# PHYSIOTHERAPY TECHNICIAN

## NSQF LEVEL - 3

## TRADE THEORY

**SECTOR :** HEALTHCARE

**(As per revised syllabus July 2022 - 1200 Hrs)**



Directorate General of Training

**DIRECTORATE GENERAL OF TRAINING**
**MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP**
**GOVERNMENT OF INDIA**

**NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI**

**Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032**

**Sector : Healthcare**
**Duration : 1 - Year**
**Trades : Physiotherapy Technician - Trade Theory - NSQF Level - 3 (Revised 2022)**

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# FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Media Development Committee members of various stakeholders viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Physiotherapy Technician - Trade Theory - NSQF Level - 3 (Revised 2022) in Healthcare Sector under Yearly Pattern.** The NSQF Level - 3 (Revised 2022) Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 3 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development.I have no doubt that with NSQF Level - 3 (Revised 2022) the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these Instructional Media Packages IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

Addl.Secretary / Directorate General of Training
Ministry of Skill Development & Entrepreneruship
Government of India.

New Delhi - 110 001

# PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of Federal Republic of Germany. The prime objective of this Institute is to develop and provide instructional materials for various trades as per the prescribed syllabi under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

**Chennai - 600 032** **EXECUTIVE DIRECTOR**

# ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisation to bring out this IMP **(Trade Theory)** for the trade of **Physiotherapy Technician - Trade Theory - NSQF Level - 3 (Revised 2022)** under the **Healthcare** Sector for ITIs.

**MEDIA DEVELOPMENT COMMITTEE MEMBERS**

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NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

# INTRODUCTION

**TRADE THEORY**

This manual consists of theoretical information for the course of the **Physiotherapy Technician**. The contents are sequenced according to the practical exercise contained in the manual on Trade practical. Attempt has been made to relate the theortical aspects with the skill covered in each exercise to the extent possible. This co-relation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The Trade theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indicating about the corresponding practical exercise are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

| | | |
|---|---|---|
| Module 1 | - | Anatomy |
| Module 2 | - | Physiology |
| Module 3 | - | Conductive thermal energy modalities |
| Module 4 | - | High frequency current |
| Module 5 | - | Low frequency current |
| Module 6 | - | Massage therapy |
| Module 7 | - | Exercise therapy |
| Module 8 | - | Clinical physiotherapy |

The Trade Theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indications about the corresponding practical exercises are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not for the purpose of self learning and should be considered as supplementary to class room instruction.

**TRADE PRACTICAL**

The trade practical manual is intented to be used in practical workshop . It consists of a series of practical exercises to be completed by the trainees during the Course of the **Physiotherapy Technician** supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF LEVEL - 3 (Revised 2022) syllabus are covered.

The manual is divided into eight modules.

The skill training in the shop floor is planned through a series of practical exercises centred around some practical object. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI looks forward to the suggestions from the experienced training faculty for improving the manual.

# CONTENTS

# LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

| Sl.No | Learning Outcome | Exercise No |
|---|---|---|
| 1 | Operate using suitable tools and equipments with basic outline of physiotherapy and develop a vocabulary of appropriate terminology following safety precautions. | 1.1.01 - 1.1.05 |
| 2 | Analyze and assemble the components of skeleton system. | 1.1.06 - 1.1.08 |
| 3 | Analyze the joints by using X-Ray films. | 1.1.09 - 1.1.11 |
| 4 | Differentiate various muscles. | 1.1.12 - 1.1.15 |
| 5 | Recognize basic cell structure and its organelles. | 1.2.16 - 1.2.19 |
| 6 | Identify the major neural tissues. | 1.2.20 - 1.2.24 |
| 7 | Relate the anatomical position of circulatory system on mannequin. | 1.2.25 - 1.2.28 |
| 8 | Categorize foods according to nutrients and assemble organs of digestive system. | 1.2.29 - 1.2.32 |
| 9 | Illustrate respiratory system. | 1.2.33 - 1.2.37 |
| 10 | Arrange organs on dummy of excretory and reproductive system. | 1.2.38 - 1.2.40 |
| 11 | Design a treatment plan for stiff parts of body. | 1.3.41 - 1.3.47 |
| 12 | Illustrate the effects of IRR. | 1.3.48 - 1.3.50 |
| 13 | Execute remedial effects of cryotherapy. | 1.3.51 - 1.3.53 |
| 14 | Enumerate the benefits of SWD. | 1.3.54 - 1.3.59 |
| 15 | Test and lay out therapeutic uses of UST. | 1.4.60 - 1.4.63 |
| 16 | Plan a regimen to stimulate muscles. | 1.5.64 - 1.5.72 |
| 17 | Asses and create a massage therapy | 1.6.73 - 1.6.80 |
| 18 | Carry out physiotherapy assessment and develop exercise regimen. | 1.7.81 - 1.7.108 |
| 19 | Develop remedial measures for back pain and abnormal gaits. | 1.7.109 - 1.7.122 |
| 20 | Prepare assessment chart and rehabilitation protocol. | 1.8.123 - 1.8.140 |

# SYLLABUS

## Physiotherapy Technician - One Year

| Duration | Reference Learning Outcome | Professional Skill (Trade Practical) (With inidcative hour) | Professional Knowledge (Trade Theory) |
|---|---|---|---|
| Professional Skill 20 Hrs;<br><br>Professional Knowledge 06 Hrs | Operate using suitable tools and equipments with basic outline of physiotherapy and develop a vocabulary of appropriate terminology following safety precautions. | 1 Identify electrotherapy modalities (02 hrs.)<br>2 Cataloging of exercise tools and equipments. (03 hrs.)<br>3 Draw human body and label its parts. (05 hrs.)<br>4 Demonstrate planes, axis, anatomical and fundamental positions. (05 hrs.)<br>5 Sketch planes, anatomical and fundamental positions. (05 hrs.) | **Introduction**<br>a Definition of Physiotherapy, terms of Physiotherapy: Electrotherapy, Exercise-therapy, Massage-Therapy, Ergonomics, Rehabilitation.<br>b Definition of Electrotherapy, safety precautions in Electrotherapy.<br>c Name of modalities which are used in physiotherapy.<br>**Introduction to Anatomy/ Physiology**<br>a Definition and subdivisions of anatomy.<br>b Anatomical and fundamental position.<br>c Anatomical regions, section and planes. The descriptive anatomical terms. (06 hrs) |
| Professional Skill 45 Hrs;<br><br>Professional Knowledge 12 Hrs | Analyze and assemble the components of skeleton system. | 6 Demonstrate skeleton system. (10 hrs.)<br>7 List the names, side determination and parts of all bones of upper limb and lower limb. (15 hrs.)<br>8 Identify side determination and parts of bones of skull, vertebral column and thorax. (20 hrs.) | **Osteology**<br>a Skeleton system.<br>b Structure, functions and classification of bone and cartilage.<br>c Name of human bones.<br>d Side determination and parts of bones of upper limb, lower limb, skull, vertebral column and thorax. (12 hrs) |
| Professional Skill 20 Hrs;<br><br>Professional Knowledge 06 Hrs | Analyze the joints by using X-Ray films. | 9 Prepare presentation of joints formation by using bones. (10 hrs.)<br>10 Identify the major joints of human body. (10 hrs.)<br>11 Perform X-Ray practical by using X-Ray films-<br>• Recognize bones.<br>• Identify of joints.<br>• Demonstration of some normal and abnormal X-ray plates. (05 hrs.) | **Orthology**<br>a Definition and classification of joints.<br>b The terms related to the movements of joints.<br>c Description of joints of upper and lower extremities with their ligaments.(06 hrs) |
| Professional Skill 45 Hrs; | Differentiate various muscles. | 12 Show muscles structure with proper labelling. (8 hrs.) | **Myology**<br>a Macroscopic and microscopic structure of muscle. |

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| Professional Knowledge 12 Hrs | | 13 Demonstrate major muscles of upper limb. (8 hrs.)<br>14 Demonstrate major muscles of lower limb. (8 hrs.)<br>15 Identify major muscles of abdomen trunk, thorax, neck and face with diagram. (21 hrs.) | b Classification of muscles.<br>c Parts of muscle.<br>d Neuromuscular junction.<br>e Sliding contraction theory.<br>f Description of all major muscles with their origin, insertion, nerve supply and action.<br>(12 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Recognize basic cell structure and its organelles. | 16 Sketch labelled picture of cell. (04 hrs.)<br>17 Prepare Microscopic diagram of different tissues e.g. Connective tissues, muscular tissues, nervous tissues etc. (07 hrs.)<br>18 Prepare postures of skin. (06 hrs.)<br>19 Identify cell structure. (03 hrs.) | a **Cell-** definition, structure and function, cellular organelles.<br>b **Tissue-** Structure and function.<br>**Skin and temperature regulation**<br>a Structure of skin.<br>b Function of skin.<br>c Temperature regulation system. (06 hrs) |
| Professional Skill 45 Hrs;<br><br>Professional Knowledge 12 Hrs | Identify the major neural tissues. | 20 Idea of reflexes and their examination. (08 hrs.)<br>21 Demonstrate and A.V. display. (07 hrs.)<br>22 Prepare Display charts of Nervous system (07 hrs.)<br>23 Represent neuron, brain, spinal cord, reflex arc, and plexus. (10 hrs.)<br>24 Perform Pain assessment (13 hrs.) | **Neurology**<br>a Parts of nervous system.<br>b Structure and function of Nervous, types of neurological cells.<br>c Structure and function of Brain and spinal cord.<br>d Reflex Arc, blood-brain barrier.<br>e Structure of a nerve, Cranial nerves (names and functions) and spinal nerves (Introduction).<br>f Nerve plexus of the body with their distributions (cervical plexus, brachial plexus, lumbosacral plexus).<br>g About the nerve fibres, motor and sensory.<br>h Blood circulation of brain and spinal cord. (12 hrs) |
| Professional Skill 20 Hrs;<br><br>Professional Knowledge 06 Hrs | Relate the anatomical position of circulatory system on mannequin. | 25 Prepare of charts of heart structure and circulation. (04 hrs.)<br>26 Identify heart location and position by using mannequin.(04 hrs.)<br>27 Identify A.V. display of blood circulation.(04 hrs.)<br>28 Prepare for Pulse and blood pressure examination.(08 hrs.) | **Circulatory system**<br>a Structure and function of heart.<br>b Nodes of heart, heart rates and heart sound.<br>c Physiology of heart circulation.<br>d Blood pressure and the influencing factors.<br>e Composition and function of blood.<br>f Circulatory system of body. (06 hrs) |

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| Professional Skill 20 Hrs;<br><br>Professional Knowledge 06 Hrs | Categorize foods according to nutrients and assemble organs of digestive system. | 29 Prepare balance diet chart for different age graphs. (04 hrs.)<br>30 Display the organs of digestive system on mannequin. (04 hrs.)<br>31 Demonstrate A.V. display. (04 hrs.)<br>32 Recognise Figuration of main and accessory organs of digestive system. (08 hrs.) | **Food and nutrition**<br>a Definition of food and nutrition.<br>b Carbohydrate, protein, fat, minerals, vitamins, water with example and brief description.<br>c Balanced diet.<br>**Digestive system**<br>a Structure and functions of digestive organs.<br>b Absorption and metabolism (in brief) (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Illustrate respiratory system. | 33 Demonstrate the organs of respiratory system on mannequin. (04 hrs.)<br>34 Prepare Display respiratory mechanism by using videos. (04 hrs.)<br>35 Measure chest inspiration and expiration with inch tape. (04 hrs.)<br>36 Check Respiratory rate examination. (04 hrs.)<br>37 Check Portrait charts of organs of respiratory system. (04 hrs.) | **Respiratory system**<br>a Structure and function.<br>b Process of respiration.<br>c Cardio-respiratory relation.<br>d Artificial respiration.<br>e Neurological control.<br>f Volumes and capacities values of respiration.<br>**Endocrinology**<br>a Definition, character and function of Hormones.<br>b About the hormone secreting glands (in brief). (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Arrange organs on dummy of excretory and reproductive system. | 38 Identify parts of excretory and reproductive system on mannequin. (08 hrs.)<br>39 Perform the Presentation and A.V. videos of excretory system. (04 hrs.)<br>40 Identify Micturition reflex by showing charts. (08 hrs.) | **Excretory system**<br>a Structure and function of kidney.<br>b Organs of excretory system.<br>c Structure of nephron.<br>d Formation of Urine<br>e Micturition<br>**Gynaecology and obstetrics**<br>a Pelvic floor muscles( names)<br>b Introduction of human reproductive system (in brief).<br>c Physiology of pregnancy. (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Design a treatment plan for stiff parts of body. | 41 Prepare hot packs. (02 hrs.)<br>42 Preparation of patient.(01 hrs.)<br>43 Apply hot packs at different regions of body. (02 hrs.)<br>44 Plan precautions while giving treatment to patient. (02 hrs.)<br>45 Assessment of the affected part before applying wax bath. (04 hrs.) | **Thermotherapy**<br>**Superficial heating agents**<br>a **Hot packs:** Physiological effects, indications and contraindications. Types of hot packs (hydrocollators, hot water bag, electrical heating pads) with their techniques of application |

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| | | 46 Perform Techniques of wax bath for instance with brush, bowl etc. (04 hrs.)<br>47 Apply wax bath with precautions and proper layering and thickness, removal of wax. (04 hrs.) | b Wax bath: Description of a wax bath unit, composition and method of preparation of wax bath, physiological effects, techniques of application, indications and contra indications. (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Illustrate the effects of IRR. | 48 Apply IRR with precautions. (10 hrs.)<br>49 Demonstrate different positions of patient during treatment. (05 hrs.)<br>50 Placement of IRR at proper distance from skin. (05 hrs.) | **a) Infra-Red Radiation:**<br>About the infra-red rays, sources of infra-red rays, technical data, physiological effects, techniques of application, termination of IRR, Indications and contra indications. (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Execute remedial effects of cryotherapy. | 51 Practice on preparation and application of ice pack, cold pack, ice towels, ice bath, ice cube massage according to the contour of the body. (08 hrs.)<br>52 Practice of preparation of patient.(05 hrs.)<br>53 Plan precautions while giving treatment. (07 hrs.) | **Cryotherapy**<br>a Physiological effects.<br>b Methods of application (Ice pack, cold pack, ice towels, ice bath, ice cube massage, vapo coolant sprays)<br>c Cryokinetics.<br>d Indications and contraindications. (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Enumerate the benefits of SWD. | 54 Explain all parts of SWD. (03 hrs.)<br>55 Testing of SWD. (03 hrs.)<br>56 Positioning of patient and placement of electrodes. (04 hrs.)<br>57 Draw Flow chart of SWD circuit. (04 hrs.)<br>58 SWD cable methods. (04 hrs.)<br>59 Precautions. (02 hrs.) | **Deep heating agents**<br>**A S.W.D.:** meanings of Short-wave & Diathermy, Effects of S.W.D. Technical data, Descriptions of a S.W.D Instrument, Method of application, Positioning of Electrode pads During, Treatment, Dose & Duration of treatment, Indications & Contraindications. (06 hrs) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 06 Hrs | Test and lay out therapeutic uses of UST. | 60 Methods of testing. (04 hrs.)<br>61 Methods of application. (04 hrs.)<br>62 Handling and operating of UST modality with precautions. (08 hrs.)<br>63 Precaution of patient. (04 hrs.) | **B M.W.D-** Introduction.<br>**C U.S.T-** About the Ultra sound, Effects of U.S.T in Human body, Technical data, Descriptions of an U.S.T. Instrument, Description about different types of Coupling medium, Method of application of U.S.T, Dose & Duration of treatment, Indications & Contraindications. (06 hrs) |
| Professional Skill 65Hrs;<br>Professional Knowledge 18 Hrs | Plan a regimen to stimulate muscles. | 64 Practice on muscle stimulator for major muscles of upper limb and lower limb. (10 hrs.) | **Stimulators-**<br>**a Faradic -** About the Faradic type of current, Technical data's, Description of a |

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| | | 65 Preparation of patient (04 hrs.)<br>66 Demonstration of muscles stimulator on face. (04 hrs.)<br>67 Plan precautions during treatment. (10 hrs.)<br>68 Practice on placement of electrodes with using proper gel. (10 hrs.)<br>69 Create difference between TENS and IFT for pain producing conditions. (09 hrs.)<br>70 Demonstrate on placement of TENS and IFT pads for radiating and local pain respectively. (08 hrs.)<br>71 Methods of treatment. (04 hrs.)<br>72 Testing methods of all modalities. (04 hrs.) | Faradic Stimulator & Electrodes, Physiological effects, Method of application, Application of continuous & Surged Faradic, Dose & Duration of treatment, Indications & Contraindications.<br>b **Galvanic-** About the Galvanic type of current, Technical data, Descriptions of a Galvanic Stimulator, Physiological effects, Method of application, application of continuous & Interrupted Galvanic, Dose & duration of treatment, Indications & Contraindications.<br>c **T.E.N.S-** Meaning of 'Transcutaneous', Description of a T.E.N.S., Physiological effects (along with pain gate Theory), Method of application (Trigger point stimulation method, Acupuncture point stimulation method etc.), Placements of T.E.N.S electrodes, Application of continuous, surged & burst mode. Dose & Duration of treatment, Indications & contraindications.<br>d **I.F.T-** Introduction, application, Indications & Contraindications. (18 hrs) |
| Professional Skill 45 Hrs;<br><br>Professional Knowledge 12 Hrs | Asses and create a massage therapy | 73 Positioning of patient and therapist. (04 hrs.)<br>74 Techniques used in massage for upper and lower limb. (08 hrs.)<br>75 Illustrate a practical of massage on face. (05 hrs.)<br>76 Elaborate methods of trunk massage. (07 hrs.)<br>77 Precautions while giving massage. (06 hrs.)<br>78 Rules and direction of massage. (02 hrs.)<br>79 Direction of using materials (oil, powder etc.) during massage. (03 hrs.)<br>80 Therapeutic application of massage. (09 hrs.) | **MASSAGE THERAPY & REHABILITATION**<br>a Definition of Massage<br>b Aim of Massage<br>c Physiological effects of Massage<br>d Therapeutic uses of Massage.<br>e Contraindications of Massage<br>f Materials used in Massage (oil, powder, ice etc.)<br>g Rules & direction of Massage<br>h Types of Massage<br>(12 hrs) |

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| Professional Skill 155 Hrs;<br><br>Professional Knowledge 42 Hrs | Carry out physiotherapy assessment and develop exercise regimen. | 81 Show positioning of patient and therapist. (04 hrs.)<br>82 Perform Practical of different exercises. (04 hrs.)<br>83 Rules and directions of exercises. (04 hrs.)<br>84 Demonstrate exercise to increase ROM by using continuous passive movement equipments. (04 hrs.)<br>85 Presentation of passive movements (manually). (05 hrs.)<br>86 Assessment of range of motion of major joints by using goniometer scales. (05 hrs.)<br>87 Perform measurement of spine ROM by using inch tape. (04 hrs.)<br>88 Exhibit active and active-assisted movements. (02 hrs.)<br>89 Illustrate strengthening exercises by using weight-cuffs for upper and lower limb joints. (02 hrs.)<br>90 Perform strengthening exercises by utilizing thera bands/ thera tubes. (05 hrs.)<br>91 Demonstrate resisted exercises (manually). (04 hrs.)<br>92 Representation of quadriceps and hamstring resisted exercises on quadriceps chair and multipurpose chair. (06 hrs.)<br>93 Practical use of different exercise equipments (e.g. Shoulder wheel, shoulder pulley, Swiss ball etc.) (07 hrs.)<br>94 Assessment of coordination and balance. (04 hrs.)<br>95 Describe equilibrium and non-equilibrium tests. (05 hrs.)<br>96 Schedule exercise programs for stretching of major muscles (Manually). (08 hrs.)<br>97 Elaborate methods of stretching (Static, mechanical etc.) (05 hrs.) | **EXERCISE THERAPY AND YOGA**<br>**1 Fundamental of exercise:**<br>a Definition of therapeutic exercise.<br>b Benefits of exercise.<br>c Classification of exercise- active, passive, resistive, isometric, functional, stretching, isokinetic, closed-chain, open-chain etc.<br>**2 Applied exercise therapy**<br>a Passive movements.<br>b Goniometry.<br>c Exercise with instrument.<br>d Active movements, active-assisted movements.<br>e Resistive exercise.<br>f Co-ordination and balance.<br>g Stretching exercise.<br>h Techniques for chest physiotherapy.<br>i Manual muscle testing.<br>j Techniques of PNF (brief).<br>k Indications and contraindications of passive movements.<br>l Indications and contraindications of breathing exercise.<br>m Grades of MMT.<br>n Precautions while performing these exercises on patient.<br>(42 hrs) |

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| | | 98 Explain positioning of patient during postural drainage. (05 hrs.)<br>99 Collaborate massage techniques with postural drainage. (05 hrs.)<br>100 Prepare a chart of measurements of chest inspiration and expiration by using hands and inch tape at different chest levels. (08 hrs.)<br>101 Perform resistive exercises for thorax muscles. (08 hrs.)<br>102 Practical based on breathing exercises. (08 hrs.)<br>103 Illustrate a practical on PNF techniques for upper and lower limbs. (brief) (09 hrs.)<br>104 Presentation of PNF techniques for trunk, face and neck. (brief) (08 hrs.)<br>105 Explanation of D1 and D2 patterns of PNF (brief)(05 hrs.)<br>106 Determination of grades of MMT for upper and lower limb. (08 hrs.)<br>107 Practical based on grading of MMT for trunk and abdominals. (08 hrs.)<br>108 Identify MMT exercises for face. (05 hrs.) | |
| Professional Skill 130 Hrs;<br><br>Professional Knowledge 36 Hrs | Develop remedial measures for back pain and abnormal gaits. | 109 Proper demo of relaxation techniques by using pillows. (08 hrs.)<br>110 Execute testing of traction. (05 hrs.)<br>111 Demonstrate positioning of patient while giving traction.(08 hrs.)<br>112 Teach how to calculate patient's weight to be used in treatment.(06 hrs.)<br>113 Develop different methods of application of traction.(08 hrs.)<br>114 Impart skills of manual cervical and lumbar traction.(08 hrs.)<br>115 Instruct normal gait patterns. (08 hrs.)<br>116 Presentation of gate phases on floor. (10 hrs.) | **Exercise Physiology**<br>1 Thermoregulation and exercise organs:<br>a Conduction, convection & evaporation.<br>b Homeostasis<br>c Physiological thermoregulation<br>2 Respiration:<br>a Muscles for inspiration and expiration.<br>b Static and Dynamic Lung volume.<br>c Gaseous exchange.<br>3 Cardiovascular adaptations:<br>a Sub maximal exercise.<br>b At maximal exercise.<br>4 Fatigue:<br>Types, symptoms, recovery.<br>5 Endurance: Definition, endurance training. |

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| | | 117 Perform abnormal gaits.(12 hrs.)<br>118 Demonstrate a practical on walking aids (eg. Crutches, walker). (18 hrs.)<br>119 Give a brief idea of parts of wheelchair. (05 hrs.)<br>120 Give guidelines for walking aids' usage for patients (eg. Two step, three step etc.). (11 hrs.)<br>121 Design gait pattern for weight bearing and non-weight bearing. (11 hrs.)<br>122 Performance of gait training. (11 hrs.) | 6 Kinesiology & Biomechanics: Basic terminologies.<br>7 Relaxation exercises.<br>8 TRACTION: Introductions, contraindications, therapeutic uses and effects.<br>9 Activities of daily living (in brief).<br>10 Gait: Definition, phases, abnormal gait patterns (in brief).<br>11 Walking aids: Types, indications, precautions. (36 hrs) |
| Professional Skill 70Hrs;<br><br>Professional Knowledge 24 Hrs | Prepare assessment chart and rehabilitation protocol. | 123 Display videos showing causes of clinical conditions. (03 hrs.)<br>124 Perform observational assessment in various conditions. (03 hrs.)<br>125 Perform clinical examination. (03 hrs.)<br>126 Demonstrate various orthopaedical tests. (04 hrs.)<br>127 Demonstrate various neurological tests. (04 hrs.)<br>128 Prepare a chart of orthopaedic, neurology assessment. (02 hrs.)<br>129 Make a cardiopulmonary assessment chart. (04 hrs.)<br>130 Make a diagnosis after assessment. (04 hrs.)<br>131 Plan a rehabilitation program for patients. (04 hrs.)<br>132 Develop home exercise programs.(03 hrs.)<br>133 Demonstrate precautions to be considered during and after treatment. (04 hrs.)<br>134 Develop ergonomics. (04 hrs.)<br>135 Evaluate the prognosis. (03 hrs.)<br>136 Make postures showing diagrammatical calculation of burn. (05 hrs.)<br>137 Calculate obesity according to BMI. (05 hrs.) | **Applied Anatomy:**<br>Causes, Deformity, loss of functions in following conditions:<br>a Carpal tunnel syndrome.<br>b Erb's and kulmpke palsy<br>c De Quervain's disease.<br>d Rotator cuff syndrome.<br>e Wrist drop.<br>f Trendelenburg's sign.<br>g Tarsal tunnel syndrome.<br>h Genu valgum/varum.<br>i Coxa valgus/ varus.<br>j Foot drop.<br>**ORTHO-NEURO-GENERAL**<br>**Orthopaedical condition:**<br>**Etiology, C/F & physiotherapy management of the followings:**<br>i Kyphosis, Lordosis & Scoliosis<br>ii Cervical & Lumbar Spondylosis<br>iii Ankylosing Spondylosis<br>iv Tennis Elbow<br>v Golfer's Elbow<br>vi Gout<br>vii Osteoarthritis<br>viii Rheumatoid Arthritis<br>ix Frozen Shoulder<br>x Fracture (brief)<br>xi Dislocation & subluxation<br>xii Sprain<br>xiii Tendonitis<br>xiv Rickets |

| | | | |
|---|---|---|---|
| | | 138 Illustrate precautions related to treatment. (05 hrs.)<br>139 Clinical presentation in hemiplegia, hemiparesis to differentiate it. (05 hrs.)<br>140 Plan antenatal and postnatal exercises. (05 hrs.) | xv Osteomalacia<br>xvi Osteomyelitis<br>xvii Calcaneal Spar<br>xviii Flatfoot.<br>**Neurological Condition:**<br>**Etiology,C/F, & Physiotherapeutic Management of the following:**<br>i Cerebral palsy<br>ii Hemiplegia<br>iii Paraplegia<br>iv Quadriplegia<br>v Myalgia<br>vi Fibromysitis<br>vii Polio Myelitis<br>viii Parkinsonism<br>ix Bell's palsy<br>x C.V.A (brief)<br>xi Upper & Lower Motor Neuron diseases<br>xii Peripheral Nerve Injury<br>xiii Spinal Cord Injury<br>xiv Sciatica<br>**General Condition:**<br>Etiology, C/F, Investigations & Physiotherapeutic Management of the following:<br>i Obesity<br>ii Burns<br>(24 hrs) |

**Project work/ Case Study**

**Broad Areas:**

a Perform practical of different exercises.

b Assessment of range of motion of major joints by using goniometer scales.

c Prepare a chart of measurements of chest inspiration and expiration by using hands and inch tape at different chest levels.

d Execute testing of traction.

e Prepare a chart of orthopaedic, neurology assessment.

f Calculate obesity according to BMI.

# Physiotherapy and a vocabulary of appropriate terminology

**Objectives:** At the end of this lesson you shall be able to
- **acquire the meaning of physiotherapy and electrotherapy**
- **list out the various terms used in physiotherapy**
- **state the name of modalities used in physiotherapy**
- **describe the safety precautions in electrotherapy.**

**a Meaning of physiotherapy and electrotherapy**

**Physiotherapy:** Treatment for physical disabilities and injuries by various therapeutic exercises and other activities collectively.

**Electrotherapy:** It is the use of electrical energy as a medical treatment for the purpose of pain relief and healing.

**b Different terminologies**

**Exercise therapy:** It means to accelerate the patient's recovery from injuries and disease which gives them a normal way of living.

**Massage therapy:** Massage therapy is manual manipulation of soft tissues to enhance a person's health and well-being.

**Ergonomics:** It is a field of study dealing with the comfort and safety of the human body by adjusting tools, work stations and work process to the worker.

**Rehabilitation:** The action of restoring someone to health or normal life through training and therapy after illness.

**c Name of modalities used in physiotherapy**

Ultrasound, Electrical stimulation/TENS, Traction, Massage, Heat, Ice, LASER and whirlpool.

**d Safety precautions in electrotherapy**

- Make sure power is off before starting the equipment and before brining contact with the patients.
- Begin with mild current and increase slowly.
- Keep patient out of contact with metal during treatment.
- Electrodes should not touch each other.
- Never use current more than 1mA.
- Do not use with damped condition or near to water.
- Do not use with demand type cardiac pacemaker or other implanted devices or pregnant women.

# Introduction to anatomy and physiology

**Objectives:** At the end of this lesson you shall be able to
- **acquire the meaning of anatomy and its sub-divisions**
- **list out anatomical and fundamental positions**
- **explain about the anatomical regions, section and planes and describe anatomical terms.**

**a Meaning and sub-divisions of anatomy**

It is a branch of science dealing with the study of the structures of the organisms and their part. The sub-divisions include gross anatomy, living anatomy, clinical anatomy, surface anatomy, pathology, histology, embryology, radiological and comparative anatomy.

**b Anatomical and fundamental positions**

1 Body erect

2 Feet slightly apart

3 Palms facing forward

4 Thumbs point away from body

**Fundamental positions:**

a Superior - Towards head

b Inferior - Away from head

c Anterior - Front of the body

d Posterior - Back of the body

e Medial - At the middle of the body

f Lateral - Away from the mid-line

g Intermediates - Between a more medial

h Proximal - Closer to the origin of the body part

i Distal - Far away from the origin of the body part

j Superficial - Towards or at the body surface

k Deep - Away from the body surface

**c Anatomical regions, section and planes**

Two major divisions namely axial and appendicular,

1 Axial - head, neck and trunk

2 Appendicular -Limbs

Section and planes:

a Sagittal - Perpendicular to the ground

b Mid-Sagittal - Cut body into two equal planes

c Frontal (Coronal) - Divides body into anterior and posterior

d Transverse(Horizontal/Cross-Section) - Divides body into superior and inferior

# Analyse and assemble the components of skeletal

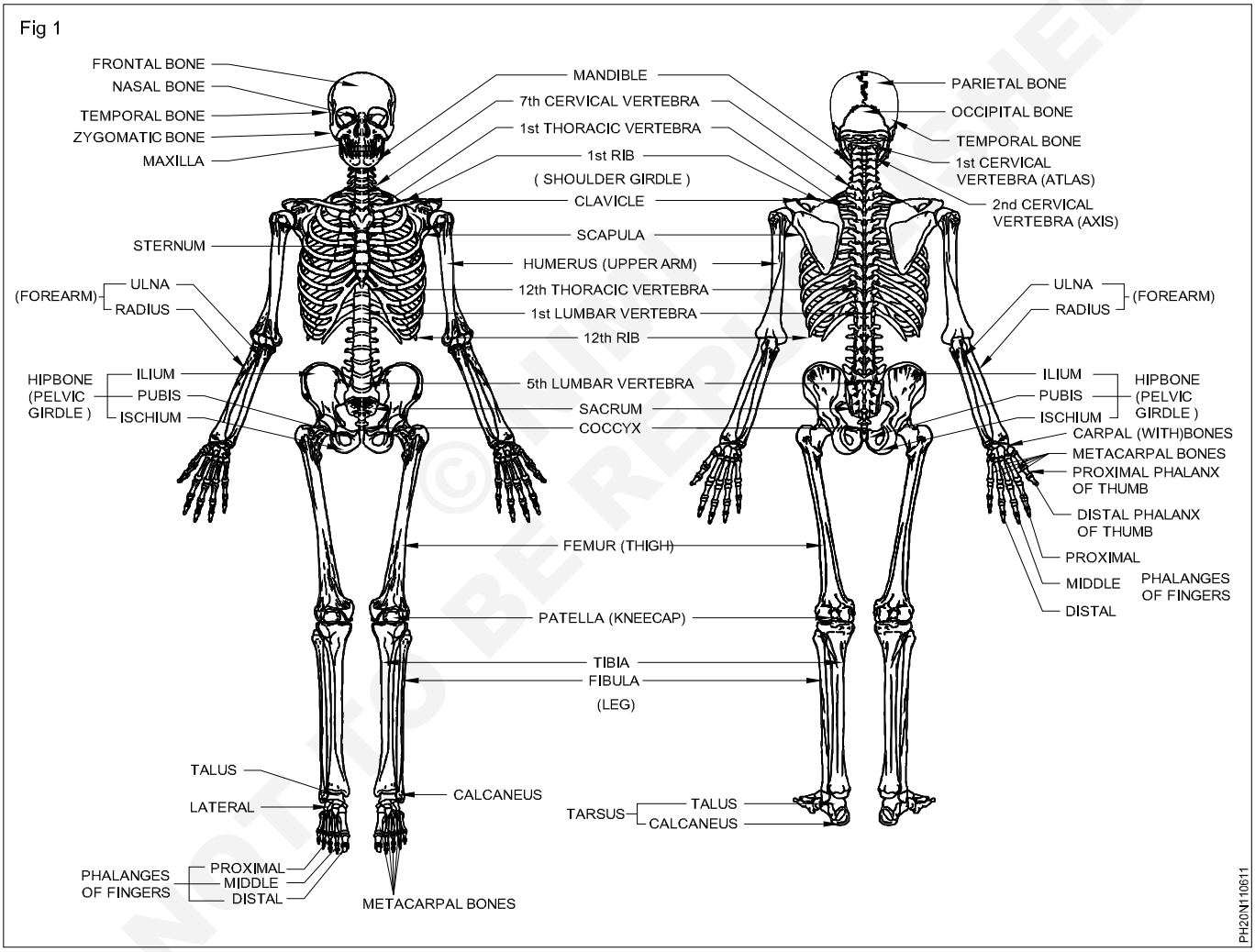
**Objectives:** At the end of this lesson you shall be able to
- **explain the functions and classifications of bones**
- **list the names of the bones**
- **explain to identify the sides of the born.**

**Osteology**

**a Skeletal system:**

It includes all the bones & joints in the body. Each bone is a complex living organ that is made up of many cells, protein fibers & minerals. The skeleton acts as a scaffold by providing support & protection for the soft tissues that made up the rest of the body. (Fig 1)

Fig 1




**b Structure**

The skeletal system includes the bones of the skeleton & the cartilages, ligaments & other connective tissue that stabilize or connect the bones.

In addition to supporting the weight of the body, bones work together with muscles to maintain body position & to produce controlled, precise movements.

**Functions:**

- Provides shape & support
- Protects internal organs
- Stores minerals & fats
- Produces blood cells & platelets
- Assists in movement

**Classification of bones:**

- **Long Bones -** This is cylindrical in shape, being longer than it is wide. Long bone function as levers, they move when muscle contracts.[Humerus, Ulna, radius]
- **Short Bones -** Cube like Shape, being equal in length, width & thickness [Carpal & Tarsal bones]

- **Flat bones -** is typically thin, it is also often curved [Stull bone, scapulae, sternum]
- **Irregular bones -** is one that does not have any easily characterized shape. [Vertebrae, many facial bones]
- **Sesamoid bone -** is a small, round bone, shaped like a Sesame seed. [Patella]

**Classification of Cartilage**

There are three types

- Elastic Cartilage
- Hyaline Cartilage
- Fibro Cartilage

**c Names of Human Bones**

The human skeletal is made up of 206 bones.

- Skull - Including the jaw bone
- Spine - Cervical, Thoracic, Lumbar, Sacrum & coccyx
- Chest - ribs & breast bone (sternum)
- Arms - Scapula, clavicle, humerus, radius & ulna
- Hands - Wrist bones [Carpals], metacarpals & phalanges
- Pelvis - Hip bones
- Leg - High bone [Femur], Knee cap [Patella], Tibia & fibula.
- Feet - Tarsals, metatarsals & phalanges.

## Side determination and parts of bones of upper limp

**Objectives:** At the end of this lesson you shall be able to
- **describe about the divisions of upper limb describe the bones in each region**
- **list the bone that articulate each joint of the upper limb**
- **explain about the side of the bones.**

**Upper limb**

The upper limb is divided into three regions. These consists of the arm, forearm & the hand.

There are 30 bones in each upper limb.

- The humerus is the single bone of the upper arm.
- The ulna [Medially] & the Radius [laterally]are the paired ones of the fore arm.
- The base of the hand contains eight bones, each called a carpal bone & the palm of the hand is formed by five bones, each called a metacarpal bone. The fingers of the thumb contain a total of 14 bones each of which is a phalanx of the hand.

**Humerus**

The humerus is a long born [based on the type of bones]. It is composed of three components: Upper end, lower end and a shaft.

**Upper End:**

The upper end of humerus provides the following five features.

- Head
- Neck
- Greater tubercle
- Lesser tubercle
- Intertubercular Sulcus

The head is smooth and rounded and forms less than a fraction of a sphere. It is directed medically backwards & upwards. It articulates with the glenoid cavity of the scapula to create the glenohumeral [shoulder] joint.

**Lower end:** The lower end of the humerus provides the following features.

Capitulum - a lateral rounded convex projection

Trochlea - a medial pulley - shaped structure

Radial fossa - a small fossa about the capitulum

Coronoid fossa - a small fossa about the trochlea

Medial epicondyle - a prominent projection on the medial side

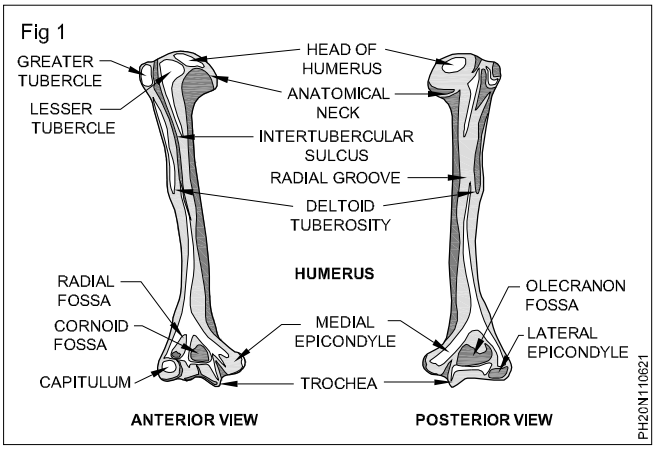
Lateral epicondyle - a prominent projection on the lateral side but less than medial epicondyle.

Olecranon fossa - a big, deep hollow on the posterior aspect about the trochlea.

**Shaft:** The shaft is the long part of the bone extending between its upper and lower ends. The shaft of the humerus is cylindrical in the upper half but flattened anteroposteriorly in the lower half. (Fig 1)

**Side Determination**

Fig 1



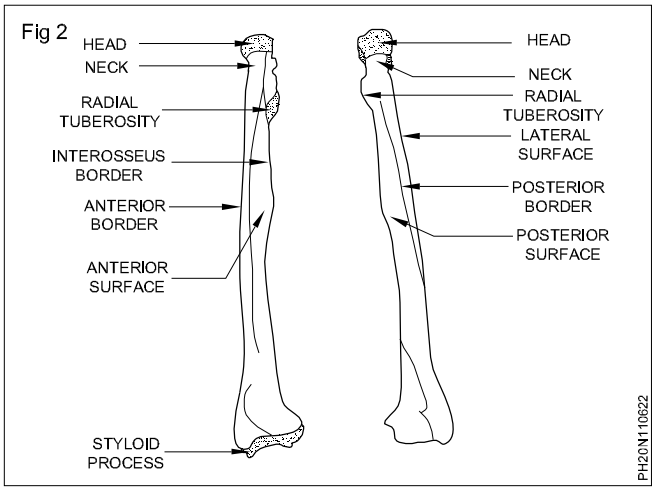

The side determination of the humerus can be identified by holding if vertically in such a way that:

- The Rotated head at the upper end faces medially backwards & upwards.

- The lesser tubercle, greater tubercle & the vertical groove (intertubercular groove) at the upper end faces anteriorly.
- The Olecranon fossa on the lower flattened end faces posteriorly.

**Radius** (Fig 2)

The radius is the long bone in the forearm. It lies laterally & parallel to ulna, the second of the forearm bones.




Important bony landmarks includes the head, neck & radial tuberosity.

- Head of radius - A disc shaped - structure, with a concave articulating surface. It is thicker medially, where it takes part in the proximal radioulnar joint.
- Neck - A narrow area of bone, which lies between the radial head and radial tuberosity.
- Radial tuberosity - A bony projection which serves as a place of attachment of the biceps bronchi muscles.

**Shaft of the radius -** The radial shaft expands in diameter as it moves distally. Much like the ulna, it is triangular in shape, with three borders and three surfaces.

Distal region of the radius - In the distal region, the radial shaft expands to form a rectangular end. The lateral side projects distally as the styloid process. In the medial surface there is a concavity, called the ulnar notch, which articulates with the head of ulna, forming the distal radioulnar joints.

Distal surfaces of the radius has two facets, for articulation with the scaphoid and lunate carpal bones. This makes up the wrist joint.

The ulna is the long bone in the forearm. It lies medially and parallel to the radius, the second of the forearm bone, the ulna acts as the stabilising bone, with the radius priority to reduce movement.

Proximally, the ulna articulates with the humerus at the elbow joint, Distally with the radius, forming the distal radio-ulnar joint.

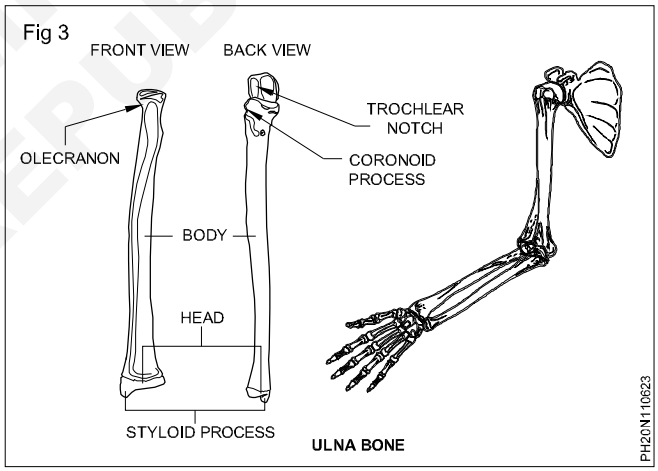
**Important Landmarks of Proximal ulna:**

- **Olecranon -** A large projection of bone that extends proximally, forming part of trochlear notch, It can be palpated at the tip of the elbow.
- **Coronoid process -** This Ridge of bone projects outwards anteriorly, forming part of the trochlear notch.
- **Trochlear notch -** Formed by the Olecranon & coronoid process. It is wrench shaped & articulates with the trochlea & humerus.
- **Radial notch -** Located on the lateral surface of the trochlear notch, this area articulates with the head of the radius.
- **Tuberosity of ulna -** A roughening immediately distal to the coronoid process. It is where the brachialis muscle attached.

**Side determination of radius:**

- The narrow disc - shaped end (head) is directed upwards.
- The sharpest border (interosseous border) of the shaft is kept medially.
- The styloid process at the lower end is directed laterally & prominent tubercles of the lower end faces dorsally.
- The convexity of the shaft faces laterally & concave anterior surface of the shaft faces anteriorly.

**Ulna (Fig 3)**




**Shaft of ulna -** The ulnar shaft is triangular in shape with three borders & three surfaces. As it moves distally it decreases in width.

Three surfaces are:

- Anterior
- Posterior
- Medial

Three borders are

- Posterior
- Interosseous
- Anterior

**Distal end:** It is much smaller in diameter than the proximal end. It is mostly unremarkable, terminating in a rounded head, with the ulnar styloid process.

The head articulates with the ulnar notch of the radius to form the distal radio - ulnar joint.

**Side Determination**

- The broad hook-like end is directed upwards
- The sharp crest like interosseous border of the shaft is directed laterally.

**Bones of the hand**

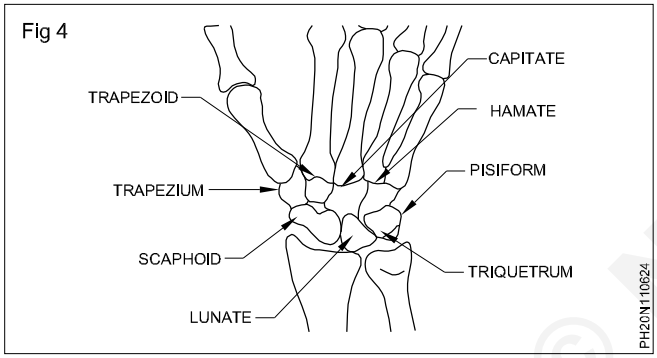
The bones of the hand provide supports flexibility to the soft tissues. They can be divided into three categories.

- Carpel bones (proximal) - A set of eight irregularly shaped bones. These are located in the wrist area.
- Metacarpal bones - There are five metacarpal bones.
- Phalanges (Distal) - The bone of fingers. Each finger has three phalanges, except for the thumb, which has two.

**Carpal bones (Fig 4)**

They are organised into two rows, proximal and distal.

Fig 4




**Proximal rows (Lateral to Medial)**

- Scaphoid
- Lunate
- Triquetrum.
- Pisiform.

**Distal row (Lateral to Medial)**

- Trapezium.
- Trapezoid.
- Capitate.
- Hamate.

Proximally, the scaphoid and lunate articulate with the radius to form the wrist joint. In the distal row, at the carpal bones articulate with the metacarpals.

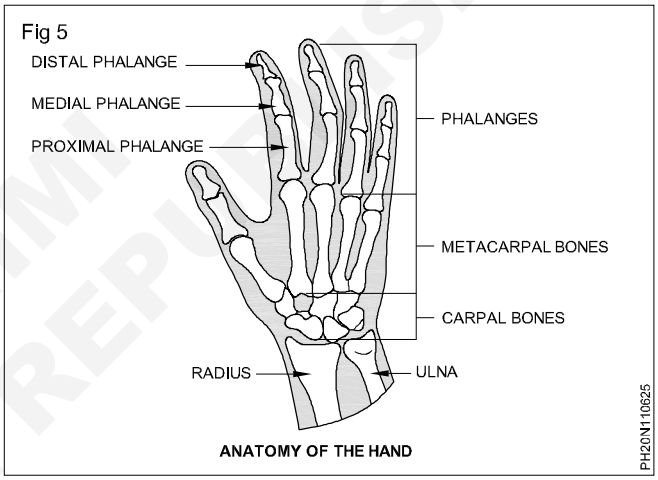
**Metacarpal bones.**

The metacarpal bones articulate proximally with the carpals and distally with the proximal phalanges. They are numbered and each associated with a digit.

- Metacarpal I - thumb.
- Metacarpal II - index finger.
- Metacarpal III - middle finger.
- Metacarpal IV - ring finger
- Metacarpal V - little finger.

Each metacarpal consists of base, shaft and head. (Fig 5)

Fig 5




ANATOMY OF THE HAND

**Phalanges:**

The phalanges are the bones of the finger. The thumb has a proximal & distal phalanx, while the rest of the digits have proximal, middle& distal phalanx

## Bones of lower limb

**Objectives:** At the end of this lesson you shall be able to

- **explain the divisions of the lower limb and describe the bones of the each region**
- **describe the bones and body landmarks that articulate of each joint of the lower limb.**

The lower limb is divided into three regions. These consists of thigh, leg, the foot. The lower limb contains 30 bones. These are the femur, patella, tibia, fibula, tarsal bones, metatarsal bones and phalanges.

| | | |
|---|---|---|
| Femur | - | The single thigh bone |
| Patella | - | Knee cap |
| Tibia | - | Located on the medial side of the leg |
| Fibula | - | Located on the lateral side of the leg. |
| Tarsal bones | - | Group of seven bones. |
| Metatarsal bones | - | Five elongated bones. |
| Phalanges | - | 14 Phalanges. |

**Femur:**

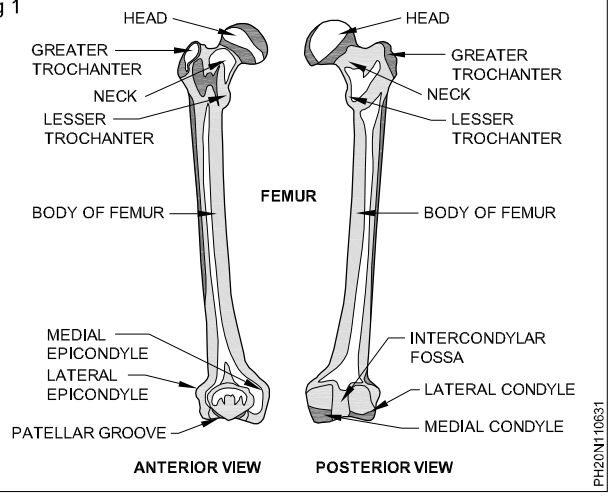
The femur or the thigh bone is the single bone of the thigh region. It is the longest and strongest bone of the body. It can be divided into proximal, shaft, distal.

**proximal**

It consists of head, neck and two bony process.

- The greater and lesser trochanters.
- Also two bony ridges connecting the two trochanters, the intertrochanteric line anteriorly and the trochanteric crest posteriorly. (Fig 1)

Fig 1




**Shaft**

The shaft descends in a slight median direction. On the posterior surface, there are roughened ridges of bone called the linea aspera. Proximally, the medial border becomes the pectineal line. The lateral border becomes the gluteal tuberosity. Distally it forms the floor of the popliteal fossa.

**Distal**

The distal end of femur is characterised by the presence of the medial and lateral condyles, which articulate with the tibia, patella to form the knee joint.

**Side determination**

- The upper end bears a rounded head whereas the lower end is widely expanded to form two large condyles.
- The head is directed medially.
- The cylindrical shaft is convex forwards.

**Tibia**

The tibia is the main bone of the lower leg, commonly known as shin bone. It can be divided into proximal, shaft and distal. (Fig 2)

**Proximal**

The proximal tibia is widened by the medial & lateral condyles. The condyles form a flat surface, known as the tibial plateau.

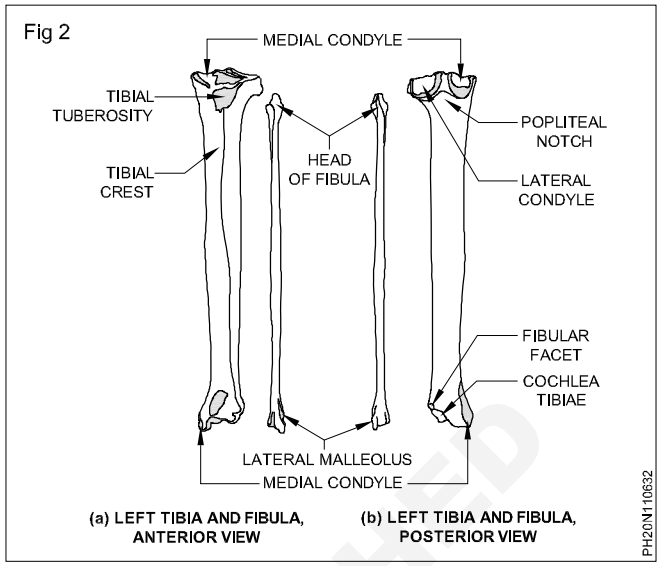
Located between the condyles is a region called the intercondylar eminence.

**Shaft**

The shaft is prism-shaped. It consists of three borders.

- Anterior.
- Posterior.
- Lateral.

Fig 2




**Distal**

The distal end widens to assist with weight-bearing. The medial malleolus is a bony projection on the medial aspect and laterally is the fibular notch.

Side determination:

- Its increased end with condyles faces upwards.
- Its fibial tuberosity and sharp sinuous anterior border of the shaft faces anteriorly.
- Medial malleolus on the medial side.

**Fibula**

The fibula is the bone located within the lateral aspect of the leg. Its main function is to act as an attachments for muscles.

It has three main articulations

- Proximal tibiofibular joint
- Distal tibiofibular joint
- Ankle joint

**Bony Landmarks** (Fig 3)

**Proximal:**

The fibula had an enlarged head, which contains a facet for articulation with the lateral condyle of tibia.

**Shaft:**

It has three surfaces anterior, lateral and posterior.

**Distal:**

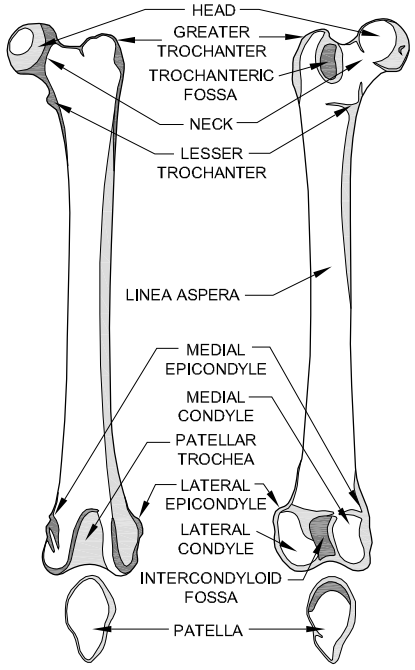
Distally, the lateral surface continues inferiorly and is called the lateral malleolus.

**Side Determination:**

- Its round end celled head is directed upward.

- Flattened end is directed downward.
- A triangular articular facet on its lower end faces medially.

Fig 3



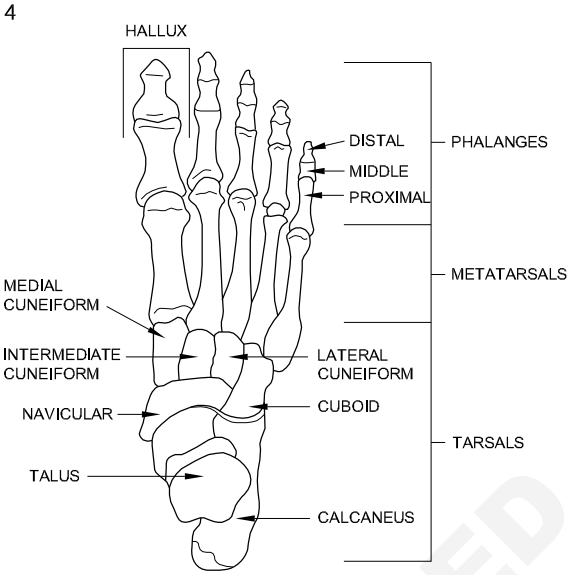

**Bones of Foot** (Fig 4)

It provide mechanical support for the soft tissues, helping the foot withstand the weight of the body in standing & in motion.

They can be divided into three groups

- Tarsals
- Metatarsals
- Phalanges

Fig 4




**Tarsal bones:**

These are organised into three rows, proximal, intermediate and distal.

- Proximal group [Wind foot] - talus and calcaneus
- Intermediate group [Mid foot] - navicular
- Distal group [fore foot] - cuboid, lateral, intermediate and medial cuneiforms

**Metatarsals**

The metatarsals are located in the forefoot between the tarsals and phalanges. They are numbered I - V (medial to lateral)

**Phalanges -** These are the bones of the toes. The second to fifth toes all have proximal, middle and distal phalanges. The greater toe has only 2. Proximal and phalanges.

## Skull

**Objectives:** At the end of this lesson you shall be able to
- **list out the divisions of skull and described the bones of each region**
- **describe the bones and bony landmarks of the skull.**

The skull is the bony structure that supports the face and forms a protective cavity for the brain.

The skull can be divided into two groups, cranium and the face.

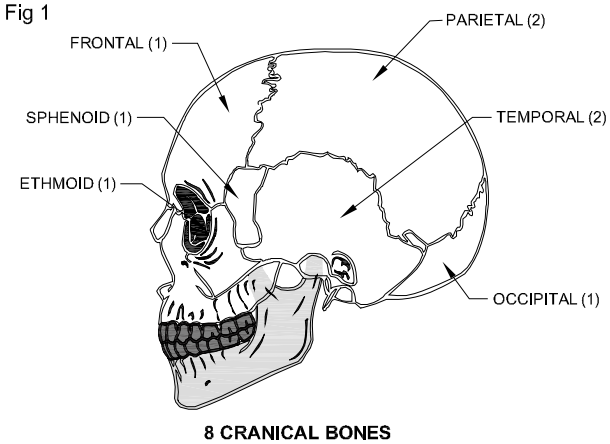
**The Cranium** (Fig 1)

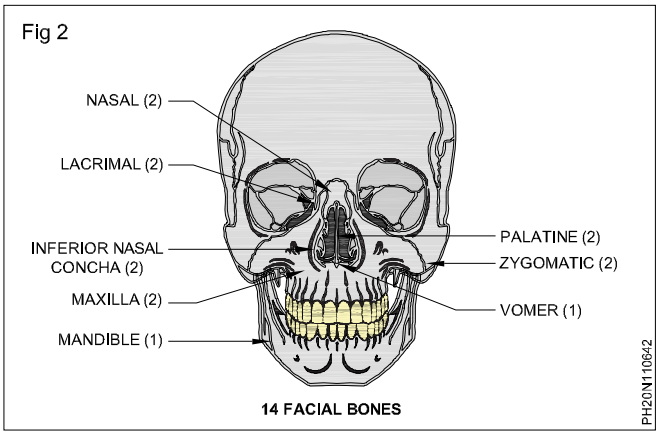
It is formed by the superior aspect of the skull. It encloses and protects the brain, meninges and cerebral vasculature.

It comprised of six bones - the frontal, sphenoid, ethmoid, occipital, parietal and temporal bones.

**The faces:** The facial skeleton supports the soft tissues of the face. (Fig 2)

Fig 1






It consists of 14 individual bones they are;

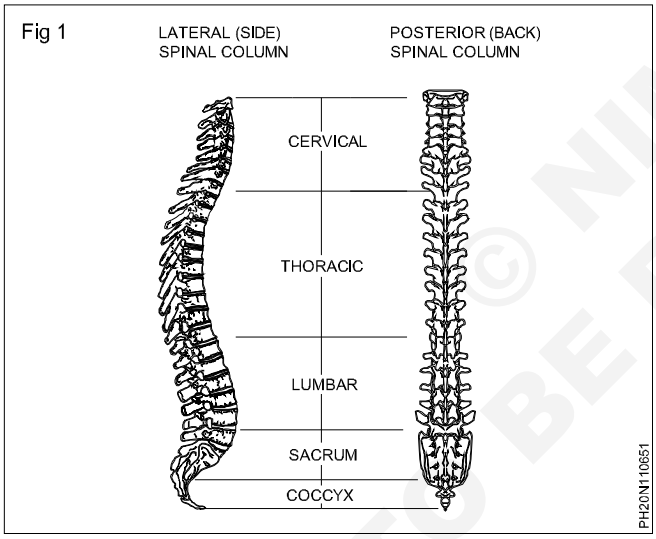
- Zygomatic (2)
- Lacrimal (2)
- Nasal (2)
- Inferior nasal conchae (2)
- Palatine (2)
- Maxilla (2)
- Vomer
- Mandible [Jaw bone]

## Vertebral column

**Objectives:** At the end of this lesson you shall be able to

- **state the divisions of vertebrae and describe the bones of each region**
- **describe the bones and bony landmarks of vertebrae.**

The vertebral column is a series of approximately 33 bones called vertebrae. which are separated by, intervertebral disc. (Fig 1)

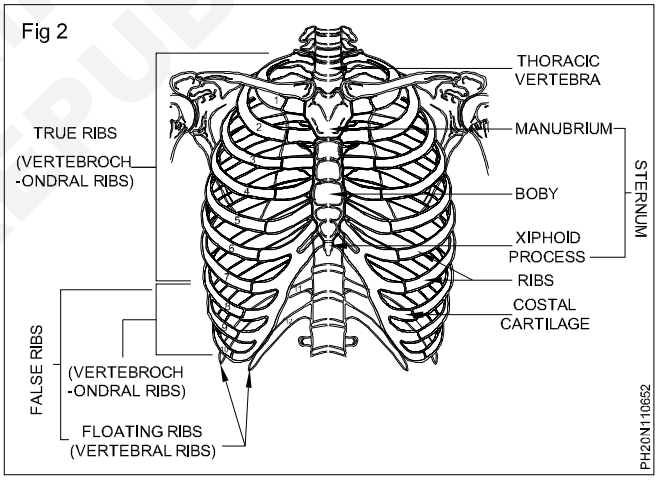



The column can be divided into five different regions.

- Cervical - 7
- Thoracic - 12
- Lumbar - 5
- Sacrum - is a collection of five fused vertebrae
- Coccyx - is a small bone which articulates with the apex of the sacrum.

### Thorax

The thorax is supported by a skeletal framework and contains the principle organs of respiration and circulation. (Fig 2)




### Formation

| | | |
|---|---|---|
| Anteriorly | : | by the sternum |
| Posteriorly | : | by the 12 thoracic vertebrae |
| On each side | : | by 12 ribs |

## X-ray films

**Objectives:** At the end of this lesson you shall be able to
- **define the joints**
- **distinguish between the structural & functional classification of joints**
- **define the terms related to the movements of joints.**

**Definitions:**

Joints are defined as connection between two bones in the skeletal system.

**Classification:**

**Structural classification**

1 Fibrous joints

2 Cartilaginous joints

3 Synovial joints

**Functional classification**

1 Synarthrosis - Immobile joints [suture of skull joint]

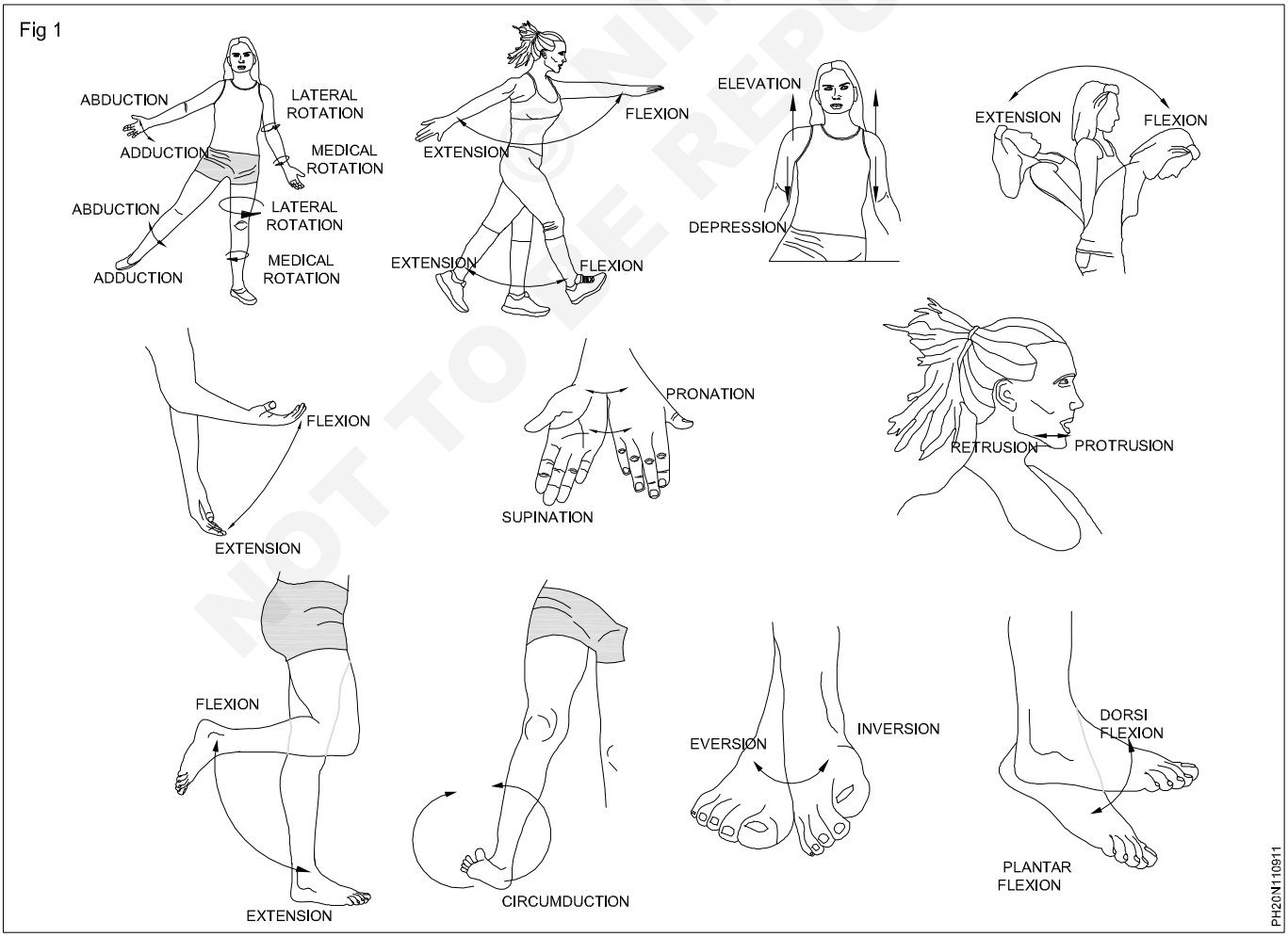
2 Amphiarthrosis - Limited mobility [vertebral column]

3 Diarthrosis - Freely mobile [limbs]

## Terms related to the movements of joints

**Objectives:** At the end of this lesson you shall be able to
- **define the different types of body movements**
- **explain the joints that allow for these movements.**

Fig 1



**Joints of Upper limbs**

| Joint | Movements |
|---|---|
| 1 Shoulder Gridle | 1 Elevation of scapula<br>2 Depression of scapula<br>3 Protraction of scapula<br>4 Retraction of scapula<br>5 Forward & backward rotation of scapula |
| 2 Shoulder Joint | 1 Flexion<br>2 Extension<br>3 Abduction<br>4 Adduction<br>5 Medial & lateral rotation<br>6 Circumduction |
| 3 Elbow Joint | 1 Flexion<br>2 Extension |
| 4 Radio ulnar Joint | 1 Supination<br>2 Pronation |
| 5 Wrist Joint | 1 Flexion<br>2 Extension<br>3 Radial deviation<br>4 Ulnar deviation<br>5 Circumduction |
| 6 Metacarpophalangeal Joint | 1 Flexion<br>2 Extension |
| **Joints of Lower Limb** | |
| 1 Hip Joint | 1 Flexion & Extension<br>2 Abduction & Adduction<br>3 Medial & Lateral rotation |
| 2 Knee Joint | 1 Flexion<br>2 Extension |
| 3 Ankle joint | 1 Dorsi flexion<br>2 Plantar flexion<br>3 Inversion<br>4 Eversion |
| 4 Metatarsophalangeal Joint | 1 Flexion & Extension<br>2 Abduction & Adduction<br>3 Circumdution |

**Movement of spine:**

1 Flexion
2 Extension
3 Lateral flexion
4 Rotation

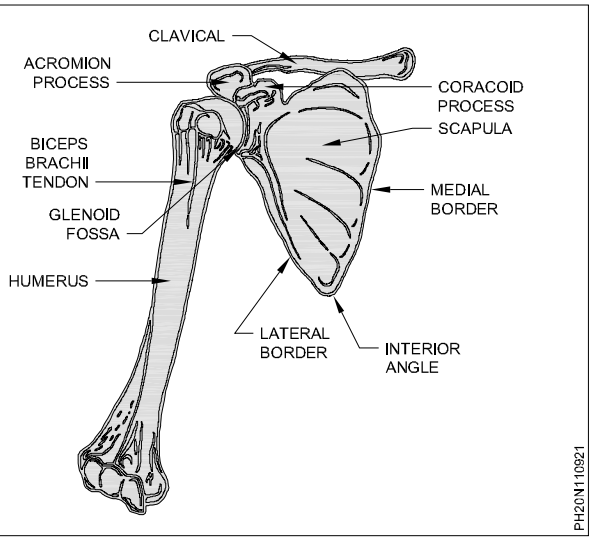
# Description of joints of upper & lower extremities with their ligament

**Objectives:** At the end of this lesson you shall be able to
- **list the name of ligament**
- **describe the joints and their ligaments.**

### Joints of upper extremities

**1 Shoulder Joint:** This is a synovial joint, formed by articulation of scapula & the head of the humerus. (Fig 1)

Fig 1




**Ligament of the joint:**

1 The Capsular ligament

2 The Coracohumeral ligament

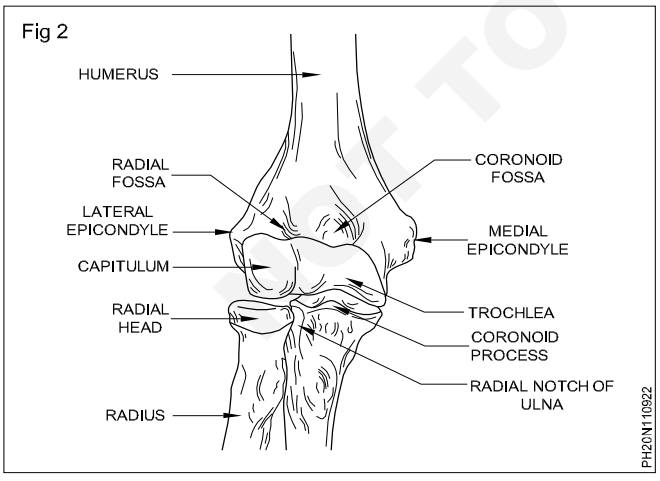
3 The Transverse humeral ligament

4 The glenoid labrum

**2 Elbow Joint:**

This is a synovial joint, formed by the capitulum & trochlea of the humerus, upper surface of the head of the radius articulates with the capitulum. (Fig 2)

Fig 2




**Ligament of the Joint**

1 Capsular ligament

2 Anterior ligament & posterior ligament are thickenings of the capsule.

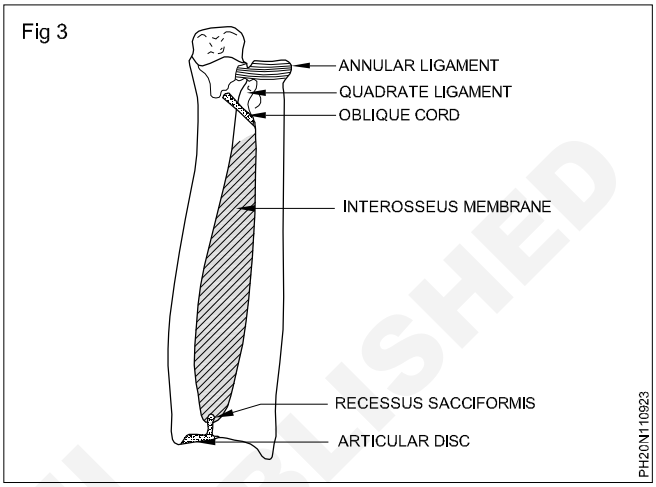
3 The ulnar collateral ligament

4 The radial collateral ligament

**3 Radioulnar Joint**

The radius and the ulna are joined to each other of the superior & inferior radioulnar joints. (Fig 3)

Fig 3




**Ligament of the joint**

1 Annular ligament

2 Quadrate ligament

**4 Wrist Joint:** This is a synovial joint (Fig 4)

**Articular surface**

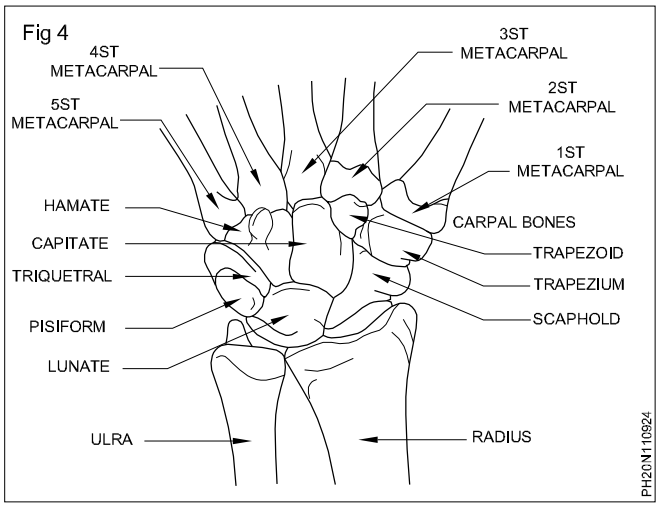
**Upper -** Inferior surface of the lower end of radius & articular disc of the inferior radioulnar joint

**Lower -** 1 Scaphoid

2 Lunate

3 Triquetral bones

Fig 4



**Ligaments of the joint**

1 Palmar radio carpal ligament

2 Palmar ulna carpal ligament

3 Dorsal radio carpal ligament

4 The radial collateral ligament

5 The ulnar collateral ligament

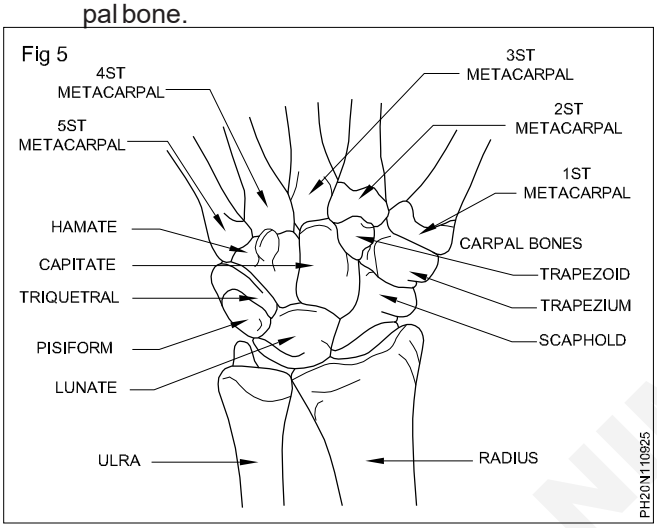
**5 Intercarpal, Carpometacarpal & Intermetacarpal Joints (Fig 5)**

**Articular surfaces**

i Distal surface of the trapezium, and

ii The proximal surface of the base of the 1st metacarpal bone.

Fig 5




**Ligament of the joint**

1 Palmar ligament

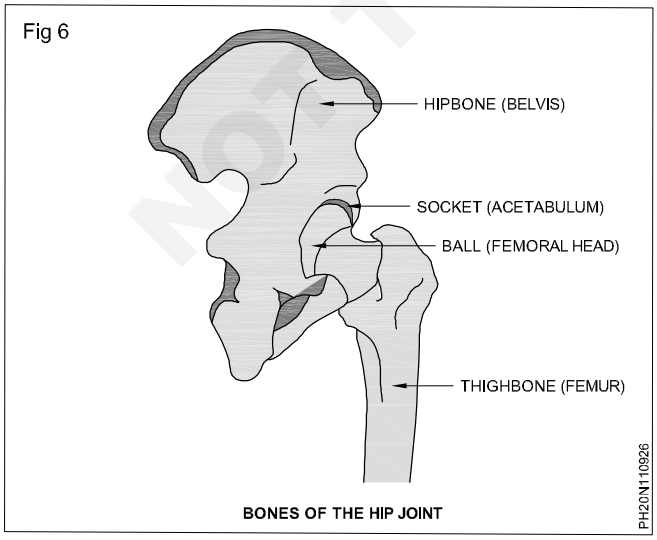
2 Collateral ligament

**Joints of Lower Limb**

**1 Hip Joint** - This is a synovial joint (Fig 6)

**Articular surface :** The head of femur articulates with the acetabulum of the hip bone to form the hip joint.

Fig 6




BONES OF THE HIP JOINT

**Ligament**

i Fibrous capsule

ii Iliofemoral ligament

iii Pubofemoral ligament

iv Ischio-femoral ligament

v Acetabular labrum

vi Transverse acetabular ligament

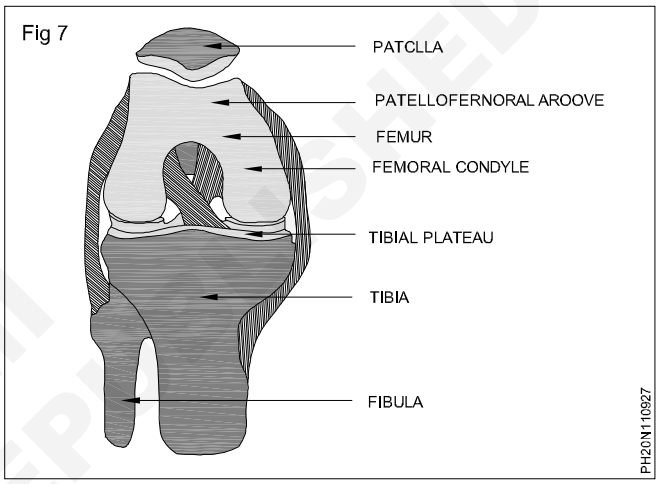
**2 Knee Joint:** This is a synovial joint. (Fig 7)

**Articular surface:** The knee joint is formed by

i Condyles of the femur

ii Condyles of the tibia & the patella

Fig 7




**Ligament**

i Medial collateral ligament

ii Lateral collateral ligament

iii Anterior cruciate ligament

iv Posterior cruciate ligament

**3 Ankle Joint** - This is a synovial joint of hinge variety. (Fig 8)

**Articular surface:**

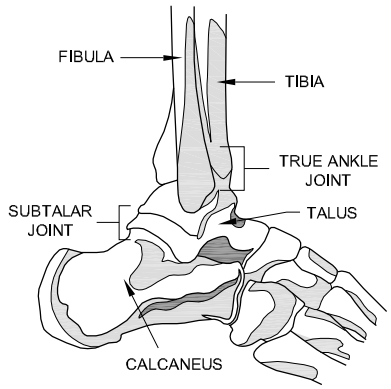
i Lower end of tibia including the medial malleolus

ii Lateral malleolus of the fibula

iii Inferior transverse tibiofibular ligament.

The inferior articular surface is formed by upper, medial and lateral aspects of the talus.

Fig 8




**Ligament**

i Deltoid ligament

ii Three lateral ligament
- anterior talofibular
- posterior talofibular
- calcaneofibular ligament

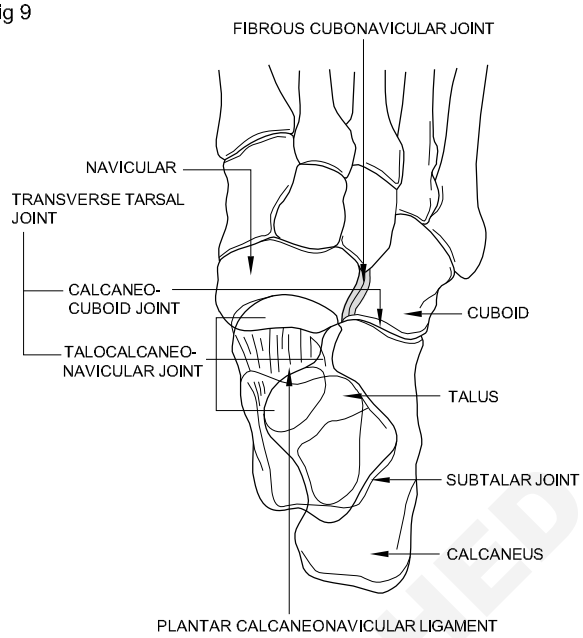
**4 Joints of the foot**

The joints of the foot are numerous. They can be classified as intertarsal, tarsometatarsal, intermetatarsal, metatarsophalangeal & interphalangeal. (Fig 9)

**Ligament**

The main ligaments of the foot are:

Fig 9




1 Plantar fascia

2 Plantar calcaneonavicular ligament

3 Calcaneocuboid ligament

# Differentiates various muscles

**Objectives:** At the end of this lesson you shall be able to
- **describe the structures and classification of muscles**
- **list the parts of the muscles**
- **describe the major muscles with their origin, insertion, nerve supply and action.**

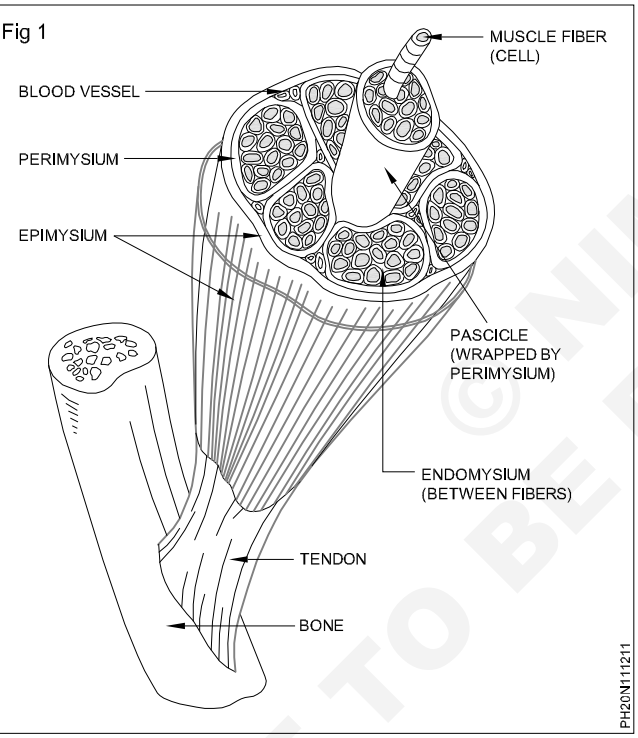
**Myology**

**Definition:** Skeletal muscles are voluntary muscles which are attached to the bones of the skeletal forming the muscles of the limbs, abdomen, head, neck, eyes, diaphragm and tongue.

The number of skeletal muscles in the body is about 640 muscles.

**a Structure of skeletal muscles (Fig 1)**

Fig 1




Each skeletal muscles fiber is a single cylindrical muscles cell. An individual muscle may be made up of a hundreds or even thousands, of muscle fibers. Each muscle is surrounded by a connective tissue sheath called the epimysium.

Fascia, connective tissue outside the epimysium, surrounds and separates the muscles. Each bundles of the muscle fiber is called a fasciculus and is surrounded by a layer of connective tissue called the perimysium, within the fasciculus, each individual muscle cell, called a muscle fiber is surrounded by a connective tissue called the endomysium.

Skeletal muscle cell (fiber), like other body cells, are soft and fragile

Commonly the epimysium, perimysium and endomysium extend beyond the fleshy part of the muscle, the belly to form a thick rope like tendon, or a board, flat sheet- like aponeurosis.

The tendon and aponeurosis form indirect attachment from muscles to the periosteum of bones.

Skeletal muscles have abundant supply of blood vessels and nerves.

**b Classification of muscles**

Classified according to the function of muscle fibers

**Functional groups**

i Prime movers - Provide the major forced for producing a specific movement.

ii Antagonists - Oppose or reverse a particular movement

iii Synergists - Add force to a movement

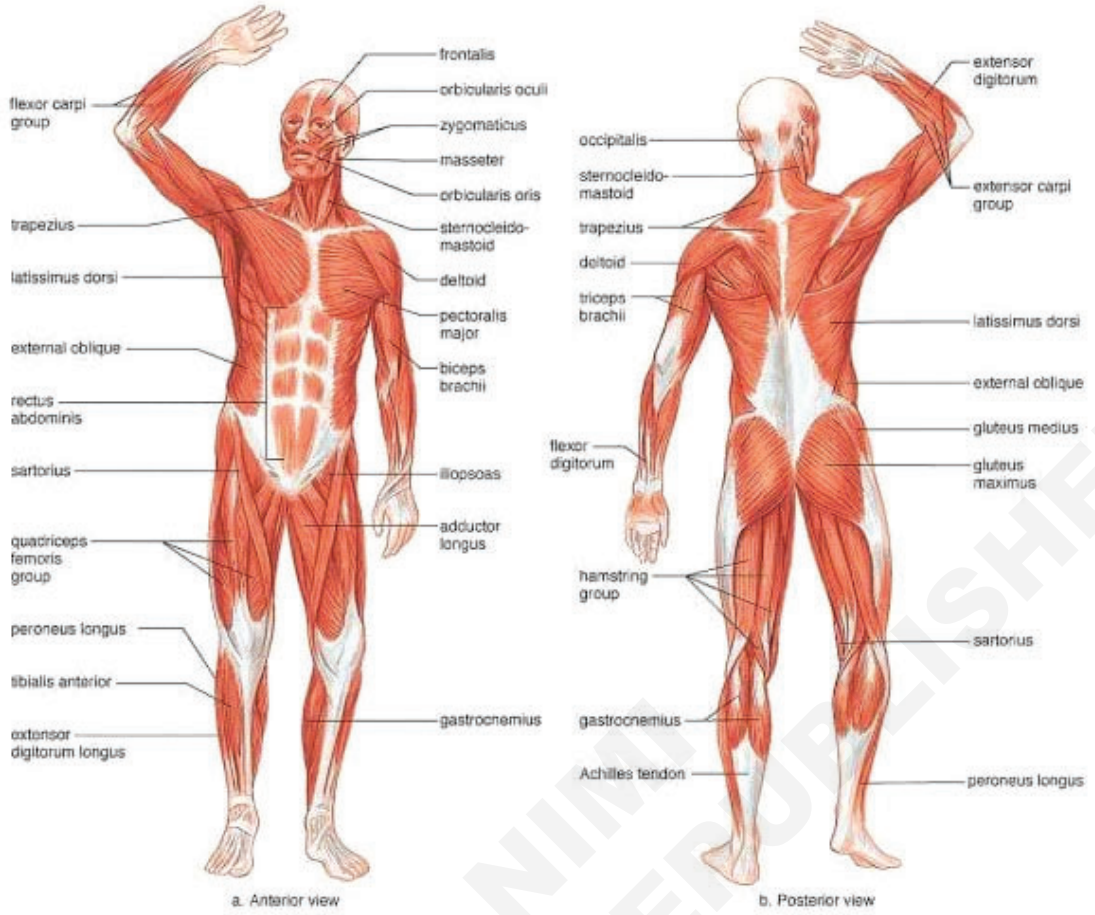
- Reduce undesirable or unnecessary movement.

iv Fixators - Synergists that immobilize a bone or muscles origin

## c Parts of Muscles

A typical skeletal muscle consists of two end and two parts. (Fig 2)

Fig 2




**Ends**

1 Origin is one end of the muscle which remains fixed during its contraction.

2 Insertion is the other end which moves during its contraction.

**Parts**

1 Fleshy part is contractile, and is called the 'belly'

2 Fibrous part is non-contractile and inelastic. When cord-like or rope-like , it is called tendon, when flattened, it is called aponeurosis.

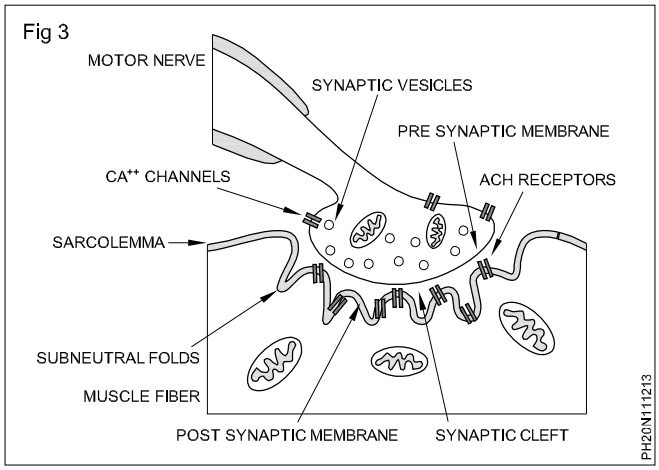
The fleshy part is red in colour, while the flattened part is white in colour.

## d Neuro Muscular junction

The Neuro muscular junction is a micro structure present at the junction of motor neurons and the skeletal muscles fibers. It acts as a bridge connecting the skeletal system and the nervous system. (Fig 3)

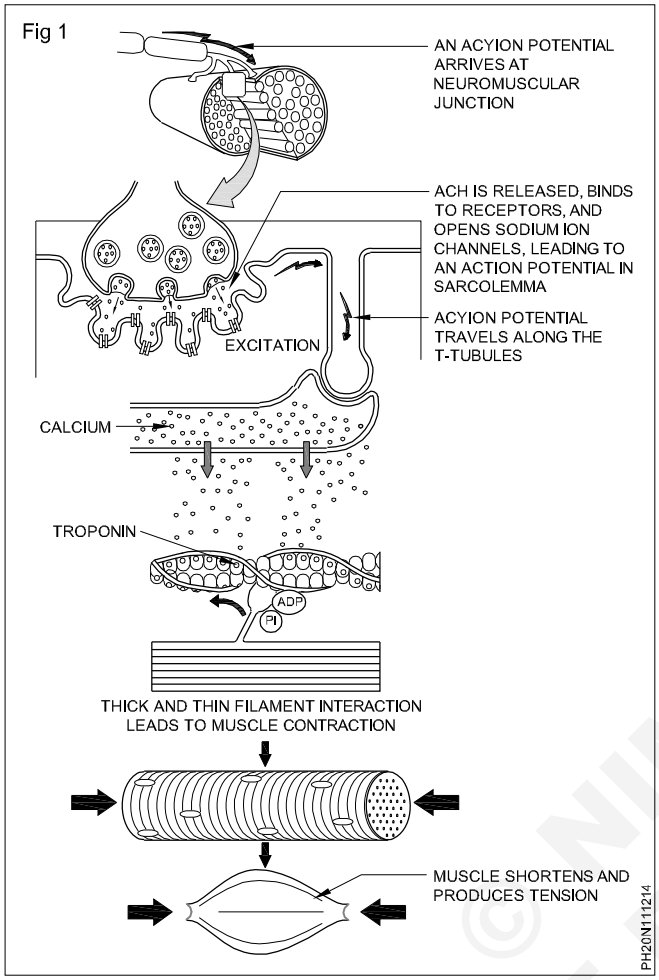
- The neuromuscular junction is a chemical synapse.
- The presynaptic terminal is the axonal terminal of motor neuron containing synaptic vesicles.
- These vesicles are released into the synaptic cleft when a nerve impulse arrives.
- The postjunctional sarcolemma has the synaptic having acetylcholine receptors on their walls.
- The acetylcholine molecules released by the presynaptic terminal bind to these receptors and cause the opening of the cations channels.
- The sodium ions diffuse through these channels, resulting in depolarization of skeletal muscles. This depolarization initiates the process of muscle contraction.
- The acetylcholine is soon metabolized by the acetylcholines- tease, which eliminates all its effects.

Fig 3



**e Sliding contraction theory**

The sliding filament theory explains the process of muscle contraction during which the thin filament slide over the thick filament. (Fig 4)




The muscle contraction can be broken down into four distinct stages, these are;

1 **Muscle Activation:** The motor nerve stimulates on action potential (impulse) to pass down a neuron to the neuromuscular junction. This stimulates the sarcoplasmic reticulum to release calcium into the **muscle cell.**

2 **Muscle Contraction:** Calcium floods into the muscle cell binding with troponin allowing actin and contract using ATP as energy.

3 **Recharging:** ATP is resynthesised allowing acting & myosin to maintain their strong binding state.

4 **Relaxation:** Relaxation occurs when stimulation of the nerve stops. Calcium is then pumped back into the sarcoplasmic reticulum breaking the link between actin & myosin. Actin & myosin return to their unbound state causing the muscle to relax. Alternatively relaxation will occur when ATP is no longer available.

In order for a skeletal muscle contraction to occur,

1 There must be a neural stimulus.

2 There must be calcium in the muscle cells.

3 ATP must be available for energy.

**f Description of major muscles with their origin, insertion, nerve supply and action.**

The major muscle group forming the upper body are the abdominal, pectoral, deltoid, trapezium, latissimus dorsi, erector spinae, biceps & triceps.

The major muscle group of lower body are the quadriceps, hamstrings, gastrocnemius, soleus & glutes.

**Abdominal Muscles**

**1 External oblique:**

Origin - The Muscles arises from the lower eight ribs. The fibers run downwards, forward & medially.

Insertion - Insertion into the xiphoid process, the linea alba, the pubic symphysis, the pubic crest & the pectineal line of the pubic- the lower fibers of the muscle are inserted directly into the anterior two thirds of the outer lip of the iliac crest.

Nerve supply - Lower six thoracic nerves.

Action - Flexion of the trunk.

**Internal oblique muscle**

Origin - a The lateral two thirds of the inguinal ligament.
b The anterior two thirds of the intermediates area of the iliac crest.
c The thoracolumbar fascia

Insertion - Insertion into the lower three or four ribs & their cartilages.
- The greater part insertion into the 7th, 8th & 9th costal cartilages, the xiphoid process, the linea alba, the pubic crest & the pectineal line of the pubis.

Nerve supply - Lower six thoracic nerves and the first lumbar nerve.

Action - Bilaterally to flex the trunk & compress its contents
- Unilaterally flex the trunk & rotate it to the same side

**Transverse abdominis**

Origin - a The lateral one third of the inguinal ligament.
b The anterior two third of the inner lip of the iliac crest.
c The thoracolumbar fascia.
d The inner surfaces of the lower six costal cartilages.

Insertion - Inserted into the xiphoid process, the linea alba, the pubic crest & the pectineal line of the pubis.
- The lower fibers of the muscle fuse with the lower fibers of internal oblique to form the conjoint tendon

Nerve supply - Lower six thoracic nerves and the first lumbar nerve.

Action - Compresses abdomen.

**Rectus abdominus**

Origin - From the pubic crest & pubic symphysis of the pelvis.

Insertion - Costal cartilage of the fifth through seventh rib and xiphoid process

Nerve supply - Lower six or seven thoracic nerve

Action - Flex the lumbar region of the vertebral column increase intra abdominal pressure.

**Erector Spinae**

Origin - Spinous processes of T9 - T12 Thoracic vertebrae, media slope of the distal segment of iliac crest

Insertion - Spinous process of T1 & T2 thoracic vertebrae and the cervical vertebrae.

Nerve supply - Posterior branch of spinal nerve

Action - Extend the book, lateral flexion of the back & maintain correct posture & curvature of the spinal column.

**2 Upper Limb Muscles**

**Pectoralis Major**

Origin - Clavicular head: Medial half of the clavicle
- Sternal head: Sternum, upper costal cartilages (1-6) & the aponeurosis of the external oblique.

Insertion - Lateral lip of the bicipital groove of the humerus
- Crest of the greater tubercle of the humerus

Nerve supply - $C_5$, $C_6$, $C_7$ [Lateral pectoral nerve of the clavicular head]
- $C_8$ & $T_1$ [Medial pectoral nerve of the sternal head]

Action - Clavicular head - flex the arm
- Sternal head - extends the arm
- Both the head working together - Medially rotates the arm
- Abduction of the arm

**Pectoralis Minor**

Origin - 3,4,5 ribs

Insertion - Medial & upper surface of coronoid process of scapula

Nerve supply - Medial pectoral nerve ($C_8$ , $T_1$)

Action - Elevates ribs if scapula is fixed, protracts scapula

**Deltoid**

Origin - The anterior border & upper surface of the lateral third of the clavicle, acromion, spine of the scapula.

Insertion - Deltoid tuberosity of the humerus

Nerve supply - Axillary nerve

Action - Shoulder abduction, flexion & extension

**Trapezius**

Origin - External occipital protuberance, spinous processes of vertebrae $C_7$ - $T_{12}$ , Nuchal ligament, occipital bone, medial one third of superior nuchal line, external occipital protuberance ligament nuchae $T_1$ - $T_{12}$ spine.

Insertion - Nuchal ligament
- Medial superior nuchal line
- Posterior border of the lateral one third of the clavicle
- Acromion process & spine of the scapula

Nerve supply - Accessory nerve (motor)
- Cervical spine nerve $C_3$ & $C_4$

Action - Rotation, retraction, elevation & depression of scapula

**Latissimus dorsi**

Origin - Spinous processes of vertebrae $T_7$ - $L_5$
- Thoracolumbar fascia
- Iliac crest
- Inferior 3 or 4 ribs & inferior angle of scapula

Insertion - Floor of intertubercular groove of the humerus

Nerve supply - Thoracodorsal nerve ($C_6$, $C_7$, $C_8$)

Action - Adducts, extends & internally rotates the arm

**Biceps**

Origin - Short head : Coracoid process of the scapula
- Long head : Supraglenoid tubercle

Insertion - Radial tuberosity & bicipital aponeurosis into deep fascia on medial part of forearm

Nerve supply - Musculocutaneous nerve ($C_5$ - $C_7$)

Action - Flexes elbow

- Flexes & abducts shoulders
- Supinates radio - ulnar joint in the forearm

**Triceps**

Origin - Long head : Infraglenoid tubercle of scapula

- Lateral head : above the radial groove
- Medial head : below the radial groove

Insertion - Olecranon process of ulna

Nerve supply - Radial nerve & Axillary nerve

Action - Extends forearm

- Abducts arm
- Extends arm

**3 Lower Limb Muscles**

**Hamstrings**

Origin - Tuberosity of the ischium

linea aspera

Insertion - Tibia, fibula

Nerve supply - Sciatic nerve

Action - Flexion of knee

- Extension of hip

**Quadriceps**

Origin - Rectus femoris from the iliac spine of hip bone, other quadriceps from the femur

Insertion - Tibial tuberosity

Nerve supply - Femoral nerve

Action - Knee extension, hip flexion

**Soleus**

Origin - Fibula, medial border of tibia

Insertion - Tendo calcaneus

Nerve supply - Tibial nerve

Action - Plantar flexion

**Gastrocnemius**

Origin - Superior to articular surface of lateral condyle of femur & medial condyle of femur

Insertion - Tendo calcaneus into mid posterior calcaneus

Nerve supply - Tibial nerve from the sciatic ($S_1$ - $S_2$)

Action - Plantar flexes foot

Flexes knee

**Gluteal (Maximus, mediums, minimums)**

Origin - Ilium, Sacrum

Insertion - Femur

Nerve supply - Superior & Inferior gluteal nerves ($L_4$, $L_5$,$S_1$ & $S_2$ nerve roots)

Action - Extension, abduction, external rotation & internal rotation of hip joint.

# Recognize basic cell structure and its organelles

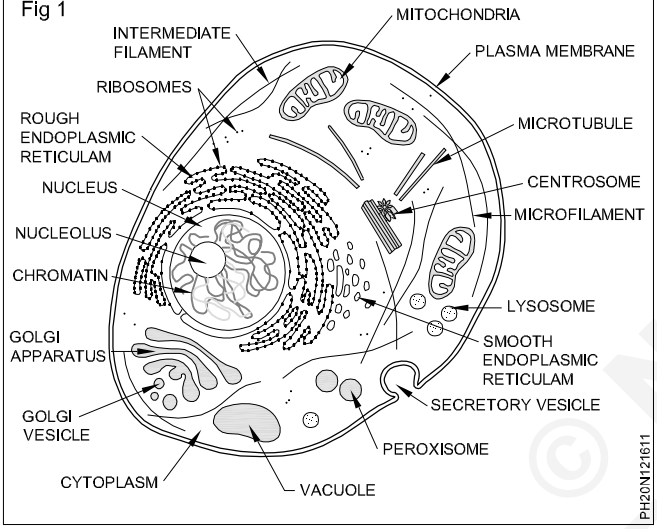
**Objective:** At the end of this lesson you shall be able to
- **define structure & function of cellular organelles.**

### Cell

**Definition:** The cell is the basic structural, functional and biological unit of known organisms. A cell is the smallest unit of life.

**Structure:** The cell structure comprises individual components with specific functions essential to carry our life's processes. These components include - cell wall, cell membrane, cytoplasm, nucleus & cell organelles. (Fig 1)

Fig 1




### Cell membrane

- The cell membrane supports & protect the cell. It controls the movement of substances in & out of the cells. It separates the cell from the external environment. The cell membrane is present in all the cells.
- The cell membrane is the outer covering of a cell within which all the other organelles, such as the cytoplasm & nucleus, are enclosed. It is also referred to as the plasma membrane.
- By structure, it is also porous which permit the movement of selective substances in & out of the cell.
- It forms the wall-like structure between two cells as well as between the cell & its surroundings.

### Cell wall

- The cell wall is the most prominent part of cell structure.
- It is made up of cellulose, hemicellulose & pectin.
- It protects the plasma membrane & other cellular components.
- It is a rigid & stuff structure surrounding the cell membrane.
- It provides shape & support to the cells& protects them from mechanical shocks & injuries.

### Cytoplasm

- The Cytoplasm is a thick, clear jelly like substances present inside the cell membrane.
- The cell organelles such as endoplasmic reticulum, vacuoles, mitochondria, ribosomes are suspended in the cytoplasm.

### Nucleus

- The nucleus contains the hereditary material of the cell, DNA.
- It sends signal to the cell to grow, mature, divide & die.
- The nucleus is surrounded by the nuclear envelope that separates the DNA from the rest of the cell.
- The nucleus protects the DNA and is an internal component of cell structure.

### Function of cell

A cell perform these major function essential for the growth & development of an organism. Important functions are,

- Provides support & structure
- Facilitates growth mitosis
- Allows transport of substances
- Energy production
- Aids in reproduction

### Cell Organelle and its functions

- Nucleolus - The nucleolus is the site of ribosome synthesis. Also, it is involves in controlling cellular activities & cellular reproduction.
- Nuclear membrane - It protects the nucleus by forming a boundary between the nucleus & other cell organelles
- Chromosomes- It plays a crucial role in determining the sex of an individual. Each human cells contain 23 pairs of chromosomes.
- Endoplasmic reticulum - It is involved in the transportation of substances throughout the cell. It plays a primary role in the metabolism of carbohydrates, synthesis of lipids, steroids & proteins.
- Golgi bodies - Golgi bodies are called the cell's post office as it is involved in the transportation of materials within the cell.

- Ribosome - Ribosomes are the protein synthesis of the cell.
- Mitochondria - It is called "the powerhouse of the cells". It is called so because it produces ATP - the cell's energy currency.
- Lysosomes - It protects the cell by engulfing the foreign bodies entering the cell & helps in cell renewal. Therefore, it is known as the cell's suicide bags.
- Vacuoles - It stores food, water & other waste material in the cell.

## Tissue

**Objective:** At the end of this lesson you shall be able to
- **describe about the structure & function of tissues.**

**Definition:** Tissues are group of cells that have a similar structure and act together to perform a specific function.

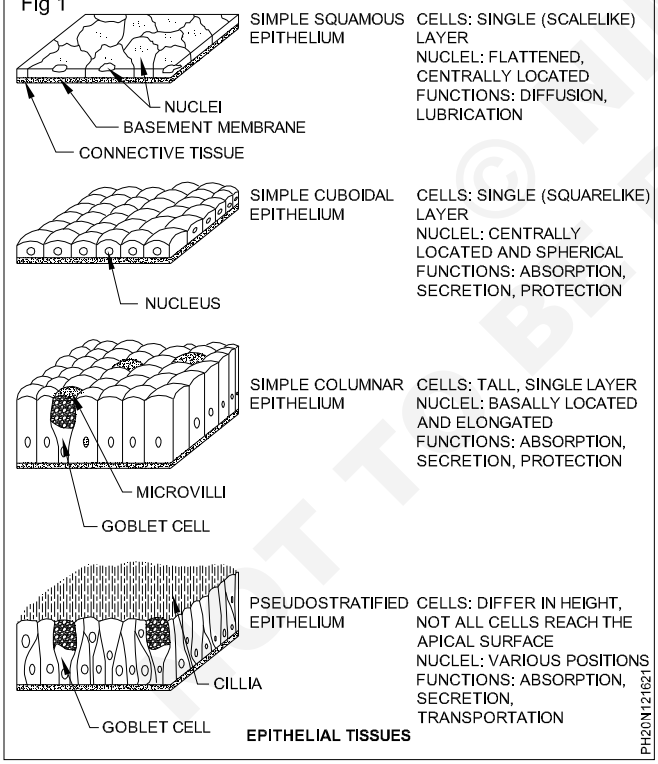
**Structure and Function:**

There are four basic tissue types:

- Epithelial tissue
- Connective tissue
- Nervous tissue
- Muscular tissue

**Epithelial tissue:** It lines the outer surface of organs & bloods vessels throughout the body as well as the inner surface of cavities in many internal organs. (Fig 1)

Fig 1




**Functions:** Functions includes secretion, selective absorption, protection, transcellular transport & sensing.

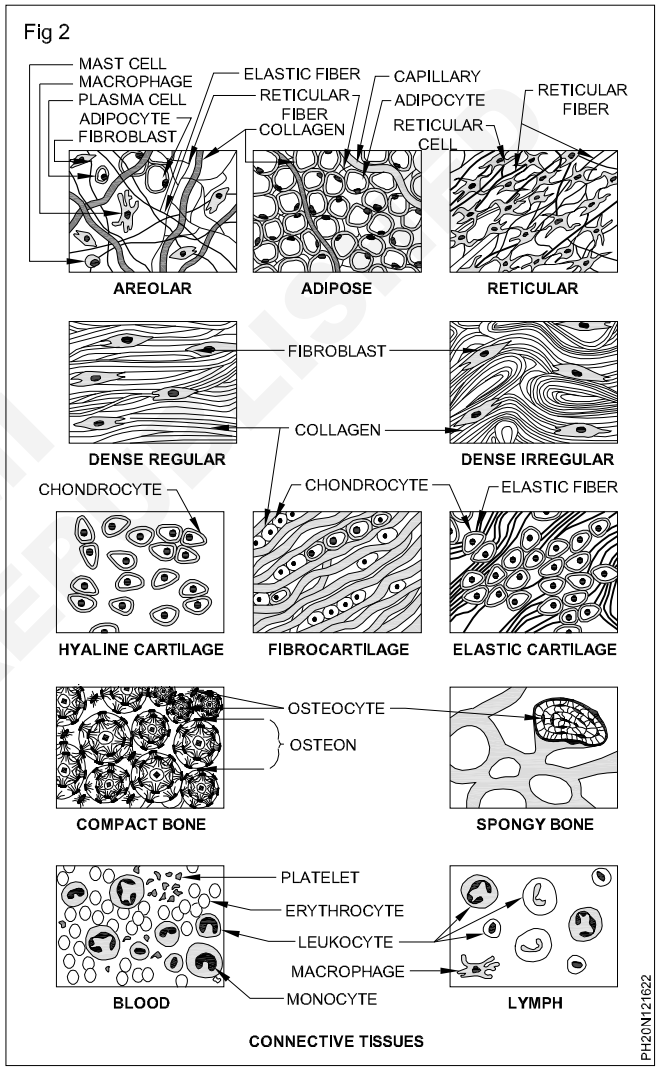
**Connective tissues:**

It is a group of various cells that interlaced together & connect various cells & structure of the body. (Fig 2)

**Functions:**

- Binding structures - Connects tissues to one another - tendons & ligaments

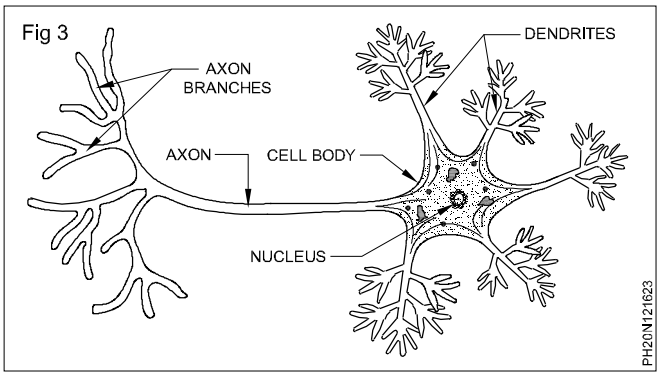
Fig 2




- Provides supports & movements - bones
- Protection - bones, cells of the immune system
- Serve as framework
- Transportation - blood
- Storage - fat
- Insulation - fat

**Nervous tissues:**

It is composed of three main parts nerves, the spinal cord & the brain. (Fig 3)

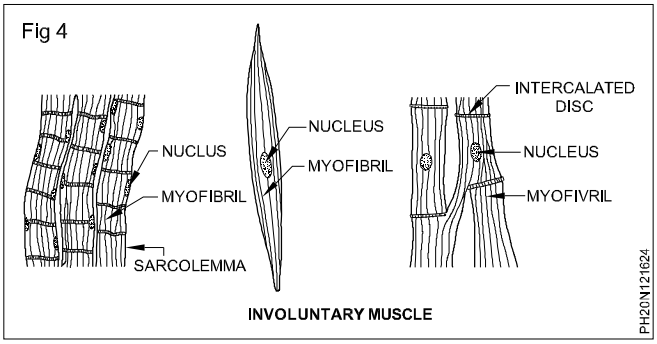



**Functions**

Primary functions is to receive stimuli & send the impulse to the spinal cord & brain. The brain sends back a response to the muscles via the bones.

**Muscular tissues:**

Each type of muscular tissue has a unique structure & specific work. (Fig 4)




**Functions**

- Skeletal muscles - moves bones & other structure
- Cardiac muscles - contracts the hearts to pump blood

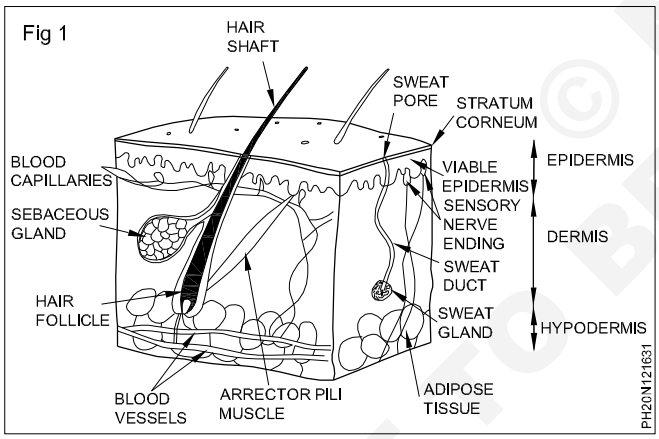
The smooth muscle tissue that forms organs like the stomach, bladder changes shape to facilitate bodily functions.

## Skin and temperature regulations

**Objectives:** At the end of this lesson you shall be able to
- **explain about the structure & function of the skin**
- **define the system of temperature regulation.**

### a Structure of skin

The skin is the largest organ of the body, with a total area of about 20 sq.ft. (Fig 1)




**Skin has three layers:**

- Epidermis - the outermost layer of the skin, provides a waterproof barrier & creates our own skin tone.
- Dermis - beneath the epidermis, contains tough connective tissue, hair follicles & sweat glands.
- The deeper subcutaneous tissue (hypodermis) is made of fat & connective tissue.

The skin colour is created by special cells called melanocytes, which produces the pigment melanin, melanocytes are located in the epidermis.

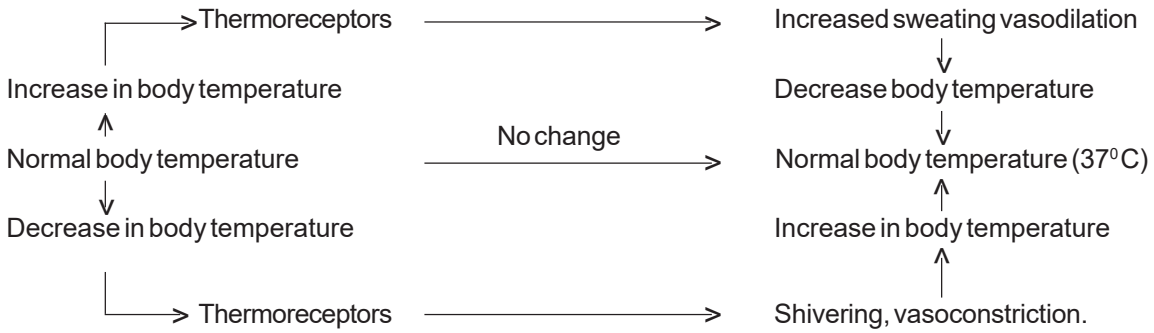
### b Function of skin

The primary function is to act as barrier. The skin provides protection from mechanical impacts & pressure variations in temperature, micro organisms, radiation & chemicals.

- Regulates body temperatures
- Permits the sensations of touch, heat & cold.

### c Temperature regulation system:

Our internal body temperature is regulated by a part of our brain called the hypothalamus. The hypothalamus works with other parts of the body's temperature regulation system such as skin, sweat glands & blood vessels, the vents, condensers & heat ducts of our body's heating & cooling system. Water evaporating from the skin cools the body, keeping its body temperature in a healthy range.



# Neurology

**Objectives:** At the end of this lesson you shall be able to
- **list out the parts of nervous system**
- **define the structure & function of nerves, types of neurological cell**
- **describe the structure & function of brain & spinal cord.**

### a Part of nervous system

The nervous system has two main parts

- The central nervous system is made up of the brain & spinal cord.
- The Peripheral nervous system is made up of nerves that branch off from the spinal cord &extend to all parts of the body.

### b Structure & Functions of Nervous System:

The nervous System is a network of nerves whose main feature is to generate, modulate & transmit information between all the different part of the human body.

The two basic types of cells are present in the nervous system;

- Neurons
- Glial Calls

**Neurons** or nerve cell, are the main structural & functional units of the nervous system. Each neuron Consists of body (soma) & a number of processes (neuritis).

The nerve cell body contains the cellular organelles & is where neural impulses (action potentials) are generated. The processes stem from the body ,they connect neurons with each other & with other body cells, enabling the flow of neural impulses. There are two types of neural processes that differ in structure & function,

- Axons are long &conduct impulses away from the neural body.
- Dendrites are short & act to receive impulses from other neurons, conducting the electrical signal towards the nerve cells body.

Every neuron has a single axon, while the number of dendrites varies.

Based on structure types of neurons,

- Multipolar
- Bipolar
- Pseudo unipolar
- Unipolar

There are two types of neurons, named according to whether they send an electrical signal towards or away from the CNS.

- Efferent neurons- Send neural impulses from the CNS to the peripheral tissues
- Afferent neurons- Conduct impulses from the peripheral tissues to the CNS.

**Glial cells -** It is also called neuroglia or simply glia are smaller non - excitatory cells that act to support neurons.

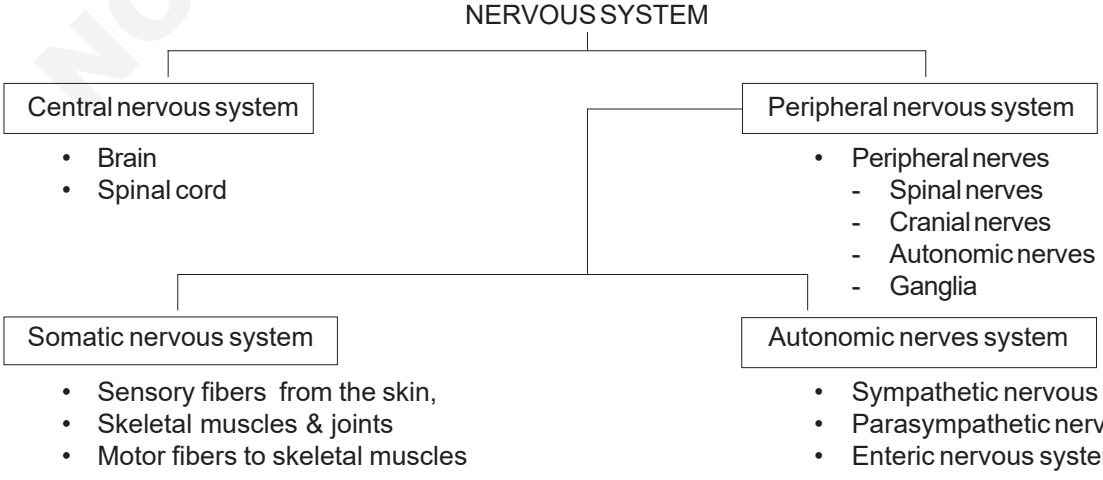
It maintain homeostatic balance, provide structural support, protection & nutrition for neurons through out the nervous system.

This set of function is provided by four different types of glial cells.

- Oligodendrocytes in the CNS
- Schwann Cells in the PNS

**White & Gray matter**

- White matter comprises the outer most layer of the spinal cord & the inner part of brain.
- Gray matter is located in the central part of the spinal cord,& the outer most layer of the brain



**Central nervous system**

It consists of the brain & the spinal cord.

The brain is made up of four parts, Cerebrum, diencephalon, cerebellum & brain stem.

The spinal cord continues time the brain stem, it also has the ability to generate commands but for involuntary processes only (i.e) reflexes, main function is to pass information between the CNS Periphery

**Peripheral nervous system**

It consists of 12 pairs of cranial nerves, 31 pairs of spinal nerves,& a number of small neuronal clusters throughout the body called ganglia.

**Function of nervous system**

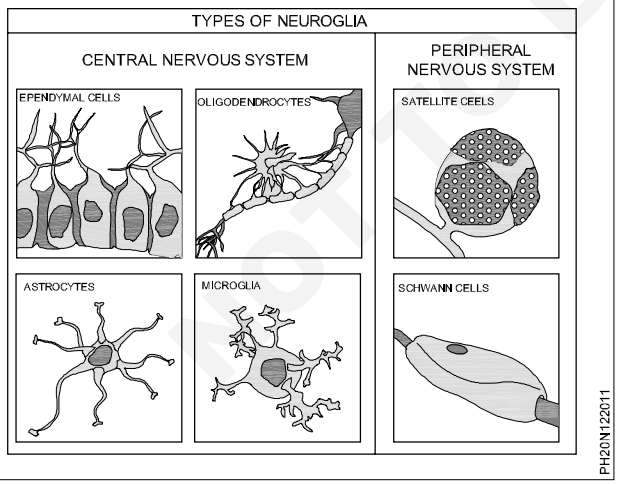
There are three main functions:

- To collect Sensory input from the body & external environment.
- To process & interpret the sensory input.
- To respond appropriately to the sensory input.

**Types of neurological cells: (Fig 1)**

- Neuroglia - There are six types of neuroglia - four in the CNS & two in PNS.
- Astrocytes - are shaped like star & are the most abundant glial cells in the CNS.
- Microglial cells.
- Oligodendrocytes.
- Satellite cells.
- Schwann cells.
- Neurons.

Fig 1




**c Structure & function of brain & spinal cord**

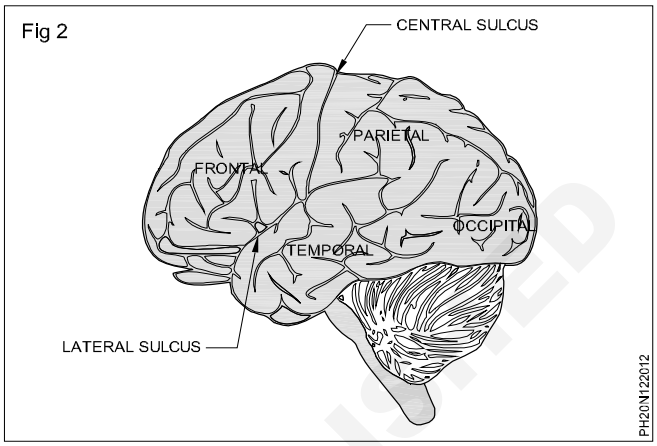
**Brain**

There are for major regions; the cerebrum, the diencephalon, the brain stem & the cerebellum.

**The Cerebrum**

The iconic gray matter of the human brain, is the cerebrum the wrinkled portion is the cerebral cortex. There is a large Separation between the two sides of the cerebrum called the longitudinal fissure. It Separates the cerebrum into two halves, a right & left cerebral hemisphere. Deep within the cerebrum, the white matter of the corpus callosum provides the major pathway for communication between & two hemispheres of cerebral cortex. (Fig 2)

Fig 2




The basal nuclei are responsible for cognitive processing the basal forebrain contains nuclei that are important in leaning & memory. The limbic cortex is the region of the cerebral cortex that is part of the limbic system, a collection of structure involved in emotion, memory & behavior.

**Cerebral Cortex:**

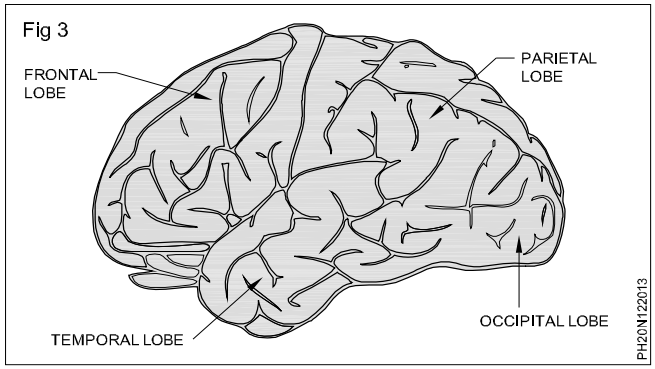
The cerebrum is covered by a continuous layer of gray matter that wraps around either side. Of the forebrain - cerebral cortex.

A gyrus is the ridge of one of those wrinkles, & a sulcus is the groove between two gyri

The cortex can be separated into four major regions, or lobes.

- Temporal lobe
- Frontal lobe
- Occipital lobe
- Parietal lobe

Fig 3




**The Diencephalon**

The diencephalon is the one region that region its name from embryologic development.

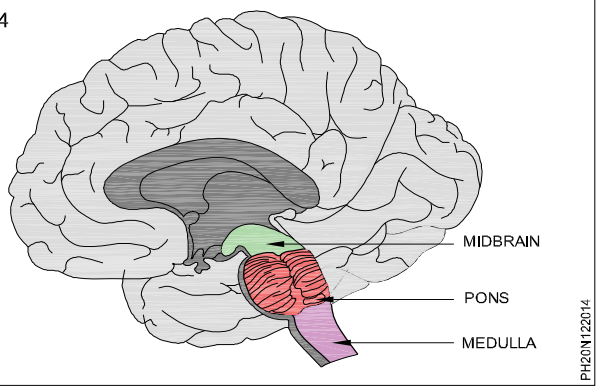
The diencephalon is deep beneath the cerebrum & constitutes the walls of the third ventricle. The two major regions of the diencephalon are the thalamus & the hypothalamus.

There are other structures, such as the epithalamus, Which contain the pineal gland or the subthalamus which includes the subthalamic nucleus that is part of the basal nuclei.

**Brain stem**

The midbrain & the pons & of the hindbrain are collectively known as the "brain stem". (Fig 4)

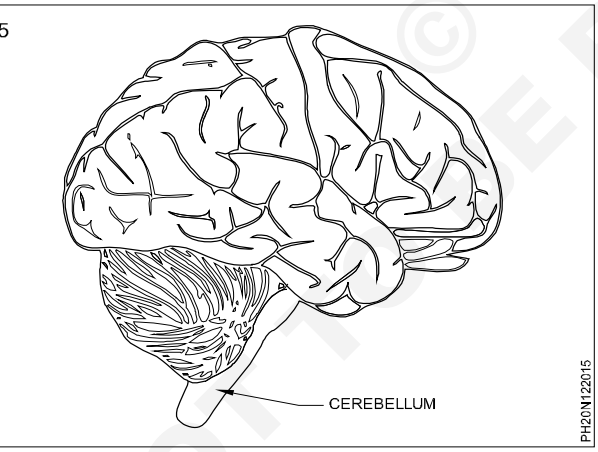
Fig 4




**Cerebellum**

The cerebellum, is the little brain, It little brain, It is covered in gyri sulci like the cerebrum. The cerebellum is largely responsible for comparing in formation from the cerebrum with sensory feedback from the periphery though the spinal cord. (Fig 5)

Fig 5




**Brian parts & their functions:**

Cerebrum - Processes & coordinates sensory messages

Mid brain - Regulates vital function such as heart beat & breathing

Pons - Relays messages from the cerebrum to the cerebellum & spinal cord.

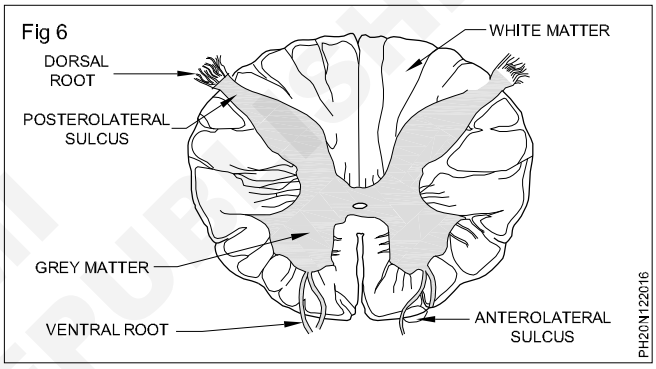
Medulla oblongata - Allow brain to communicate with the rest of the nervous system.

Cerebellum - Helps, coordinates & fine tune movement & balance.

**Structure of spinal cord:**

The Spinal cord is the part of CNS. It is situated inside the vertebral canal of the vertebral column. The spinal cord is a continuation of the brain stem. It extends from the foramen magnum at the base of the skull to the L1/L2 Vertebrae where it terminates as the Conus medullaris. A thin thread called filum terminate extends from the tip of the conus medullaris all the way the 1st coccygeal vertebrae & anchors the spinal cord in place. (Fig 6)

Fig 6




The spinal cord is made up of gray & while matter just like other parts of the CNS. It shows four surfaces, anterior, posterior & two lateral. & they feature fissures (Anterolateral, Posterolateral & posterior).

**Function of Spinal cord:**

- Carrying Signals from the brain: The spinal cord receives signals from the brain that control movement & autonomic functions.
- Carrying information to the brain: The spinal cord nerves also transmit messages to the brain from the body , such as sensations of touch, pressure & pain.
- Reflex responses: The spinal cord also act independently of the brainin conducting motor reflexes.



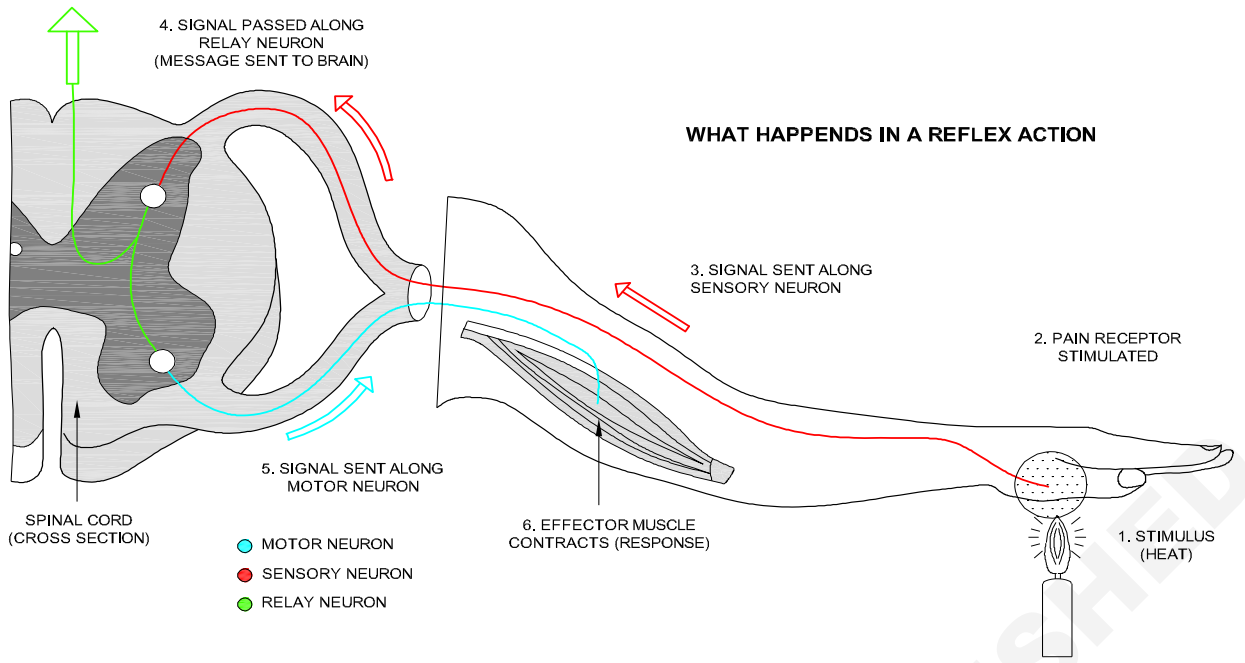
## Reflex are

**Objectives:** At the end of this lesson you shall be able to
- **state reflex are & how it works**
- **explain about the blood - brain barrier.**

**Reflex are**

It is a neural pathway that controls a reflex. In vertebrae, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. This allows for faster reflex actions to occur by activating spinal motor neurons without the delay of routine through the brain. (Fig 1)

Fig 1

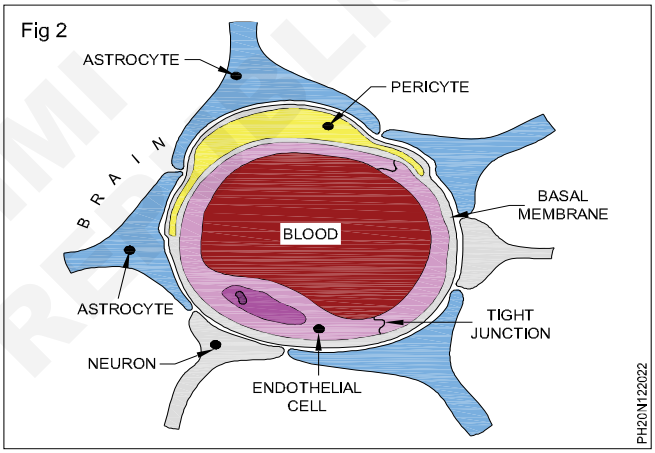



How it works - In a reflex are, an action potential nerve travels to the brain for processing & so results in much quicker reaction. When a stimulus is encountered, the signal from that stimulus will travel up to the sensory neuron to the spinal column. There it will likely pass through a short infer neuron before continuing down a motor neuron to the origin of the signal, then a contraction of muscles is triggered, moving the bone.

### Blood - brain barrier

The blood - brain barrier is a highly selective semi permeable border of endothelial cells that prevents solutes in the circulating blood from n on - selectively crossing into the extracellular fluid of the central nervous system where neurons reside. (Fig 2)

Fig 2




### Functions

1 Protects the brain from foreign substances in the blood that may injure the brain.

2 Protects the brain rom hormone & neuro transmitters in the rest of the body.

3 Maintain a constant environment for the brain.

## Structure of a nerve, cranial nerves & spinal nerves

**Objectives:** At the end of this lesson you shall be able to
- **describe about the structure &names of cranial & spinal nerve**
- **describe the functions of cranial & spinal nerves.**

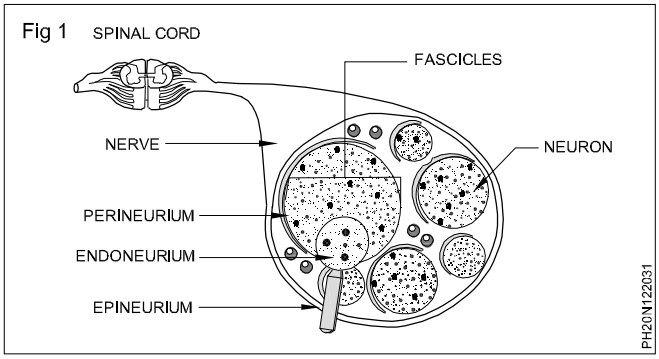
### Structure of a nerve

A nerve is the primary structure of the peripheral nervous system that encloses the axons of peripheral neurons. A nerve provides a structured pathway that supports neuron function.

A nerve consists of many structures including axons, glycocalyx, endoneuria fluid, endoneurium, perineurium & epineurium. (Fig 1)

- Inside the nerves, group of neurons are organized into bundies called fascicles.
- Surrounding & holding together each fascicle is the perineurium.

Fig 1



- Inside the fascicles, neurons & blood vessels are held in place by a loose connective tissue referred to as endoneurium.
- Epineurium, a layer of dense connective tissues, covers & holds together the outer surface of nerves.
- Arteries & veins are located between the fascicles.

**Cranial nerves: There are 12 pairs of cranial nerves**

| Nos. | Name | Function |
|---|---|---|
| I | Olfactory | Smell |
| II | Optic | Sight |
| III | Oculomotor | Moves eye, pupil |
| IV | Trochlear | Move eye |
| V | Trigeminal | Face sensation |
| VI | Abducens | Eye movement |
| VII | Facial | Facial expression, taste, salivation |
| VIII | Vestibulo cochlear | Hearing, balance |
| IX | Glosso Pharyngeal | Taste, Swallow |
| X | Vagus | Heart rate, digestion |
| XI | Accessory | Moves Head |
| XII | Hypoglossal | Moves tongue |

**Spinal nerves**

Spinal nerves are an integral part of the peripheral nervous system .they are structures though which the central nervous system receives sensory information from the periphery, & through which & activity of the trunk & the limbs is regulated. Also they transmit the motor commands from the CNS to the periphery.

They are composed of both motor & sensory fibers, so well as autonomic fibers & exist as 31 pairs of nerves emerging intermittently from the spinal cord to exit the vertebral canal.

**Divisions of spinal nerve pairs**

| | | |
|---|---|---|
| Cervical | - | 8 |
| Thoracic | - | 12 |
| Lumbar | - | 5 |
| Sacral | - | 5 |
| Coccygeal | - | 1 |
| Total | - | 31 |

## Nerve plexus of the body & their distribution

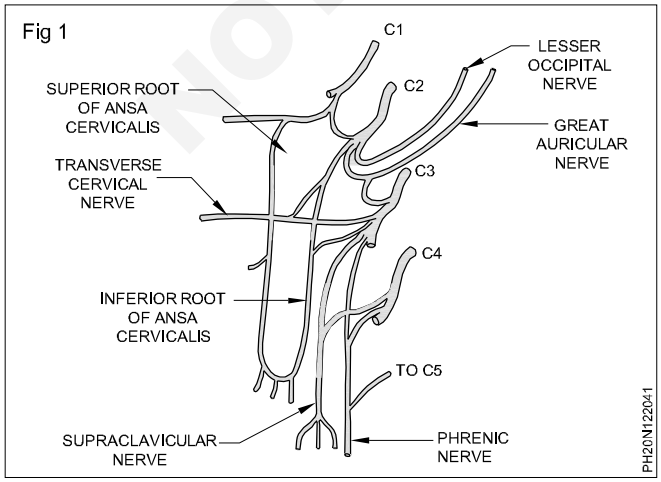
**Objectives:** At the end of this lesson you shall be able to
- **define nerve plexus**
- **types of nerve plexus & their distribution.**

**Nerve plexus**

A nerve plexus is a plexus of intersecting nerves, there are five spinal nerve plexus, cervical plexus, brachial plexus, lumbar plexus, sacral plexus, coccygeal plexus.

**Cervical plexus -** It is a network of nerve fibers that supplies innervation to some of the structures in the neck, halfway up the stemocleidomastoid muscle, & with in the prevertebral layer of cervical fascia. (Fig 1)

Fig 1




**Branches**

**I Cutaneous branches:**

1 Lesser occipital ($C_2$) - Supplies the skin on the medial side of the pinna of the ear & the adjacent scalp.

2 Great auricular ($C_2$,$C_3$) - Supplies the skin over the ear, angle of the mandible & the parotid gland.

3 Transverse cutaneous nerve ($C_2$,$C_3$) -Supplies the skin of the front of the neck.

4 Supra clavicular nerves ($C_3$,$C_4$) - Supply skin over the upper part of the front of chest wall.

**II Muscular branches**

1 $C_1$ Supplies rectus capitis anterior & the langue capelins.

2 Ansa cervicalis ($C_1$,$C_2$,$C_3$) Supplies the sternohyoid, sternothyroid.

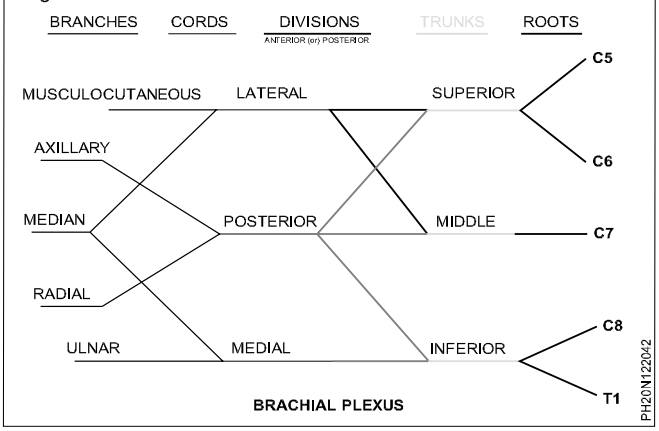
3 $C_2$ Carries Sensory branches from the sternomastoid $C_3$,$C_4$ Carry sensory branches from the trapezius.

4 Phrenic nerve ($C_3$,$C_4$,$C_5$) Motor to the diaphragm.

## Brachial plexus

The brachial plexus is formed by the anterior primary rami of the lower four cervical & greater part of the anterior primary ramus of the first thoracic spinal nerves. (Fig 2)

Fig 2




BRACHIAL PLEXUS

### Branches

**I Branches from the root stage:**

1 Nerves to longus coli & scaleni - from $C_5$,$C_6$,$C_7$ & $C_8$.

2 Nerve to rhomboids - from $C_5$.

3 To phrenic nerve - from $C_5$.

4 Nerve to serratus anterior - from $C_5$,$C_6$ & $C_7$.

**II Branches from the cords:**

A Lateral cord

1 Lateral pectoral nerve $C_5$,$C_6$ & $C_7$.

2 Lateral root of median ($C_5$),$C_6$ & $C_7$.

3 3 Musculocutaneous nerve $C_5$,$C_6$ & $C_7$.

B Medial cord

1 Medial pectoral nerve $C_8$,$T_1$.

2 Medial root of median $C_8$,$T_1$.

3 Medial cutaneous nerve of arm $C_8$,$T_1$.

4 Medial cutaneous nerve of forearm $C_8$,$T_1$.

5 Ulnar nerve ($C_7$),$C_8$ & $T_1$.

C Posterior cord

1 Upper subscapular nerve $C_5$,$C_6$.

2 Nerve to latissimus dorsi $C_6$,$C_7$,$C_8$.

3 Lower subscapular nerve $C_5$,$C_6$.

4 Circumflex nerve (axillary nerve) $C_5$,$C_6$.

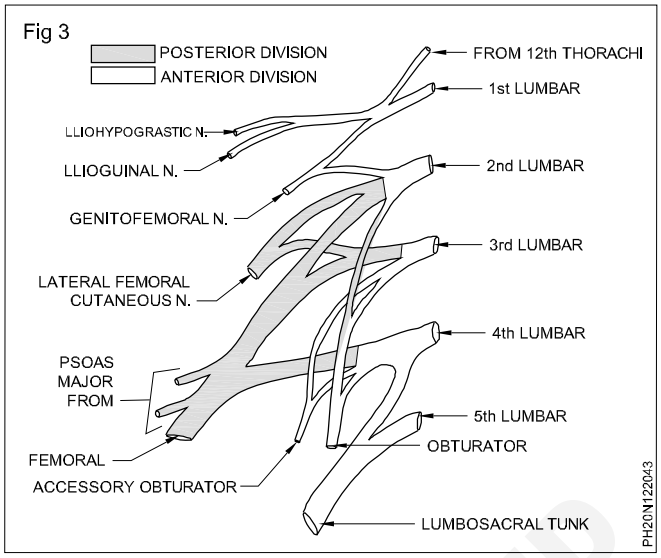
5 Radial nerve $C_5$,$C_6$,C,$C_8$ & $T_1$.

### Lumbar plexus (Fig 3)

The lumbar plexus chiefly supply the lower extremity & is formed by the anterior primary rami of the upper three lumber nerves a major portion of the anterior primary ramous of the fourth lumbar nerve.

**Situation:** It is situated within the substance of the psoas major.

Fig 3




### Branches:

**I Branches of communication:**

1 The while ramus communicans from $L_1$ & $L_2$ roots joins the corresponding sympathetic ganglia.

2 The grey rami communicans from all the lumber ganglia reach the corresponding lumbar nerves.

**II Branches of distribution**

1 Muscular branches from the root stage supplies:

a Psoas minor from $L_1$.

b Psoas major from $L_2$,$L_3$ & $L_4$.

c Illiacus - from $L_2$ & $L_3$.

2 Illiohypogastric

3 Illioinguinal

4 Lateral cutaneous nerve of thigh

5 Femoral nerves

6 Genitofemoral nerve

7 The obturator nerve

8 The accessory obturator nerve.

### Sacral plexus

It is formed by the lumbosacral trunk, the anterior primary rami of $S_1$,$S_2$ & $S_3$ & Part of the anterior primary rams of $S_4$.

### Branches having ventral components of the spinal nerves

1 Nerve to quadratus femoris & gemellus inferior.

2 Nerve to obturator internus & gemellus superior - $L_5$,$S_1$ & $S_2$.

3 Nerve to levator ani, coccygeus & sphincter ani externus, $S_4$.

4 Pudendal nerve - $S_2$, $S_3$ & $S_4$.

5 Pelvic splanchnic nerves - $S_2$,$S_3$ & $S_4$.

**Branches having dorsal components of spinal nerves**

1 Nerve to piriformis - $S_1$ & $S_2$.

2 Superior glutted nerve - $L_4$, $L_5$ & $S_1$.

3 Inferior gluteal nerve - $L_5$, $S_1$ & $S_2$.

4 Perforating cutaneous branches, $S_2$ & $S_3$.

**Branches having both dorsal & ventral components**

1 Posterior cutaneous nerve of thigh - D - $S_1$ & $S_2$, V - $S_2$ & $S_{33}$.

2 Sciatic nerve - D - $L_4$, $L_5$, & $S_1$ & $S_2$ (Common peroneal)
V - $L_4$4, $L_5$, $S_1$, $S_2$, & $S_3$ (Tibial)

## Nerve fibres

**Objectives:** At the end of this exericse you shall be able to
- **define nerve fibers**
- **explain classification of nerve fibers (motor, sensory).**

**Nerve fibers -** An axon or nerve fiber is a long, slender projection of a nerve cell, or nerve, in vertebrates, that typically conducts electrical impulses known as action potentials away from the nerve cell body.

**Categories**

Nerve are categorized into three group based on the direction that signals are conducted.

- Afferent nerve conduct signals from sensory nerve to the CNS.
- Efferent nerve conduct signals from the CNS along motor nerve to their target muscles & glands.
- Mixed nerves contain both afferent & efferent axons & thus conducts both incoming sensory inflation & outgoing muscle commands in the same bundle.

**Sensory & motor neurons (Fig 1)**

Sensory neurons carry signals from the outer parts of your body into the CNS.

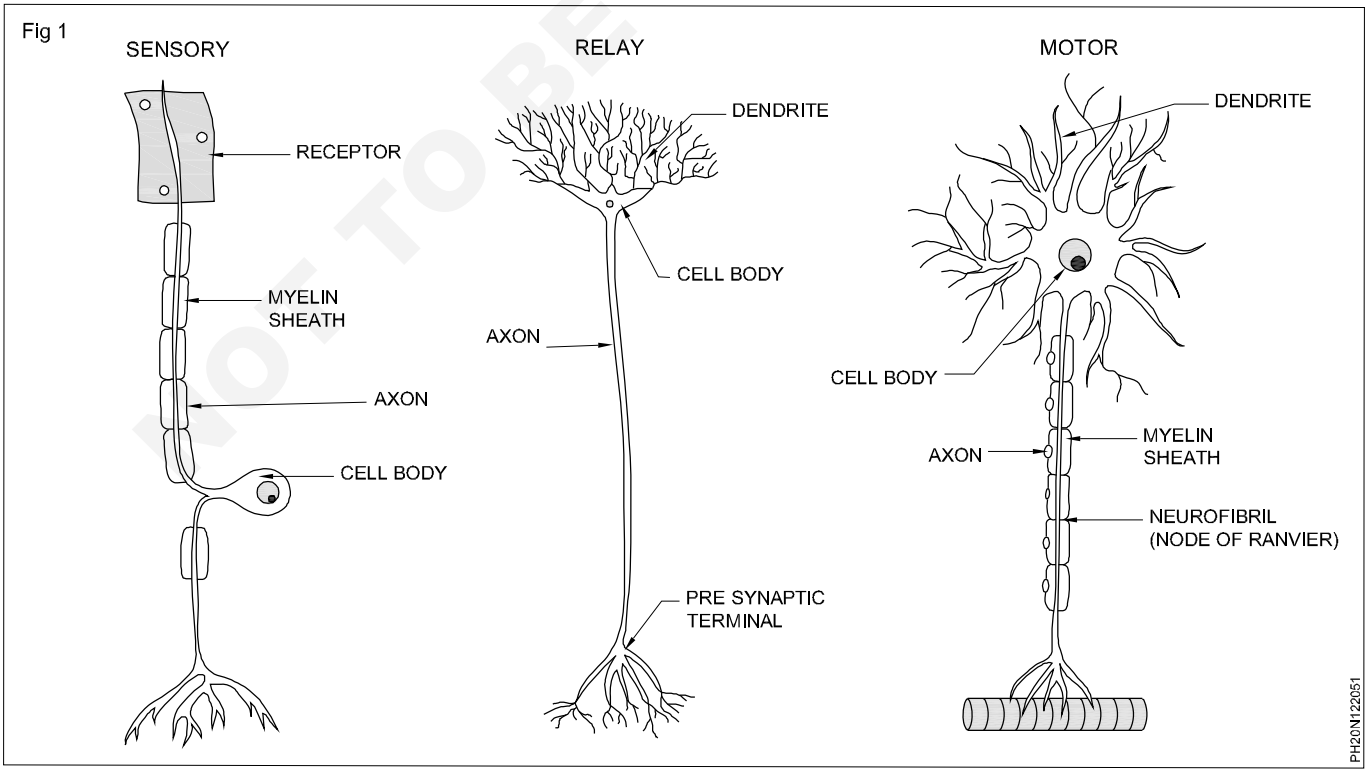
Moto neurons carry signals from the CNS to the outer parts of your body.

Interneurons connect various neurons within the brain & spinal cord.

**Differences in between sensory & motor (structural)**

| | Motor neuron | Sensory neuron |
|---|---|---|
| 1 | Long axon | Short axon |
| 2 | No receptor | Receptor |
| 3 | Cell body terminal & has dendrites | Cell body at the side, no dendrites |
| 4 | Many short dentons | One long denton |

Fig 1

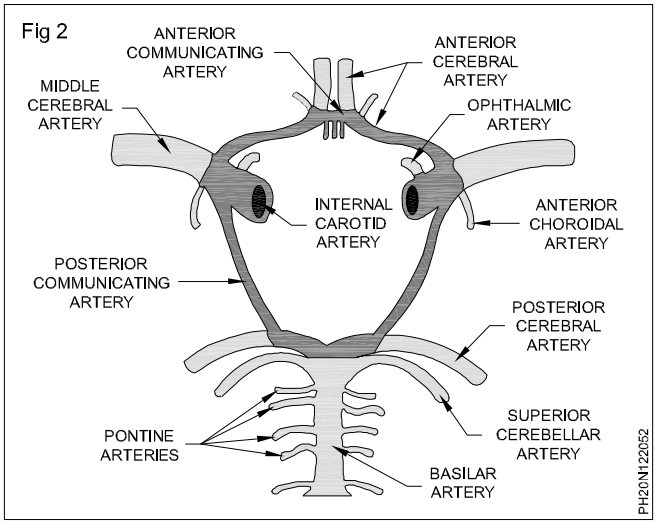


## H Blood supply of brain & spinal cord

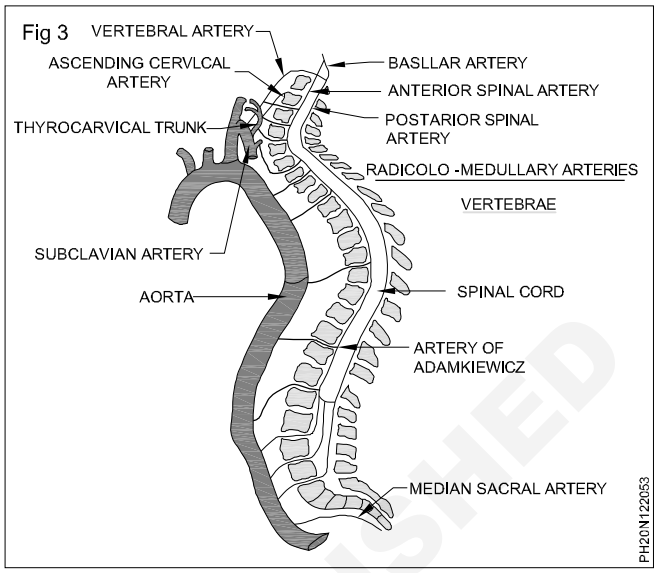
### Brain (Fig 2)

The brain is supplied by the internal carotid artery, two vertebral arteries.

The four arteries lie within subarachnoid space, & their branches anastomose on inferior surface of the brain to from the circle of willis.




**Spinal cord :** The vertebral arteries are the main source of blood to the spinal cord however, the following arteries branch from the vertebral arteries to directly supply the spinal cord itself; one anterior artery, two posterior spinal artery. (Fig 3)



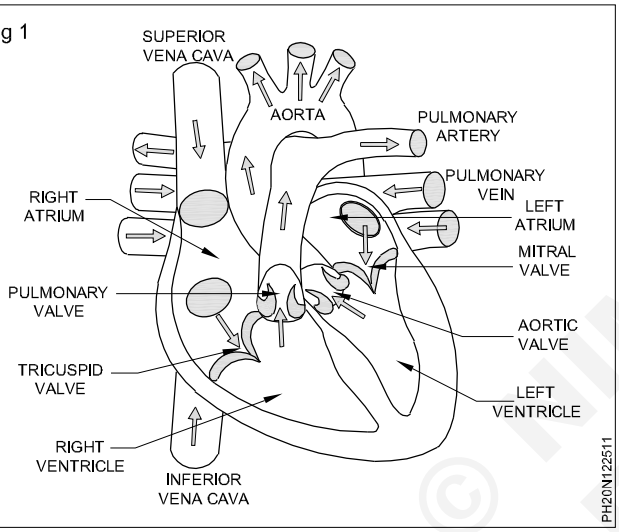
# Heart

**Objectives:** At the end of this lesson you shall be able to
- **describe structure and function of heart**
- **define nodes of heart, heart rates and heart sound.**

## a Structure of heart

The human heart is four - chambered muscular organ, shaped and sized roughly like a man's closed fist with two-thirds of the mass to the left of mid-line. The heart is enclosed in a pericardial sac that is lined with the parietal layers of a serous membrane. The visceral layer of the serous membrane forms the epicardium. (Fig 1)

Fig 1




### Layers of the heart wall

Three layers of tissue from the heart wall.

- Outer layer - epicardium
- Middle layer - myocardium
- Inner layer - endocardium

### Chambers of the heart

The internal cavity of the heart is divided into 4 chambers.

- Right atrium
- Right ventricle
- Left atrium
- Left ventricle

### Valves of the heart

The heart has two types of valves that keep the blood flowing in the correct direction.

The valves between the atria and ventricles are called atrioventricular valves (also called cuspid valves)

- The right atrioventricular valve is the tricuspid valve.
- The left atrioventricular valve is the bicuspid or mitral valve.
- The valve between right ventricle and pulmonary trunk is the pulmonary semilunar valve.
- The valve between left ventricle and the aorta is the aortic semilunar valve.

### Functions of heart

1 The primary function of the heart is to pump blood throughout the body.

2 It supplies oxygen and nutrients to the tissues and removes carbon dioxide and wastes from the blood.

3 It also helps to maintain adequate blood pressure throughout the body.

## b Nodes of heart

The heart has two nodes that are instrumental in cardiac conduction, which is the electrical system that powers the cardiac cycle. These two nodes are the sinoatrial (SA) node and the atrioventricular (AV) node.

The SA (Sinoatrial) node generates an electrical signal that causes the upper heart chambers (atria) to contract. The signal then passes through the AV node to the lower heart chambers (ventricles), causing them to contract or pump.

The SA node is considered the pacemaker of the heart.

### Heart rates:

The normal resting heart rate for adults over the age of layers, is between 60 to 100 beats per minute (bpm). The resting heart rate can vary within this normal range.

### Heart sounds:

In healthy adults, there are two normal heart sounds, often described as a lub and a dub that occur in sequence with each heart beat. These are the first heart sound (S1) and sound (S2) produced by the closing of the atrioventricular valves and semilunar valves, respectively.

# Physiology of heart circulation

**Objectives:** At the end of this lesson you shall be able to
- **state about the pumping of the blood**
- **explain how does the blood flow through the heart.**

The heart is at the centre of your circulatory system, which is a network of blood vessels that delivers blood to every part of your. Blood carries oxygen and other important nutrients that all body organs need to stay healthy & to work properly.

**How does heart pump blood?**

Heart is divided into two separate pumping systems, the right side and the left side.

- The right side of your heart receives oxygen -poor blood from your veins and pumps it to your lungs, where it picks up oxygen and gets rid of carbon dioxide.
- The left side of your heart receives oxygen-rich blood from your lungs and pumps it through your body.

Heart has four separate chambers that pump blood, two on the right side and two on the left.

**How does blood flow through the heart?**

Blood flows through the heart and lungs in four steps:

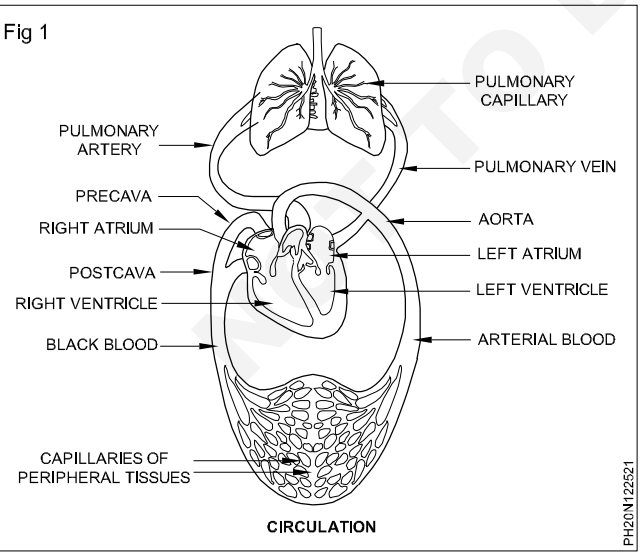
1 The right atrium receives oxygen-poor blood from the body and pumps it to the right ventricle through the tricuspid valve.

2 The right ventricle pumps the oxygen-poor blood to the lungs through the pulmonary valve.

3 The left atrium receives oxygen-rich blood from the lungs and pumps it to the left ventricle through the mitral valve.

4 The left ventricle pumps the oxygen-rich blood through the aortic-valve out to the rest of the body. (Fig 1)

Fig 1




**d Blood pressure and the influencing factors:**

Blood pressure is the force that moves blood through our circulatory system.

It is an important force because oxygen and nutrients would not be pushed around our circulatory system to nourish tissues and organs without blood pressure.

**Influencing factors:**

- Blood pressure increases with
  - Increased cardiac output
  - Peripheral vascular resistance
  - Volume of blood
  - Viscosity of blood and
  - Rigidity of vessel walls
- Blood pressure decreases with
  - Decreased cardiac output
  - Peripheral vascular resistance
  - Volume of blood
  - Viscosity of blood
  - Elasticity of vessel walls

**e Composition and function of blood**

**Composition of blood**

It has four main components

1 Plasma

2 Red blood cells

3 White blood cells

4 Plate lets

**Functions of blood**

- Transports gases, nutrients, waste, cells and hormones throughout the body.
- Transports $O_2$, $CO_2$, nutrients, hormones, heat and wastes.
- Regulates pH, temperature, water content of cells
- Protects against blood loss through clotting
- Protects against disease through phagocytic white blood cells and antibodies.

**f Circulatory system of body**

The circulatory system is a network consisting of blood, blood vessels, and the heart. This network supplies tissues in the body with oxygen and other nutrients, transports hormones and removes unnecessary waste products.

# Food and nutrition

**Objectives:** At the end of this lesson you shall be able to
- **define food & nutrition**
- **explain vitamins & balanced diet.**

**a Definition of Food & Nutrition**

Food and nutrition are the way that we get fuel, providing energy of our body. we need to replace nutrients in our bodies with a new supply every day. Water is an important components of nutrition. Fats, proteins & carbohydrates are all required.

**b Definition:**

**Carbohydrates:**

- Carbohydrates are the sugars, starches & fibers found in fruits, grains, vegetables & milk products.
- It is one of the basic food groups - are important to a healthy diet.

**Protein:**

- Protein is a nutrient by the human body for growth & maintenance. Aside from water, proteins are the most abundant kind of molecules in the body. protein can be found in all cells of the body & is the major structural components of the cells in the body. esp. muscles.

  Examples: soya bean, cheese, pumpkin seed.

**Fats:**

- The body uses fat as a fuel source & fat is the major storage from the energy in the body. Fat also has the many other important functions in the body and a moderate amount is needed in the diet for good health.

  Examples: butter, oil, nuts, meat, fish and some diary products.

**Minerals:**

- Minerals are those elements on the earth and in foods that our bodies need to develop and function normally. Those essential for health includes calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, iodine, chromium, copper, fluoride, molybdenum, manganese and selenium.

  Examples: meat, cereals, fish, fruits & vegetables, nuts, milk and diary products.

**Vitamins:**

- Vitamins are group of substances that are needed for normal cell function, growth & development.

There are 13 vitamins your body needs. They are

- Vitamin A
- Vitamin B (thiamine, riboflavin, niacin, pantothenic acid, biotin, vitamin B-6, vitamin B-12, & folate)
- Vitamin C
- Vitamin D
- Vitamin E
- Vitamin K

Examples: Soymilk, cheese, whole grains, chicken, egg, meat, citrus fruits, potatoes, tomatoes, fish, carrots, vegetable oils.

**Water:**

Body water is an important measure when it comes to a healthy body. The human body needs water to function the right way. The human body should consist of atleast 50% of water.

It helps to regulate the internal body temperature, strengthens your muscles and moistures your skin.

A human body can lose body water through skin, via sweat, urine and by breathing. If the balance is right, you will feel at your best!

### C Balanced diet

Daily calorie needs on age, gender and activity level.

| Age (years) | Gender | Sedentary (Non - Active) | Moderately Active | Active |
|---|---|---|---|---|
| 2-3 | Male or Female | 1000 | 1000 | 1000 |
| 4-8 | Male | 1200 - 1400 | 1400 - 1600 | 1400 - 2000 |
| | Female | 1200 - 1400 | 1400 - 1600 | 1400 - 1800 |
| 9-13 | Male | 1600 - 2000 | 1800 - 2200 | 2000 - 2600 |
| | Female | 1400 - 1600 | 1600 - 2000 | 1800 - 2200 |
| 14-18 | Male | 2000 - 2400 | 2400 - 2800 | 2800 - 3200 |
| | Female | 1800 | 2000 | 2400 |
| 19-30 | Male | 2400 - 2600 | 2600 - 2800 | 3000 |
| | Female | 1800 - 2000 | 2000 - 2200 | 2400 |
| 31-50 | Male | 2200 - 2400 | 2400 - 2600 | 2800 - 3000 |
| | Female | 1800 | 2000 | 2200 |
| 51 & Older | Male | 2000 - 2200 | 2200 - 2400 | 2400 - 2800 |
| | Female | 1600 | 1800 | 2000, 2200 |

## Digestive system

**Objectives:** At the end of this lesson you shall be able to
- **state the structure & functions of digestive organs**
- **describe about absorption & metabolism.**

### a Structures of digestive organs: (Fig 1)

The digestive system includes the organs of the alimentary canal & accessary structures.

- The organs of alimentary canal are the mouth, pharynx, esophagus, stomach, small intestine & large intestine.
- The accessary digestive structures include the teeth, tongue, salivary glands, liver, pancreas and gall bladder.

The process of digestion is a fascinating & complex one that takes the food we place in our mouth & turns it into energy and waste products. This process takes place in the gastro intestinal tract, a long, connected, tubular, structure that starts with the mouth & ends with the anus. The food is propelled forward within the system, altered by enzymes and hormones into usable particles & absorbed along the way. Other organs that support the digestive process are the liver, gall bladder & pancreas. The time it takes for food to travel from entering the mouth to be excreted as waste is around 30 to 40 hours.

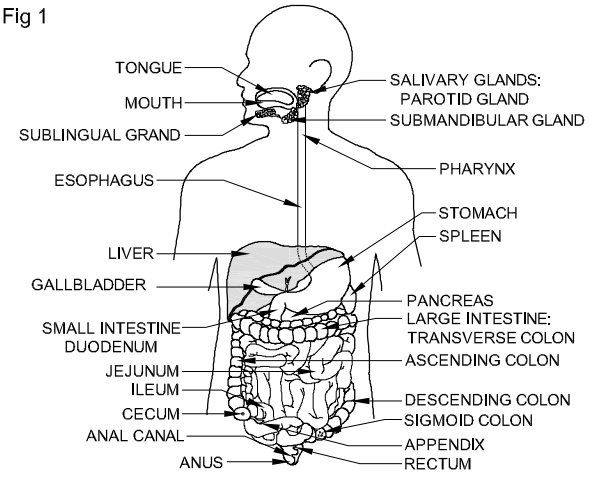
### b Absorption and Metabolism

**Absorption:** When digestion is finished, it results in many simple nutrient molecules that must go through the process of absorption from the GI tract by blood or lymph so they can be used by cells throughout the body. A few substance are absorbed in the stomach & large intestine. About 95% of molecules are absorbed in the second part of the small intestine, called the jejunum. There are few exceptions, that some are absorbed in the last part of the small intestine, called the ileum. After being absorbed in the small intestine, nutrient molecules are transported to other parts of the body for storage or further chemical modification.

**Metabolism:** Converting food into energy

Metabolism is the process by which your body converts what you eat & drink into energy. During this complex biochemical process, calories in food & beverages are combined with oxygen to release the energy your body needs to function.

Fig 1



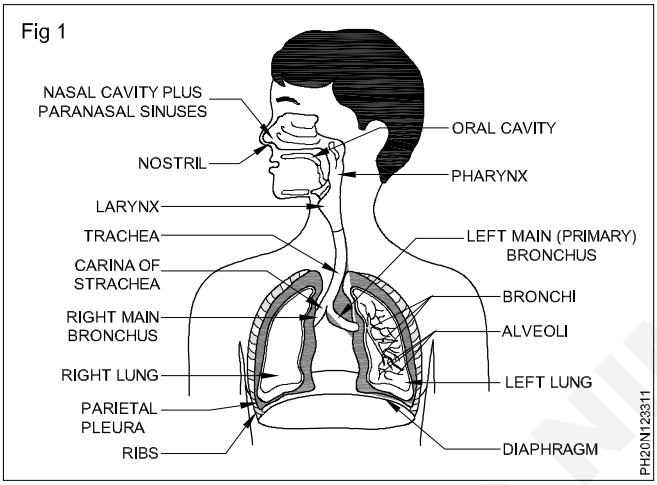
# Respiratory system

**Objectives:** At the end of this lesson you shall be able to
- **describe the structure & function of respiratory system**
- **describe the process of respiration & artificial respiration.**

**Structure of respiratory system:**

The respiratory system consists of all the organs involved in breathing. These include the nose, pharynx, larynx, trachea, bronchi & lungs. The nose, pharynx, larynx, trachea & bronchi all work like a system of pipes through which the air is funneled down into our lungs. (Fig 1)

Fig 1




**Functions of Respiratory system:**

- Inhalation & Exhalation are pulmonary ventilation-that's breathing.
- External respiration exchanges gases between the lungs & the blood stream.
- Internal respiration exchanges gases between the blood stream & body tissues.
- Air breathing the vocal cords creates sound.
- Olfaction or smelling, is a chemical sensation.

**Process of Respiration:**

Respiration - The process of releasing energy by the oxidation of food is known as Respiration. The Process of Respiration involves intake of oxygenated air into the cells for breaking the food & releasing energy.

**Mechanism of Respiration:**

i Air is drawn into the body through the nostrils.

ii The Air from the Nasal cavity passes to the pharynx, which leads to the trachea, through a slit called Glottis.

iii The Trachea runs down the neck & divides into two bronchi, which lead into the lungs & further divided into smaller bronchioles. The smallest bronchioles terminate into alveoli.

iv The Walls of the alveoli are thin & covered by blood capillaries to facilitate the exchanges of gases in the lungs.

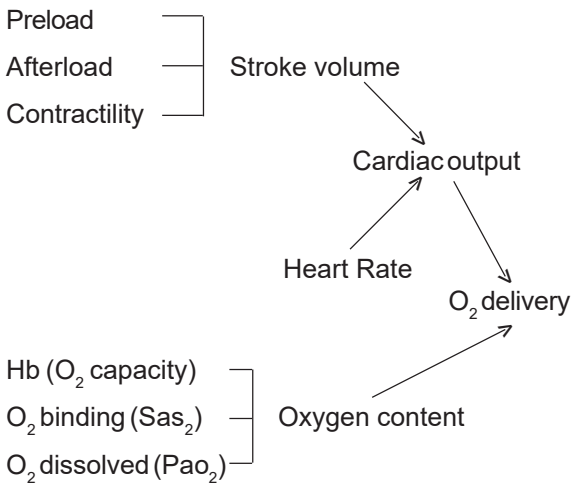
v In the Alveoli, the exchange of gases takes place, $CO_2$ from the blood is replaced with $O_2$ & $CO_2$ is removed out of the body.

vi In Humans, for the process of Respiration, air is drawn into the lungs by the process of breathing.

When an individual inhales, the diaphragm moves down & the chest cavity expands and the oxygen rich air is drawn into the lungs. When the individual exhales, the diaphragm relaxes & the chest cavity moves back to its relaxed position & the $CO_2$ rich air is expelled out of the body.

**Cardio respiratory relation:**

The overall goal of cardio respiratory system is to provide the organs & tissues of the body with an adequate supply of oxygen in relation to oxygen consumption ($O_2$). Most of these conditions can be managed by increasing the arterial oxygen content & or cardiac output.



**Artificial Breathing:**

Artificial breathing is forcing of air into the lungs of someone who has stopped breathing, usually by blowing through their mouth or nose, in order to keep them alive & to help to start breathing again.

**Types of Artificial breathing:**

- Cardio pulmonary resuscitation (CPR)
- Respiratory Therapy
- Breathing
- Prone - pressure method
- Mouth - to - mouth breathing

**e Neurological control**

The Medulla & The Pons are involved in the regulation of the ventilatory pattern of respiration.

- **Respiratory control centres:** The Medulla which sends signals to the muscles involved in breathing & the pons which controls the rate of breathing.
- **Chemoreceptors:** These are receptors in the medulla & in the aortic & carotid bodies of the blood vessels that detect changes in the blood PH & signals the medulla to correct those changes.

**f Volumes & Capacity values of Respiration:**

Average lung volumes in healthy adults

| Volume | Value (litres) | |
|---|---|---|
| | Men | Women |
| Inspiratory reserve volume (IRV) | 3.5 | 1.9 |
| Tidal volume (TV) | 0.5 | 0.5 |
| Expiratory Reserve Volume (ERV) | 1.1 | 0.7 |
| Residual Volume (RV) | 1.2 | 1.1 |

Lung Capacities in Healthy Adult

| Volume | Average value (litres) | | Derivations |
|---|---|---|---|
| | Men | Women | |
| Vital Capacity | 4.8 | 3.1 | IRV+TV+ERV |
| Inspiratory Capacity | 3.8 | 2.4 | IRV+TV |
| Functional Residual pacity | 2.4 | 1.8 | ERV+RV c a - |
| Total lung Capacity | 6.0 | 4.2 | IRV+TV+ERV+RV |

## Endocrinology

**Objectives:** At the end of this lesson you shall be able to
- **state the definition & function of hormones**
- **state about the hormone secreting glands.**

**Definition of Hormones:**

Hormones are chemical messengers secretes from special cells of Endocrine Glands & maintain the physiological activities very specifically on target cells through circulation & disintegrated after action.

**Characteristics of Hormones:**

- Are molecules that are produced by special cells.
- Are secreted directly to blood (with no ducts).
- Are available in very low concentrations in blood.
- Are transported in blood to work in distant sites.
- Have systematic actions.
- Have specific receptors in target tissues.
- Have different special mechanisms of action.

**Functions of Hormones:**

The Main function of Endocrine glands is to secrete hormones directly into the blood stream. Hormones are chemical substances that affect the activity of another part of the body. In essence, hormones serve as messengers, controlling & coordinating activities, throughout the body.

**Hormone secreting glands:**

| S.NO | GLANDS | HORMONES | FUNCTIONS |
|---|---|---|---|
| 1 | Pituitary | Growth Hormone | 1) Regulates growth<br>2) Controls the functioning of endocrine glands |
| 2 | Thyroid | Thyroxine | 1) Controls the metabolism rate<br>2) It also brings about balanced growth |
| 3 | Parathyroid | Parathormone | 1) Controls Calcium balance for the body |
| 4 | Adrenal | Adrenal | 1) Prepares body for emergency |
| 5 | Testes | Testosterone | 1) Controls growth & development of male Reproductive system |
| 6 | Ovaries | Oestrogen & Progesterone | 1) Controls growth & development of female Reproductive system |

# Excretory system

**Objectives:** At the end of this lesson you shall be able to

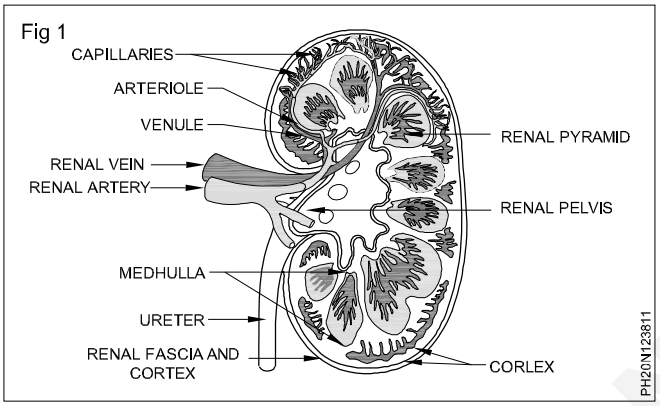
- **describe the structure & function of kidney**
- **explain about the organs of excretory system**
- **describe the structure of nephron & formation of urine.**

### a Structure of kidney:

The kidneys are a pair of bean-shaped structures that are located just below & posterior to the liver in the peritoneal cavity.

Externally, the kidneys are surrounded by three layers, (Fig 1)

Fig 1




The outermost layer is the renal fascia. The second layer is called the perineal fat capsule. The third & innermost layer is called the renal capsule.

Internally the kidney has three regions - an outer cortex, a medulla in the middle and the renal pelvis in the region called the hilum of the body.

The medulla consists of multiple pyramidal tissue masses, called the renal pyramids. The renal pelvis leads to the ureter on the outside of the kidney, the renal pelvis branches out into two or three extensions called the major calyces. The ureters are urine-bearing tubes that exists the kidney and empty into the urinary bladder.

**Functions of Kidney**

The kidneys perform many crucial functions, including:

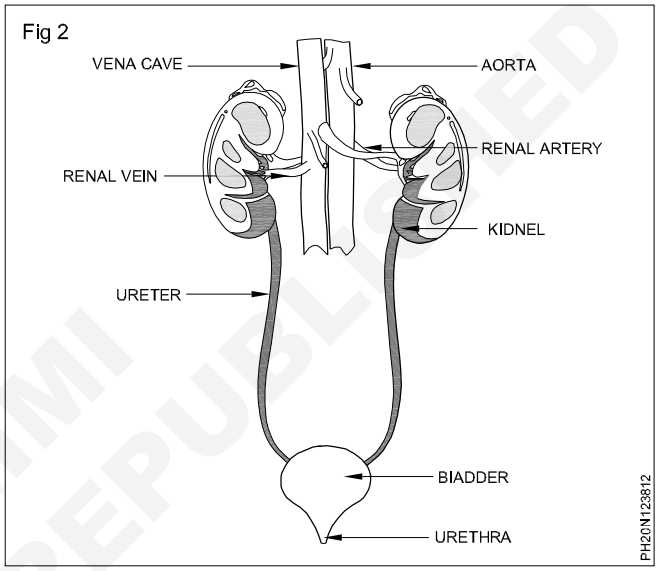
- maintaining overall fluid balance.
- regulating and filtering minerals from blood.
- filtering waste materials form food, medications and toxic substances.
- creating hormones that help produce red blood cells, promote bone health, regulate blood pressure.

### b Organs of Excretory system (Fig 2)

The human excretory system comprises of the following structures.

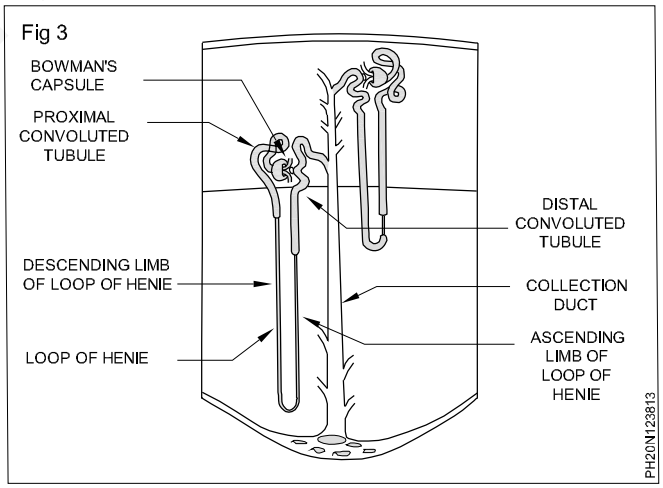
- 2 kidneys
- 2 ureters
- 1 urinary bladder
- 1 urethra

Fig 2




### c Structure of Nephron (Fig 3)

Fig 3




The structure and functional unit of kidney is the nephrons. Each kidney consists of millions of nephrons that are all functioning together to filter urine and expel the waste products. It consists of the following parts:

- **Bowman's capsule -** Is the first part of the nephron which is cup-shaped structure and receives the blood vessels. The glomerular filtration occurs here.

- **Proximal convoluted tubule -** The Bowman's capsule extends downwards to form the proximal tubule. Water and reusable materials from the blood are now reabsorbed back into it.
- **The Loop of Henle -** The proximal tubule leads to the formation of a U-shaped loop called loop of Henle. It has 3 parts: The descending limb, the U-shaped bend, and the ascending limb. It is in this area that the urine becomes concentrated as water is reabsorbed.
- **Distal convoluted tubule -** The loop of henle leads into the distal convoluted tubule leads to the collecting ducts.
- **Collecting duct -** The distal convoluted tubule of each nephron leads to the collecting ducts. The collecting ducts together form the renal pelvis through which the urine passes into the ureter and then into the urinary bladder.

### d Formation of urine

The process of urine formation in kidneys include the following steps:

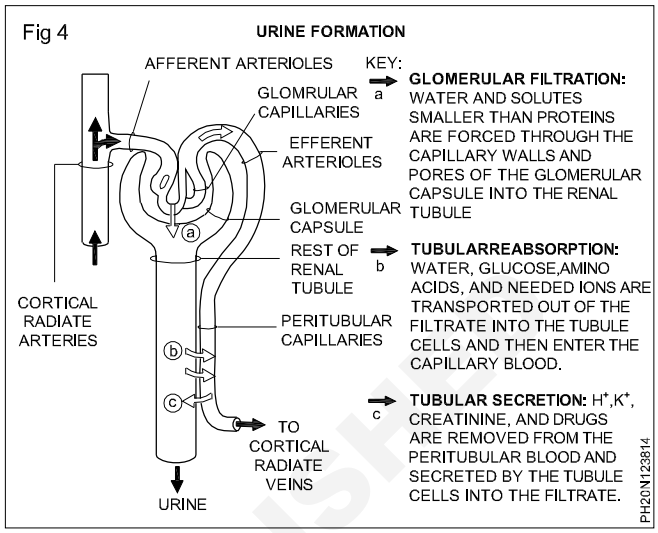
- Glomerular filtration
- Tubular reabsorption
- Secretion

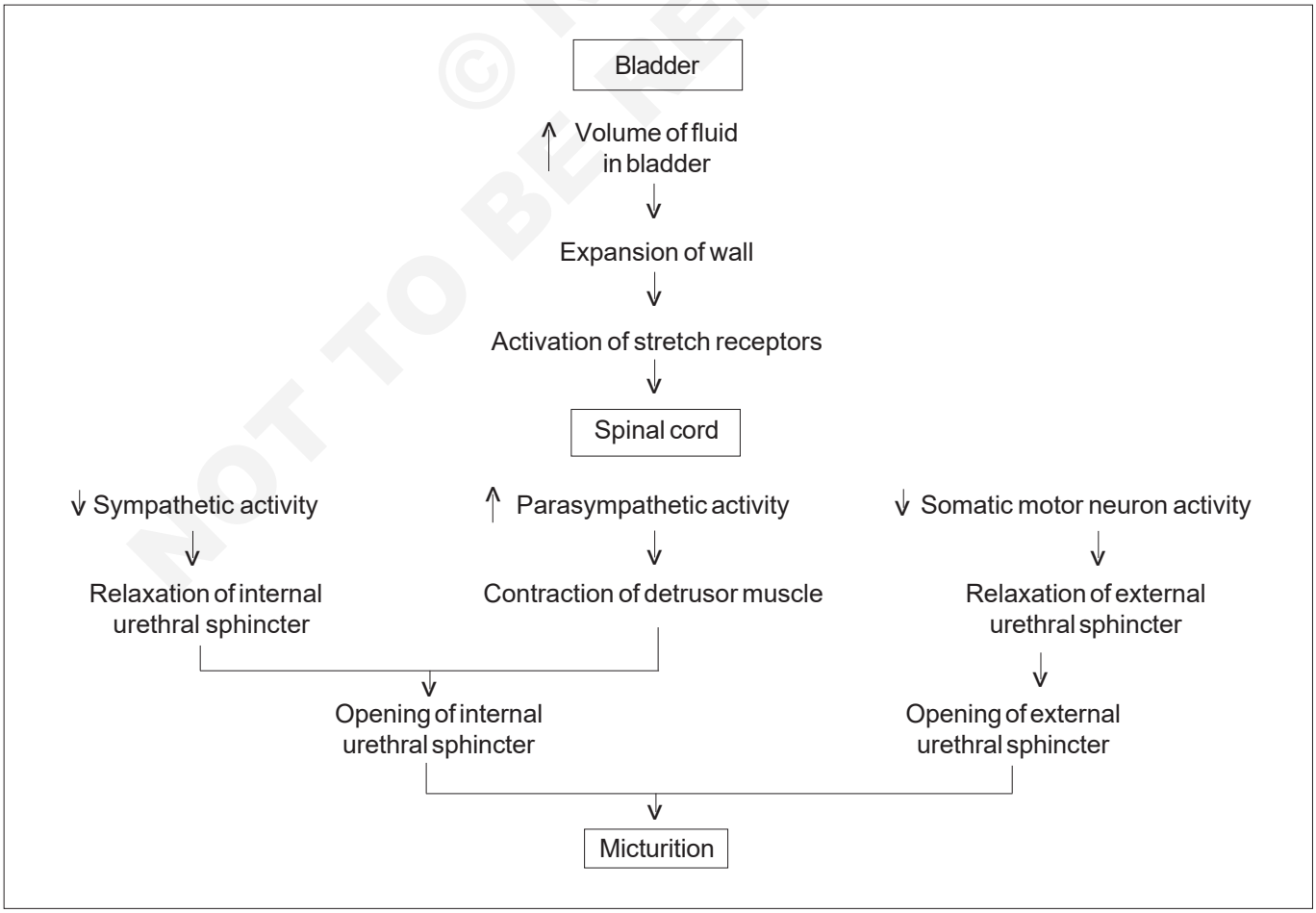
These process ensure that only waste and excess water are removed from the body. (Fig 4)

### e Micturition

Micturition (Urination) is the process pf urine excretion from the urinary bladder. Most of the time, the bladder is used to store urine. As it fills, the rugae distend and a constant pressure in the bladder is maintained. This is known as the stress-relaxed phenomenon.

Fig 4



# Gynecology and obstetrics

**Objectives:** At the end of this lesson you shall be able to
- **state the pelvis floor muscles**
- **describe the reproductive system.**

## a Pelvic floor muscles

The pelvic floor muscles support the contents of the pelvis.

The pelvic floor or pelvic diaphragm is composed of muscles fibres of,

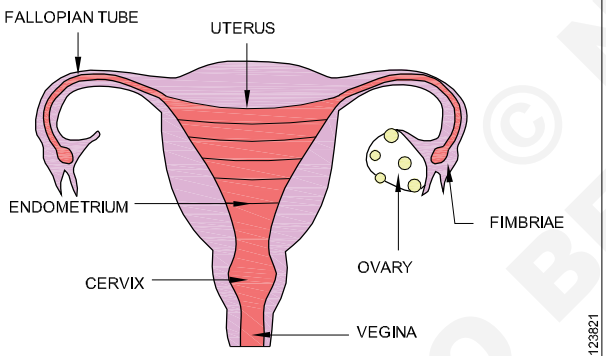
- Levator ani
- Coccygeus muscle
- Associated connective tissue which span the area underneath the pelvic.

## b Introduction to human reproductive system

The reproductive system or genital system is a system of sex organs within an organism which work together for the purpose of sexual reproduction.

The major internal organs of female reproductive system include the vagina and uterus - which act as the receptable for semen and the ovaries, which produce the female's ova. The vagina is attached to the uterus through the cervix, while the fallopian tubes connect the uterus to the ovaries. (Fig 1a)

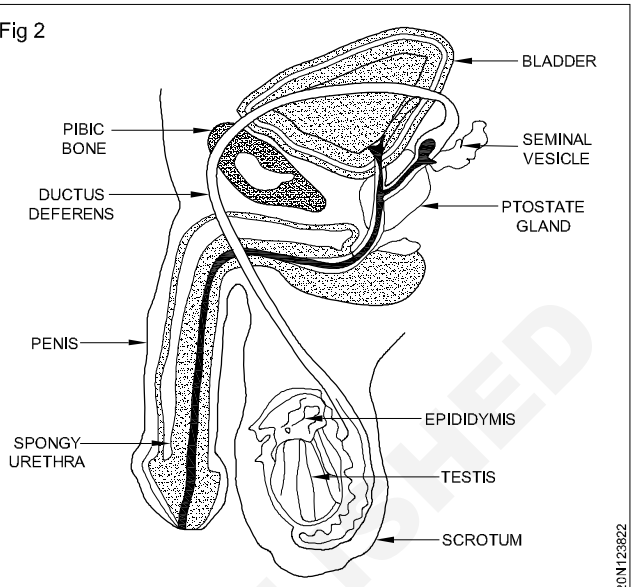
Fig 1




FEMALE REPRODUCTIVE SYSTEM

The male reproductive system consists of two major parts: the testes, where sperm are produced and the penis. The penis and the urethra belong to both the urinary and reproductive system in males. The testes are carried in an external pouch known as the scrotum. (Fig 1b)

Fig 2

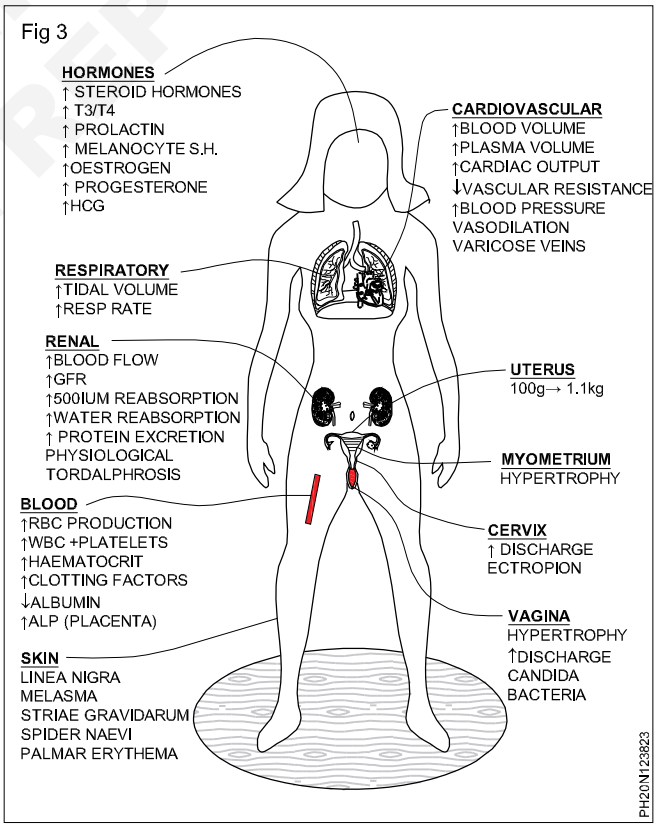



MALE REPRODUCTIVE SYSTEM

## c Physiology of Pregnancy:

Physiological changes that occur during pregnancy. (Fig 2)

Fig 3



# Thermotherapy - Superficial heating agents

**Objectives:** At the end of this lesson you shall be able to
- **explain the types of hot packs, physiological effects, indications & contra indications**
- **define method of wax bath, preparation & application.**

**a Hot packs**

**Physiology effects of heat**

1 Vasodilation
2 Viscosity
3 Increased nerve stimulation
4 Increased pain threshold
5 Charges in muscle strength
6 Increased metabolic rate
7 Increased tissue extensibility effects on collagenous tissue.
8 Increased sweating
9 Effects on pulse rate & BP
10 Increased rate of breathing

**Indications**

- Subacute or chronic inflammatory conditions
- Reduced of subacute or chronic pain
- Subacute or chronic muscle spasm
- Decreased range of motion
- Hematoma resolution
- Reduced of joint contractures

**Contra indications**

- Existing fever
- Cardiac irregularities
- Decreased skin sensation
- Infections
- Active bleeding
- Acute inflammatory conditions
- Malignancy
- Impaired kidney, heart & lung functions
- Headache

**Types of hot packs**

1 **Hydrocollators -** It is a stationary or mobile stainless - steel thermostatically controlled liquid heating device designed to heat bentonite - Filled packs in water up to 160 degrees where the packs will be removed & wrapped in several layers of toweling & applied to the affected body area of a patient to relieve pain.

**Techniques of application:**

The packs are made of bentonite, a mineral that holds heat for up to 30 min. They come in a variety of sizes so they may be wrapped around neck & shoulders or knees & elbows as well as smaller joints.

- Packs are removed from the tank with tongs & well - drained to avoid scalding the therapist or patient.
- They are wrapped in three or five layers of toweling or a cover to prevent direct contact with the akin.
- Then the pack is applied to the affected body area & left in place for 15 - 30 min.
- Hydrocollators should be drained & cleaned for every two weeks for optimum sensation.

**2 Hot water bag**

It is a container, usually made of rubber or similar material that is filled with hot water & sealed with a stopper.

These are used to provide warmth & for the local application of heat to relieve pain & discomfort.

**3 Electrical heating pads**

It maintains a constant level of heat as long as it is plugged in.

**Techniques of application:**

- Make sure the cord in hot broken open in any area before you plug it in.
- Place the patient in position.
- Once plugged in, set to the heat setting according to the condition of the patient.
- Cover the heating pad to protect the skin.
- Heat is applied to the affected area for 15 - 30min.

**b Wax bath**

Wax bath unit container is made up of enameled baths or stainless steel & fiberglass shell. Container contains wax & paraffin oil in the prescribed ratio. Thermostat keeps the temperature adjusted with knob. Thermostat pilot lamp indicates whether thermostat is on or off.

The wax bath uses paraffin wax that is soft & melts at a lower temperature normal, therefore it does not cause any burns or blisters.

**Composition & method of preparation of wax bath:**

It is a combined immersion technique with paraffin wax + mineral oil for conductive heat gains.

- For therapeutic use - 7 Units of wax
  - 1 Unit of mineral oil.

The paraffin wax is then kept at low temperature & remains warm for a longer time than water.

**Physiological effects**

- Analgesic effects:
  - Most important effect as sedative effect on tissues.
  - Moist heat gives a soothing effect
  - Very good prior to the exercise for superficial joints.
- **Stretching effects:** Wax leaves the skin moist, soft & pliable. It is useful for stretching scars & adhesions.
- **Circulating effect:** Stimulation of superficial capillaries & arterioles cause local hyperaemia & reflex vasodilation. This is marked only in the region of the skin.

**Techniques of application**

There are four methods of application of wax therapy & treatment is given for about 10 - 20 min.

1 Dipping method (Direct immersion)

2 Wrapping method (Bandaging)

3 Brushing method

4 Pouring method

**Dipping method**

It this method body part to be treated is directly immersed into the container of paraffin wax for 2 - 3 sec. & taken out. After 2 - 3 sec. The part is again immersed to make another layer of wax. This process is repeated 6 - 12 times Until 3 - 4 mm layer is formed, & then wrapped around by plastic sheet & towel. This method is preferably used for treating parts of the body.

**Wrapping method**

A roll of bandage is immersed in molten paraffin wax & then wrapped around the body part. This is used for treating proximal parts of the body.

**Brushing method**

- It is less commonly used method
- 8 -th 10 Coats of wax are applied to the area with a paint brush using even & rapid strokes.
- The area is then wrapped with tower for 10 - 20min & after this time, paraffin wax is removed & discarded.

**Pouring method**

- The molted wax is directly poured by a mug or utensil on the part to be treated arid.
- Wrapped around by a towel
- The wax is allowed for about 10 - 20min
- Several (4 - 6)layers can be over the body tissues.

**Indications**

- Rheumatoid arthritis of hands & feet
- Osteoarthritis
- Post - traumatic/ Fracture stiffness
- Trigger finger pain & muscle spasm
- Pain & muscle spasm
- Oedemic & inflammation
- Adhesion & scar

**Contra - indications**

- Anesthetic area
- Open wound
- Unreliable patient
- Impaired thermal sensation
- Scar tissue
- Infections area
- Circulatory dysfunction
- Analgesic drug
- Tuberculosis
- Deep x - ray therapy.

# Infra - red radiation

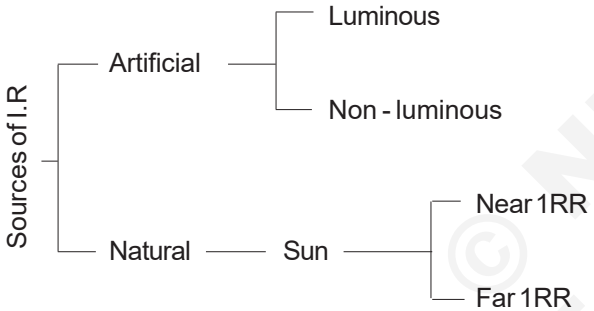
**Objectives:** At the end of this lesson you shall be able to
- **describe infra red rays its sources, physiological effects**
- **list the application**
- **describe its indications, & contra - indications.**

### Infra- red radiation

Infra - red radiation that portion of the electro magnetic spectrum that extends from the long wave length, or red, end of the visible - light range to the micro wave range. Invisible to the eye, it can be detected as a sensation of warmth on the skin.

### Sources of Infra - red radiation

The primary source of infrared radiation is heat or thermal radiation. Such objects include the sun & the planets, certain stars, nebulae, & galaxies. A number of known infrared sources can be observed at the wavelengths of visible light & in certain cases at radio & X - ray wavelengths as well.




### Physiological effects

- Increases metabolic rate
- Cutaneous vaso dilatation
- Sweating
- Stimulation of thermal heat receptors
- Axon reflex activity
- Stimulation of sensory nerve
- Leukocytes & phagocytes activity

### Indications

- Relief of pain
- Prior to other treatments [ eg. Stretching, Mobilization, fraction, massage, exercise therapy, electrical stimulation & bio feed back]
- Increased blood flow & circulation [eg. Reduce chromic oedema]
- Muscles relaxation
- Increase healing of tissue.

### Contra - Indications

- Acute inflammatory conditions
- Impaired cutaneous Thermal sensation & Circulation
- Peripheral vascular disease
- Markedly loss of consciousness
- Acute skin disease eg. Dermatitis or eczema
- Deep X - ray therapy
- Defective blood pressure

### Precautions

- Unreliable & elderly patients
- Never apply heat directly to eyes or the genitals
- Never heat the abdomen during pregnancy (first & last trimester)

### Techniques of application

Two types of infra red sources are used in physiotherapy practice.

a Non - Luminous generators - Produces only infrared rays of wavelength 750nm to 1500nm.

b Luminous generators - Also known as high temperature generators. Emits visible rays, uv rays , & 1RR of wavelength 350nm to 4000nm.

**Patient position:** Place the patient in a suitable, Well supported position with the area to be treated exposed.

**Apparatus -** Non - luminous generators take some time to get heated, so they should be switched on before 5 - 7 min of treatment.

Luminous generator needs no warm up time & can be switched on once the patient is ready for the treatment.

### Arrangement of lamb & patient

- Expose the skin to be irradiated & cover or shield the eyes.
- The lamb is positioned opposite to the treatment area such that rays strike the skin at right angles.
- Set the lamb at an appropriate distance which is usually 50 - 70 cm.

### Instructions & warnings

- The patient is warned that be should experience comfortable warnings.
- Patient should report immediately if the heating becomes excessive.
- Patient should not touch any part of the lamb or to move nearer to it.

**Application**

- At the commencement of the treatment, intensity of the radiation should be low but after 5-10 min intensity can be increased.
- Therapist should be near the patient throughout the treatment.

**Termination of IRR**

- On completion of the treatment the skin should be checked carefully.
- On palpation it may feel mildly or moderately warmth & a moderate erythema should be evident.
- After radiation the patient should not rise suddenly from the recumbent position or go out in cold therapy.

**Dosage**

For acute case - 10-15 min daily to 1 to 3 times as per the requirement.

For chronic case - upto 30 min once (daily) or on alternate days.

# Cryotherapy

**Objectives:** At the end of this lesson you shall be able to
- **define cryotherapy and list out physiological effects**
- **explain about its method of application.**

**Cryotherapy**

It is a pain treatment that uses a method of localised freezing temperature to deaden an irritated nerve.

**A Physiological effects**

- Reduces pain .
- Reduces spasticity.
- Reduces muscle spasm.
- Reduces swelling.
- Promote repair of the damaged tissues.
- Provide excitatory stimulus to inhibited muscles
- Used in strength training.
- Reduces tissue bleeding.
- Lowers tissue temperature.

**B Methods of application.**

A Ice packs.

i Ice is wrapped in dry or moist toweling.

ii Applied for 10-15 min for more superficial areas and 15-20 min for areas of deeper tissue.

B Cold gel packs.

i Kept in cooling unit at temperature of 0-10 F.

ii Improper use may cause frostbite.

iii They do not lower skin temperature as much as ice, thus patients may not reach point of anesthesia.

C Ice immersion.

i Used to treat distal extremities.

ii Container big enough to hold extremity is filled with ice and water. Body part is then immersed.

iii Temperature range between 13-18 c for treatment, which may last 10-20 min.

D Ice massage.

i Slow circular motion for 5-10 min.

ii Used mostly for small areas of inflamed tissue or acute muscle guarding.

iii Direction of application should be parallel to muscle fibers.

iv Application is continued for 3-10 min until anesthesia is reached.

E Vapocoolant sprays (eg. fluro methane, ethyl chloride).

i Vapourised liquid nitrogen.

ii When sprayed on skin, it produces significant cooling through evaporation.

iii Container should be held about 2 feet from the body part and sprayed in one direction only at rate of 4 inches/sec using 1-2 sweeps while maintaining passive stretch.

iv Ethyl chloride is flammable and may freeze skin on contact, therefore, fluro methane is preferred.

v Effective in reducing painful muscle guarding and desensitizing trigger point areas.

**C Cryokinetics.**

Cryokinetics is a rehabilitation technique involving ice application followed by progressive active exercises. It has been shown to be very successful in treating ligament sprains.

**D Indications.**

- Acute pain.
- Chronic pain.
- Acute swelling.
- Myofascial trigger points.
- Muscle guarding.
- Muscle spasm.
- Acute muscle strain.
- Acute ligament sprain.
- Acute contusion.
- Bursitis.
- Tenosynovitis.
- Tendinitis.
- Delayed onset muscle soreness.

1 Impaired circulation.(i.e. Raynaud's phenomenon).

2 Peripheral vascular disease.

3 Hypersensitivity to cold.

4 Skin anesthesia.

5 Open wounds or skin conditions.

6 Infection.

**Precautions**

- Prolonged exposure will lead to freezing of tissue.
- Previous treatment to cryotherapy.
- Do not use on suspected cancerous lesions.
- Cautions around nails and nail bed.
- Do not use on eyelids, elbow, digits-relative contra indications.
- Nose, ears, lips, anterior, tibial area-caution.
- Dark skin.
- Vascular compromised.
- Immuno compromised patients.

# Deep heating agents

**Objectives:** At the end of this lesson you shall be able to
- **explain about short wave diathermy, its effects**
- **list the method of application**
- **list the indications & contra indications.**

**A Short wave Diathermy:**

Short wave diathermy uses high frequency electromagnetic energy to generate heat. It may be applied in pulsed or continuous energy waves. It's commonly used for conditions that cause pain and muscle spasm such as:

- Sprains
- Strains
- Bursitis
- Tenosynovitis

**Physiological effects:**

- Effects on metabolism
- Effects on blood supply
- Effects on nervous tissue
- Effects on muscular tissue
- Effects on sweat glands

**Therapeutic effects:**

1 Increase blood flow
2 Help resolution of inflammation
3 Accelerate wound healing
4 Increase extensibility of deep collagen tissues
5 Decreased joint stiffness
6 Relief deep muscle pain & Spasm

**Technical Data & Description of Instrument:**

Short Wave Diathermy is a modality that produces deep heating via conversion of electromagnetic energy to thermal energy.

Short Wave Diathermy current frequency 10 - 100MHz. The commonly used in medical work having frequency of 27.12MHz with wavelength of 11meters.

There are two types of Short Wave Diathermy:

- Continuous Short Wave
- Pulsed Short Wave

**Technical Specifications:**

Output of 400 - 500w in continuous mode & 500 - 1100w in Pulse mode repetition frequency of 20 - 200Hz adjustable in 10 steps. LCD Screen display of parameter, treatment timer with all standard accessories, condenser pad with cable, Dis electrodes with arm & cables, Patient safety switch.

**Power supply:** Power input to be 220 - 240 VAC, 50Hz fitted with plug.

**Method of Application:**

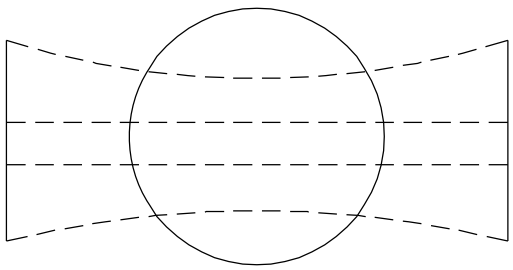
1 Condenser field method
2 Cable method

**Condenser field method**

1 Contra planar method
2 Coplanar method
3 Cross - fire method
4 Monopolar method

**1 Contra planar method** - It is the most satisfactory method, especially for the treatment of deeply - placed structures. In this method electrodes are placed in opposite direction around the body area which has to be treated. A Uniform production of electrostatic force is produced which results into deep heat as compare to superficial heat. Mostly used for the treatment of Ankle & Shoulder, etc.

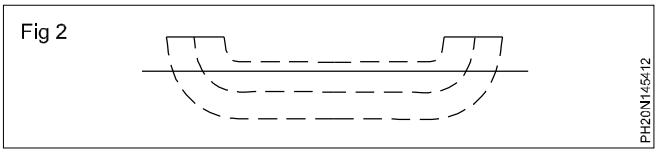
Fig 1




**2 Coplanar method:**

- Electrodes are placed side by side on the same aspect of the part, provided adequate distance between them.
- In this method heat is more superficial.
- Mostly used for back pain.

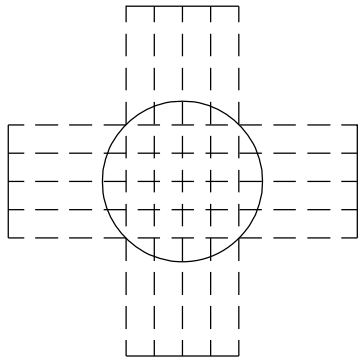
Fig 2




**3 Monopolar method -** The Active electrode is placed over the site of the lesion, while the indifferent one is applied to some distant part of the body. This method is used for very superficial lesions (face & sinuses).

4 **Cross fire -** In this method half of the treatment period is given with the electrodes in one position & then they are moved to be at right angle to that obtained during the first half of the treatment.

Fig 4




**Cable method:**

1 Arrangement at the ends of cable

2 Arrangement through centre of cable

3 Grid arrangement

**Patient Preparation:**

- Ensure that the patient is free of all contraindications & the patient must be comfortable & the part to be treated should be fully supported.
- Remove all jewelery, coins & other metallic items from the patient.
- The treatment tissue should not be covered by clothing.
- Wash the skin over treatment area, thoroughly dry the skin prior to treatment.
- Treatment should be on a couch, chair or a table, which must be wooden & free from metals.
- Skin sensation must be tested before treatment starts.

**Monitoring the treatment:**

- Before starting treatment, all meters of the apparatus should be on zero position.
- Select the power level according to the patient's condition.
- Increase the intensity gradually till the desired heating level is reached.
- Immediately check for any complaint of hot sensation.
- At the end of the treatment, the control knobs are returned to zero position, current switched off the electrodes removed.

**Position & Size of electrodes:**

This has been considered in the sections of the condenser field & cable methods of treatment. When arranging the electrodes it is important to remember that an electric field can be set up around the edges & back of the electrode as well as from the front. If these parts approach too close to the patient's tissue a field is set up in this area & may cause uncomfortable heating.

For Ex. When treating one knee-joint the back of the electrode placed on the medial aspect of the joint may lie too close to the other knee, which is consequently heated.

**Dosage & Duration:**

In most cases the intensity of the application should be sufficient to cause a comfortable warmth & duration should be 20 - 30 min. The treatment may be carried out daily or an alternate days.

**Indications:**

- Bursitis
- Joint capsule contractures
- Degenerative joint disease
- Sacro iliac strains
- Deep muscle spasms
- Ankylosing spondylitis

**Contra-Indications:**

- Hemorrhage
- Venous thrombosis or Phlebitis
- Arterial disease
- Pregnancy
- Metal in the tissues
- Disturbed skin sensation
- Tumors
- X - ray therapy

**Dangers & Precautions:**

- Aim of diathermy safety should be prevent mains voltage from entering the patient circuit
- Care with use on pedunculated structures
- Inflammable anesthetic gases - sparks prohibited within 25cm of gases
- Electrocution
- Alcohol preps
- Gas accumulation within the bladder
- Poor plate to patient contact - thermoelectric burn
- Never allow cables to touch (short circuit)
- Do not allow perspiration
- Never allow direct contact with skin
- Excessive fat in area may overheat area
- Difficult to be localized areas
- Overheating tissues may cause damage
  - Deep aching
  - Fat neurosis
  - Burning

**Dangers:**

- Burns
- Scalds
- Electric shock
- Overdose
- Precipitation of gangrene
- Faintness
- Giddiness

# Micro wave diathermy

**Objectives:** At the end of this lesson you shall be able to
- **understand the effect of microwave diathermy**
- **understand the effect of UST**
- **gain knowledge about the indications and precautions of UST.**

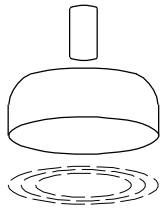
### Micro wave Diathermy

Micro wave Diathermy user electromagnetic radiation by microwaves & heats to a lesser tissue depth than short - wave. It is primarily used to head superficial muscles & joints such as the shoulder

### Director used in microwave diathermy

1 Circular directors - The heating pattern is more intense around the outer portion than centre.

Fig 1



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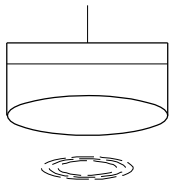
2 Rectangular directors - The heating pattern tends to be more concentrated in the centre of the treated area.

Fig 2



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### Indications

- Sprain
- Strain
- Joint stiffness
- Capsular lesions
- Muscles & tendon fear
- Degenerative joint disease.

### C Ultra sound therapy

Ultra sound therapy is the use of sound waves to treat medical problems, esp. musculoskeletal problems like information from injuries (Sprains, tendinitis, bursitis)…

### Effects of UST in human body

### Thermal effects

- The advantage of using ultra sound to achieve heating is due to the preferential heating of collagen tissue & effective penetration of this energy to deeply placed structures.
- Heating fibrous tissue structures decrease in joint stiffness.
- Mild heating can also have the effect of reducing pain & muscle spasm & promoting healing process.

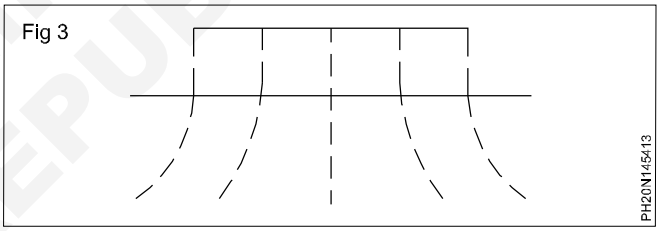
### Chemical & biological effect

Acoustic streaming is an effect produced by ultrasonic bean streaming has been shown to produce changes in the rate of protein synthesis & could thus have a role in stimulation of repair - Ultra sound also reduces pain.

### Description of UST Instrument & Technical data

For a 1 MHz Machine a vibrating source with a frequency of one million cycles per sec. is needed. This is achieved by using either a quartz or barium titanite crystal.

Fig 3



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The basic components are shown in the fig. there is a source of high frequency current, which is conveyed by a coaxial cable to a transducer circuit, the high frequency current is applied to the crystal via a linking electrode, the crystal being fused to the metal front plate of the treatment head. Any change in the shape of the crystal causes a movement of metal front plate which in turn produces an ultrasonic wave.

### Depth of near field for 1 MHz & 5MHz ultrasonic transducers of different sizes:

| Transducer radius (mm) | Frequency (MHz) | Extent of near field (cm) |
|---|---|---|
| 15 | 1 | 15 |
| 15 | 3 | 45 |
| 10 | 1 | 6.5 |
| 20 | 1 | 26.5 |

### Coupling media

Ultrasonic waves are not transmitted by air, thus some couplant which does transmit them must be interposed between the treatment head & the patient's skin.

Efficiency of transmission of ultrasound by various by coupling media.

| Couplant | % Transmission |
|---|---|
| Aquasonic gel | 72.6 |
| Glycerol | 67 |
| Distilled water | 59 |
| Liquid paraffin | 19 |
| Petroleum jelly | 0 |
| Air | 0 |

**Methods of application:**

**Testing the apparatus -** Testing should always be carried act prior to treatment. The simplest way of finding out whether ultrasound is in fact being produced is to use a water bath & to reflect an ultrasonic beam up to the surface where it should produce ripples. The apparatus is turned on & off with the treatment head below the water.

**Techniques of application**

**i Direct contact**

- If the surface to be treated is fairly regular then a coupling medium is applied to the skin.
- The treatment head is moved in small concentric circles over the skin.
- The machine is turned on & off while in contact with the patient.

**ii Water bath**

- A water bath filled with de - gassed water is used if possible.
- If top water has to be used then the gas bubbles must be wiped from these surfaces frequently.
- The technique of application is that the treatment head is held 1cm from the skin & moved in small concentric circles, keeping the front plate parallel to the skin surface to reduce reflection to a minimum.

**iii Water bag**

- On irregular bong surface a rubber bag filled with de - gassed water can be used.
- A coupling medium has to be placed both between the rubber bag & between the rubber bag & the treatment head to eliminate any air.

**Dosage**

In acute conditions: In the initial stages a low dose [0.25 or 0.5 watts/$cm^2$] is used for 2 - 3 min.

The some dose can repeated.

**In chronic conditions:**

Initially a low dose is given [0.8 watts/$cm^2$ for 4min] If no improvement results, the dose can be gradually increased by increasing the intensity or the period of insolation until the treatment is found to be effective.

**Indications of ultra sound therapy**

- Increase deep tissue head
- Decrease information
- Decrease muscle spasm
- Decrease pain
- Decrease joint adhesions
- Contraindications
- Vascular conditions
- Acute sepsis
- Radio therapy
- Tumors
- Pregnancy
- Cardiac disease

**Dangers**

- Burns
- Cavitation
- Over dose
- Damage to equipment

**Precautions**

- Symptoms may increase after the initial treatments
- Use caution when applying around the spinal cord, esp. After laminectomy.
- The use of ultrasound over metal implants is not contra indicated.
  - Keep the sound head moving
- Use caution when applying over epiphyseal plates of growing bone.
- Open wounds
- Impaired communication
- Pregnancy
- Peripheral vascular disease
- Pain with pressure
- Lack of sensation.

# Stimulators - Faradic

**Objectives:** At the end of this lesson you shall be able to
- **explain faradic current, its physiological effects**
- **explain about the method of applications, its dose & duration.**

**Faradic-type current**

It is a short duration interrupted current, with a pulse duration ranging from 0.1 and 1ms and a frequency of 30 to 100Hz.

1 Induced asymmetrical, unbalanced, spiked.

2 Biphasic asymmetrical, unbalanced, spiked.

3 Positive portion-short duration, high amplitude & spiked.

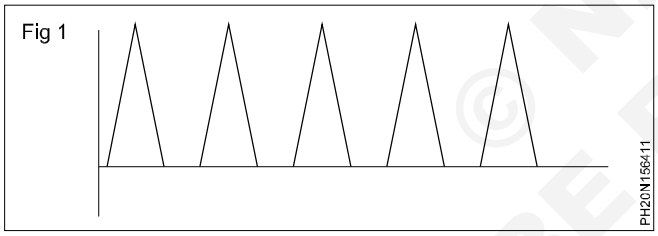
4 Negative portion-long duration, low amplitude & curved.

Faradic current are always surged for treatment purposes to produce a near normal tetanic-like contraction of muscles.

- Current surging means the gradual increase & decrease of the peak intensity.

Faradic coils have now been superseded by the same physiological effects as the original faradic current, although often differing considerably from them in wave form.

Fig 1




Faradic-type current from a modern electronic stimulator.
The features essential for the production of these physiologic effects are the impulses with a duration of between 0.1 and 1ms are repeated 50-100 times per sec. the electronic stimulator for the production of the faradic type current works on the same principles as that for the interrupted d.c, but the resistances controlling the duration of the impulses and the intervals between them have a very low value to give the required duration & repetition rate.

- The most comfortable pulse is either 0-1m sec pulse with a frequency of 70Hz or 1m sec pulse with a frequency of 50Hz.
- The most comfortable tetanic contractions obtained with frequencies between 40Hz and 80Hz.

**Physiological effects**

- Increased circulation brings fresh oxygen & nutrients to the muscles and removes waste products, thus improving appearance & functioning of the muscles.
- Muscular contractions improves the tone of the muscle.
- Sensory nerve endings are initially stimulated producing a tingling sensation at the beginning of the treatment.
- Motor nerves are stimulated resulting in muscle contraction.
- Blood supply increases therefore bringing fresh oxygen & nutrients to the area.
- Waste products are more efficiently removed from the area.
- Vasodilatation of the blood vessels improves the colour of the skin under the pads.
- Muscle contractions improve the lymphatic circulation in the area, which the removal of waste products.
- Reduction of swelling & pain.

**Techniques of applications:**

**Preparation of apparatus:**

A low-frequency electronic stimulator with automatic surgery is commonly used.

The operator should test the apparatus by attaching leads, electrodes to the terminals, holding the two electrodes in a moistened hand & turning up the current until a mild pricking sensation is experienced & a muscle contraction produced. Describe to the patient can see the muscle contraction produced.

The Active electrode may be a disc-electrode or a small lint pad with a flat plate-electrode.

A flat plate-electrode & lint pad are used for the indifferent electrode, to complete circuit. The pads consist of atleast eight layers of lint. They should be folded evenly with no creases, or there will be uneven distribution of current consequent discomfort.

Electrodes should be 1cm smaller all around than the pads, to reduce the danger of their coming in contact with the skin & causing uncomfortable concentration of current & possible damage to the tissues from chemical action.

**Preparation of the patient:**

- Clothing is removed from the area to be treated and the patient is supported comfortably in a good light.
- The skin has a high electrical resistance as the superficial layers, being dry, contain few icons. The resistance is reduced by washing with soap & water to remove the natural oils.
- The indifferent pad should be large to reduce the current density under it to a minimum.
- The indifferent electrode may be bandaged or fixed with a rubber strap, or body-weight may be sufficient to hold it in position.

**Stimulation of motor points:**

The method has the advantages that each muscle performs its own individual action and that the optimum contraction of each can be obtained.

The Apparatus and Patient should be prepared of previously described. The indifferent electrode is applied & secured in a suitable area. The Active electrode may be a disc electrode, which is held between the index & middle fingers, or a small pad which is held in the palm of the hand. It is placed over the motor point of the muscle, to be stimulated.

Firm contact ensures a minimum of discomfort & where possible the whole of the operator's hand should be in contact with the patient's tissues so that she can feel the strength of the contractions produced.

A Suitable duration & frequency of surge must be selected. The intensity of the current is gradually increased until a good muscle contraction is obtained at the maximum point of each surge, then the surging is continued to produce alternate contraction & relaxation of the muscle.

The duration of the treatment session is determined by the length of time for which the patient can concentrate on the movement & assist in its production.

**Stimulation of muscle groups:**

Stimulation which makes all the muscles of a group work together is a satisfactory method of re-educating the action of muscles which normally work as a group, such as the quadriceps, the small muscles of the foot & the muscles of the pelvic floor.

**Indications of faradic current:**

- Facilitation of muscle contraction
- Re-education of muscle action
- Training of new muscle action
- Neuropraxia of a motor nerve
- Served motor nerve
- Improved venous & lymphatic drainage
- Prevention & loosening of adhesions

**Contraindications:**

- Undiagnosed pain
- Pacemakers
- Heart disease
- Epilepsy
- Pregnancy
- Over the carotid sinus
- On broken skin
- On dysesthesia skin
- Over the eyes, larynx, pharynx, over mucosal membranes

**Precautions:**

- Always perform skin sensitivity testes
- Remember that not all muscles are of equal strength, you cannot expect smaller muscle group to be able to receive the same current intensity as a larger group of muscles.
- Always ensure that all intensity dials are at zero before applying.
- Test the machine on yourself prior to application
- Only turn up the intensity during the surge period
- Do not move the electrode when the current is surging
- Do not overheat the muscles
- Always check the condition of the wires & electrode pads before connecting
- Ensure the electrode pads are moistened with sufficient saline solution or water
- Therapist must ensure that they have a clear view of the treatment
- Do not stimulate muscles that do not require strengthening for example the corrugator muscle.

**Galvanic current:**

**Definition:** It is a direct current, unidirectional used to activate muscle directly, without activation of the peripheral nerve. Direct muscle stimulation requires pulse or phase durations of atleast 1ms & more often uses even longer durations.

Constant direct current are used for Iontophoresis.

Modified direct current are used to stimulate denervated muscles.

Unipolar motor point stimulation Bipolar motor stimulation. Electrodes used one small active electrode & one large dispersive electrode equal sized electrodes site of stimulation motor point for stronger response effect depends on placement description sane amount of current passes through each electrode. Smaller sized electrode will have higher current density, thus effect here is stronger (active electrode). Current density equal in both electrodes. Convenient for stimulating mm groups or very large mm equally small electrodes used for stimulating denervated mm.

**Technical notes:**

1 Galvanic current is long duration

2 Pulse duration of 100ms

3 Frequency 30Hz

4 Pulse shaped, rectangular, trapezoidal, triangular, saw-tooth, depolarized

5 Pulse length between 0.03ms-300ms

**Physiological effects:**

1 Contraction of the denervated muscle

2 Stimulation of sensory & motor nerve

3 Improve venous & lymphatic drainage

4 Chemical effects

**Therapeutic effects:**

- Gives as a group activity
- Facilitate muscle contraction
- Re-educate muscle action
- Train new muscle action
- Increase strength
- Prevent & loosen adhesions

**Method of applications:**

When applying modified d.c, the aim of treatment must be arranged so that the current passes through all the fibers of the muscle.

There are various methods of achieving this, one pad may be fixed over the origin of the muscle group & each muscle stimulated in turn with the active electrodes.

As an alternative two disc electrodes may be used, one placed over each end of the muscle to be stimulated. The two pads may be fixed (stabilize technique0, one over the origin & the other over the lower end of the muscle group to be stimulated.

Another technique which may be convenient is to be apply an active pad which completely covers the muscle or group of muscles to be stimulated, the circuit being completed with a large directing or indifferent electrode.

**Preparation of equipment:**

The Apparatus is tested & other equipment prepared as for the treatments previously described. Make sure that the coverings of the disc electrodes & the pads consist of atleast eight layers of lint. This is because if is possible to get a chemical burn with long-duration pulses if the treatment is given at the same spot for long periods of time. No metal should be allowed come into contact with the patient's tissues.

**Preparation of the patient:**

The skin is prepared by washing & protecting abrasions as for other electrical treatments.

Contractions are obtained most easily if the part is supported so that the muscles to be stimulated are in a shortened position.

**Applications of interrupted D.C:**

Muscle contractions are often obtained most easily if the active electrode is connected is connected to the anode.

Each patient should be tested whether the anode or the cathode produces the better response & the more effective pole used for the active electrode.

When the electrodes have been applied the intensity of current is increased until a good muscle contraction Is obtained. Contractions are usually produced in groups, allowing rest periods between.

**Dose & Duration:**

Frequency selection:

100Hz- Pain relief

50-60Hz- Muscle contraction

1-50Hz Increased circulation

**Time consuming:**

Three stimulation session/day three or five sets of 5-20 isometric contractions

5s- Rest period/contraction

1m- Rest period/set

**Indications:**

- Electro diagnostic
- Rehabilitation of paralysed muscles
- Peripheral nerve injury
- Bell's palsy
- Iontophoresis

**Contraindications:**

1 Pacemaker

2 Malignancy

3 Overheat

4 Pregnancy

**Precautions:**

- Always check wiring & equipment before each treatment
- Check that the intensity is at the start & finish
- Do not allow the client to touch the machine
- Ensure that there is sufficient product applied to the skin
- Check what sensation the client is experiencing during the application of the current
- Remove all jewelery & metal objects from the client
- Avoid electrodes from the client
- Turn the current up & down slowly
- Ensure that the treatment time does not exceed 7 minutes for facial work

**c TENS:** Transcutaneous Electrical Nerve Stimulation

TENS is a therapy that uses low voltage electrical current to provide pain relief. A TENS consists of a battery-powered device that delivers electrical impulses through electrodes placed on the surface of you skin.

Meaning of Transcutaneous is passing, entering, or made by penetration through the skin.

**Physiological Effects:**

- It reduces pain (Pain gate therapy)

The Gate control therapy of the pain asserts that non-painful input closes the nerve "gates" to painful input, which prevents pain sensation from travelling to the central nervous system.

**GATE THEORY:**

- In the dorsal horn (where pain signals relay) there is a gate that opens & closes to allow pain signals upto the pain.
- C and A delta fibers are small pain fibers, when their signals get to the brain, you feel pain.
- A beta fibers are larger fibers that carry non painful signals (vibration, light touch etc)
- When A beta fibers are stimulated, they 'close the gate', signals from the smaller pain fibers cannot get up to the brain.

**Method of application:**

1 Conventional or high frequency TENS

2 Acupuncture or low frequency TENS

3 Brief intense TENS

4 Burst mode TENS

5 Modulated TENS

**Conventional or high frequency TENS:**

- Creates fastest relief
- Relief is short lived
- Paresthesia is created without motor response
- A Beta fibers are stimulated
- Applied 30 minutes

Pulse Rate - High 75 - 100Hz

Pulse Width - Narrow less than 30m sec

Intensity - Comfortable to tolerate

**Acupuncture or low frequency TENS:**

- Activation of descending pain suppression pathway activating endorphins.
- Longer lasting pain relief but slower to start

Frequency usually - 1-5Hz

Pulse width - 200 - 300Hz

**Brief Intense TENS**

- Hyper stimulation analgesia
- Similar to high frequency TENS
- Higher Rate (100Hz)

Pulse width - 200 micro sec

Intensity - Very strong but tolerate level

Treatment times is only - 15 min, if no relief then treat again after 2-3 min.

**Burst TENS**

- Pulses within burst can vary
- Burst frequency is 1-5 Bursts/sec
- Strong contraction at lower frequencies

Pulse Width - High 100-200Hz

Pulse Rate - 70-100pps modulated to 1-5 burst/sec.

Intensity - Strong but comfortable

Treatment length - 20-60 min

**Modulated Stimulation:**

- Keeps tissues reactive so no accommodation occurs.
- Simultaneous modulation of amplitude & pulse width.
- Frequency can also be modulated.
- As Amplitude is decreased, pulse width is automatically increased to deliver more consistent energy per pulse.

**Electrode Placement** - Directly over painful sites : trigger points, Dermatomes, Myotomes, Acupuncture points, Spinal nerve roots, may be crossed or uncrossed, horizontal or vertical.

**Indications:**

- Control chronic pain
- Management post - surgical pain
- Reduction of post - traumatic & acute pain.

**Contraindications:**

- Pacemakers
- Malignancy
- Over carotid sinus
- Pregnancy
- Active infections, skin conditions
- Cardiac conditions
- Cardiac conditions - Arrhythmia
- Neurological conditions - Epilepsy, stroke
- Non - cooperative patients.

**Notes and precautions:**

- Do not use to treat pain of unknown origin
- TENS is a symptomatic treatment
- Improper use can result in electrode burns or skin irritation
- Intense or prolonged stimulation may result in muscle spasm & for muscle soreness.
- Narcotics decrease the effectiveness of TENS

**d Interferential theory (IFT)**

IFT is a form of electrical treatment in which two medium - frequency currents are used to produce a low - frequency effect.

An interference effect at a 'beat frequency' equal to the difference in frequency between the two currents, is produced in the tissues at the point where two currents cross. For Ex.

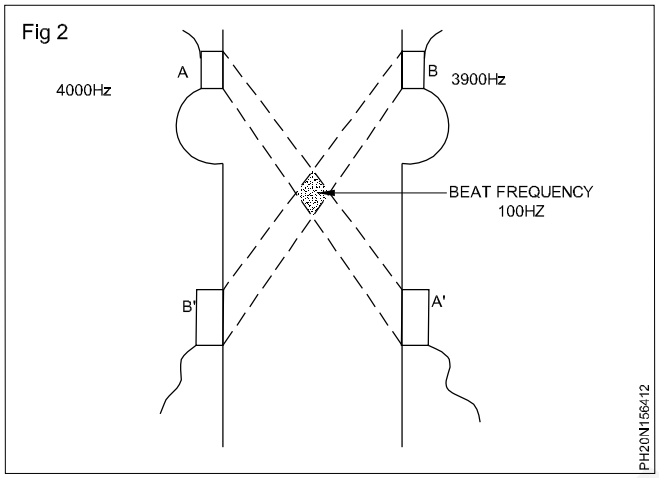
Circuit A 4000Hz - Medium frequency

Circuit B 3900Hz - Medium frequency

Beat frequency 100Hz - Low frequency

By varying the frequency of the second circuit relative to the constant frequency of the first, if is possible to produce a range of beat frequencies deep frequencies deep in the patient tissues.

Fig 2




Four electrodes are used in two pairs, each pair being indicated by the colouring of the wire from the machine. The electrodes of each pair are placed diagonally opposite one another in such a way that the interference effect or beat frequency is produced in the tissues where if is required, which may be very deep.

Current is controlled by the therapist and is equal to the sum of the two separate currents

**Physiological Effects**

- Relief of pain
- Motor stimulation
- Absorption of exudate

**Technique of treatment**

- The patient is positioned comfortably & the skin is prepared as for any low - frequency stimulation.
- The site for treatment is accurately located & the two pairs of electrodes positioned so that the crossing point of the two current is over or within the lessons.
- The patient is warned that he will fell a tingling sensation which should not be uncomfortable or burning.
- An appropriate treatment frequency is selected (e.g. between 0-100Hz, constant, to relieve pain) and the current intensity is turned up until the patient experiences a mild tingling sensation.
- After 15min of treatment if is common for the machine to be turned down.

**Dangers**

- Electrical burn if a bare electrode touches the skin are too close, allowing a skin current to pass between them rather than through the deeper tissues.

**Indications**

- Pain
- Muscle spasm
- Oedema
- Hematoma
- Chronic ligament lesions
- Triggers spots in myofascial syndrome
- Stress incontinence

**Contraindications**

- Cardiac pacemaker
- Advanced cardiac disease
- Hypertension
- Thrombosis
- Hemorrhage
- Pregnancy
- Neoplasm
- TB
- Fever
- Infections
- The eyes
- Skin disorders
- Epiphyseal region in children
- Febrile conditions
- During menstruation over abdomen
- Open wounds.

# Massage therapy and rehabilitation

**Objectives:** At the end of this lesson you shall be able to
- **describe physiological and therapeutic effects of massage**
- **list out its contra indications**
- **state its rules and direction.**

**Massage Therapy**

**Definition:** Massage is the application of force to the soft tissues of body with palmar aspect of hands and or fingers.

**Aim**

1 Technique should apply mechanical force to the soft tissue of the body.

2 These forces must not produce any change in the position of the joint.

3 The technique must evoke some physiological/ psychological effect which serve to achieve the therapeutic, restorative or, the preventive goal.

**C Physiological effects:**

- Cardiovascular
  - Increase blood flow,histamine release and temperature.
  - Decreased heart rate,respiratory rate and blood pressure.
- Neuromuscular.
  - Increase flexibility,decrease neuromuscular excitability(relaxation),edema,reduction and stretch muscle and scar tissue.
- Pain
  - Activate spinal gates and release of endogenous opiates.
- Psychological.
  - Reduces patient anxiety,depression and mental stress.

**D Therapeutic uses.**

- To improve the mobility of the soft tissues.
- To reduce muscle spasm and pain under abnormal conditions.
- To reduce oedema.
- To increase circulation.
- To mobilise secretions in the lung.
- To induce local and general relaxations.

The various conditions in which massage is used for mobilisation of soft tissue are listed below.

- Tendinitis.
- Tenosynovitis.
- Fibrositis.
- Muscular injury.
- Ligament sprain.
- Post surgical scar.
- Post burns contracture.
- Pre and post operative cases in plastic and reconstructive surgery.

**E Contra-indications of massage.**

| General | Local |
|---|---|
| High fever | Acute inflammation. |
| Several renal or cardiac disease | Skin disease. |
| Deep x-ray therapy | Recent fractures. |
| Osteoporosis | Severe varicose veins. |
| Severe spasticity | Atherosclerosis. |
| Very hairy skin | Thrombosis. |
| Patient's preference | Myositis ossificans. |
| | Malignancy. |
| | Open wound. |

**F Lubricant.**

The purpose of using the lubricating contact media during massage is mainly to:

- Make skin soft and smooth.
- Reduce friction between therapists hand and patients skin.
- Gain placebo effect.

The commonly used lubricants are:

- Powder, oils, creams.

**Powder**

Preferably it should be a non-perfumed one,as many people are allergic to the fragrance.French chalk or falcum powders are commonly used in the presence of profuse sweating as it is readily absorbs the moisture.

**Oils.**

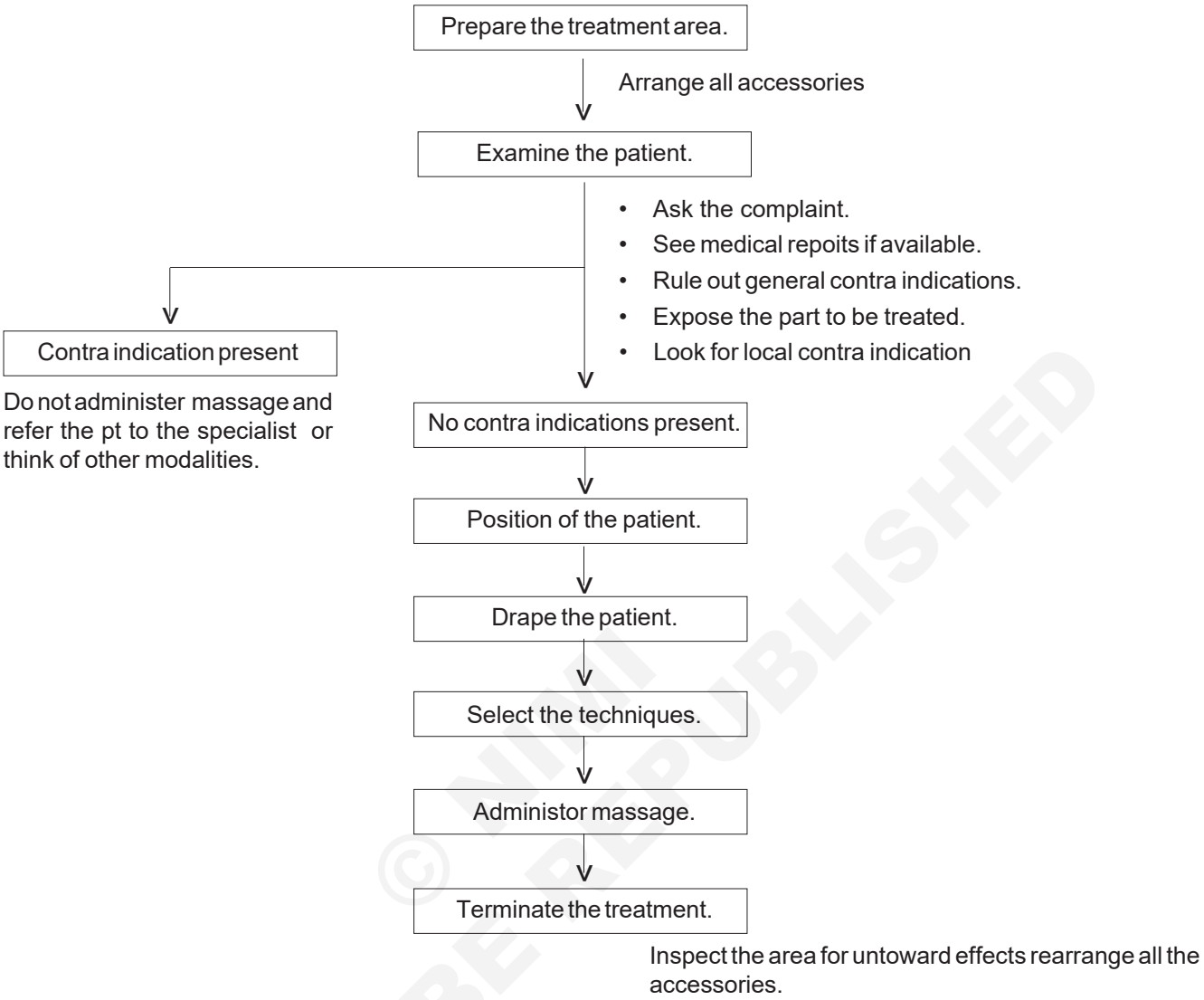
Oil is helpful when the skin is dry and scaly.Most commonly used oils are edible oils (mustard and coconut oil, olive oil,etc) mineral oil (liquid paraffin) and some medical oils.

**Creams.**

Lanolin or lanolin-based creams are suitable for the mobilisation of scars due to burns and surgical trauma.

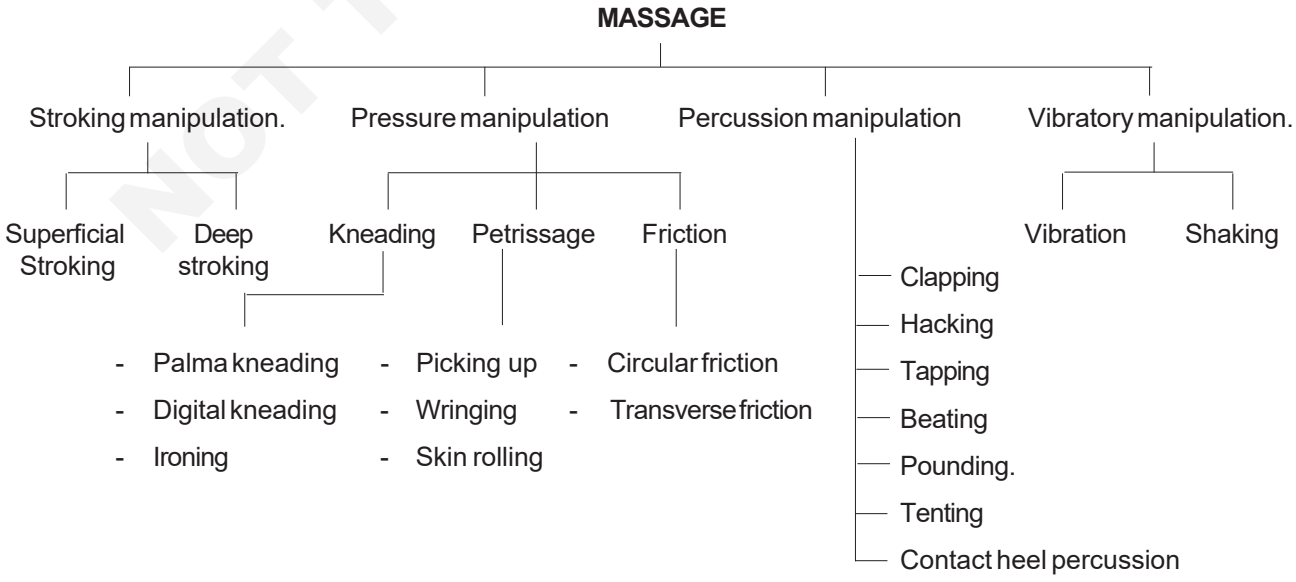
## G Rules and direction of massage.

**Flow chart of massage treatment.**




## H Types of massage

**Classification of massage techniques on the basis of character of techniques.**



| Technique | Administered with |
|---|---|
| Clapping | Cupped plam |
| Hacking | Ulnar border of the 5th, 4th and 3rd digits |
| Beating | Anterior aspect of the clenched fist |
| Tapping | Pulp of the fingers |
| Pounding | Medial aspect of the clenched fist |
| **Technique** | **Salient features** |
| Stroking | Linear movements if hand or parts thereof, along the entire length of segment, with the lightest pressure and constant touch |
| Effleurage | Linear movement of hand or a part thereof, along the entire length of segment, with moderate pressure and constant touch |
| Kneading | Circular movements of soft tissue, parallel to the long axis of underlying bone, with constant touch and intermittent pressure. |
| Petrissage | Circular movements of soft tissue, perpendicular to the long axis of underlying bone, with constant touch and intermittent pressure. |
| Friction | Small range to and for movement of soft tissue with constant touch and constant deep pressure. |
| Precession | Oscillatory movement of hand or a part thereof with intermittent touch and pressure. |
| Shaking | Small range oscillatory movement of hands in sideways directions with constant touch. |

# Exercise therapy and yoga

**Objectives:** At the end of this lesson you shall be able to
- **define therapeutic exercise in cost of physical**
- **list the benefits of exercise**
- **explain about the classification of execrise.**

**Definition**

Therapeutic exercise is the systematic and planned performance of the bodily movements, postures or physical activities intended to provide a patient or client with the means to:

1 Remediate or prevent impairments.

2 Improve, restore or enhance physical function.

3 Prevent or reduce health-related risk factors.

4 Optimize overall health status, fitness or sense of well-being.

**Benefits of exercise**

- Weight management. The most prominent benefit of exercising is that if helps with weight management.
- Bone & muscle health
- Relief from physical pains
- Protection against health conditions
- Younger, healthier skin
- Boost mental health
- Energy level boost
- More quality sleep

**Classification of exercise**

**i** **Active exercise:** Exercise is that which an individual does using one's own strength or energy. Active Exercises involve conditioning, strengthening, flexibility and functional training.

**ii** **Passive Exercise:** Movement of the body, usually of the limbs, without effort by the patient, the patient is passive. Movement is within the unrestricted ROM for a segment that is produced entirely by an external force.

**iii** **Resistive:** Exercise in which a muscle contraction is opposed by force to increase strength or endurance.If the resistance is applied by using weights.it is mechanical resistance, iif applied by a clinician, if is manual resistance.

**iv** **Isometric:** An isometric is a form of exercise involving the static, contraction of a muscle without any visible movement in the angle of joint.

**v** **Functional:** Functional exercise is any movement that mimics activities that we do every day. They are exercises which involve the movement of multiple joints or body parts.

**vi** **Stretching:** Stretching is a form of physical exercise which a specific muscle tendon is deliberately flexed or stretched in order to improve the muscle tone.The result is feeling of increased muscle control, flexibility and range of motion.

**vii** **Isokinetic:** It is a type of strength training. It uses specialized exercise machines that produce a constant speed no matter how much effort you expend. These machines control the pace of an exercise by fluctuating resistance throughout your range of motion.

**viii** **Closed chain:** Closed-chain exercises involve motions in which the body moves on a distal segment that is fixed or stabilized on a supprt surface.The extremity remains in constant contact with the immobile surface, usually the ground or the base of a machine.

**ix** **Open-chain:** Open chain exercises are performed where the hand or foot is free to move. Limb movement occurs distal to the moving joint.

**2 Applied exercise therapy**

a Passive movements-It is the movement of the body or extremities of a patient performed by another person without voluntary motion on the part of the patient.

**Classification of passive movements**

1 Relaxed passive movements, including accessory movements.

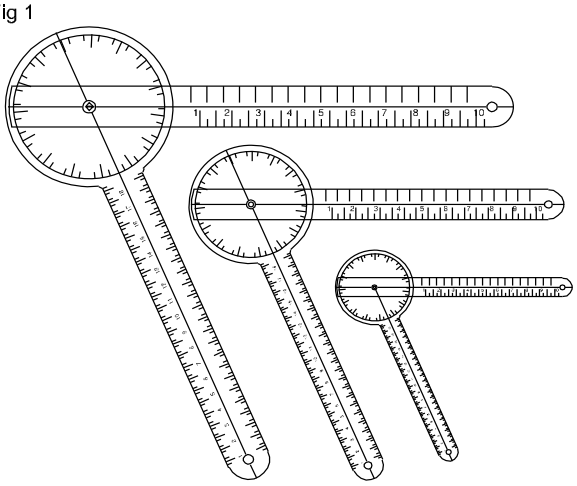
2 Forced passive movements

3 Continuous passive movements

**b Goniometry**

A Goniometry is an instrument that either measures an angle or allows an object to be rotated to a precise angular position. The term goniometer is derived from two Greek words, gonia meaning angle and metros, meaning measure. (Fig 1)

Fig 1



**c Exercise with instrument** (Fig 2,3,4 & 5)

Fig 2

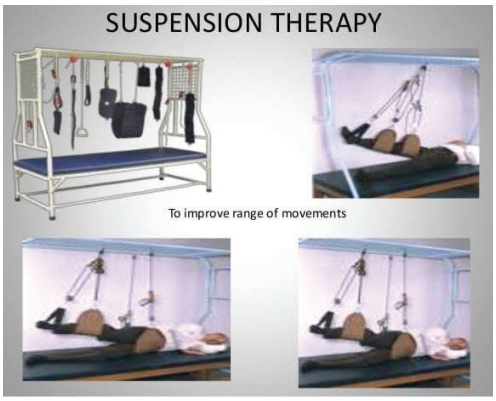



Fig 3


Fig 4


Fig 5

**d Active movements**

Patients performs the exercise to move the part or joint without any assistance to the muscles surrounding the joint.

**Active-assisted movements**

Movement of a joint or limb in which the patient provides some effort, but also receives some assist from an outside force. This outside force may provided , by the therapist, the patient, use of leverage, or any other means.

**e Resistive Exercise**

Resistance exercise is any form of exercise that forces your skeletal muscles to contract. An external resistance (such as heavy weights) is used to cause the contractions, and those contractions leads to increases in muscular mass, strength, endurance and tone.

**f Co-ordination and balance**

Co-ordinated movement, which is smooth, accurate and purposeful, is brought about by the integrated action of many muscles, superimposed upon a basis of efficient postural activity.

Balance includes the ability to maintain positions, recover and reacts from forces that might throw you off balance, as well as the ability to safely fall, minimizing injuries.

**g Stretching exercise**

Stretching exercise is a general term used to describe any therapeutic maneuver designed to increase mobility of soft tissues and subsequently improve ROM by elongating structures that have adaptively shortened and have become hypomobile over time.

**h Techniques for chest physiotherapy**

Chest physical therapy is the term for a group of treatments designed to improve respiratory efficiency, promote expansion of the lungs, strengthen respiratory muscles and eliminate secretions from the respiratory system.

The following techniques are all part of chest physical therapy:

1 Percussion/clapping/cupping

2 Vibration

3 Postural drainage

**i Manual muscle testing**

Manual muscle testing (MMT) is used for a variety of purposes in health care by medical, osteopathic, chiropractic, physical therapy, rehabilitation and athletic training professionals.

**Procedure:** For each muscle tested, the examiner stands to the side being tested and the patient is sitting upright and positioned to allow full movement of the joint against gravity. The examiner demonstrates the desired movement against gravity. The examiner then requests the patient to repeat the motion.

**j Techniques of PNF**

- It is often a combination of passive stretching and isometric contractions.

| Scale | Explanations |
|---|---|
| 0 | No contractions is present |
| 1 | There is flicker contractions |
| 2 | Full ROM with gravity counter balance |
| 3 | Full ROM against gravity |
| 4 | Full ROM against gravity + added resistance |
| 5 | Muscle function normally |

- Putting a muscle in stretched position (also called a passive stretch) and holding for a few seconds.
- Contracting the muscle without moving (also called isometric) such as pushing gently against the
- Relaxing the stretch, and then stretching again while exhaling.

PNE techniques can be used to develop muscular strength and endurance; facilitate stability, mobility, neuromuscular control & co-ordination movements; lay a foundation for the restoration of function.

**k Indications & contra indications of passive movements**

**Indications**

- In acute, inflammed tissues, where active movements is painful.
- In comatose, paralytic or complete bedridden patient.
- In muscle re-education as a first step.

**Contraindications**

- Immediately after acute tears, fractures & surgery
- Signs of too much effusion or swelling (DVT)
- Severe sharp & acute joint pain
- When motion disturb to healing process
- When bony block limits joint motions
- Acute infection around or in the joint (Arthritis)
- In case of increased joints hypermobility or hematoma

**l Indications & contraindications**

**Indications**

- Post surgical pain (Rib fracture / ICC)
- Chronic increased sputum production (e.g. in chronic bronchitis, cystic fibrosis)
- Acute increase sputum production
- Poor expansion
- Sputum retention
- Cystic fibrosis
- Bronchiectasis
- Lung Abscess
- COPD
- As a relaxation procedure

**Contraindications**

- Increased ICP
- Unstable head or neck injury
- Recent spinal injury
- Emphysema
- Bronchopleural fistula
- Flail chest
- Uncontrolled hypertension
- Rib or vertebral fractures or osteoporosis
- Acute Asthma or TB
- Patients who have recently experienced a heart attack
- Patients with skin grafts or spinal fusions will have undue stress placed an areas of repair.

**m Grades of MMT**

| Grading scale | Explanations |
|---|---|
| 0 | No contraction is present |
| 1 | There is flicker contraction |
| 2 | Full ROM with gravity counter balance |
| 3 | Full ROM against gravity |
| 4 | Full ROM against gravity of added resistance |
| 5 | Muscle function normally |

**n Precautions while performing exercises on patients**

- Select ambient room temperature.
- Select clothing that facilitate heat dissipation.
- Exercise should be pain free .
- Initiate with low loads / avoid high intensity.
- Do not apply pressure to unstable joint or distal to fracture site.
- Avoid uncontrolled ballistic movements.
- Prevent incorrect or substitute motion.
- Avoid exercise that put exercise, unintended secondary stress on body.
- Be aware of medications a patient is using.
- Avoid fatigue.
- Discontinue exercise if patient experience pain, dizziness or unusual shortness of breath.
- Prevent pathological fractures.

# Exercise physiology

**Objectives:** At the end of this lesson you shall be able to
- **define thermoregulation & know about exercise organs**
- **state about muscles of respiration and lung volume**
- **describe about cardiovascular adaptations.**

**1 Thermoregulation and exercise organs**

**a Conduction** - The process by which heat or electricity is directly transmitted through the material of a substance when there is a difference of temperature or electrical potential between adjoining regions, without movement of material.

- The process by which sound waves travel through medium.
- The transmission of impulses along nerves.

**b Convection -** It is the movement caused within a fluid by the tendency of hotter & therefore less dense material to rise, colder, denser, material to sink under the influence of gravity, which consequently results in the transfer of heat

" The final transfer of energy is by convection"

**Evaporation**

It is the process of a substance in a liquid state changing into a gaseous state due to an increase in pressure or temperature.

**b Homeostasis**

It refers stability , balance or equilibrium within a cell or body. Homeostasis can be thought of as a dynamic equilibrium rather than a constant , unchanging state.

The endocrine system plays an important role in homeostasis because hormones regulate the activity of body cells.

**c Physiological thermoregulation**

Thermoregulation, by definition is a mechanism , by which mammals maintain their body temperature by tightly controlled self regulation, no matter the temperature of their surroundings.

Thermoregulation is a process that allows your body to maintain its core internal temperature.

**2 Respiration**

Various muscles of respiration aid in both inspiration and expiration, which requires changes in the pressure within in the thoracic cavity .

The primary muscles of inspiration are the diaphragm, the upper and more lateral intercostals , the parasternal portion of the internal intercostal muscles.

| Muscles of inspiration | Muscles of expiration |
|---|---|
| • Sternocleidomastoid | • Internal intercostals |
| • Scalenus | • External oblique |
| • External intercostals | • Internal oblique |
| • Diaphragm | • Transverse abdominus |
| | • Rectus abdominus . |

**B Static and dynamic lung volume**

- Static lung volume - Measures the dimensional component of air movement for the pulmonary tract.
- Dynamic lung volume - Measures the power component of the pulmonary during different stages of the ventilatory excursion.

**C Gaseous exchange**

Gas exchange is the delivery of oxygen from the lungs to the blood stream to the lungs. It is lungs between the alveoli and a network of tiny blood vessels called capillaries, which are located in the walls of alveoli. (Fig 1)

**3 Cardiovascular adaptations**

**a Sub maximal exercise -** Sub maximal exercise tests can be used to predict aerobic capacity or to asses the ability to perform a standardized exercise or task. in addition, measurements taken before, during and after the test can yield valuable information regarding the person's exercise response.

**b Maximal exercise** - A maximal exercise test is one that is performed with progressively increasing workloads up to limiting fatigue and/or dispense caused by the exhaustion of the capacity for adaptation of the patient's cardiovascular system.

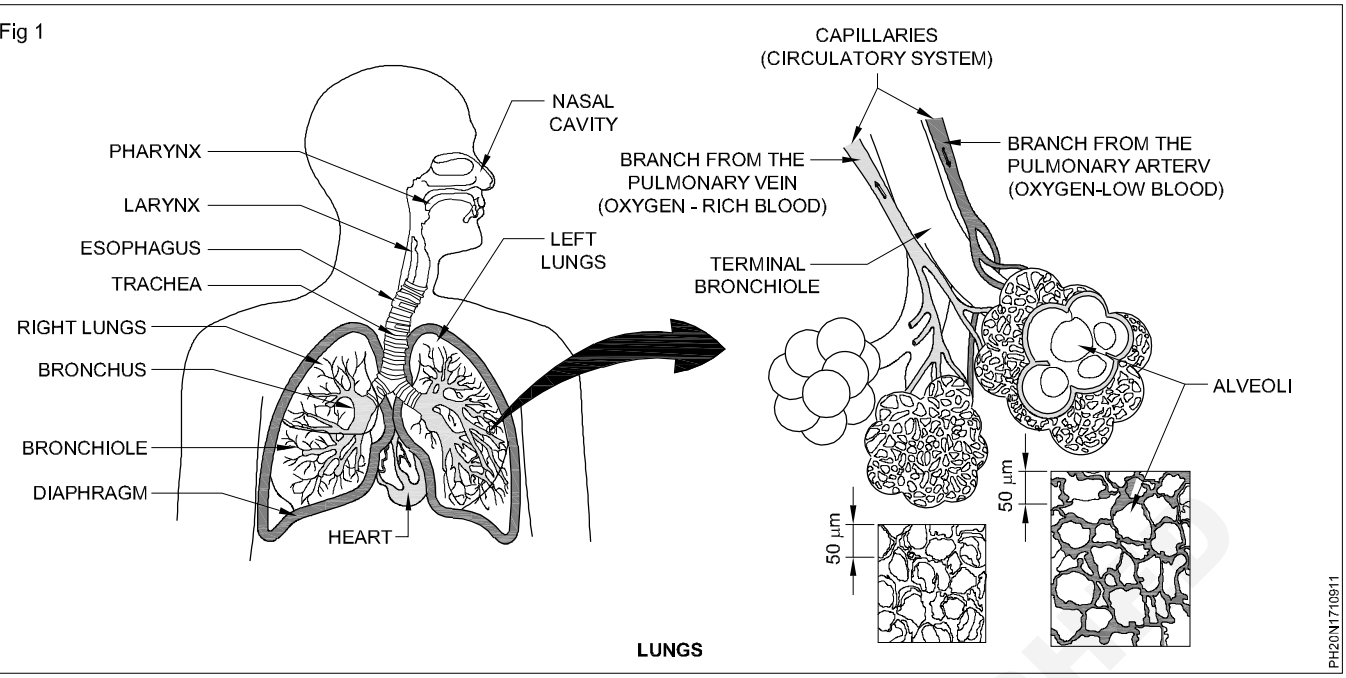
**4 Fatigue**

Fatigue is a term used to describe an overall feeling or tiredness or lock of energy

**Symptoms**

- Chronic tiredness or sleepiness
- Headache
- Dizziness
- Sore or aching muscles
- Muscle weakness
- Slowed reflexes and responses

Fig 1




**Types**

- Transient fatigue is acute brought on by extreme sleep restriction or extended hours awake across a series of days.
- Cumulative fatigue is a fatigue brought on by repeated mild sleep restriction or extended hours awake across a series of days.
- Circadian fatigue refers to the reduced performance during an individuals "window of circadian low" (typically between 2.00 am and 5.00 am).

**Recovery**

1 Rule out health problems. Fatigue is a symptom of many illness, including diabetes, heart disease, arthritis, anemia, thyroid disease and sleep apnea

2 Get moving

3 Strike a pose

4 Drink plenty of water

5 Get to bed early

6 Keep time with your body clock

7 Shed extra weight.

**5 Endurance**

Endurance is the ability of an organism to exert itself and remain active for long period of time, as well as its ability to resist, withstand, recover from and have ability to trauma ,wounds or fatigue

**Endurance training** - It is the act of exercising to increase endurance .The term endurance training generally refers to training the aerobic system as opposed to the anaerobic system.

**Examples of endurance exercise;**

- Walking briskly
- Running / jogging
- Dancing
- Biking
- Climbing stairs at work or at home

**6 Kinesiology and biomolecules**

**Kinesiology -** The study of muscular movements, the mechanisms of human motion.

**Biomolecules** - The application of the principles of mechanical physics to understand movements and actions of human bodies and sport implements.

**Basic terminologies**

- **Muscle force:** When muscle contract or stretched they create muscle force . This muscle force pulls on bones which create joint torque.
- **Joint angular velocity:** Joints in the human body move through arcs and therefore accelerate through a range of angular motion.
- **Isokinetic:** Isokinetic is performed on dynamometer which provides variable resistance to movements so that regardless of the effort exerted, the movement takes place at the constant speed
- **Isoinertial:** It maintains constant mass and is characteristic of typical free write exercise that are commonly employed in the strength training.
- **Displacement:** Displacement is a change in position of a body.
- **Squat jump:** It is a common test used in research to measure jumping ability and is performed starting in the bottom position at a 900 knee angle.
- **MVC:** Maximum voluntary contraction or sometimes referred to as MVIC is the measurement of the greatest possible output that the individual can create by their own volition.

- **Concentric:** Concentric muscle action occur when shorten under tension.
- **Eccentric:** It occurs when muscles lengthen under tension.
- **Isometric:** Occur when no movement in the joint take place.
- **Plyometric:** Plyometric ex take advantage of the stretch-shortening cycle whereby a muscle rapidly lengthens and explosively reverses its action.
- **Active:** In biomolecules, active muscle forces are generated by muscle contractions ,namely the sarcomeres.
- **Passive:** Passive muscle forces are generated by the elastic properties of materials, ligaments, bones, tendons and fascia.

**7 Relaxation exercises**

1 Progressive muscle relaxation: PMR was developed to help patients with muscle pain and regardless of a physical or mental illness

To practice PMR, follow these step:

- Find a quiet place and get into a comfortable place for sitting and lying down.
- Start by inhaling deeply through, your nose slowly exhaling through your mouth for 3-5 cycles.
- Tighten your muscles by squeezing your body, clenching your toes and pushing your heels to the ground.
- Release, then flex your feet towards your head for few seconds until releasing again.
- Move into new muscle groups, your abdomen, legs, arms, shoulders, neck and face.
- Tighten then release.

you can repeat these steps as needed and finish your practice with same deep calm breaths.

**Breathing exercises.**

Controlling and regulating your breath through various breathing exercises is a powerful way to claim your mind and relax your body.

**Stretching exercises.**

- Shoulder shrugs
- Chin turns
- Head tilts
- Back stretch
- Elbow pull

**Meditation and visualisation**

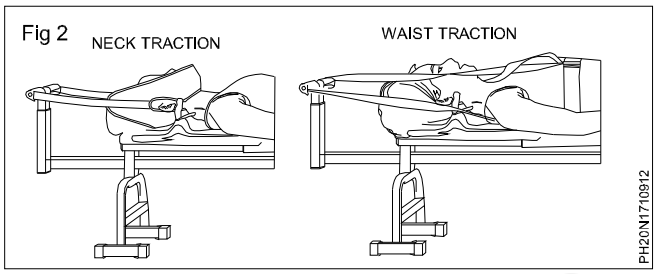
Meditation and visualisation are the same best ways to alternate or alleviate stress.

**Massage**

Getting a massage is a powerful act of self-care . It also has benefits for your body and health.

**8 Traction**

Traction either by hand or mechanical unit has been used commonly by physiotherapists. Traction is a gentle or moderate force that is applied to the spine for the purpose of slightly separating the bones or vertebrae of the spine. (Fig 2)




**Cervical and lumbar traction**

- Cervical spinal traction is accepted as effective for short term relief of neck pain. It can relieve muscle spasm and nerve root compression by stretching soft tissues and increasing the spaces between cervical vertebrae.
- Lumbar traction can relieve on compressed nerves help muscles relax & reduce muscle spasms. Traction increases the space between vertebrae-reducing pressure on intervertebral disc and nerve root.

**Contra Indications**

- Malignancy
- Infectious disease of the spine - TB
- Uncontrolled hypertension
- Rheumatoid arthritis
- Spinal cord compression
- Osteoporosis
- Vertebral fractures
- Cardiovascular disease
- Extruded disc fragmentation

**Therapeutic uses and effects**

- Pain reduction
  - Decrease mechanical pressure on nerve roots.
  - Continuous fraction allows reabsorption of nucleus pulposus of disc lesions.
- Muscle spasm reduction
  - Breaks pain - spasm-pain cycle by lengthening affected muscles.

**Physiological effects**

- Pain relief
- Increasing the space between vertebrae
- Stretching muscles and ligaments
- Reducing muscle spasm
- Relaxing muscles

- Changing intervertebral disc pressure

### 9 Activities of daily living

Activities of daily living (ADL'S) are routine activities people do, every day without assistance. There are six basic ADL'S: eating, bathing, getting dressed, toileting, transferring and confidence.

**Role of physiotherapy in ADL'S**

- Asses, manage and treat a brood range of medical conditions from sprained ankles to strokes.
- Relieve physical pain and heal injuries.
- Increase mobility, build strength, improve balance and enhance cardiopulmonary performance.
- Use a variety of techniques to maintain the properties of muscle and joint.
- Move immovable independent for his/her activity of daily living.
- Provide gait training and posture correction.

### 10 Gait

Human gait refers to locomotion achieved through the movement of human limbs .human gait is defined as bipedal, biphasic forward propulsion of center of gravity of the human body, in which there are alternate sinuous movements of different segments of the body with least expenditure of energy.

**Phase of gait**

Classification of the gait cycle involves two main phases.

1 Stone phase: The phase during which the foot remains in contact with the ground.

2 Swing phase: The phase during which the foot is not in contact with the ground.

The stance phase occupies 60% of the gait cycle while the swing phase occupies only 40% of it.

A more detailed classification of gait recognises six phases.

1 Heel strike .

2 Foot flat .

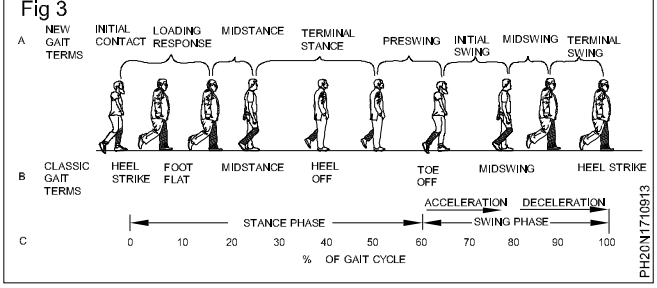
3 Mid-stance.

4 Heel-off

5 Toe-off.

6 Mid-swing.

Fig 3




**Abnormal gait patterns**

There are eight basic pathological gaits that can be attributed to neurological conditions:

Hemiplegic, spoatic, diplegic, neuropathic, myopathic, parkinsonism, choreiform, atoxic and sensory. (Fig 4)

Fig 4

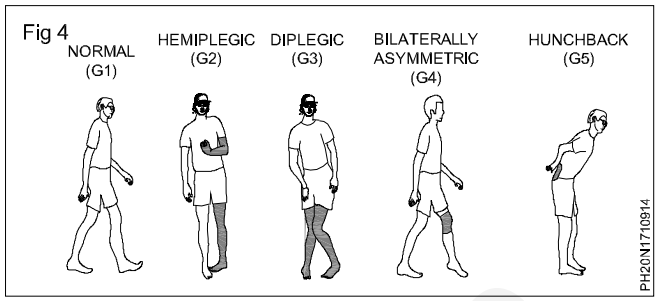



Fig 5

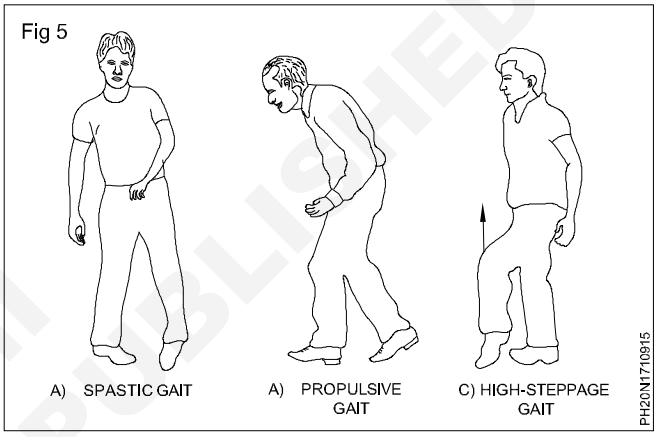
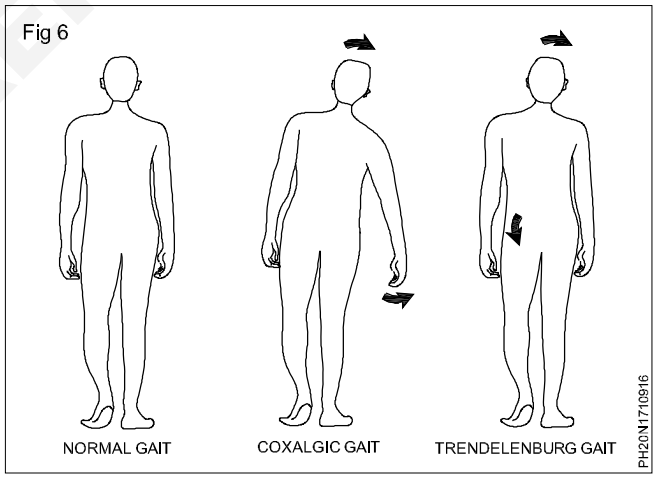



Fig 6




### 11 Walking aids

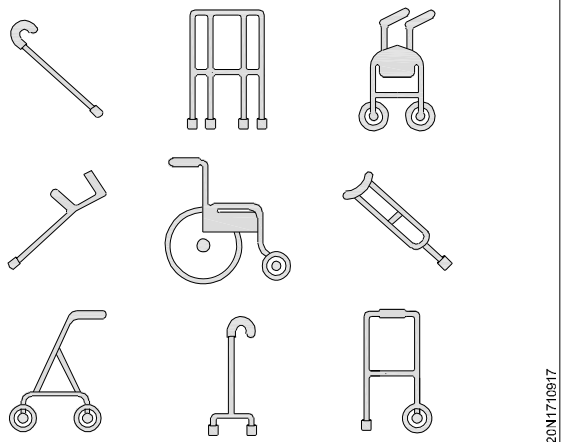
**Types**

- Cone
- Crutches
- Walkers
- Walking frames
- Walking sticks. (Fig 7)

**Indications**

- People with arthritis
- Victims of accidents involving the lower extremities

Fig 7



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- People with injuries in the lower extremities such as fractures, sprains, strains, a broken kneecap, dislocations.
- Injury to the back.
- Visual impairment.
- Recent stroke or brain injury.
- Development disabilities

**Precautions**

- Have someone nearby for assistance until a customer to the crutches.
- Frequently check that all the pools are securely in the place.
- Check screws atleast once per week.
- Clean out crutch ties to ensure they are free of dirt and stones.
- Remove small, loose rugs from walking paths .
- Beware of ice, snow, wet or waxed floors.
- Never carry anything in hands, use a backpack.
- Don't use crutches that are too short or mismatches. They can cause back pain and falls.

# Applied anatomy

**Objectives:** At the end of this lesson you shall be able to
- **state about the causes & deformity of various anatomical conditions**
- **learn the clinical features of various conditions.**

**a Carpal tunnel syndrome**

Carpal tunnel syndrome is a syndrome of compression neuropathy of the median nerve of the wrist.

**Causes**

- Rheumatoid inflammation the flexor tendon sheets.
- Compound palmar ganglion due to tuberculous tenosynovitis of the radial bursa.
- Anterior dislocation of the lunate bone into the funnel.

**Clinical features**

- The patient complaints of numbers of ting ling in the thumb, index and middle fingers worsening at night.
- There may be wasting and weakness of the there or muscles with sensory deficiency in the area.

**b Erb's palsy**

This is the common form of birth palsy. The lesion is usually of the junction of the $C_5$ $C_6$ roots.

**Clinical Features**

It causes paralysis of the Deltoid, supraspinatus. Infra spinatus, Biceps and Brachialis muscles.

**Klumpke's polsy**

This involves the lower trunks and there is paralyses of the muscles supplied by $C_8$ and $T_1$ roots.

The small muscles of the hand are paralysed in addition to the paralysis of wrist and finger flexors.

**c De Quervain's disease**

It is a chronic constrictive tenosynovitis affecting the abductor polices longus and extensor policies brevis tendory of the thumb at the wrist.

**Clinical features**

- Pain along the aspect of the distol end of the radius.
- Swelling along then tendon of that level of it is tender on palpation.

**d Rotator cuff syndrome**

With advancing age, the supraspinatus tender, a part of the musculo tendinous cuff, under goes degenerative changes with diminishing subdelted based efficiency.

**Clinical features**

- Pain and inability to abduct the shoulder.
- Tenderness over the top of the greater tubersty.

**e Wrist drop**

The radial nerve is commonly injured as it winds round the spiral groove in cases of fracture of numerous at this level: Pressure on the nerve when a person sleep with his arm resting over the edge of the cot causes wrist drop.

**Clinical features**

- Ask the patient to actively dorsi flex the wrist. He will be unable to do this, due to paralysis of the extensor carp radialis longus and brevis muscles.
- Unable to extend the thumb due to paralysis of extensor politics longus and brevis.
- Sensory loss is mini most and is confirmed to a small area in the derson of the hand over the mediodorsal bones of the thumb of index fingers.

**F Trendelenburg's sign**

Anatomical description on the right side.

**Causes**

- Non union fracture neck of fenor
- Dislocation of hip joint

**Clinical features**

- The pelvis drops on the opposite (ie.left) side causing instability.
- To restore the stability and present fall to the left the body lorches to the right side and shift the centre of gravity over the stance side right tip. This movement of every stance phase is called the Trendelenburg gait.

**G Tarsal funnel syndrome**

The posterior tibial nerve gets compressed in the fibro - osseous tunnel deep to the flexor retinaculum behind the medial malleates.

**Clinical features**

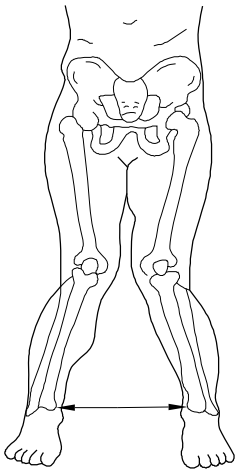
- Burning and tingling in the medal border and side if the foot.
- Later there is severe plan which is worse of night and is relieved by hanging the leg.

**H Genu valgum (Fig 1)**

Genu valgum is an outward deviation of the leg at the knee. It can be unilateral or bilateral.

Genu valgum results in secondary flat foot excessive genu valgum often causes outward dislocation of the patella.

Fig 1



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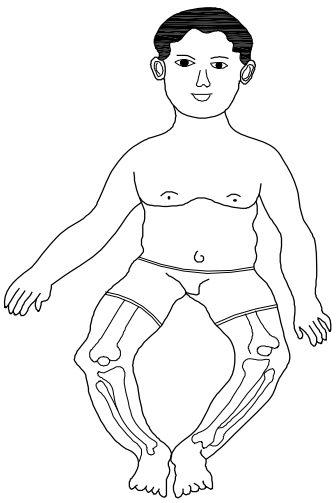
**Genu varum (Bow leg) (Fig 2)**

Genu varum is a deformity where in there is lateral bowing of the legs at the knee.

It is usually bilateral. It is commonly seen in conditions like rickets and Paget's disease

Fig 2



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**I Coxa vara**

It is deformity where in the angle between the neck and shaft of femur is reduced . Normally the angle is between 130º and 140º in adults and 140º and 150º in children. Reduction of the neck shaft angle below 110º is called coxa vara.

**Coxa valga**

Coxa valga is a deformity of the hip where the angle formed between the neck of the femur of its shaft is increased, usually above 135º.

**Clinical features**

- Patient experience shortening of the leg.
- Difficulty in bearing weight to stand on the affected leg.

**J Foot drop**

A general term for difficulty lifting the front of the foot, is called foot drop.

**Causes**

The important one being leprosy as a cause of foot-drop.

**Local** - Causes are seen along the course of the nerve.

- Tumors of spine
- Disc prolapsed
- Fractures around the hip
- Fracture shaft femur
- Dislocation of knee
- Surgical damage

**Clinical features**

- Patient cannot dorsiflex a invert the foot.
- Front of the leg is wasted.



## Ortho - Neuro general - Orthopaedical condition

**Objectives:** At the end of this lesson you shall be able to
- **describe about the orthopedically conditions, its causes and clinical features**
- **explain about the physiotherapy management for these conditions.**

**I Kyphosis (Fig 1)**

It is defined as increase in normal posterior convexity of the thoracic spine and it is referred to as 'hyper kyphosis'.

**Causes**

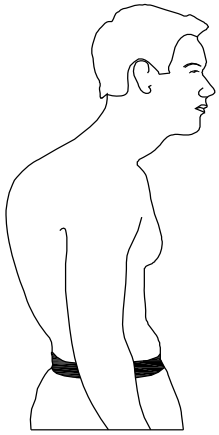
- Localised injury and disease like fracture, pott's disease secondaries in the spine etc.
- Generalized bone disease like ankylosing spondylitis, osleomalacia, paget's disease etc.

**Physiotherapy management**

1 Maintenance of proper posture of head and neck.

2 Resistive exercise ore indicated to the back muscles.

Fig 1



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3 Controlled pelvic tilt and rocking ore helpful.

4 With the brace on, the patient is instructed to push against the posterior pads thereby stretching the shoulder of the gibbus deformity.

**Lordosis**

Lordosis is the exaggeration of the anterior curve of the spine.

**Causes**

- Hip flexion contracture due to disease of the hip joint like congenital dislocation and tuberculosis.
- Paralysis of abdominal or the flexor of tumbler side.
- Congenital or required spinal deformities like spandy lolisthesis.

**Treatment**

1 Mobilisation of lumbar spine.

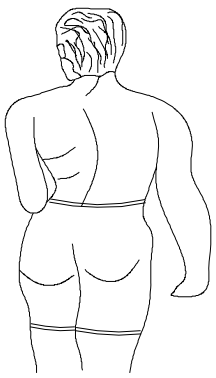
2 Strengthening of the abdominals, glutei and hamstrings.

3 Correction of pelvic tilt.

**Scoliosis (Fig 2)**

It is the lateral curvature of the spine in the upright position.

Fig 2



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**Causes**

- Due to lock of imbalance on either side of the trunk, the most common cause being poliomyelitis.
- Cerebral palsy, muscular dystrophies, etc are the other common cause.

**Management**

- Correction of faulty posture by active and passive methods.
- Instruct the patient to hang from a suspension with one hand.
- Axial traction - with the patient in supine position traction is given along the direction of the leg and pelvis by the therapist while counter traction is given by another therapist in the opposite direction along the chin of occiput. This helps to obtain the correction.

**II Cervical spondylosis**

It is defined as arthrosis of the posterior intervertebral joints in the cervical vertebrae.

**Clinical features**

- Chronic pain in the neck with or without radiating pain down the arm.
- Tenderness in the cervical spine with limitations of all movements.

**Management**

- SWD to the neck
- Intermittent cervical traction
- Cervical collar is prescribed

**Lumber spondylosis**

It is defined as arthrosis of the posterior. Inter vertebrate joints in the lumbar vertebrae.

**Clinical features**

- Chronic pain in the back with or without radiating pain down the leg.
- Tenderness in the lumbar spine with limitations of all movements.

**Management**

- SWD to the bock
- Intermittent lumbar traction
- Lumbo - scroll belt is prescribed

**III Ankylosing spondylitis**

It is a chronic, progressive and crippling disease affecting the spine.

**Causes**

- It is related to certain tissue types of human leucocyte. Antigen (HLA) system.
- The majority of disease patents are found to belong to HLA B21 group.

**Clinical features**

- Diffuse pain in the back and vague pains in other joints.
- Movements of the whole spine are limited.
- Tenderness over one or both macro -iliac joints.
- Chest expansion is diminished to less than 5 cms due to the involvement of the costovertebral joints.

**Management**

- Deep breathing exercise and exercises for the spine.
- Patient is advised to use a hard bed and sleep supine with a single pillow.

**IV Tennis elbow**

painful elbow syndromes, pain and tenderness on the lateral side of the elbow. It is a lesion affecting the tendinous origin of common wrist extensors.

**Causes**

- Epicondylitis

- Inflammation of adventitious bursa
- Classified deposits within the common extensor tendon.
- Pain of neurological origin, e.g. cervical spine affection radial nerve entrapment, etc.

**Clinical features**

- Pain during activity - stage I.
- Pain during activity and of rest - stage II.
- Pain of rest, night pains and pain during daily activities - stage III.

**Management**

- Heat modalities like TENS, ultra sound and SWD.
- Massaging.
- Exercise - Active exercises for the shoulder elbow, wrist and hand are indicated.

**V Golfer's Elbow**

It is similar to lateral epicondylitis but occurs on the medial side of the elbow, where the pronator teres is the flexors of the wrist and fingers originate.

Tenderness is often less and well localized than in tennis elbow.

**Treatment**

It is the same as for the tennis elbow.

**VI Gout**

It is a metabolic disorder manifesting in the primary or secondary forms characterized by hyper uricemia and joint lesions.

**Causes**

- Due to an inborn error of uric acid metabolism.
- Sodium urate crystals are deposited on the articular cartilage, synovial membrane and in the periarticular tissues like tendons and bursae. This provokes an inflammatory reaction in these tissues.

**Clinical features**

- The most commonly affected joint is the meta tarso phalangeal joint of the big toe.
- Sudden onset of pain at night with marked swelling and redness of the joint of the big toe.

**Treatment**

At the acute stage, the joint is rested in a splint. Large gouty tophi may need surgical curvetting or evasion.

**VII Osteoathritis**

It is defined as a degenerative, non-inflammatory joint disease characterized by destruction of articular cartilage and formation of new bone at the joint surface and margins.

**Causes**

- Obesity
- Genetics and heredity
- Occupation involved prolonged standing
- Sports
- Multiple endocrinal disorders
- Multiple metabolic disorders

**Clinical Features**

- Pre dominant symptom is pain
- Mild swelling of the knee joint
- Early morning stiffness
- Tenderness and crepitus
- Terminal movements of the knee are restricted

**Management**

- Reduction of weight
- Isometric quadriceps exercises
- Walking exercises
- Heat therapy
- TENS, Ultrasound, SWD, cryotherapy, etc

**VIII Rheumatoid Arthritis**

It is the most common inflammatory disease of the joints characterized by proliferative or destructive changes in synovial membrane, periarticular structures, skeletal muscles and perineural sheaths.

**Causes**

The exact cause is unknown but mal function of the cellular and humeral arms of the immune system are cited as the probable cause.

**Clinical Features**

- Pain, swelling , stiffness of the small joints of hands and feet are common presenting complaints.
- Joints swelling could be symmetrical of the patient presents with deformities of bones and joints in the last stage.
- Instability of the knee.

**Management**

- Cryotherapy, thermotherapy, TENS and IFT is recommended.
- Isometric exercises to the shoulder, hip and knee muscles.
- Active ROM exercises to all the joints.
- Splints should be used to maintain the joints in functional position.
- Pastural guidance.
- Hydrotherapy helps.

**IX Frozen shoulder**

A condition characterized by stiffness and pain in the shoulder joint.

**Local causes**

- Impingement syndrome
- Bursitis
- Synovitis
- Trauma

**General**

- Diabetes
- Thyroid
- Gout

**Clinical Features**

- Pain shoulder, upper arm
- Severe acting pain
- Restricted shoulder movement
- Difficulty in routine activities
- Uniform impairment of all shoulder movements

**Management**

- Ultra sound, IET, TENS, etc
- Passive mobilization
- Hydrotherapy
- Stretching and strengthening exercise of shoulder

**X Fracture**

A fracture is a broken bone a bone may be completely fractured or partially fractured in any number of ways (Cross wise, length wise, in multiple piece).

**Causes**

- Trauma - A fall, a motor vehicle accident, or a tackle during a football game can all result in fractures
- Osteoporosis - This disorder weakens bones and maker them more likely to break
- Overuse - Repetitive motion can tire muscles and place more force on bone. This can result in stress fractures. Stress fractures are more common in athletes.

**Clinical features**

Pain areas : in the bones.

Also common: bleeding, bruising, limping, loss of height, physical deformity, swelling or tenderness.

**Physiotherapy management**

- Manual therapy
- Soft tissue release / stretching techniques
- Bracing / taping
- Pain relief modalities
- Muscle strength for stability

**XI Dislocation and subtraction**

A dislocation is defined as "displacement of a bane from its natural position in the joint".

A subluxation is defined as "a partial distortion".

**Clinical features**

- Pain around the injured joint
- A sensation of the joint being unstable
- Swelling of the joint
- Limited mobility of the joint
- Possible loss of feeling or numbers.

**Causes**

- Direct force injury, such as from a motor vehicle accident or sports injury.
- Wear and tear from daily activities.
- Over use injuries, includes when athletes are training.

**Management**

- Relaxed passive mobilasation.
- Assisted active movements.
- Appropriate thermo therapy modality may be used.

**XII Sprain**

It is a tear in the ligaments. The severity varies from grade I to III.

**Causes**

- Direct force injury
- Wear and tear from daily activities
- Over use injuries

**Clinical features**

- Pain around the area
- Swelling of the joint
- Limited mobility

**Management**

- Thermotherapy - Ultrasound, SWD, TENS, IFT, etc.
- To control oedemc - Leg elevation, Compression bandage.
- Isometric exercises.
- Active exercises.

**XIII Tendonitis**

It is a tendon injury resulting from repetitive mechanical load with a subsequent inflammatory response.

**Causes**

- It is common in sports persons.
- Common over use injury in long distance runners.

**Clinical Features**

- Pain, Swelling
- Immobility of the affected site

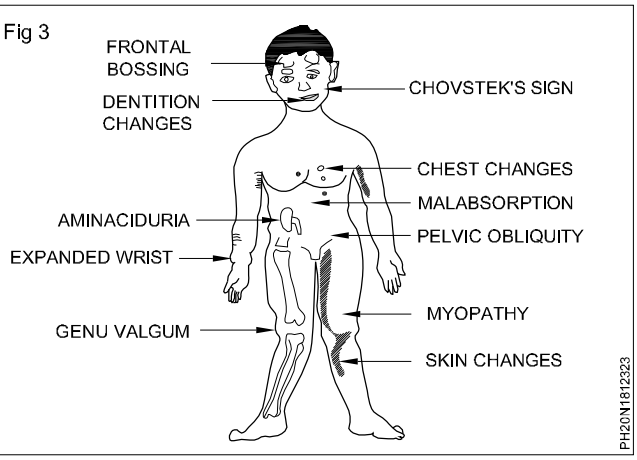
**Management**

- Thermotherapy
- Mobilisation

**XIV Rickets (Fig 3)**

It is a metabolic disease of childhood, in which the osteoid, the organic matrix of bone, fails to mineralize due to interference with calcification mechanism.

Fig 3




**Causes**

- Vitamin D deficiency.
- Malabsorption - due to celiac disease, hepatic osteodystrophy.
- Renal disease
- Antiepileptic drugs

**Clinical Features**

- Wizened look
- Delayed dentition
- Prominent abdomen
- Separation of recti
- Pole of flabby skin
- Incomplete fractures

**Management**

- Prevention of deformity can be done by absolute and strict bed-rest, rickets splints, etc.
- Correction of splints.

**XV Osteomalacia**

It is the adult counter part of rickets and is characterized by failure of mineralization and an excess of osteoid due to an interference with calcification mechanism.

**Causes**

- Decreased vitamin D absorption from the intestine.
- Derangement of Vitamin D and phosphorous metabolism.

**Clinical features**

- Skeletal pain and muscle weakness. The following deformities are encountered, scoliosis. Kyphosis, coxa vara, thighs and legs are bent, etc.

**Management**

- Same as that of rickets
- Correction by splints
- Prevention of deformities

**XVI Osteomyelitis**

It is defined as a supportive process of the bone caused by pyogenic organisms or infection of the cancellous portion of the bone.

**Causes**

**1 Organisms**

- Staphylococcus aureus
- Pseudomonas
- Pneumococcus
- Coliforms
- Brucella bacillus
- Tubercle bacillus
- Actinomycosis

**2 Environmental factors**

**Clinical features**

- Fever
- Swelling
- Limitation of movement
- Tenderness
- Effusion
- Local erythema

**Management**

- Proper splinting of the affected joints.
- Limb elevation to control oedema.
- Cry therapy.
- The unaffected joints put through active vigorous exercises.
- Mild isometric exercises for affected joints.
- Passive and resistive exercises.

**XVII Calcaneal Spur**

It is a spike of bone at the anterior edge of the calcaneal tuberosity (usually medial).

**Causes**

- Due to repeated attacks of plater fasciitis.

- Due to repeated trauma.
- Fibromatosis of the planter fascia.
- It fitting footwear.

**Clinical features**

- Pain over all the heel.
- Tenderness on plantar aspect of the heel.
- Swelling.

**Management**

- Patient is instructed to weight bear on the toes instead of the heel.
- Instruct to immense his foot in warm water and curl his toes and hold it for sometime.
- Faradic stimulation of the foot.
- Straight leg raising exercises.
- Isokinetic exercises.

**XVIII Flat foot**

Flat foot is a condition where there is flattening of the arches of the foot.

**Causes**

- Muscle weakness due to general debility.
- Rapid increase of body weight.
- Post traumatic flat foot following injury to the calcaneum, metatarsal, etc. due to wasting and weakness of intrinsic muscles.

**Clinical features**

- The feet appear flat.
- Hyper extension of toes of MTP joint.
- Hyper flexion at the IP joints.
- Pronation and adduction of fore-foot.

**Management**

- Exercises to the intrinsic foot muscles.
- Use of modified footwear relieve the symptoms.

## Neurological condition

**Objectives:** At the end of this lesson you shall be able to
- **explain the causes, clinical features of various neurological conditions**
- **describe about the physiotherapy management of various neurological conditions.**

**I Cerebral Palsy**

Cerebral palsy is a group of heterogenous development disorders of motor function which is present from infancy or early childhood.

**Causes**

- In utero - There may be a failure in development or mol development of the brain. This may be due to the mother having a viral infection such as rubella.
- Injury during birth may cause damage to the brain.

**Clinical features**

- Impaired movement
- Sensory defects
- Deformities
- Mental retardation
- Emotional disturbance
- Epilepsy

**Management**

- Should encourage the development of skills such as head control, rolling, balance in sitting. Kneeling, standing and walking.
- Try to inhibit abnormal reflexes and patterns of movement and to prevent deformity.
- Sensory stimulation for activation and inhibition of movement.
- Neuro developmental treatment.

**II Hemiplegia**

It is defined as paralysis of one side of the body and usually affects the arm, leg and trunk.

**Causes**

- Ischemia
- Cerebral haemorrhage
- Sub arachnoid haemorrhage
- Cerebral embolism

**Clinical features**

- The patient may complain of a headache, and weakness of one side of the body and there may be dysphasia.
- The weakness is followed by a flaccid paralysis and later spasticity may develop.
- Sensory loss
- Visual defects
- Communication defects
- Behavioral problems

**Management**

- Correct positioning will continue to be emphasized progressing through sitting and standing.
- Passive movements should be continued as long as is necessary.

- Once the patient is able to sit unaided and adjust his position without falling he can learn to perform other movements in the sitting position.
- Gradually activities will be carried out in standing and progress to walking and stairs.

**III Paralegia**

It refers to partial or complete paralysis of a part of trunk or whole trunk and both the lower extremities paraplegia results due to thoracic or lumbar cord lesion.

**Causes**

- Accidents
- Severe spinal cord injury
- Motor neuron disease
- Spine bifida
- Prolonged disease
- Tumors

**Clinical features**

- Loss of ability to feel remove.
- No control over bevel and bladder activities.
- Problems in breathing and coughing.
- Intense pain or tingling sensation in the trunk, legs to the pelvic regions.

**Management**

- **Range of motion**
  - Active ROM exercises.
  - Passive stretching.
  - Ankle boots and night splints.

**IV Quadriplegia**

It is a condition characterized by creakiness in all four limbs.

**Causes**

- An infection, like patio.
- Neuro muscular disease, like muscular dystrophy.
- Damage to the nervous system due to an injury or another medical condition.

**Symptoms**

- Loss of ability to feel and more.
- Loss of bladder control.
- Depressed reflexes.
- Inability to walk.
- Lock of motor control.
- Uncial stiffness or tightness of the muscles.

**Management**

- Breathing exercises.
- Strengthening exercises.
- Stretching.
- ROM and positioning.
- Ankle boots and right splints.

**V Myalgia**

The medical term for muscle pain is myalgia.

**Causes**

- Injury or overuse
- Electrolyte imbalance
- Muscle abscess
- Muscle rupture
- Tension
- Viral Infection

**Clinical features**

- Tenderness
- Swelling
- Redness or fever

**Management**

- Physical therapy --> modalities
  - Manual therapy
  - Stretching
- Home program
  - Massage tools
  - Warm clothes
  - Pillows -Beds
- Exercise - low impact aerobic activity and straight training.

**VI Fibromyositis**

It is a chronic inflammation of a muscle with an over growth of the connective tissue.

**Causes**

The most important ones are emotional stress whereby symptoms of fear, depression, etc, lead to muscle tension and insertion tendinitis.

**Clinical features**

- Muscle pain, burning, twitching or tightness.
- Draining fatigue.
- Insomnia or not sleeping well.
- Feeling nervous, worried, or depressed.

**Management**

- Ice and heat pock
- Exercise therapy
- Massage
- TENS

- Pain management

**VII Polio synthetics**

Polio is a highly contagious disease caused by a virus that attacks the nervous system. Children gauges then 5yr old are more likely to contact the views that any other group.

**Clinical features**

- Loss of reflexes.
- Service sparsons and muscle pain.
- Sudden paralysis.
- Deformed limbs, especially the tips, articles and feet.

**Management**

- Heat therapy - reduce pain, specs and stiffness.
- Resistive exercise - for strength and endurance training.
- TA lengthening.
- Orthoses should be used.

**VIII Parkinson's disease**

Parkinson's disease is a progressive nervous system disorder that affects movement.

**Causes**

Many of the symptoms are due to a loss of neurons that produce a chemical messenger in your brain called dopamine. When dopamine level decrease, it causes abnormal brain activity, leading to symptoms of Parkinson's disease.

**Clinical features**

- Tremor
- Slowed movement
- Rigid muscles
- Impaired posture and balance
- Loss of automatic movements
- Speech changes
- Writing changes

**Management**

- Relaxation exercises
- Flexibility exercises
  - Rom exercises
  - Passive stretching
  - Hold and contract relax
  - Passive positioning
- Strengthening exercises
- Functional Training
  - Moving in bed
  - Pelvic tilt
  - Sit - stand activities
  - Standing training with rotations
  - Facial exercises

**IX Bells palsy**

This is a condition in which there is a lesion of the facial nerve and resultant paralysis in the muscles that it supplies.

**Causes**

The exact cause is unknown. It's believed to be the result of swelling and inflammation of the nerve that controls the muscles on one side of your face.

**Clinical features**

- Loss of facial expression.
- Drooping of the face - lower eyelid, eyebrow and corner of the mouth sag.
- Closing of the eye is difficult.
- Eating is difficult.
- Speaking, whistling and drinking are impaired.

**Management**

- Ultrasound given over the nerve trunk to reduce the inflammation.
- Electrical stimulation given to the nerve root.
  - Massage
  - Icing, brushing, tapping or brisk stroking may be applied along the length of the muscles.
  - Exercises

**X CVA (Stroke)**

Cerebrovascular accident is the medical term for a stroke. A stroke is when blood flow to a part of your brain is stopped either by a blockage or the rupture of a blood vessel.

**Causes**

- High blood pressure
- High cholesterol
- Diabetes
- Smoking, increasing age

**Clinical Features**

- Acute change in level of consciousness or confusion
- Acute onset of weakness or paralysis of half or part of the body
- Numbness of one half or part of the body
- Partial vision loss
- Double vision
- Difficulty speaking or understanding speech
- Difficulty with balance and vertigo

**Management**

- Early mobilization
- Balance training
- Gait and mobility
  - Bio feed back
  - Functional electrical stimulation
- Tread mill training
- Orthotics
- Bilateral arm training
- Electrical stimulation
- Mirror therapy
- Mental practice
- Strength training
- Hydro therapy
- Stretching

**XI Upper and lower motor neuro disease**

An upper motor neuron lesion is a lesion of the neural pathway above the anterior horn of the spinal card or motor nuclear of the cranial nerves.

A lower motor neuron lesion is a lesion which affects nerve fibers travelling from the anterior horn of the spinal cord to the associated muscles.

**Causes**

Upper motor neuron lesions occur in the brain or the spinal cord as the result of stroke, multiple sclerosis traumatic brain injury, cerebral palsy, a typical parkinsonism's, multiple system atrophy and amyotrophic lateral sclerosis.

The most common causes of LMN injuries are framer to peripheral nerves that serves the axons, and viruses that selecting attack ventral horn cells, botulism, polio and cauda equine syndrome, amyotrophic lateral sclerosis.

**Clinical features**

**UMN Lesions**

- Muscle weakness
- Overactive reflexes
- Tight muscles
- Clonus
- The Babinski response

**LMN Lesions**

- The effects can be limited to small group of muscles
- Muscle atrophy
- Weakness
- Fasciculation
- Fibrillation
- Hypotonia
- Hyporeflexia

**Management**

- Stretching and strengthening exercises may help to reduce spasticity, increase ROM.

  Applying heat may relieve muscle pain.
- Braces, orthotics and wheel chairs may help.

**XII Peripheral nerve injury**

Peripheral nerve injuries include a variety of conditions in which one or more peripheral nerves are damaged leading to neurological deficits distal to the level of the lesion.

**Causes**

- Traumatic injuries
- Infections
- Metabolic problems
- Inherited causes
- Exposure to toxins
- Diabetes

**Clinical features**

- Gradual onset of numbness
- Prickling or tingling in your feet or hands
- Sharp, jabbing, throbbing or burning pain
- Extreme sensitivity to touch

**Management**

- Massage
- Laser therapy
- TENS
- Hydra therapy
- Passive ROM stretches
- Strengthening exercises

**XIII Spinal card injury**

A lesion may occur in any part of the spinal cord-cervical, thoracic, lumbar and the resulting disability may be temporary or permanent depending on the causes extent of the damage.

**Causes**

- Trauma
- Post -viral infections
- Degenerative conditions of the vertebral column.
- Degenerative conditions of the spinal cord.
- Developmental abnormalities-cerebral palsy, spina bifida.
- Other diseases such as multiple sclerosis may progress to a paraplegia.

**Clinical Features**

- Loss of control of the bladder or bowels.

- Inability to move the arms or legs.
- Problems walking.
- Feeling of spreading numbness or tingling in the extremities.
- Unconsciousness.
- Headache.
- Pain, pressure and stiffness in the back and neck area.
- Signs of shock.

**Management**

- Positioning
- Passive movements
- Exercises

Paraplegics - strengthening exercises should be started for the upper limbs as soon as this permitted.

Tetraplegics - Any active movement in the upper limbs should be encouraged

**XIV Sciatica**

Sciatica refers to pain that radiates along the path of the sciatic nerve, which branches from your lower back through your hips and buttocks and down each leg. Typically it affects only one side of your body.

**Causes**

- Herniated disc
- Bone spur on the spine
- Narrowing of the spine

**Clinical features**

Pain areas: In the back, buttocks, hip or lower extremities

- Difficulty in walking or muscle weakness
- Leg numbness
- Burning sensation or weakness

**Management**

- TENS
- Lumbar traction
- Extension and flexion exercises
- Strengthening exercises

**General conditions**

**I Obesity**

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health. It is defined by body moss index (BMI) a further evaluated in terms of fat distribution via the waist - hip ratio and total cardio vascular risk factors.

**Causes**

- Excessive food
- Lack of exercise
- Genetics
- A diet high in simple carbohydrates
- Frequency of eating
- Medications
- Psychological factors
- Diseases such as hypothyroidism, insulin resistance, polite ovary syndrome and Cushing's syndrome.

**Clinical Features**

- Breathlessness
- Increased sweating
- Snaring
- Inability to cope with sudden physical activity
- Feeling very tired every day
- Back and joint pains
- Low confidence and self esteem
- Feeling isolated

**Management**

- Aerobic exercises
- Resistance training
- Cycling
- Weight training
- Yoga
- Dilutes

**II Burns**

A burn is a type of injury to skin, or other tissues, caused by heat cold, electricity, chemicals, friction or radiation. Most burns are due to heat form hot liquids, solids or fire.

**Causes**

- Heat
- Cold
- Electricity
- Chemicals
- Friction and radiation

**Symptoms**

Burn symptoms vary depending as how does the skin damage is. It can take a day or two for the signs and symptoms of a server but to develop.

- 1st degree burn: This minor burn affects only the outer layer of the skin. It may cause redness and pain.
- 2nd degree burn: This type of burn affects the both epidermis of the second layer of skin (dermis). It may cause swelling and red, while or splotchy skin. Busters may device, and pain can be server deep second degree burns can cause scaring.

- 3rd degree burn: This burn reaches to the fat layer beneath the skin. Burned areas may be black, brown or white. The skin may leathery. Third degree burns can destroy nerves, causing numbers.

**Management**

- **Acute phase**
  - Breathing exercise
  - Manual techniques of chest physiotherapy
  - Thoracic mobility exercises
  - Positioning
  - Therapeutic exercise
- **Sub-acute phase**
  - Continue with respiratory care
  - Continue with therapeutic exercise
  - Continue with joint involved in correct position
  - Do mobility movement
- **Healing and scar maturation phase**
  - Therapeutic exercise
  - Stretching exercise
  - Muscle strength exercise
  - Exercise to increase endurance
  - Exercise to increase co-ordination

**Scar management**

- Scar massage
- Skin hygiene