on the back of the fabric, the long floats is cut away after weaving is completed. Example : silk sarees.

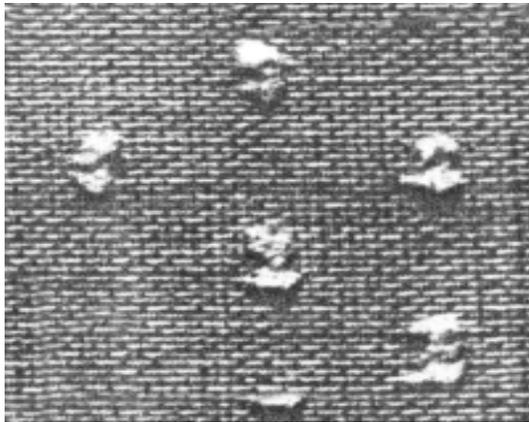


Fig. 22-Swivel weave

Spot Weave

Spot designs are formed by extra warp or filling yarns. The yarns are inserted the entire length or width of the fabric, spots or dot designs are formed. The long floats on the back side are cut away, leaving the dots. The threads can be pulled easily. Filling threads are easy to cut but warp floats are difficult. Example : dotted swiss.

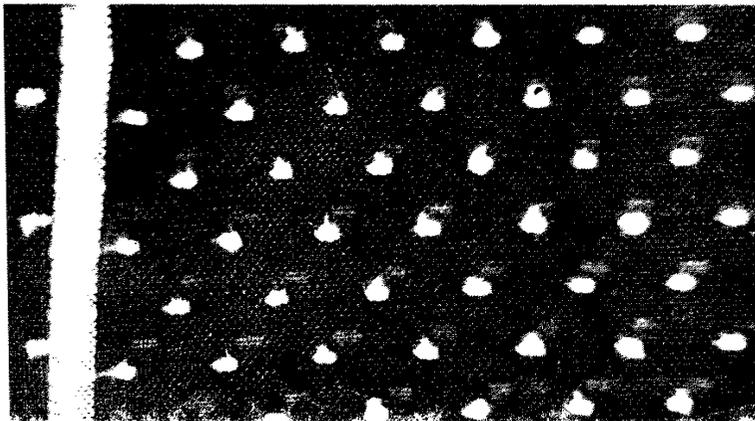


Fig. 23-Spot weave

6.4.7. Pile Weave

Pile fabrics are formed by having the basic plain or twill weave as a backing and a third yarn is woven to yield a surface pile. The pile may be warp pile or weft pile. For making ground fabric, plain or twill weave is used, the extra set of filling yarn floats over three or more warp yarns. The floats are cut and brushed up to form pile. This is called filling pile. Examples are velveteen and corduroy fabrics.

If an extra warp yarn floats over the filling yarn, it is called warp pile. Examples are velvet, velour and rug velvet.

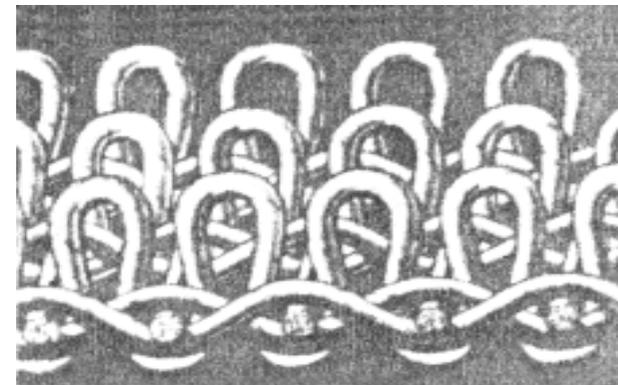


Fig. 24 - Pile weave

6.4.8. Double weave

Double weave fabrics are obtained by using five or more set of yarns. The most common types of double cloth have two set of warp and two set of weft yarns with an extra yarn interlacing both the cloth. The double cloth has additional bulk, strength and warmth. Examples are coatings, blankets, double brocade and brocatelle.

6.5.FINISH AND COLOUR APPLICATION

Fabrics which reach the consumer are finished by one treatment or other. Except for the white fabrics, colour is applied to all the fabrics. **“A Finish is any treatment given to a fabric to change its appearance”**. The fabric can be finished so as to be smooth, shrink

resistant, easy care, flame resistant, etc. Finishes can be divided into two types, general and functional.

General finishes or routine finishes are identified as mechanical, chemical or combination of the two. Durability or performance of the finish is considered, and fibres and fabrics usually receiving the treatment are identified, if there are special problems or types involved. In other words it is a basic procedure in preparing fabrics for consumer use. Example: Bleaching, Heatsetting, Mercerization.

Functional finishes are those which alter, improve or change the behavior or service characteristics of the fabric and produce certain properties. Example: A durable press fabric, A waterproof fabric.

Scouring : Fabrics can be scoured by immersing them in 2- 4 percent of caustic soda (NaOH) with addition of wetting agents and emulsifiers under heat to remove waxes, foreign matter and discoloration.

Bleaching : Bleaching is done to fibers, yarns and fabrics to make them white or prepare them for dyeing and printing. It is a chemical finish where sodium chloride or hydrogen per oxide bleach is used to bleach the fabrics. The chemical for bleaching depends on the textile fiber. Cellulose fabrics such as cotton can be bleached with sodium hypochlorite whereas silk and wool respond well to hydrogen peroxide.

Calendering (Pressing) : Calendering is also called pressing done on cotton, wool, silk as well as rayons. It is a mechanical process where the fabric is fed between flat, heated plates and pressed under heat and pressure. As for wool the fabric is fed between needle boards, which help retain the pile finish. Calendering must be renewed after each laundering or cleaning.

Heat Setting : Mostly thermoplastic fibers are given heat-setting finish to produce fabrics which are wrinkle resistant, good elastic recovery, and give relative permanent design details such as pleats, planned creases and surface embossing. The fibers are exposed to a certain temperature called the glass transition temperature

(T_g temperature) where they are shaped. If at any later period the fabric is exposed to temperature higher than T_g temperature the fabric may take a new shape. So fabrics should be laundered or dried under the T_g temperature.

Mercerization : Mercerization is a chemical finish mostly done on cotton fabrics. The fabric is immersed in 16-27 percent of sodium hydroxide and fed between rollers for a specific period of time. Then it is passed on a tentering frame to have specified dimensions. At last it is washed and dried. This process causes the fabric to have increased luster, improves dyeing characteristic and strength.

Sizing : Sizing is a process of stiffening materials to yarns or fabrics. Sizing is composed of starch or resin. Starch is applied mostly to cellulose fabrics to improve its luster and to add strength. Resin when applied reacts with the fiber molecules and chemical change occurs in the fiber. Starch is applied to the fabric which then passes between rollers that pad the starch into the fabric and remove excess solution. Thus a fabric with additional stiffness and improved luster is obtained.

Tentering : Tentering is a mechanical finish where the fabric is held horizontally by each selvedge between pins. There is a tenter frame which moves with a speed slightly higher than the speed with which the chains holding the fabric are moving. This process straightens the fabric which involves many finishing processes like mercerizing, resin finishing and drying.

Weighting : Weighting is a process applied to silk fabrics. After removal of gum (i.e) degumming, the silk fabric, becomes very soft. To make the silk fabric heavy and stiff, the Federal Trade Commission ruled out that silk fabric can be given stiffness by addition of 10% stannous chloride a metallic salt. If this 10% exceeds very high the silk fabric tends to crack and split. Weighted silk has body and density but they are not durable and can be damaged by sunlight, air and perspiration.

Water proofing :Water proof finishes are those that prevent water entering the fabrics. These fabrics do not allow air also to enter and thus not suitable for wearing apparel. Earlier, **rubber, oxidized oil or varnish** were used to waterproof fabrics. Modern fabrics are coated with **synthetic** polymers.

6.5.1 Dyeing and Printing

Dyeing and printing are the methods of applying colour to white fabrics. **Dye is a substance which is fixed more or less permanently on the fabric which evokes colour.**

Types of Dyes

Dyes are classified according to hue produced, chemical class, method of application and the types of fibers to which they are applied. Some of the different dyes include :

1. **Direct Dyes :** Direct dyes are water soluble and are applied mostly to cellulosic fibers. These dyes are dissolved in water and salt is added to control the absorption rate of the dye by the fiber. Then the cloth which is to be dyed is immersed. Direct dyestuffs have relatively excellent light fastness and good colourfastness to sunlight.
2. **Acid Dyes :** Acid dyes are used on protein, acrylic and nylon fibers. They have no affinity for cellulosic fibers and are not suitable for fibers which are sensitive to weak acid solutions. They have excellent lightfastness and some have good colourfastness to dry cleaning and perspiration.
3. **Basic Dyes :** Basic or cationic dyes are excellent for colouring acrylic fibers. They are mostly used as “topping” colours to give brilliant colour effects on fabrics. Because of the variety of colour effects produced, it is successfully used on modified nylon and modified polyester.
4. **Vat Dyes :** Vat dyes have excellent colourfastness property and is suitable on all cellulosic fibers and man-made fibers. It is not suitable on protein fibers because of the alkaline bath which will

damage the fibers. There is a wide choice of colours in vat dyes and they withstand hard wear and are fast colours.

5. **Reactive Dyes:** Reactive dyes are suitable for mostly all fibers-cellulosic, wool, nylon, silk, acrylics, as well as blends. Bright colours with excellent wash fastness & colourfastness are obtained. Colour fastness to crocking, perspiration and fume fading are excellent.

6.5.2. Application of Dyestuffs

There are four stages of manufacture in which colour may be applied to textile materials.

- a) **Solution :** Pigments or dyestuffs are dispersed in the spinning solution where the fibers are manufactured. There are some difficulties in this process of obtaining colour on fabric.
- b) **Fiber Dyeing :** Fibers are dyed in their loose state where the fibers are less tangled and dyed thoroughly. Fiber dyeing is expensive to produce. There is better penetration of the dye into the fiber which produces a higher degree of colourfastness on fabrics. Direct, sulphur, vat and developed dyes are used on cellulose fibers.
- c) **Yarn Dyeing :** Yarns are dyed by three methods namely, skein dyeing, package dyeing and beam dyeing. Yarn dyeing is best adapted to large- quantity dyeing. Gingham, chambrays, denims and madras are dyed by this method. Vat dyes are mostly used as well as limited amount of other dyes.
- d) **Fabric Dyeing :** Fabric dyeing consists of either piece dyeing the fabric or printing followed by an after treatment to fix the dye. Piece dyeing is nothing but most solid color fabrics are dyed after the fabric has been completed. Fabrics made of cellulosic fibers, cotton; rayon and flax are most frequently piece dyed.

6.5.3. Printing

Designs are applied on fabrics by means of printing. Printed fabrics are defined as those that have been decorated by a motif, pattern or

design applied to the fabric after it has already been constructed (Marjory-Joseph, 1977) Printing can be done by two basic methods - Resist printing and Direct printing.

Resist Printing : Resist printing is done by preventing the dye to enter some specific portions of the fabric by some methods.

1. **Tie and Dye :** Fabrics are made into tiny puffs with some object inside and tied with a waxed thread wherever the dye has to be prevented. The fabric is immersed in the dye solution. If two or more colours are desired the thread is removed and the fabric retied. After drying the object is removed. Other methods of tie and dye include folding the fabric and stitching it and pulling the threads to draw the fabric to resist the dye from penetrating into the fabric, called as **tritik**.. Tie & dye fabrics are quite popular in apparel and home furnishings.

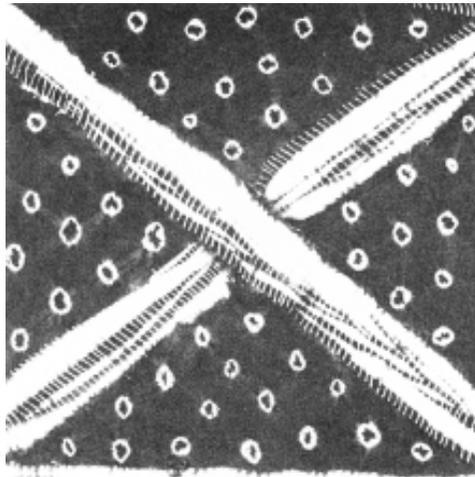


Fig.25-Tie and dye

2. **Batik :** A resist method developed by the Javanese involves wax as the resist substance. A copper cup called tjanting is attached to a reed handle. The wax is taken in this tjanting and applied in the design areas, wherever necessary to resist the dye. The fabric is

immersed in dye solution. The wax resists the dye from entering the fabric. In some places it forms cracks and forms fine lines in the design. The fabric is later washed in boiling water to remove the wax.



Fig. 26 - Batik

3. Screen Printing

A screen resist is made by covering a frame with bolting cloth of silk, metal or nylon filament yarns. The fabric is covered with a film and the design areas are cut out of the film. Some areas of the mesh are left open to allow the dyestuff to pass through and print the fabric.

The frame is laid on the fabric, and the dye is placed at one end of the frame. A rubber knife moves the dye across the screen and forces the dye through the open mesh of the fabric, One screen is prepared for each colour. Screen printing is considered by many textile authorities to be newest method of decorating fabrics.



Fig. 27-Screen printing

4. Discharge printing :

Discharge printing is used to print designs on fabrics which has been previously dyed. A reducing bleach is used which removes the base dye and leaves a white pattern on a coloured ground. Dark fabrics with white designs such as polka dots are examples of discharge printing.

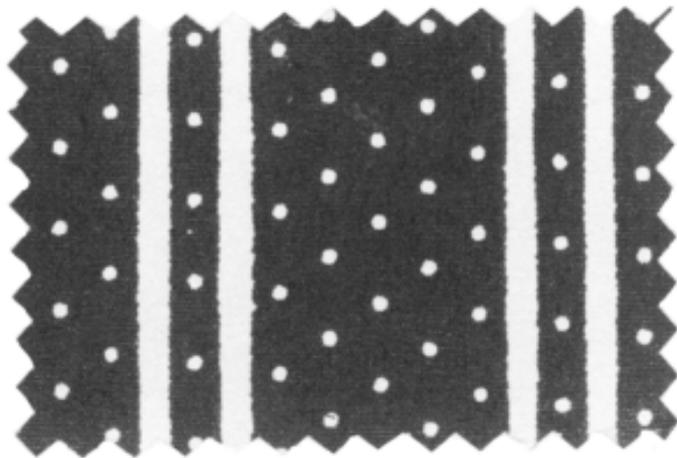


Fig.28 -Discharge printing

Stencil printing : Stencil printing was developed by the Japanese. Designs are cut in stencil paper which is coated with wax. The stencil designs are placed on fabric and colour is applied by sponge, air brush or by spray gun. This method is done on minimum fabrics like scarves and similar products.

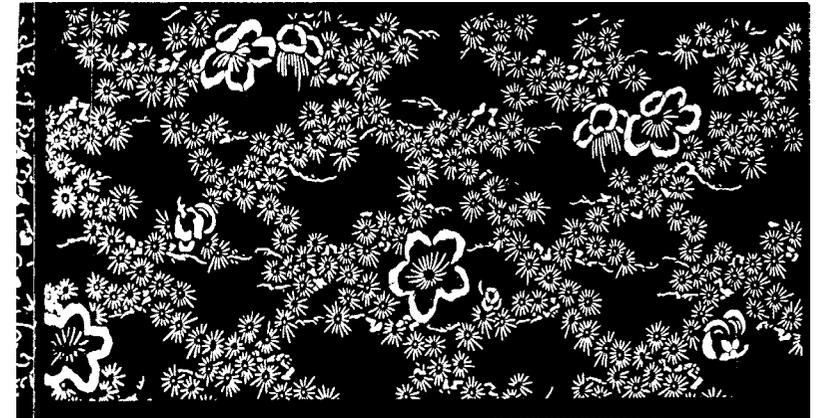


Fig.29-Stencil printing

Direct Printing

Direct printing is the method of applying colour directly on to the fabrics by one of the following methods.

1. Roller Printing: Designs are engraved in metal rolls and arranged around a main cylinder and locked into place. Many rolls can be used. A trough containing the dye solution along with a doctor blade which scrapes off the excess dye is placed for each roll. The large cylinder is covered by a padded blanket and a grey cloth is used on top of the printing blanket.

The cloth to be printed is on the outer surface. The layers move together, the rolls take up the dye from the trough print on the cloth as it comes and goes to the drying oven which sets the colour on the fabric. Roller printing is steadily increased during the past decades for its quality prints and unusual patterns produced.

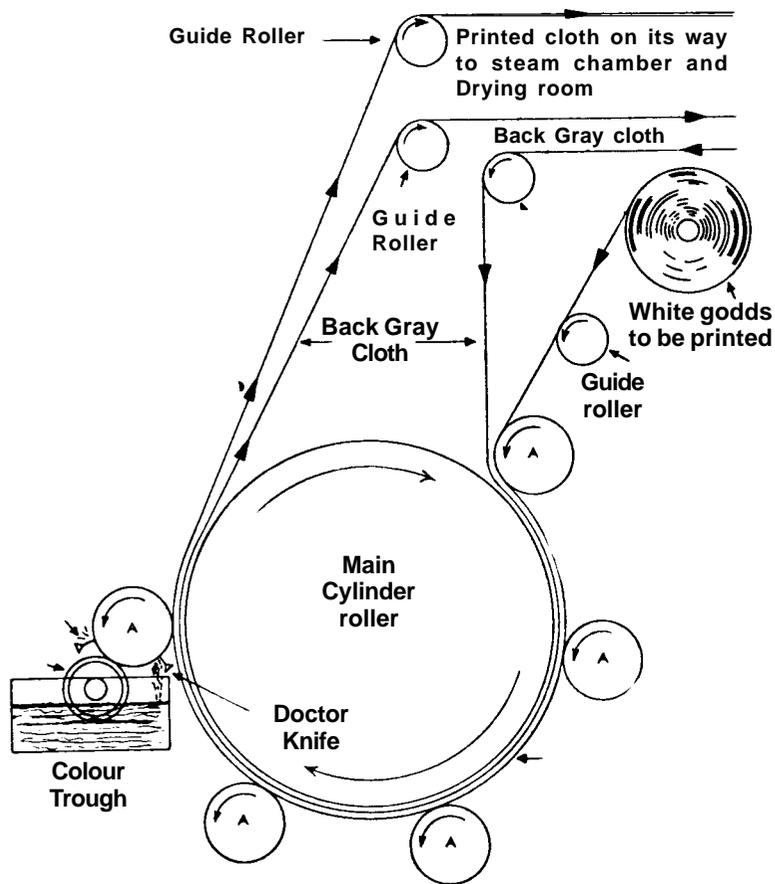


Fig. 30 - Roller Printing

2. Block printing :

Block made of wood or metal are engraved with designs. Each block prints only one colour. The blocks are dipped in dye solution. Only the raised portion in the blocks picks up the dye and is then pressed on the fabric, forcing the dye to be printed on the surface.



Fig. 31 -Block printing

3. Duplex prints

Duplex prints are produced by modified direct roller print equipment. The design is made by a machine, which is set up to print on both the face and back of the fabric.

4. Photographic prints

Photographic prints are made similar to that used in making photograph. A negative is placed on the fabric and light is transmitted to it and the design is developed. The fabric is washed and the design is as permanent as a photo.

5. Transfer printing

Transfer printing involves heat and pressure. The dye in the desired design, is first printed onto a special paper. The paper is laid on the fabric and the design is transferred by-sublimation. The dye is changed from solid state on, the paper to vapour and again changes to solid and fixes on the fabric. The heat sets the colour on the fabric. Transfer printing is suitable for nylon and some acrylic fabrics.

Practical

1. Collect samples of fabric and study the characteristic for identification.
2. Carry out burning test for different fibres in small samples of fabric, colourfastness test-to laundering, dry cleaning, sunlight rubbing, crocking and ironing.
3. Collect samples of fabrics and identify the different weaves.
4. Dyeing - plain, tie and dye, painting a small fabric using fabric paints and vegetables, stenciling. Make your own fabric samples.

Procedure for practical

Tests for fibre identification

The Burning Test

The burning test is a good preliminary test. Although it does not identify fibres specifically, it provides valuable data regarding appropriate care. The procedure is as follows:

1. Select one or two yarns from the warp of the fabric.
2. Untwist so that the fibres are in a loose mass.
3. Hold yarns in forceps; move them towards the flame from the side.
4. Observe the reaction as they approach the flame.
5. Move them into the flame, and then pull them out of the flame and observe the reaction.
6. Notice any odour given off by the fibre.
7. Observe ash or residue formed.
8. Repeat for the filling yarns of the woven fabrics.

Home tests for colourfastness of fabrics

Dry cleaning

Take a sample fabric, approximately 2 by 4 inches, and immerse in cleaning solution for 10 to 20 minutes. Observe to determine whether any colour has bled into the cleaning solution, then dry and compare the sample with an original piece to determine colour change.

Laundering

A small fabric sample can be taken from seam allowance or hem of a fabric. Take one cup of water and one teaspoon of soap or synthetic detergent in a jar. Add the fabric sample. Shake the jar frequently and allow the fabric to remain in solution for 10 minutes. Observe the colour of the wash water. Rinse the sample in warm water atleast twice and observe any loss of colour into the rinse water. Dry the sample and compare it with the original fabric to determine whether any colour change has occurred.

Sunlight

Textile fabric that is exposed to sunlight for many hours each day such as curtains and draperies should be colourfast to sunlight or sunfast. Expose the fabric to sunlight between 10.00 am and 4.00 pm, standard time, the period between may and September, Keep a record of the number of hours of exposure. Compare the sample with an original at frequent intervals.

Ironing

Colour may be altered by ironing or pressing with either dry or wet heat. When dry heat is used, the fabric will usually return to its normal colour after cooling. Press the: sample fabric with iron set at the temperature recommended for the fibre. Observe any colour change. If colour does change, observe the fabric as it cools to determine whether it returns to its original shade.

Rubbing and Crocking

Place small square of white cotton fabric preferably muslin or percale over the forefinger. With even pressure rub the white fabric atleast ten times over a coloured one. Observe to see whether the colour rubs off onto the white square of fabric. Repeat with the white square of fabric that has been moistened thoroughly. Either by test, using home methods or laboratory equipment, or label information a consumer has the ability to determine, to some degree atleast, the care a product will require.

CHART OF BURNING CHARACTERISTICS OF FIBRES

Fibres	Cotton	Silk	Wool	Rayon	Polyester	Nylon
Approaching flame	Ignites upon contact, does not shrink away.	Gurls away from flame	Curls away from flame	Ignites upon contact, does not shrink away	Fuses, melts and shrink away from flame	Melts way from flame, shrink and fuses
Inflame	Burns quickly	Burns slowly and sputters	Burns slowly	Burns quickly	Burns slowly and continuous to melt	Burns slowly with melting
Removed from flame	Continues burning, after glow	Usually self extinguish	Self extinguishes	Continuous burning, after glow	Self extinguishing	Self extinguishing
Odour	Similar to burning paper	Similar to burning hair	Similar to burning hair	Similar to burning paper	Chemical odour	Celery
Residue	Light, feathery ash grey in colour	Crushable bead, black in colour	Brittle, small black bead	Light, fluffy residue, very small amount	Hard, tough, black or brown bead	Hard, tough, grey tan bead

QUESTIONS

Section -A

I. Fill in the blanks

1. _____ are the smallest visible units from which fabrics are made.
2. Cotton has low _____.
3. _____ is a mineral fibre.
4. Cotton is referred as _____.
5. Silk is known as _____.
6. _____ is the process of treating silk with metallic salts to give weight and body to the product.
7. _____ is from young sheep.
8. Viscose rayon is called as the _____ fibre.
9. Polyester burns with an _____ odour.
10. Yarns are made from _____.
11. _____ is the process most used for making fabrics.
12. _____ printing is a direct printing method.

II. One Word Question

1. Name a protein fibre.
2. What is the name of the silkworm?
3. What type of fibre is wool?
4. How is colour applied on fabric?
5. Which is the strongest man-made fibre.

6. Name a decorative weave.
7. What are the two methods of printing?

III. Match The Following

- | | |
|--------------------|-----------------------|
| 1. Cotton | Synthetic Fibre |
| 2. Dyes | Short fibres |
| 3. Nylon | Vegetable fibre |
| 4. Protein Fibre | Lustre |
| 5. Stape yarn | Wool |
| 6. Sizing | Direct Printing |
| 7. Mercerization | Produces colour |
| 8. Roller Printing | Starch |
| 9. Duplex Printing | Resist Printing |
| 10. Tie and Dye | Modified Roller Print |

Section -B

1. Give the uses of cotton fibre?
2. Give the physical properties of silk fibre.
3. Give the microscopic appearance of wool fibre.
4. List the thermal properties of polyester.
5. What are the three types of yarns?
6. What is a Novelty weave?
7. What is a Lappet Weave? Give example.
8. Discuss scouring.
9. Define dyes. Give two examples of dyes.
10. What are Vat dyes?
11. What is Piece dyeing?
12. What is Block printing?
13. How is Batik done on fabrics?

Section - C

1. Describe the physical, chemical and thermal properties of cotton fibers.
2. Describe the manufacture of silk fibers.
3. Describe the physical and thermal properties of silk fibers.
4. Discuss the properties of viscose rayon fibers.
5. Give the classification of yarns.
6. Discuss the parts of a loom?
7. Define finish. Discuss general and functional finishes with example.
8. Discuss the types of dyes.
9. Discuss the different types of direct printing methods.
10. Describe the various novelty weaves with examples.

Section-D

1. Describe the manufacture of Viscose rayon and discuss its properties.
2. Describe the manufacture, properties and uses of cotton fibres.
3. Give the classification of yarns and how are yarns processed?
4. Discuss Weaving mechanism and its operation?
5. What are the different types of Weaves? Explain Plain, Twill and Satin Weaves with examples.
6. Explain the various finishing methods used on fabrics
7. Write notes on
 - a) Tie & Dye
 - b) Batik
 - c) Roller Printing
 - d) Photographic Prints
 - e) Transfer Printing with examples.

7. COMMUNICATION SKILLS

Communication is considered in its broadest sense, not only as the exchange of news and messages but as an individual and collective activity embracing all transmission and sharing of ideas, facts and data.

7.1 FUNCTIONS OF COMMUNICATION

1. Information - the collection, storage, processing and dissemination of news, data, pictures, facts and messages, opinions and comments required in order to understand and react knowledgeably to personal, environmental, national and international conditions, as well as to be in a position to take appropriate decisions.

2. Socialization - the provision of a common fund of knowledge which enables people to operate as effective members of the society in which they live and which fosters social awareness thereby permitting active involvement in public life.

3. Motivation - the promotion of the immediate and ultimate aims of each society and the stimulation of personal choices and aspirations, the fostering of individual or community activities, geared to the pursuit of agreed aims.

4. Debate and discussion -the provision and exchange of facts to facilitate agreement or to clarify differing view points on public issues. The supply of information needed to foster greater popular interest and involvement in all local, national and international matters of common interest.

5. Education - the transmission of knowledge so as to foster intellectual development, the formation of character and the acquisition of skills and capacities at all stages of life.

6. Cultural Promotion - the dissemination of cultural and artistic products for the purpose of preserving the heritage of the past, the development of culture by widening the individuals horizons,

awakening his imagination and stimulating his aesthetic needs and creativity.

7. Entertainment - the diffusion through signs, symbols, sounds and images of drama, dance, art, literature, music, sports, games etc. for personal and collective recreation and enjoyment.

8. Integration - the provision to all persons, groups and actions of access to the variety of messages which they need in order to know and understand each other and to appreciate others living conditions, viewpoints and aspirations.

7.2. THE UNIQUENESS OF HUMAN COMMUNICATION

Among animals, human beings are unique. Human beings may be the only animals that can selectively communicate. Only human beings can think in abstractions, plan events in the future, and store and recall information. We can express emotions, describe events and objects and combine sounds into complicated structure.

People have an **open language system** while most animals have **closed language system**. People, because they have developed many sounds and have the ability to combine these sounds into various words, symbols with defined meanings, can combine the sounds to create meaningful units. We communicate through our primary signal systems, the senses. We see, hear, taste and touch.

Human communication involves the development of relationship among people that results in the encoding and decoding of messages. This relationship incorporates a **message, communicator/ source, channel(s), communicator/ receiver, feed back, noise and environment**.

7.3 COMMUNICATION MODELS

Communication models help us to see the components of communication.

1. The linear model - According to this a speaker encodes a message and sends it to a listener through one or more of the sensory

channels. The listener then receives and decodes the message. This is just a speaker / listener model and is called a one - way communication.

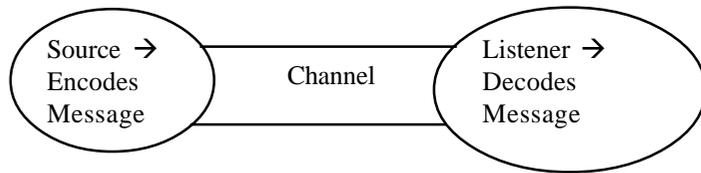


Fig. 1. Linear Model (one-directional)

2. Interaction Model - In this model of communication, the source encodes a message and sends it to the receiver through one or more of the sensory channels. The receiver then decodes the message received. The receiver then encodes feed back (a reaction) and sends the feed back to the source, thus making it a two-way process.

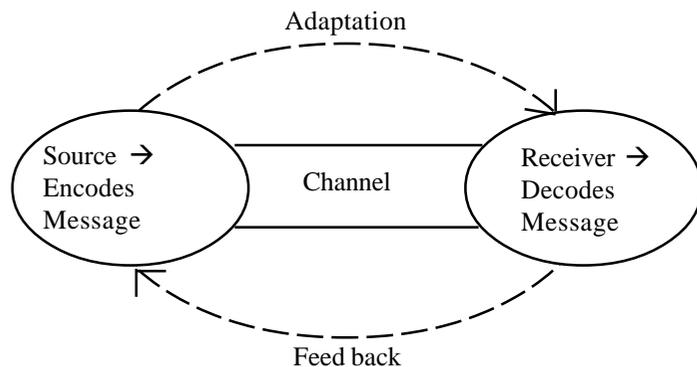


Fig. 2. Interaction Model - (two directional)

3. Transactional Model - In this model encoding and decoding of the message and feed back is happening continuously or simultaneously and so one person is not labeled as the source and the other as the receiver. Both communicators assume sender and receiver roles in the transaction.

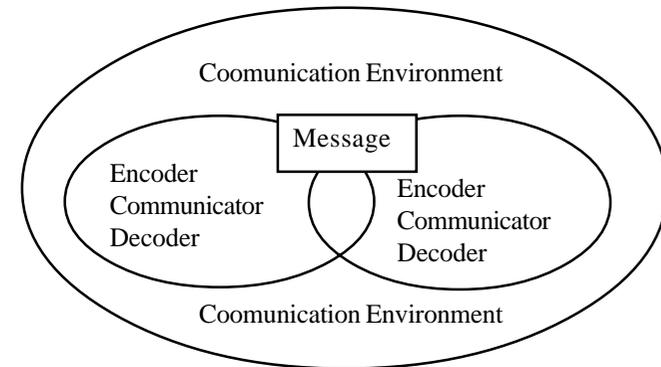


Fig. 3 Transactional model (multi directional)

Feedback - is a message sent to the original communicator / source to reflect how the message has been perceived. This feedback can be verbal or non verbal.

The models discussed above use the very basic ones. Whatever may be the communication process there is always a lot of disturbance called “noise” or distortion. This affects the communication process.

7.4 BARRIERS TO COMMUNICATION

Noise represents any internal or external interference in the communication process, it can be caused by

1. **Physical noise** - is the outside interference that blocks the communicator / receiver from receiving the message. This noise can be from any loud speaker, music system, fan in the room, running water etc.
2. **Physiological noise**- any impairment like deafness, tooth removed, headache or pain in the body which can cause a block in effective communication.
3. **Semantic problem** - this problem arises from the choice of words used to convey a message.
4. **Syntactical problem** -caused by how a sentence is structured.

5. **Psychological problem** - when people are nervous, or reluctant to speak or preoccupied with other problems, then this causes a barrier to communication.
6. **Social noise** - when preconceived ideas are strong and if an individual is influenced by the unchangeable societal input, then these will cause problem to communication.

From noise, let us try to understand the meaning of communication, scope and levels of communication and also the important elements involved in the communication process.

7.5 MEANING OF COMMUNICATION

Communication means a common ground of understanding. It is a process of exchange of facts, ideas, opinions and as a means that individuals or organizations share meaning and understanding with one another.

7.5.1. Scope of Communication

The scope of communication is very wide and comprehensive. It is a subject of almost unlimited dimensions and is an interdisciplinary one.

It is a **continuous process of exchange** of information and uses a set of symbols like words, action, pictures, figures etc.

Communication can be **downwards**, for example the Head Master giving instruction to the students through the teachers.

Communication can be **upward**, for example students opinion conveyed to the Principal through the teachers

Communication can be **horizontal**, for example discussions among teachers themselves or the students deciding on some issues related to their club activities.

7.5.2. Levels of Communication

a) Self Communication or Intrapersonal Communication

Communication scholars and researchers recently have come to realize the logical way to start improving our communication skills by understanding our own **self**-communication or

otherwise called **intrapersonal communication**. This involves the internal communication patterns we use to 'talk to ourselves' either consciously or unconsciously. Example: When we talk to ourselves about what we have done or completed over a week or say to yourself 'I ate too much'.

b) Dyadic Communication or Interpersonal Communication This represents the type of communication that involves two or more persons communicating directly within a relatively informal two- person or small-group setting.

Dyadic communication is a **transaction between two people**. This level of communication can take many forms -conversation, debate, interview, etc.

We spend most of our communication time at this level. Example: we interact with people at home, at work place, while traveling and so on.

c) Small group Communication

This is a form of interpersonal communication that usually **involves three or more persons** but generally not more than twelve. The group is brought together for some common purpose or goal. Example: meetings at workplace, family get together.

d) Large group communication

This is also a common level in communication where **more than thirty people** come together to share their ideas, experience, knowledge, etc. They have common interests and aspirations. Example: Conferences, meetings, etc.

e) Mass Communication

In today's interdependent world, one needs to look beyond face to face communication to cater to our need to speak to many people at a time spread all over the world. In mass communication we reach **large groups of people**. Modern civilization has devised almost magical methods to carry our

messages even to the remotest corner of the world with astonishing speed, much beyond the wildest imagination of the earliest generation. The method is known as mass communication. Eg: press, cinema, radio and T.V.

7.5.3 Successful Communicatio

Involves six elements - **communicator** (who) sending a useful **message** (what) through proper **channels** (how), effectively **treated** to an appropriate **audience** (whom) to evoke the desired **response** (effect).

That is who says what to whom, how and with what effect:

- I. A good communicator should
 1. know his audience well.
 2. know his message well.
 3. know the different channels that can be used.
- II. A good message must be.
 1. clear simple and understandable
 2. significant and need based
 3. appropriate and applicable.
- III. Treatment of message helps in
 1. organizing the subject matter
 2. relating the message to suit the audience
 3. avoiding any misinterpretation. .
- IV. Channels of communication are the physical bridges between the sender and the receiver of messages
 1. Channel will depend on the size of the audience- individual/group/mass.
 2. Channel used will depend upon the skills of the communicator and the audience knowledge.
 3. Channel chosen will depend on the message to be conveyed.
- V. The audience
 1. may consist of one person or many or mass.
 2. homogenous or heterogenous

3. highly motivated and actively participate
4. communication process

VI Audience Response

- 1 . reaction of the audience to the message they received.
2. can be verbal or non-verbal.
3. is important to make the communication process complete.

The choice of a channel or method of communication, also m called **Teaching Methods**, generally depends on the **number of people** (audience) location or the place where communication is taking place, time available for communication and the skills of the communicator.

In any communication process, how you communicate is very important since this determines the effect or impact of the process. The important **channels of communication are the teaching methods and the use of audio/visual aids.**

7.6 TEACHING METHODS

Teaching methods are classified into:

Individual methods

Group methods

Mass methods

- **Individual Methods:** This method is followed or chosen when the number of people to be contacted are few, are conveniently located, close to the communicator and sufficient time is available for communication. In this, individual attention can be given.
- **Group Methods :** A group may be defined as an aggregate of small number of people. This method is adopted when it is necessary to communicate with a group of people simultaneously and who are located not far off from the communicator, and reasonably good time is available for communication. Individual attention is difficult and may not be possible.
- **Mass Methods :** This method is followed where a large and widely dispersed heterogeneous audience is to be

communicated within a short time . There is no personal contact in this method.

7.6.1 Classification of Teaching methods

Individual

1. Farm and home visits.
2. Personal interviews.
3. Letters and phone calls.

Group

1. Demonstrations.
2. Group discussions.
3. Exhibitions.
4. Field trips.
5. Camps.
6. Lecture method.

Mass

1. Print Media
2. Radio
3. Television
4. Cinema
5. Documentary
6. Use of Computers

7.6.2 Classification of audio / visual aids

Audio aids

1. Tape recorder
2. Public address system
3. Telephone

Visual aids (Non projected aids)

1. Chalkboard
2. Bulletin board

3. Pictures and photographs
4. Flannel graph, flash cards, flip charts
5. Posters
6. Diagram, map, chart, graph
7. Specimen, models

(Project aids)

1. Slide projector
2. Film strip projector
3. Opaque projector
4. Over head projector

Audio - Visual Aids (Non projected)

1. Folk Arts
2. Puppetry
3. Drama

(Projected)

1. Cinema
2. Documentary
3. Video

The teaching methods and audio/visual aids mentioned above are the formal techniques. But if we have to communicate to the illiterate mass then the informal/nonformal methods have to be used.

7.7 COMMUNICATING TO THE RURAL POPULATION

Education is considered by the national leaders and planners as one of the **most important factors for Human Resource Development**, leading to economic development, technical progress and creating a social order based on freedom, social justice and equal opportunities. Unfortunately, every effort made by the Government to develop the poor and the disadvantaged sectors of the society through proper adult learning strategies has not yielded the desired results for

many reasons. The main problem being the illiteracy level among the rural population, it can be stated that the lapses are due to the failure on the part of the planners and change agents in properly encoding the messages and in utilizing the proper media for the intended learners.

In order to overcome this problem, developmental communicators tried using 'Folk Media'. Folk Arts are the **expressions or methods and when these arts are used in conveying messages they form a media of communication**. This is the most suitable media for rural or illiterate adults, for extension education or community development work.

Mass media has a wide reach yet it has not been properly understood and used. Radio still remains a music box and is a one-way communication media. Television is bound to remain a luxury or else used mainly for entertainment. Films have always been a medium of entertainment. Under these circumstances, **traditional folk arts have been used as a media for propagating several ideas of modernization to the illiterate masses successfully**.

Folk arts are the spontaneous expression of the tribal and peasant people all over the world, which is evolved by themselves to suit their own needs. In folk arts, cultural symbols are used and expressions is given to people's lifestyle and values through spoken words songs and rhythm. They are theme carriers and are ventilated without any stipulated rules or regulations. The cost involved in organizing such programs and the need for trained organizations is limited in comparison with the mass media. Due to this folk media of communication gives pleasure to both the artists and the audience and becomes a **participatory communication** in delivering **developmental messages**.

In rural areas of Tamil Nadu, a number of folk-arts is in existence. Over the years the use of these arts has diminished and only a few have been developed and is made available in educational program. Folk arts are broadly classified into **folk songs, folk drama and folk dance**.

Folk Songs are the spontaneous, meaningful expression of the village folk tuned to a very simple, melodious music which is very much characteristic to each area. Folk songs are sung at many occasions like marriage, birth, death or at work. Example: **Thalattu**

Drama is an art, serving feast for the eyes, ears and mind simultaneously. It not only amuses but also instructs the audience. Dance and drama had not been identified as two different arts during early days. They were called "Koothu" in ancient Tamil Nadu. Example: **Therukoothu**.

Folk Dancing is the characteristic dancing of the people of a country or state, some are very ancient and have their origin in the history of the nation. They contain special steps and gestures that have deep meaning to members of that group. Dancing is accompanied by singing and music and the dancers take different forms while dancing. Example: **karakattam**

Puppetry or puppet show is one of those interesting folk arts where dolls are animated by human fingers, to dance move or perform, so as to mimic human actions. Puppetry first appeared in India and spread to other countries. Even before people could write and reason, puppetry was a means of presenting religious and historical traditions of a country. The different types of puppets used are - string puppets, shadow puppets, glove or hand puppets and finger puppets.

QUESTIONS

Section -A

I. Fill in the blanks:

1. The collection, storage processing and dissemination of news is _____.
2. _____ is a transmission of knowledge to foster intellectual development.
3. Only _____, _____ can think in abstraction, plan events for the future and store and recall information.
4. Any disturbance in communication is called _____
5. _____, _____ is caused by the choice of wrong words.

II. Match the following:

- | | |
|-------------------------|--------------------|
| 1. Feedback | Interpersonal |
| 2. Transactional model | Preconceived ideas |
| 3. Social noise | Response |
| 4. Dyadic communication | Multidirectional |
| 5. Group methods | Lecture method |

III. True or false

1. Puppetry is a recent form of communication.
2. Folks songs are the spontaneous expression of rural folk.
3. Education is an important factor for human resource development.
4. Flannel graph is a projected aid.
5. Mass media reaches heterogeneous audience.

Section -B

1. What are the other terms for channels?
2. When the number of people to be reached are small what method will you resort to.
3. Give one characteristic for a good message.
4. Give an example for upward communication.

Section -C

1. Define communication
2. What is cultural promotion?
3. Give the diagram for transactional analysis.
4. Write on mass communication.
5. Write on the importance of channels in communication.

Section - D

1. Write the scope of communication.
2. Explain the three levels in communication.
3. What is folk media of communication?
4. Give the classification for teaching methods.
5. Write on the difference types of 'Noise'.
6. Discuss the functions of communication.

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