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SRI SWAMI SIVANANDA

Born on the 8th September, 1887, in the illustrious family of Sage Appayya Dikshitar and several other renowned saints and savants, Sri Swami Sivananda had a natural flair for a life devoted to the study and practice of Vedanta. Added to this was an inborn eagerness to serve all and an innate feeling of unity with all mankind.

His passion for service drew him to the medical career; and soon he gravitated to where he thought that his service was most needed. Malaya claimed him. He had earlier been editing a health journal and wrote extensively on health problems. He discovered that people needed right knowledge most of all; dissemination of that knowledge he espoused as his own mission.

It was divine dispensation and the blessing of God upon mankind that the doctor of body and mind renounced his career and took to a life of renunciation to qualify for ministering to the soul of man. He settled down at Rishikesh in 1924, practised intense austerities and shone as a great Yogi, saint, sage and Jivanmukta.

In 1932 Swami Sivananda started the Sivanandashram. In 1936 was born The Divine Life Society. In 1948 the Yoga-Vedanta Forest Academy was organised. Dissemination of spiritual knowledge and training of people in Yoga and Vedanta were their aim and object. In 1950 Swamiji undertook a lightning tour of India and Ceylon. In 1953 Swamiji convened a World Parliament of Religions'. Swamiji is the author of over 300 volumes and has disciples all over the world, belonging to all nationalities, religions and creeds. To read Swamiji's works is to drink at the Fountain of Wisdom Supreme. On 14th July, 1963 Swamiji entered Mahasamadhi.

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Health and Hygiene

INTRODUCTION

1. Health Is a Great Treasure

Good health is a valuable asset to man. It is a great treasure. It bestows happiness and prosperity. Health is essential to happiness. Health is not merely absence of disease. It includes the full development of physical, mental and spiritual power of man. Health is a condition of physical and mental well-being, a normal state of body and mind in which all parts and organs perform their functions regularly, easily and satisfactorily and are free from disease, pain and weakness. A person who is endowed with good health, digests his food well, sleeps soundly and does his daily work satisfactorily. He is ever joyful and energetic.

You should have a clear idea of what disease is and how it is caused. Then alone you will be able to prevent a disease. Diseases can be averted if you understand the biological laws which govern life, the rules of health and hygiene and the importance of cleanliness. A more general knowledge of the laws of health would help considerably to prevent sickness and death and improve the health of the people.

Of every hundred deaths occurring in India, Europe and other countries sixty are said to be due to disease, which can be, to a very large extent or altogether prevented, if people are only wise and will take to those measures advocated by sanitary science.

Some persons are born with sound healthy bodies; unfortunately others are not. How do you account for this? The doctrine of Karma will give you the best answer. Those who have done good actions in their previous births get sound, healthy, strong bodies; those who have done wicked actions obtain unhealthy, weak bodies.

Many people make themselves ill by eating too much and not eating the right things at the right time. What are the ordinary things around you which help to keep you in good health? They are the sun, fresh air and pure water. Sunlight helps growth and gives vigour. Breathe pure air, bask in the sun, eat good nutritious, wholesome food, drink pure water and observe cleanliness. You will possess a high standard of health, vim, vigour and vitality.

Life here is a continuous battle. It is a never-ending adventure. There are dragons to be destroyed. You will have to wage war with the enemies of health, viz., impure water, bad ventilation, overwork, un-wholesome food, disease-germs, domestic pests such as flies, mosquitoes, the rats and so on. You are surrounded on all sides by invisible foes—the pathogen or disease-causing microbes or bacteria. You should certainly learn all you can about your enemies, their ways, habits and strength. In some cases you will have to attack them directly. In some other cases you must starve them out. You must adopt the most up-to-date weapons which modern sanitary science and preventive medicine, have given you. You must husband your resources in every possible way.

Public health is not a matter that solely concerns Sanitarians, Municipalities or the Health departments. Every citizen, every individual is directly and intimately concerned in the preservation of the health and welfare, not only of himself but of the community as a whole.

Most of the diseases which are preventable are produced by some specific germs which are carried by air or water or food or clothing or other insects. A study of the life-history of these, disease-causing germs and the methods to exterminate them will be extremely helpful for the health and welfare of the community. Impure air, impure water, infected food, uncleanliness of houses and its surroundings improper or bad disposal of excretion play a vital part in the dissemination of disease.

Every individual must be educated in the science of hygiene and sanitation so that he may be able to appreciate the value of sanitation not only for his own health but also for the community at large.

The child must be protected before birth by ante-natal precautions. The health and well-being of the child is the primary foundation of its education. Pregnant and nursing mothers must also be well protected. Maternity and child welfare centres must be established in each Taluk and district. People must be protected from diseases like small-pox, plague, cholera, typhoid by taking recourse to artificial immunity through injection of vaccines.

May you all possess good health and vitality by observing the rules of health and hygiene and study of science of sanitation and preventive medicine?

It thus appears that, for the sake of our fellow-creatures, as well as for ourselves, it is our duty to use all proper means for preserving health.

2. Health and Disease

Health is that condition of the body in which all its functions are efficiently performed without any difficulty. It is the condition of comfort, ease and ability to eat, move and perform other functions of life. It is the state which results from the harmonious performance of the various functions of bodily organs. It is the condition of the body when every organ or part of it is sound, and performs without pain or suffering the functions or duties assigned to it.

If the stomach or bowels possess all their natural strength and efficiently discharge their duties in the digestion of foodstuffs; if the heart and its blood vessels are in good order and circulate the blood properly and Satisfactorily; if the lungs work properly in allowing the blood to receive its due supply of oxygen; if the brain performs all its functions and if the skin carries off the perspiration normally, the chief conditions of health are observed. We then experience no uneasiness or painful sensation and are able to attend to all our appointed duties. To be in this state is to enjoy one of the greatest blessings.

It has been provided by our beneficent Creator that all the organs or parts of our frames, if we only take care not to injure them, should continue in their original soundness and that we should consequently be healthy. But if we do not take care to keep them sound, it is impossible that we can be healthy.

For instance, taking habitually too much food or food of an injurious kind, is sure to hurt the stomach; a draught of cold air upon the skin, when warm, closes up its pores, so that it is no longer able to carry off the perspiration; each organ is liable to be thus hurt or deranged in its function, by some erroneous course of conduct or some accident that may befall it and the consequence is disease which, in its worst form, often occasions death. Disease is discomfort and is the opposite state of comfort, ease and ability to perform the avocations of life. It is disorder or deviation from health in response to the retardation of some vital process. It is the state which follows the rupture of the harmonious performance of the various functions of the bodily organs. It ordinarily involves more or less pain and discomfort and is generally dreaded in proportion as it is painful.

The human body is the weakest piece of mechanism on earth likely to go out of order without a moment's notice. Its parts are made not of steel or brass but of the flimsiest materials imaginable which cannot be replaced, if deranged or worn out. What a blessing, if the dyspeptic could cast off his feeble old stomach and replace it by a strong and sound new set and if the man of weak nerves could tear off his shattered old stuff and put on a grand new system of ramified, throbbing, vigorous nerves. That unfortunately cannot be done. The human machine, however, unlike all machines of steel and brass is provided with a

circulatory system by which nourishment, properly chosen can be imparted to the remotest portion of the body and the damaged and worn out tissues repaired.

Some people inherit diseases from their parents. There are also diseases which spread by infection or contagion, that is to say, the air carries them, or they are imparted from one person to another by touch; these diseases consequently seize many persons who had no concern in originating them. Nevertheless, in such cases, as in all others, the malady can be traced to human error, however innocent particular victims may be. The parents, grandparents, or some other ancestors, must have contracted by imprudence. the diseases which they handed down to their children. Infectious and contagious diseases invariably take their rise from people dwelling in unhealthy places, as marshes, or in the close and filthy parts of large cities, or from their not taking wholesome and sufficient food, or from not keeping themselves and their houses clean.

It thus appears that, for the sake of our fellow-creatures, as well as for ourselves, it is our duty to use all proper means for preserving health.

The chief conditions required for maintaining a naturally sound man in health are these:— The place where he lives must be dry. His house must be clean, and fresh air must be allowed to circulate through it by night as well as by day. He must frequently wash the whole surface of his body. He must take, each day, not less than twenty-four ounces of solid food. He must avoid too great a sameness in his food, and also too great a variety at one meal. He must avoid indulgence in spirituous and fermented liquors. He must spend an hour at least, and as much more of his time as possible, every day in the open air. He must have some occupation to give him bodily and mental exercise, and which may engage his attention eight or ten hours every day. He must spend some part of the leisure time of every day in Japa, Kirtan, meditation, study of religious books. He must never sit for a single minute in damp clothes, or in a room where a cold draught of wind is passing. He must sleep for six hours daily. He must be careful to avoid great anxiety of mind, and endeavour to sustain his fortitude against the sorrow which arises from misfortune. If all men were to live in accordance with these rules, diseases would in time be little known on earth, and human happiness would be increased to a degree of which we cannot now form any notion.

In order, then, to preserve health, it is obvious that we must follow certain rules—"we must observe the laws of health, certain golden rules for life. It is one of the highest duties which we owe to ourselves to study to act in such a way that we may possess all our native strength and health."

3. Why Grow Old?

Advances in medical knowledge have given new impetus to research aimed at postponing the physical process of ageing in man. At several American universities, studies are being conducted on how body cells age, why they fail to stay active and productive into late years. Dr. Edward L. Bortz, president of the American Medical Association, believes man's average life-span, measured against that of animals, should be 150 years instead of the present life expectancy of 68 years.

Researchers want to find out why man is not living up to his expectations. Is it an accumulation of his experiences, both physical and emotional, that makes his age? A newly-established Institute of Human Nutrition at North-western University (Evanston, Illinois) is attacking this problem from the diet angle to see whether what man eats and drinks contributes to ageing.

Metabolic Disorders

The Fels Research Institute for the study of Human Development at Antioch College Yellow Springs (Ohio), is studying the effects on the human body of man's experiences from birth to maturity. Columbia University (New York City) is concentrating on heredity and environment.

A clue to what ageing might be, was noted recently by Dr. Andrew C. Ivy of the University of Illinois. Degeneration, he thinks, is a group of changes in which abnormal materials collect in and between the cell-walls of the human body. They might be due to metabolic disorders of the cells arising from latent weakness or external factors, or both.

Effect of Diet

Dr. I.A. Landis of George Washington University (St. Louis, Missouri) is investigating a calcium-binding protein that appears to control cell-growth and can become both overactive or underactive. In the cell-ageing process, this substance becomes overactive, binding too much calcium.

Dr. C. Ward Crompton of New York City points out that yearly millions of people die of chronic diseases, and that preventive medicine must step in. What he has in mind has resulted in tests at the University of Minnesota. There 500 men between 18 and 54 have volunteered for a ten-year study of factors which lead to hardening of the arteries and high blood-pressure. Seven researchers in physiological hygiene under world famous physiologist Dr. Ancel Keys hope to find whether habits of physical activity or diet can prevent or delay degenerative diseases

Worry and Tension

Special attention also is being focused on the effects of worry and tension, found capable of turning youngsters into criminals. In all instances which Dr. David Abrahamsen investigated in New York City, he found that the family background of criminals was tension, hostility, resentment and nagging. These conditions not only bred criminals, but illness as well—trouble with heart, skin, respiration or digestion and in turn possible origins of degenerative diseases. Thirty years from now the number of age-disabled persons between 60 and 75 is expected to be double that of today. But through present research in geriatrics, the study of old age, many of them may be able to contribute to society more of their useful fund of wisdom and experience.

4. Observe the Rules of Health

Uncleanliness and bad ventilation married.

They had two children—disease and death.

Ignorance, dirty habits and germs attended the wedding.

They are intimate friends of the two children.

Where there is cleanliness, there is Godliness.

Where there arc uncleanliness and filthy habits,

There are germs, infection and contagion.

Where there is very good ventilation,

The germs cannot flourish.

There are good health and cheerfulness.

Be clean and observe the rules of health and hygiene.

Live in well-ventilated rooms.

Cultivate clean habits.

Breathe pure air, drink pure water.

Eat wholesome and good food.

Appreciate the value of sanitation.

Eat not unwashed fruits and vegetables.

Acquire a knowledge of hygiene and sanitation.

You will have wonderful health and vitality,

Peace, prosperity and longevity.

Chapter One

PUBLIC HEALTH

1. Public Health

What higher aim can man attain?

Than conquest over human pain?

That health is wealth, is as much true of the nation as it is of the individual. It is no denying that sound health is the greatest of all blessings and is a factor of fundamental importance that works a long way to contribute to the material prosperity and unalloyed felicity of humanity. Millions of human lives are annually sacrificed to preventable disease. The majority of mankind meet with premature demise from preventable disease and the natural decay of age that supervenes as senility advances, plays as a matter of fact, a very minor part.

Ignorance of the origin and nature of disease, lamentable lack of hygienic knowledge on the part of the mass of the population, chronic poverty and cold indifference are responsible for a higher death rate in India. Public health is no longer a matter of fatalism. The advancement of scientific study and the dissemination of modern civilisation can efficiently influence the state of public health, which is a matter of grave import. Modern nations have recognised the value of public health and work for its preservation as a natural offshoot of the conservation of national resources and all sanitary measures aim at improving the conditions of life with a view to lengthen the period of labour of the population. Every child born is worth so much capital to the state, and the loss is still greater if a man is cut down in the flower of his age before life's work has commenced properly. Public health and material prosperity are so interdependent that when the former is essential for the improvement of the latter, material degeneracy accelerates the deterioration of public health.

The improvement of public health has attracted the anxious attention and active strenuous endeavours on the part of statesmen and humanitarians and nothing is a greater asset to the resources of the state than the health of its individuals.

The people must try their best to acquire a sufficient knowledge in sanitary science and general pathology of diseases which will surely aim at rendering growth more perfect, decay less rapid, life more vigorous and death more remote. The lamentable economical state of our land is more responsible for our rural and urban sanitary drawbacks than the sanitary ignorance of our masses in towns and villages.

National efficiency and economic development directly depend on the standard attained in general sanitation and individual vigour. The influence of sanitary measures on the health and longevity has been most marked in European countries. Take the case of England. Sixty or seventy years ago, it was extremely backward in sanitation. There was no sanitary law at all. The statistics indicated a higher death-rate. Impurity of air, water and soil was very marked. The sanitary conditions were, as a matter of fact, worse than those of our country. As soon as the people of England directed their steps towards rectifying the sanitary defects, by improvements in drainage, air, water, food and dwellings, the health of the nation improved and the mean duration of life also increased.

The practical starting point for the improvement of public health under the existing circumstances is the wide diffusion of education so as to enliven the sanitary conscience of the people on the one hand and to stimulate their working power in order to attain the means to a higher standard of living. Diffusion of knowledge by elementary education is found

invaluable even to make a beginning in the propagation of hygienic principles and adoption of sanitary measures. The introduction of sanitary methods will have very little effect in the face of illiteracy of the mass of population of a country and unless measures are taken to banish the ignorance of the mass by universal diffusion of knowledge, the proposal of making sanitary reforms hopelessly falls to the ground. Hon'ble Mr. Gokhale's elementary education bill is really a boon to the humanity and paves a great way for the material prosperity and bliss in life of the people of India.

Hygiene must be taught in schools and colleges as a compulsory subject and it is a great pity that this matter has not attracted the attention of the education authorities.

Absolute purity of air we breathe, water we drink and the food we eat must be ensured with a view to maintain a satisfactory standard of public health. It is a patent fact that in proportion as respiration and ventilation are imperfectly performed the standard of health will be lowered and disease must inevitably result and the person will suffer from all the disastrous results arising from a poisoned condition of the blood. The great importance of ventilation and giving the lungs free play cannot be overrated.

Epidemics of cholera, and typhoid fever, dysentery, elephantiasis, guinea worm, stone in the urinary tract, etc., owe their origin to an impure supply of water. Water should not be taken from any source unless it is pronounced to be perfectly safe by the health authorities who examine the water chemically, microscopically and bacteriologically. You will be always erring on the safe side if you invariably drink hot (and not scalded, as it is generally done), water. The practice of adding cold water to hot water should be deprecated and the habit of drinking hot water which has completely cooled down is deleterious to health.

That unwholesome food is injurious to health, is needless to mention. It causes irritation and inflammation of the gastro-intestinal tract and as a consequence, indigestion, diarrhoea, dysentery result. Sometimes, sudden death is caused by taking unwholesome articles of food. The evident cause is Ptomaine poisoning, which stimulates an attack of cholera. During the process of putrefaction, some poisonous bacterial alkaloids (Ptomaines) are formed and these products of decomposition prove inimical to healthy physiological functions of the body. Food may carry infection by contamination with germs as in the case of cholera or typhoid fever. Cold rice, unripe or overripe fruits should be avoided during an epidemic of cholera. Undercooked dhall, sweetmeats which contain raw rice and vegetables in raw state ought not to be eaten. If the bazaar-man happens to be a syphilitic or a leper or a consumptive, you should at once shun him.

Measures should be adopted to save future generation from short life and disease. The system of early marriage is ruining the health of our men and women, causing premature decline and death. It inevitably creates a predisposition to disease and deterioration. Nowadays children beget children. This kind of marriage-system is crushing all enterprise from the nation and is causing racial degeneration both in constitution and longevity. Unless proper remedy is forthcoming in this direction, disaster is certainly impending on us.

The health of children and thus too of the next generation is in large measure due to the hygienic conditions of the mother's existence during pregnancy. Whatever causes pain to a pregnant woman equally affects the child in the womb. Laborious work by pregnant women is extremely dangerous to their unborn offspring and the terrible infant mortality is due to excessive work of pregnant women as well as to the inability of the mothers to suckle their own children during the first twelve months of existence and nurse them properly.

Overcrowding is one of the causes of ill-health. It is not strange to find 10 or 12 persons sleeping together in a room in large towns. Leaving altogether the grave moral dangers that

result from this system when persons of different sex share the same sleeping chamber, the organic emanations of the different members and the absence of cleanliness are highly detrimental to good health, not to speak how many communicable diseases as consumption are disseminated by this overcrowding of families.

2. Health and Hygiene

Hygiene is the science of the improvement in the health of the community and individuals by sanitary improvements and the encouragement of cleanly habits. Hygiene usually relates to consideration of individual health.

Sanitation is the science of sanitary conditions and of preserving health, synonymous with Hygiene, usually restricted, however to the methods and apparatus for making and maintaining houses healthy. It generally refers to matters of corporate life regarding health. The chief items are water supply, disposal of excreta, drainage, etc.

You must have a knowledge of the rules of hygiene. You must observe the rules also. Then only you can maintain a high standard of health. The laws of Hygiene are the laws of health or the laws of natural living. Hygiene teaches "Live in open air. Inhale fresh air. Drink pure uncontaminated water. Take wholesome food. Live in a healthy place, in healthy surroundings and in a healthy house. Keep your clothes clean. Protect your food from flies. Take plenty of exercise. Keep your house and surroundings perfectly clean." Follow these rules and attain good health.

If the water is muddy dip a big piece of alum in the water and turn it round and round ten times. Or add a few grains of alum to the water. Keep it for sometimes. The settled water should be decanted and boiled well.

Germs or bacteria get access to cooked food through flies. Therefore keep the food always well-covered, particularly during epidemics of cholera. Frequent heating of food is bad. Vitamin 'A' is destroyed by reheating.

Do not sleep in another man's bedding. Do not use another man's cloth. Do not eat in the same plate with another person or even your children. Many diseases like consumption, pyorrhoea, etc., may pass on from one to another by contact through food eaten from the same plate. Do not eat the sweetmeats of the bazaar during cholera season. Pare your nails close and keep them quite clean.

Textbooks containing elementary knowledge of anatomy, physiology, bacteriology and hygiene should find a place in the curriculum of primary and high schools. Instruction on Hygiene should be given through movies, talkies, gramophones and lantern slides in towns and villages and in all schools.

Whenever the barber comes to shave you ask him to wash his hands and razor thoroughly. A dirty razor will inoculate you with disease-germs.

The Dhobi or the washerman mixes promiscuously the clothes collected from small-pox-stricken areas with those of other customers and thus spreads the disease from one place to another. He has neither the knowledge nor the means of disinfecting clothes contaminated by the patients. During epidemics of small-pox put the clothes you receive from the washerman, in the sunshine for a pretty long time. Sun's light is the most powerful disinfectant.

The sweetmeat-vendor becomes the centre of attraction to children in the street. Their parents too are hopelessly ignorant of what dangers lurk in the tray after the flies have had their share. The flies sit on the excreta of cholera-patients and with the soiled feet sit on the

sweetmeats and other articles of diet. Thus the flies act as the carriers of cholera-germs and disseminate the disease. Hence do not purchase any sweetmeat from the shop or the vendor. The Medical Officer of Health should take proper measures to have the tray made fly-proof.

You should certainly have an elementary knowledge of hygiene. You should know how many diseases are carried by flies from one person to another. The ladies of the house should have a knowledge of hygiene. Then many diseases can be easily prevented.

Milk is doubtless the best food. But how little man knows about the steady process of contamination which goes on beginning from the milking of dirty udders with dirty hands into a dirty vessel to storing it and exposing it in surroundings most suitable for the growth of pathogenic or disease-causing germs. Before it is consumed unsuspectingly bacteria or microbes grow very readily in milk. It should always be kept covered in a very clean vessel. It should not be taken in a raw state during cholera season.

It is the duty of the parents, professors, the schoolmasters, teachers and the educational authorities to train the future mother in hygiene, home-nursing, maternity welfare and similar subjects so that her children may grow unhampered by insanitary practices and untrammelled by pernicious customs.

It is the onerous duty of doctors and sanitary inspectors to teach the gospel of prevention of disease or the science of "Health and Hygiene" to the public (boys, girls and lay people) by holding classes on Sundays and other holidays.

Public feasts sometimes become centres of infectious diseases. Persons who cook food should be free from any communicable disease. They should have clean habits. The utensils and vessels should be scrupulously clean.

The sputum of consumptives should not be thrown out here and there. It should be received in a spittoon containing some disinfecting lotion. Afterwards it should be buried or burnt. The excreta of cholera and typhoid patients should be buried.

The bed and clothing of sick persons, the discharges of the sick. Contaminated water are all disseminators of disease. Disease germs are most abundant where sick people are congregated. They are breathed into the lungs or taken in through food or drink or absorbed by a recent sore. Cholera and typhoid are water-borne diseases. They are disseminated through contaminated water. Small-pox is an air-borne disease. A weak, fatigued man will be-come affected more easily than a robust, vigorous, healthy man.

You must have knowledge of disinfection. Disinfection means not only the removal of bad smells but the most important operation of rendering innocuous all germs or decomposing or diseased matter from which germs arise.

Utensils used by the sick such as cups, spoons, plates, tumblers should be immediately immersed in potassium permanganate lotion. If your hands are soiled by infectious discharges when you attend on sick persons you must wash your hands with permanganate lotion and then with soap and water. The nails should be scrubbed with a brush.

Develop the hygienic sense which will guide you to live a healthy life so that the necessity of medicines may be dispensed with.

3. Hygiene and Sanitation

Hygiene usually relates to consideration of individual health. It is the science which treats of the preservation of health. The word "hygiene" is derived from a Greek word bygeia' which

means health. The word 'hygia' or bygeia' is also the name given to the goddess of health, who was adored by the ancient Greeks for her beauty and bodily perfection. She was described as a young, active, smiling, happy and beautiful goddess. In any picture you get, you can see that she is carrying a serpent, which is a symbol of young life. Hygeia helps by feeding it from a plate the good things of life.

She was the daughter of the God Aesculapius, who was the God of health of the ancient Greeks. Aesculapius carried a staff which denoted that he was a wanderer. There was a serpent around the staff. So he carried the young Goddess of health with him wherever he went. He helped all to secure good health. This staff with the climbing serpent is used as the emblem of medicine. It is seen on the badge of the A. M .C.

Hygiene signifies personal health and cleanliness. Hygiene is really the science of life. It is the science which teaches us how best to combat the harmful things around us with which we are daily in conflict. A knowledge of hygiene teaches us how to live, where to live, what food to eat, and what to avoid, what water is safe to drink and what is dangerous and unfit to use.

The practice of hygienic life does not lie so much in profound erudition as in an intelligent grasp and sincere acceptance and following of the rules of hygiene and the laws of health and the careful cultivation of wise, healthy, personal habits.

Hygiene teaches us also how to construct our houses and the dangers of living in dirty and over-crowded, ill-ventilated houses and localities. It teaches s what to do in order to prevent disease and keep our bodies in an active and healthy state. It helps us to select the kind and quality of clothing we should wear and the kind and amount of exercise best suited for us.

The science of healthful life tells us to take the greatest care in protecting our food from anything that would render it unwholesome or unclean, to see that the air we breathe is pure and to keep our clothing clean and free from disease-causing microbes.

The practice of hygiene implies a full knowledge and cordial acceptance of all the wise rules which guide us in the attainment of a high standard of health, vigour and vitality.

This branch of the subject is known as Personal Hygiene. Domestic Hygiene is only a branch of this.

Sanitation generally refers to matter of corporate life regarding health, the main items being water supply, disposal of excreta, drainage, etc. It is the science of sanitary conditions and of preserving health. It is usually restricted however to the methods and apparatus for making and maintaining houses healthy.

Sanitation refers to the means adopted to protect the health of the general public and not that of individuals. This is known as public hygiene or public health. Public hygiene deals with the disposal of all kinds of refuse in towns and villages, the making and cleaning of roads, drains, sewers, latrines, stables and cattle-sheds and the construction of houses. It also deals with the adulteration of foodstuffs, the supply of water and the prevention of the pollution of water and air. It also deals with the notification of infectious diseases, the measures required to prevent their spreading and the registration of births and deaths.

4. Sanitary Laws

Man alone violates the laws on account of egoism and arrogance. All other beings obey the laws. He commits nuisance. He gets up in the early morning and answers calls of nature in front of his neighbour's house. He defecates in the beds of rivers near the water. He does not care for the well-being of his neighbours. He is greedy and does all sorts of abominable acts. He adulterates milk with water, arrowroot, etc.

Laws have been passed by the Ministry of Health to prevent people from doing acts which will injuriously affect the health of their neighbours. These are called sanitary laws. Health Inspectors visit the shops and inspect articles of food, such as vegetables, fruits, sweetmeats, etc. If shopkeepers sell very stale fruits and vegetables, if milk and ghee are adulterated, if the sweetmeats are not kept in fly-proof almirahs they are taken to task. They are fined. The stale and adulterated stuffs are thrown away. Milk is tested by the hydrometer.

If such sanitary laws were not passed the foodstuffs would be adulterated to a much greater extent than they are at present. People will commit all sorts of nuisances. Infectious diseases will spread like wild fire. People will build their houses without caring for public health. Streets will be narrow, dirty, dark on account of the absence of sunlight. There will be ill-ventilated overcrowded houses. There will be no open spaces left for taking exercises and breathing in pure fresh air. Drains and latrines will be kept in a very dirty condition. Refuse will be accumulated everywhere. The consequences will be formidable. There will be outbreak of all sorts of infectious diseases. The mortality rate will be very high everywhere. The state of affairs will be appalling, lamentable and horrible, indeed.

It is the onerous duty of every man to assist the health authorities in their efforts to improve the state of health of communities. The people must appreciate the philosophy and spirit that originated sanitary laws and measures which aim at the prevention of diseases and maintaining a high standard of health in the people. They should get their children vaccinated and thus help to prevent attacks of small-pox. It is their duty to report the occurrences of infectious diseases in their houses to the health authorities in order to check their spread. It is also their duty to obey the sanitary laws themselves and make others also to carry out the laws.

Those who violate the sanitary laws are the worst criminals because they become the causes for the occurrence of sanitary evils, the spread of infectious diseases, the death of many persons and the ill-health of countless souls.

O man! Obey the laws, cooperate with the health authorities and thus assist them in their endeavours to bring about an improved state of the health of the communities. Obedience is better than sacrifice. Obedience maintains order, concord and sweet harmony.

Chapter Two

HOUSES AND BUILDINGS

1. Houses and Buildings

In the selection of a site the following points require careful attention. The selection of the site for building purposes must be done with due regard to its suitability from a sanitary point of view.

If you want to be healthy, you must live in a healthy place, in healthy surroundings and in a healthy home. You must choose a healthy site for the construction of your house. The primary consideration in the selection of a site should be dryness, warmth, light and air.

High ground from which water readily runs off is best. Gravel, sandy and rocky ground and sand-stone form good sites. Clay is not good. Water does not pass freely through clay. It is very treacherous. Buildings built on clay soil crack quickly. The water collects above it and the ground becomes water-logged. Rheumatism, fever, chest complaints and other diseases are common amongst people who live in houses built on clay sites. Damp sites should be well-drained.

The ground selected must be high with a sufficient slope to allow the rain-water to be drained off rapidly. Then alone the soil will be dry.

The soil should be of a loose gravelly nature to allow free discharge. Shallow beds of gravel or sand lying over clay and also alluvial soil are the worst soils owing to their frequent water-logged condition.

Made-up soil such as tanks which have been filled with street sweepings should be entirely avoided. The danger of made-up soil is the carbonic acid gas and other foul products which are given off from the decaying animal and vegetable refuse.

Places which are near to the trenching grounds, refuse heaps, brickfields, graveyards, marshes, open lands where refuse is thrown or factories or mills which give off much smoke, irritating gases or offensive smells, are not suitable for building houses.

The site should be at a distance from marshes, cowsheds, stable, paddy fields etc. The surface soil or subsoil should not be tainted by sewage or other refuse.

Ground which is very loose and porous is not quite safe. There is always the danger of impure matter finding its way through loose soil into wells or other sources of water-supply. If water is found at a depth of less than 10 feet from the surface, the site is not a good one.

The building should be open on the east and south to allow free passage of light and air. A part of the building at least should be exposed to the sun.

A plan is necessary before you start building a house. Get a plan from an engineer. In all large towns the law requires plan to be submitted for the approval of the municipal authorities before people can begin to build houses. If this is not done, houses will be built too closely together. Streets will be narrow. There will be no open space. There will be no provision for the admission of sufficient light and air. Latrines will be built in wrong places. There will be no easy means of accession to latrines. Too little space will be left to enable scavengers to keep them clean. Therefore, the importance of plans is quite obvious.

Houses should be well-ventilated. Sunlight kills microbes. It is a valuable means for producing vitamin D for skin. Vitamin D deficiency in ill-ventilated and ill-lighted houses has a deleterious effect on the health of the people. Thus rickets and osteomalacia are found in overcrowded cities with narrow lanes and sunless houses, among purdah observing women and their children.

Back to back houses should be avoided. Cross ventilation is impossible in such houses. The rooms are naturally dark and ill-ventilated.

The foundation must be solid and substantial. Cracks on the walls and roofs occur on account of bad foundation. When the soil is soft and yielding, the walls should be broad and built on a solid basis of good cement concrete. The depth of the concrete should be not less than 18 inches. The brick work of the walls should be at least 15 inches thick. A good brick should be well burnt, and when struck should give a clear metallic sound. Some alum or gum may be added to protect the whitewash from being rubbed off. The upper floors may be made of wood or terraced and cemented. Broken bricks and mortar, cement, bricks, stones, tiles, can be used for the floor. There should be a plinth at least one foot high. There should be a verandah for protection against sun, rain and glare.

Rooms should not be more than 12 feet high. They should be well ventilated by means of windows, doors and skylights or ventilators. There should be two windows. They should be opposite to each other to secure good ventilation. There should be provision for the escape of smoke. Each fireplace should have a chimney.

There should be gutters and pipes leading down the wall at short distances to take away the rain-water from the roof. This will prevent dampness of the walls. There should be a masonry drain surrounding the house to carry off rain-water. This will keep the ground dry.

The kitchen should not be near privy. It must be provided with fly-proof automatic closing doors and windows. There should be chimneys to take the smoke up. It should have floors with impervious materials such as cement concrete.

The latrine should be at a distance from the main building. The floor and walls upto a certain height should be plastered with cement or covered with glazed tiles. It must be easily accessible from behind for the sweepers, cleaned daily and with a door and window large enough to allow plenty of fresh air and light.

Chapter Three

AIR

1. Air

Pure air is indispensable for keeping good health. Perfect health can only be maintained when there is an abundant supply of pure air. You can remain for some weeks without food but you cannot live without pure air even for a short time. That is the reason why air is all-pervading and is present everywhere. Mark the divine grace!

Air is a mixture. It is not a chemical compound. The principal gases in the air are (1) Nitrogen 78.20, (2) Oxygen 20.76, (3) Argon .01 (4) Carbon dioxide .04. There are also watery vapour, ammonia, organic matter, ozone, salts of sodium and other mineral substances. Pure oxygen is very strong by itself and so nitrogen forms a large proportion of the air.

The following is the approximate composition of the air—

Oxygen 209.6 per 1000 volumes

Nitrogen 790.0 per 1000 volumes

Carbonic acid 0.4 per 1000 volumes

Watery vapour varies with temperature

Ammonia a trace

Organic matter

Ozone varoable

Salts of sodium

Other mineral substances

A smoky atmosphere causes irritation of the upper respiratory passages, predisposes to consumption and increases the mortality from pulmonary tuberculosis. It shuts out light and the ultra-violet rays of the sun.

Dust forms an important impurity in the atmosphere. It is composed of inorganic matter, soot, decaying leaves, manure, bacteria, organic matter, fibres of cotton and wool, dried sputum and particles of excreta. Street dust pollutes food exposed for sale without proper protection. Industrial impurities such as silica dust, lead fumes, phosphorous fumes from match factories, zinc fumes from brass works, hydrogen sulphide from chemical works pollute the air of towns.

Respiration, fuel combustion, decomposition of animal or vegetable matter, etc., are the chief sources of carbonic acid gas in the air. The proportion of carbon dioxide is generally greatest on the surface of the earth and decreases as elevation increases.

The chief sources of impurities of the air are (1) products of respiration, (2) products of combustion, (3) products of decomposition, (4) dust (5) and bacteria. In the unventilated, occupied room the air is polluted by respiration and emanation from the skin. Health and disease are in direct proportion to the purity or otherwise of the atmosphere. The increased percentage of carbon dioxide and the organic poison from expired air and the diminution of oxygen in ill-ventilated buildings produces various sorts of diseases.

Man breathes in oxygen and breathes out carbonic acid gas that is formed within the body through metabolism. He breathes 18 times a minute. An adult gives out 22 cubic inches (500 c.c.) of air.

The proportion of gases in inspired and expired air per 100 feet is as follows:

	Inspired air	Expired air
Oxygen	20.96	16.90
Nitrogen	79.00	79.19
Carbonic acid	0.40	4.41

The expired air contains 4 to 5 per cent less of oxygen and 4 per cent more of carbonic acid. There is 14 to 15 per cent of oxygen in the depth of the lungs. There will not be any ill-effect until the oxygen is reduced to 12 per cent. If the oxygen goes below seven per cent consciousness becomes lost. In a mixed community .06 cubic foot of carbon dioxide per hour per head is added to the atmosphere.

Organic matter contaminates the air. Persons who suffer from infectious diseases such as Consumption, Pneumonia and Diphtheria contaminate the air of the room.

It is not safe to sit near patients who are suffering from consumption, influenza and such other infectious diseases. The expired air is charged with pathogenic or disease-causing germs. You will catch the infection quickly.

Decomposing animal and vegetable substances generate poisonous gases. Marshes give off sulphured hydrogen. Collections of refuse, certain factory products produce foul effluvia. All refuse and waste products from the house and its vicinity should be removed promptly and burnt. Otherwise you will get giddiness, headache, depression and other diseases.

Water-vapour is always present in the atmosphere however dry it may be. About 10 ounces of water from the lungs and 20 to 30 ounces from the skin is the average quantity given off by each person daily.

The bad odour of badly ventilated and crowded rooms is due to perspiration and foul breath from carious teeth, indigestion, the decomposition of food particles in the mouth, from gases in the digestive canal and from dirty clothes. Houses, clothes and bodies of persons should be perfectly clean and free from bad smell.

Air of marshes contains an excess of carbon dioxide. Watery vapour, marsh gas, sulphurated hydrogen and ammonia.

Coal gas is formed by the destructive distillation of coal. It contains hydrogen, marsh gas, carbon monoxide, carbon dioxide. Minute escape of coal gas from leaky pipes inside rooms is very dangerous. Cases of poisoning occur from burning coal, wood, cases of poisoning occur from burning coal, wood, charcoal etc. if there is no sufficient provision for the products of combustion to escape.

Carbon monoxide is a colourless gas without any taste or smell. It is pressed in minute quantities in air of towns. Inhalation of air containing carbon monoxide brings loss of consciousness. Carbon monoxide is a poison.

The air of sewers is dangerous. It is a source of infection in certain diseases. The sewer air contains carbonic acid gas, marsh gas, hydrogen sulphide and various products of decaying organic matter. The sewer air should not be allowed to enter the house and pollute the atmosphere. Those who are exposed to the sewer air suffer from headache, fever, anaemia or poverty of blood and sore throat, diarrhoea, gastro-intestinal disturbances, constant

diphtheria, ill-health. The air in the main sewer is purer than that of the house drains. The children are liable to be affected more than adults when the house drains are not properly cleaned.

Dust in the air consists of fibres of cotton, particles of decaying animal or vegetable matter, it causes catarrh, laryngitis, bronchitis, asthma and other lung diseases.

Roads should be regularly watered. The houses must be well ventilated. Dust from the streets must be prevented by proper screening of windows and use of glass shutters.

Rain and plants are Nature's purifying agents of the air. Rain carries dissolved or suspended impurities of the earth. Rain washes the air. The green parts of plants which contain chlorophyll, the green colouring matter, take in carbon dioxide from the air, assimilate carbon what is essential for their growth and give off oxygen to the atmosphere.

Oxygen and ozone, which enter into the composition of the atmosphere also purify the air.

Ozone is condensed oxygen. It is highly beneficial for us. Ozone is abundant on the sea coast.

2. Ventilation

Ventilation is supply of pure air. It is free exposure to air. It means the removal or dilution of the air which has become stagnant, warm, moist and vitiated by air what is dry, cool and moving. This is called internal ventilation. The ventilation of dwelling houses, factories, and mines is called internal ventilation.

External ventilation is secured by making the streets broad, wide and straight, building the houses moderately high and not very close to one another and keeping plenty of open spaces and parks in the thickly populated parts of the town, by watering the streets, by careful inspection of all drains and sewers, by the quick removal of street and other refuse, by transporting all offensive trades to special places. The health of the town largely depends on the degree of external ventilation. Good internal ventilation depends on the purity of outside air.

Ventilation must supply pure air from without. It must keep the air within the room at a proper temperature. There should not be uncomfortable chilling and drying of the body. It must be able to remove foul odours, dust, etc.

The amount of air needed for efficient ventilation depends upon the size of the room, the number of persons inhabiting the room, etc.

If a man enters a room from the open air he should not perceive any smell or stuffiness. If the amount of carbon dioxide in a room exceeds 0.6 per 1000, the air gives a distinct feeling of tightness to a visitor entering from outside. The object of ventilation is to prevent carbon dioxide from exceeding 0.6 per 1000.

3000 cubic feet of air is necessary for every individual per hour. In ordinary houses the floor-space for a single individual should be 150 sq. feet, for boys and girls 80 sq. feet. The air-space for an adult persons should be 1000 cubic feet, for boys and girls 700 cubic feet.

The air in the room should be replaced two or three times an hour. There should not be any perceptible draught. The minimum space is about one third the quantity of air required per hour i.e., from 700 to 1000 cubic feet per individual.

The system of ventilation is of two kinds viz., natural ventilation and artificial ventilation. Cross ventilation is free perflation between windows and other openings placed opposite each other, This is not possible in back to back houses.

Natural ventilation depends upon perflation and aspiration, differences of temperature, and diffusion of gases. When the doors and windows are open, air blows through a room naturally. This is perflation. When air moves, it drives the air before it and decreases the pressure around it. Further it makes the surrounding air to move towards it by aspiration.

If the air of a room is heated by fire or by the products of the respiration of men and animals, it expands and rises up or escapes through other openings. The outer colder air rushes in through every opening until the temperature of both outside and inside air becomes equal. The incoming of fresh air gets heated in its turn. Thus an incessant current is kept up. This is the basis of natural ventilation.

Artificial ventilation is carried on by extraction of foul air. The fresh air rushes in to fill its space. This is the vacuum system. It is also done by propelling fresh air, the Plenum system and by a combination of both, the balanced system. There is propulsion by steam jets. There is propulsion by pumps. Fans are used for extraction.

The heat of open fire expands the volume of air, diminishes the density. Thus an upward flow of air is generated. This in turn sets up a current in the room air. This is another way of artificial ventilation.

Inlets and Outlets

The openings through which internal ventilation is carried out are known as inlets and outlets. Inlets are intended for the entrance of pure air and outlets for the escape of impure air.

The inlets and outlets should be large. The total window-space must be one tenth of the area of the room. The inlets and outlets should face each other. The outlets should be near the floor.

In hill-stations the perforated iron gratings or bricks with conical holes fixed near the top of the wall serve as good ventilators.

Respired air has a tendency to go upwards. The outlets for respired air that is warmer are provided at the upper part of the room.

Chapter Four

WATER

1. Quantity of Water Required

Water is indispensable for the maintenance of life, both animal and vegetable. Pure water is very beneficial to health like pure air and pure food. Pure water dissolves the foodstuffs. It builds up the tissues of the body, maintains the fluidity of the blood. It also aids in the excretion of waste matters from the body.

Pure water consists of oxygen 88.89 per cent and Hydrogen 11.11 per cent. The Chemical formula is H_2O.

Clear water is a great human need. It should be secured for drinking purpose by persons who want to enjoy sound health.

Water is needed also for cooking, washing, bathing, watering the roads, for flushing the drains and latrines etc. It is needed also for animals.

In big cities the daily allowance of water per head is from 40 to 50 gallons. In small municipal towns 5 gallons per head is the minimum quantity allotted for drinking and domestic use.

2. Sources of Water

(a) Rain Water

Rain water is the purest water. It should be collected and stored with proper precautions. Rain water is soft on account of the absence of salts of lime and magnesia. It is suitable for cooking, washing and bathing purposes.

Rain passes down through the soil. It ultimately reaches an impervious layer. It is collected there as subsoil or ground water. The surface of this impervious stratum is sloping. The water runs along this and becomes a 6pring where the impervious stratum reaches the surface of the soil.

(b) Springs

Springs are natural wells. They are good sources of water-supply for small communities. They are of different kinds. There are common springs which yield fresh water fit for drinking. Mineral springs yield mineral water. There are sulphur springs. The water of some springs in Kashmir cures dyspepsia. There are hot or thermal springs at Gauri Kund and Badri in the Himalayas. Some springs are intermittent. The main springs which are deep-seated give continuous supply.

Spring-water is pure. It is less liable to contamination as no mechanical means are required for drawing water. Spring-water is hard and is not suitable for cooking.

(c) Wells

Wells form an important source of water-supply in villages. There are three kinds of wells viz., shallow wells, deep wells and artesian wells. Tube-wells come under the heading of shallow wells. Ring wells are economic and sanitary. Ring wells are suitable for alluvial lands.

Shallow wells derive their water-supply from the subsoil water only. They pass through the superficial porous bed only. They are not sunk through Impervious stratum. The water of

shallow wells is often polluted either from surface-water or from contamination of the subsoil water. The sewage gets into the well and the water gets dangerously contaminated.

A good well should satisfy the following conditions. It should be sunk in good soil. There should be good surroundings. There should not be any sources of pollution such as sewage farm, open drain, trenching ground within a distance of 200 feet. It should be at a distance of 100 feet from any human habitation. Its walls should be lined with good cement. It should be watertight. A pump or pulley or special bucket and chain or rope should be fitted. No other vessel should be used for drawing up water.

There should be a parapet wall of about two feet above the level of the ground to prevent surface washings from entering the well. A cemented platform with a proper slope should be built round the mouth of the well about 6 feet all round. All wells should be covered. The water should be drawn by means of a hand pump.

Neighbouring trees should be cut down to prevent leaves of trees falling into the well. Foul tanks and rat holes near about should be filled up. Clothes should never be allowed to be washed there.

(d) Tube-wells

Norton's Tube-wells are really shallow wells. Tubes 2 inches in diameter are driven into the ground. They are usually 25 feet deep. The water is drawn by a pump. It is free from most of the dangers of the open wells. These wells are specially useful in villages and camps.

Deep wells pass through the superficial porous earth and the underlying impervious stratum and ultimately reach the water-bearing strata. They give a good supply of water. The water is efficiently filtered naturally as it passes through a long distance. The water of deep wells is free from organic impurities. The water is liable to be contaminated by surface washings. Deep wells also should be protected in the same way as shallow wells.

Deep tube-wells are really artesian wells. Artesian wells are formed when a boring taps the water in a previous layer between two impervious ones. The water will even gush out above the ground. Artesian water is found in the alluvial tracts of Pondichery, Sylhet (Assam) and South Arcot District.

The area drained by a well is usually four times the depth of the well. It may be even more. If there be any source of contamination within this area, pollution will surely take place. A site where any such contamination is not possible should be carefully selected.

The chief source of contamination of the water in the wells is from the surface washings. Latrines, drains, cess pits collections of filth near about are mostly responsible for the pollution of ordinary wells. Graveyards, cracks or fissures in the soil which may result from an earthquake, rat-holes near about the well, may help polluting matter to pass into the well. Trees by sending down roots may help in admitting surface water into the wells direct.

All wells should be cleansed thoroughly once a year by emptying it. This is best done at the close of the summer season when the water is at its lowest level. The water of the uncleaned and unused well contains a large amount of organic matter and should therefore be cleansed or thoroughly treated with permanganate before using. Cleansing is done by removing the weeds from the bottom by digging and also by scraping the sides and removing all rubbish which block the pores at the bottom. The sides should be whitewashed with lime.

(e) Surface Water

Upland water, tanks, ponds, reservoirs, rivers and streams are surface water only. The water that is collected and stored in hilly places at the head of rivulets is upland surface water. It nearly approaches rain water in purity. The nature of upland surface water depends on the nature of the soil through which it has passed. The water is collected in natural lakes or in artificially constructed lakes. If the lakes are liable to pollution the water must be purified before distribution. The catchment area must be protected. There should be no human habitation in the vicinity. If the upland surface-water is collected in a nicely protected catchment area it is the safest and most economical water-supply.

(f) Tanks

Tanks are good sources of water-supply if they are free from contamination. No clothing should be washed in the tanks. People should not take bath in the tanks. Cattle also should not be bathed in the tanks. No surface drain should be allowed to enter into the tank. Then alone the water of tanks will be pure.

There should not be drains or cess pits in the neighbourhood. Tanks should be deep. They should be protected by fences. No utensils should be allowed to be washed inside the tank. There should be plenty of fishes. Fishes feed on mosquito larvae and other organic impurities and help to keep the water pure. Weeds should be removed. The tank should be emptied and re-excavated whenever the water becomes impure. Arrangement may be made to employ a special man with a separate bucket or to fix a separate pump for drawing water to reservoir fitted with pipes and taps so that no one is allowed to get into the water. A notice-board should be hung up near the entrance to the tank, saying that it is reserved for drinking only. Then alone the water of tanks will be pure.

Hard water is not suitable for domestic use. It is not economical for manufacturing purposes also.

The catchment area, the drainage area and the settling tanks must be protected from all sources of pollution.

Good drinking water may be supplied by pumping the water directly from artificial lakes or reservoirs or natural lakes into service pipes or through the medium of storage tanks.

Water supply may be either intermittent or constant.

In the intervals during which the mains and service pipes remain empty foul air and polluting matter from sewage-charged soil or drains may be sucked in through imperfect leaky joints and cracks or decaying pipes.

3. Impurities of Water

An absolutely pure water is not available in nature. All natural waters are more or less impure. Water always contains gaseous and solid matters in solution and dead or living matters in suspension received from the air or soil or from both.

Impurities in water consist of dissolved impurities and suspended impurities. The dissolved impurities may be either gases like carbonic acid or sulphurated hydrogen or salts like chlorides, calcium and magnesium sulphate which make the water hard, or iron, lead and organic matter from soil and other sources.

Suspended impurities may be inorganic like sand, milt, mud and organic derived from vegetable and animal matter, bacteria and eggs of worms.

There are impurities at the source. Impurities are derived during transit from source to reservoirs. There tire impurities from storage and distribution also.

4. Effects of Impurities of Water

A good water is not one which is chemically pure. Water that is transparent, colourless, odourless, tasteless with no suspended matter or excess of total solids with sufficient dissolving air is all that is needed.

Those who are habituated to drink pure water generally suffer from some bowel complaints by drinking impure water. Diarrhoea, Constipation, Cholera, Dysentery, Typhoid fever, Goitre, parasitic diseases (round worm, guinea worm) are caused by drinking impure water. Water gets easily contaminated with the excreta of persons suffering from Cholera, Dysentery and Typhoid fever. You should take particular care of water when such epidemics break out or even sporadic (isolated) cases occur. Use of impure or polluted water leads to general lower state of health and increased susceptibility to disease.

When Cholera and Typhoid prevail always drink boiled water.

5. Purification of Water

Storing water in lead-cisterns, and the use of lead-pipe produce lead-poisoning or plumbism.

Impure water is purified by natural methods such as sunlight and air, oxidation and settlement and artificial methods such as (1) physical (distillation and boiling), (2) chemical (precipitation and germicides) and (3) filtration (slow sand filters and rapid filters).

Purification of water on a large scale can be done through filtration, chlorination and ozonisation. Ozonisation is a satisfactory but expensive process. The water should be filtered before subjecting it to the action of Ozone.

The ultra-violet rays of the sun are largely utilised in Europe. The water should be previously filtered; otherwise the suspended matter screens the bacteria from the influence of the rays of the sun.

Purification of water consists in the removal of suspended and dissolved impurities and elimination of organisms of water-borne diseases such as Cholera, Typhoid, etc. No method of water purification can be considered efficient unless these organisms are got rid of. The greatest danger in water is from the diseases, Typhoid and Cholera.

Purification of water has worked wonders in many parts of the world. Typhoid fever and Cholera have disappeared in some parts of the world. Money spent for supplying good drinking water in the towns and rural areas will save many lives. Purification of water is the first line of defence. Water derived from carefully protected springs or tube wells needs no such treatment but in case of surface-water, river-water, or water from any source liable to sewage contamination, purification becomes absolutely necessary.

Potassium Permanganate acts as a germicide. It destroys the organic matter on which germs flourish. Quicklime also purifies water. Bleaching powder or chlorinated lime is very powerful in sterilising drinking water.

Filtration

By filtration all suspended matters are removed and dissolved, organic substances are also oxidised. It lessens the hardness of water but it cannot totally remove the mineral salts in solution. There are two kinds of filtrations (1) slow sand filtration (2) and rapid filtration.

Slow filtration consists of large, shallow reservoirs which contain sand and gravel as filtering media. The water is passed through these reservoirs.

There are four stages in sand filtration. First there is sedimentation of the grosser particles in the settling tanks. Then there is the mechanical obstruction to impurities in the interstices of the filter. Then there is the oxidation of the organic matter in the pores in the filter beds. Then there is the process of nitrification by the germs in the layer on the surface of the filter.

Rapid Filtration

Mechanical or rapid filters include Paterson, Jewell, Math, Platts, Bells, The Candy and Phoenix filters. They are worked at a rate of 50 or 60 times greater than what is permitted in the slow sand filters. They may be either pressure or gravity type. Rapid filtration is usually carried out in miniature sand filters.

The advantages of this type of filters are: (1) Simplicity in construction and economy in operation. (2) Filtration is rapid and continuous. (3) It is cheap and efficient and can be put in a small area. (4) Filtering material does not require changing and is thoroughly cleaned and refilled in a few minutes. (5) Small area of land is needed. (6) Settling tanks are not needed.

The treatment of municipal water-supply by chlorination is very useful. It is resorted to in Simla, Delhi, Calcutta, etc.

The bad taste and odour of water is removed by Potassium Permanganate.

Domestic Filtration

The Pasteur-chambered filter, the Berkfield filter, the four-Ghurra filter are useful domestic filters.

The Four-Pot Filter

The four-Ghurra (pot) filter consists of four earthen-ware pots placed one over the other on a wooden frame. Each pot has one or more holes at the bottom stuffed with cotton-wool or straw. The top one contains the unfiltered water which has been strained through muslin. The second one is half-filled with powdered charcoal. The third one contains fine sand and a layer of small gravel underneath. The lowest one is the receiving vessel.

Great care must be taken to clean every part of this filter once a week. The pots should be washed once a week. The charcoal and sand must be dried in the sun once a week. New straw and cotton-thread in the holes must be used every week. The holes should be cleaned thoroughly.

The holes of the pots are clogged with foul material which affords a suitable nidus for bacteria to flourish.

Add a little paste or solution of the clearing nut (strychnos potatorum) to the muddy water. It will become clear in a short time. Make 4 or 5 twists in the water with a big piece of alum. The water will be rendered clear in a short time. Do not put the piece of alum in the water.

The tall-necked earthen Sorahis are not safe vessels for holding water as the inside cannot be cleansed easily.

Add 2 or 3 drops of Condy's fluid (solution of permanganate of potash) to a tumblerful of the water to be examined—just enough to give a pink colour. If the water quickly becomes brown or in 24 hours loses its colour entirely, it is unfit for drinking.

Chapter Five

FOOD

1. Food

Food is a substance which builds up or repairs tissues or supplies material for the production of heat and energy.

Without food you cannot live. But you eat more than you need. You season the foodstuffs with spices which harm the stomach and the intestines. You eat in abundance to satisfy your palate without any consideration for your health. You overload your system with food which acts as poison and causes various sorts of diseases. More people die of over-feeding than of underfeeding. You press your friends to eat some extra sweets even after a full, sumptuous meal. Mothers overfeed their children. Women waste their time, energy and money in preparing different varieties of palatable dishes. They try to exhibit their utmost skill in presenting diverse, tasty dainties. You stuff the stomach even though you have no hunger, on the strength of Choorna or digestive powder. After all, man wants very little on this earth, a few breads and one or two cups of Dhall only.

The principal food-substances which are essential for the maintenance of health are proteins, fats, carbohydrates, salts, water and vitamins. Food should also contain some roughage to stimulate the peristaltic movements of the intestines. No single foodstuff contains all these constituents.

Man continually works whether he sleeps or sits quietly. Breathing is work. When work is done energy is spent. The body supplies this energy by combustion of blood. Blood gets its supply from food-materials.

The lamp burns oil as fuel and gives light as heat and energy. Even so the human body burns food as fuel and gives energy in the form of heat and motion. In an engine, oil or petrol is burnt. In this marvellous human engine, food serves the purpose of fuel. The fuel that is burnt is food. Engines are in need of different kinds of fuel, coal, oil or petrol according to their construction. All the fuels contain carbon. Carbon burns and supplies energy. In the human engine which is very delicate and complex carbohydrates, fats, etc., provide this carbon.

Proteins

Proteins are nitrogenous or flesh-forming substances. They supply material for growth and wear and tear of tissues. They build tissues and repair waste.

A piece of skin is torn off. The body promptly sets to work to renew it. New cells are manufactured rapidly. The part is reconstructed within a short time. Protein is necessary for this.

In an engine, parts have to be renewed from time to time. So it is with the body. The working parts need continual overhauling and renewal. This necessitates the supply of protein.

The proteins of milk are superior proteins. The proteins of corn, wheat and beans are inferior proteins. The value of proteins depends on their amino-acid contents. They are all formed by the linkage together of substances called amino-acids. There are twenty different amino-acids found joined up to each other in proteins. The difference between proteins is due to the number, arrangement and proportions of the different amino-acids. Lysin, Cystill, tryptophan, tyrosin are some of the amino-acids. They are essential for nutrition. These are absent in the vegetable proteins. The proteins provide energy also. The daily requirement of the body for protein is approximately one gramme per kilo of body-weight.

In cow's milk there are two main proteins—lactalbumin and caseinogen. Wheat contains gluten.

Fats

Fats or hydrocarbons are great heat-producers. They are "protein sparing foods". They are our main source of calories. They are more concentrated than carbohydrates. One gramme of fat when burnt in the body produces 9.5 calories, while one gramme of starch will yield only 4.8 calories and cane-sugar only 3.95 calories. Animal fats are carriers and sources of the fat soluble vitamins, vitamin A, D and E. Fat is not easily burnt in the body unless there be carbohydrate present. The fats delay the passage of food from the stomach and so give a lasting feeling of satisfaction. Fats yield about 2y, times as much energy as an equal amount of carbohydrate or protein. Fat reduces the bulk of food intake. Fats reduce the need of Vitamin E.

Carbohydrates

Carbohydrates include substances like starch, rice, arrowroot, barley, wheat, sugar, etc. They supply energy to the system. They are sources of heat and energy. They are fuels for the human engine. Sugar is a concentrated and readily combustible form of carbohydrate. It supplies energy immediately when the body is exhausted. Other carbohydrates need longer time for their conversion into sugar. The boiler of a steam engine is fed with coal. The coal generates steam and the steam supplies the energy. Even so in the human engine the food or the fuel is converted into blood which burns to supply energy. Carbohydrates are also a source of fat.

During digestion, rice and other kinds of starches, milk-sugar, cane-sugar, etc., are changed into grape-sugar or glucose before they are absorbed. The excess sugar is stored up in the liver and muscles as glycogen. Prolonged muscular work during starvation may exhaust the entire store of glycogen in the body. Each gramme of sugar gives 4.1 calories of heat.

Carbohydrates are the most easily digested, absorbed and metabolised of the foods. If you take too much carbohydrates the islets of Langerhans in the pancreas are overworked. Diabetes is produced.

The body needs always carbohydrates to digest fats. The foods which give warmth and energy are fats and carbohydrates. They form 80 per cent of our diet. Protein forms only 20 per cent. Any protein is burnt and utilised for warmth and energy when the body has satisfied its needs for repair and growth material.

Mineral Salts

Lime, iron, phosphorus, sodium, potassium, magnesium, copper, iodine, sulphur, common salt, etc., are found in the blood. These salts are essential to the body. These elements are being lost each day by the body and must be replaced from the food. If we take any tissue of

the body and completely burn it, we will find a small amount of incombustible material. This incombustible material is called ash. This ash contains the mineral salts.

Mineral salts form about one-twentieth of the body weight and are necessary for the maintenance of the body. They form part of every cell. They play a vital part in the regulation of the acid-alkali balance. There are fifteen different mineral elements. Each has its own special part to play.

Phosphorus, sulphur, chlorine are the acid-forming elements. Calcium, potassium, sodium, iron, manganese, copper and magnesium are found in the body in large amounts. They are the most important. They are the alkali-forming elements.

Every cell in the body contains phosphorus. It is necessary for the multiplication of cells and the growth of the body. Its daily requirement in the diet is 1.5 gm. It is needed more during pregnancy. Its deficiency is characterised by softening of the bones, stunted growth, rickets, caries of tooth. Foods rich in phosphorus are cheese, milk, oatmeal, almonds, nuts, peas, beans, whole wheat, spinach, potatoes, lady's fingers.

Calcium phosphate is necessary for the development of bones. It is very essential for the children. Milk is the best source of lime salts. Green vegetables and certain of the millets are rich in calcium, but this calcium is not so easily absorbed as the calcium of the milk. Calcium is required in greater quantity by children and during pregnancy and lactation. The minimum requirement of calcium in the body is .45 gm.

Iron is the most important part of the red pigment of the blood (haemoglobin) and enables it to carry oxygen from the lungs to the tissues. Pulses, whole cereal grains, lettuce, dried fruits, spinach, dates, figs, raisins and tomatoes contain iron.

Iodine is an essential constituent of thyroid gland. Goat's milk, fresh vegetables, sea vegetables contain iodine. Goitre is due to lack of iodine in the water.

Vitamins

In the last twenty years a revolution has occurred in the history of dietetics. Scientists and doctors have found that although the required quantity of proteins, fats, carbohydrates and mineral salts are taken daily, yet the system fails to discharge its functions. Growth is checked, loss of weight follows leading eventually to death.

After repeated and continued researches they found out that in addition to the building, repairing and working materials some other substances in minute amount were needed to make the body function properly. These mysterious substances were named Vitamins or life-giving substances.

If the diet contains milk, fresh fruits and fresh green vegetables, man's dietary needs for Vitamins will be satisfied.

Vitamins exist in the foods in minute quantities. A diet that is free from Vitamins produces certain diseases, generally known as deficiency diseases and even causes death. Rickets, Scurvy, Pellagra, Beriberi, Xerophthalmia or Keratomalania, Osteomalacia are some of the diseases produced by the lack of Vitamins in food. Green vegetables and fresh fruits are rich in Vitamins. Some Vitamins are water-soluble, some are fat-soluble.

Vitamin "A": It is a fat-soluble Vitamin. It protects the body from infection. It is known as the anti-infective Vitamin. Butter, milk, cheese, the green and yellow vegetables, fruits and tomatoes are rich in Vitamin "A". Carotene which is found in abundance in carrots can act as Vitamin "A". Deficiency of Vitamin "A" leads to night blindness, ulceration of the eye,

Xerophthalmia, infection of respiratory and alimentary tracts, bladder and urethra, lowers resistance to bacterial infection and causes dryness of the skin.

Vitamin "B": Vitamin "B" is complex and consists of certainly two factors, probably three factors and possibly five. Vitamin "B" is anti-neuritic and protects one from skin trouble.

Vitamin "B" is water-soluble. Vitamin "B" is known as Thiamine or Aneurine. Vitamin "B2" includes Riboflavin or Lactoflavin and Nicotinic acid.

Absence of Vitamin "B 1" causes beriberi. Vitamin "B" is found in the outer layers of cereals and legumes, yeast, nuts, tomatoes, green leaves, oranges, milk. Marmite is a valuable source of this Vitamin.

The substance in rice polishing, the absence of which causes beriberi is called Vitamin "B". Vitamin "B" is in the outer coating of rice and wheat. When this outer coating of rice is removed in polishing, rice is deprived of Vitamin "B". Vitamin "B" is the most important Vitamin for health and well-being.

Vitamin "B2" is composed of two factors, viz., Riboflavin which helps growth and Nicotinic acid which is Pellagra preventive, P.P. of Goldberger. Riboflavin is found in milk (lactoflavin), yeast, etc. Human Pallagra is associated with eating of maize only.

Vitamin "C": Vitamin "C" has the function of warding off Scurvy. It is present in the juices of a large number of fruits and vegetables. It is the only Vitamin which suffers much destruction in cooking. To ensure its presence in the diet some fresh fruit or salad is necessary. Apple has only a small amount of Vitamin "C". Grapes are almost deficient in Vitamin "C". Oranges, lemons, cabbages, turnips, tomatoes, Amla, citrus fruits and green vegetables are rich in Vitamin "C". Vitamin "C" is soluble in water. It is called anti-scorbutic Vitamin, Ascorbic acid or Cevitamic acid.

Scurvy is due to the prolonged absence from the diet of Vitamin "C". Sailors in sailing ships have invariably been troubled with Scurvy when they cannot get fresh fruits and vegetables. Its absence causes caries of tooth, anaemia, etc.

Vitamin "D" (Calcifero): It is fat soluble. This is anti-rachitic Vitamin. This is very necessary for the calcification of bone, prevention and cure of rickets. If ergosterol is exposed to ultra-violet light Vitamin "D" is produced. Ergosterol is the direct precursor of Vitamin "D". It is the parent substance. Lack of this Vitamin causes rickets. The human system can synthesise Vitamin "D" from sun's rays.

Vitamin "D" is contained in milk, butter, ghee. Vegetable oils develop Vitamin "D" on exposure to sun.

Even if calcium and phosphates are found in fair proportion, bones cannot be nicely developed without a proper supply of Vitamin "D", the forming agency. The practice of exposing parts, smeared well with mustard or other oil, to the sun is a good method of imbibing Vitamin "D".

Food must contain calcium and phosphorus in right proportion. If the bone-forming materials, viz., calcium and phosphorus are absent exposure to sun is not useful.

Vitamin "E": This is anti-sterility Vitamin. This is fat-soluble. It is necessary for reproduction. It is found in abundance in the embryos of the seeds and green leaves, chiefly lettuce, cotton seeds, maize, peas, oats, corn and wheat germ oil. If wheat germ oil is given to sterile women or women who had repeated abortions, it causes them to conceive and give birth to normal living children.

Vitamin "K": This is coagulation Vitamin. It is fat-soluble. Deficiency of this Vitamin causes prolongation of blood-clotting time. It is found in spinach, carrots, tomatoes and soybean oil.

Water in the Human System: It forms 64% of the body-weight. It helps the solution and dilution of solid foods. It compensates the loss caused by the excretory organs. It helps the free elimination of the products of metabolism. Thirst indicates the demand for water.

Vegetable Acids: These are not really foods but they are essential for the preservation of health. Tartaric acid, Citric acid, Oxalic acid and Malic acid are the important vegetable acids. They are derived from fresh fruits and vegetables. They form carbonates in the system and thus preserve the alkalinity of the blood and other fluids.

Calorie and Calorimeter: A Calorie is the amount of heat needed to raise one gramme of water 1.C. (small calorie) or 1 kilogramme of water 1.0 (large calorie). The large calorie is equal to 1000 small calories. The heat value of 1 gm. of protein and 1 gm. of carbohydrate is 4.1 calories each. The heat value of 1 gm. of fat is 9.3 calories.

The amount of heat and energy which each food can impart to the body if it is completely digested and utilised can be ascertained by a calorimeter.

A food that is easily digested is not necessarily one that is completely absorbed and a food that is completely absorbed is not necessarily one that is completely digested. The value of food depends upon its digestibility and absorbability. The interval between two meals should be four or five hours. Regularity in the time for taking food is very important. The stomach should not be disappointed when it is eagerly hoping to get its food for digestion. If the food is not supplied at the proper time there will be gripping pain and burning in the stomach owing to the action of gastric juice on the empty stomach and rubbing of the walls of the stomach against each other.

2. A Well-balanced Diet

A well-balanced diet is very necessary for growth, development and maintenance of good health and a high standard of vigour, vim and vitality. This is more essential for growing children, pregnant women and nursing mothers.

The supply of the inorganic mineral salts such as calcium, phosphorus, iron and iodine, protein, fats, carbohydrates, vitamins (accessories), etc., must be adequate. The diet should provide the same number of calories daily. The foodstuff must be readily digestible and assimilable. The different foodstuffs must be in proper proportion. The proteins should be of good quality. They should contain the necessary amino-acids. Then alone the diet will be a well-balanced diet.

If you have an unbalanced diet for a very long time you will develop deficiency diseases like Beriberi, Scurvy, Pellagra, Goitre; from poverty of iodine certain diseases of the eye such as Xerophthalmia. Children will suffer from rickets. Pregnant women will develop Osteomalacia.

Fruits and Milk: Fruits are rich in acids and sugar but deficient in proteins and lime. Milk contains plenty of these two necessary principles. Hence a diet of fruits and milk combined is a proper diet. This is more suitable for aspirants who wish to do lot of meditation, old persons and those with weak digestive power.

This diet keeps the urine alkaline and prevents the formation of stone in the bladder and acidosis. The best time for eating fruits is the morning or after breakfast. "Fruit in the morning is gold, in afternoon silver and in evening lead". This is the popular proverb. Overripe and unripe fruits should be avoided.

Fruits and Nuts: Fruits contain important mineral salts. They also contain levulose or fruit sugar. Bananas, dates, grapes and mangoes are nutritious. Apples, lemons, tomatoes and oranges are rich in Vitamin C.

Nuts are rich in proteins and fats but they are not easily digestible. They are suitable for those who suffer from diabetes. Nuts are substitutes for meat. They are rich in Vitamin B.

Vegetable Food: Cereals, pulses, roots and tubers, green vegetables, fruits and nuts constitute vegetable food. Cereals are rich in nitrogenous substances and starch but poor in fat. The different cereals are wheat, maize, or Indian corn, rice, millet (Joar), oats, Bajra or Cambu, barley. Cereals contain phosphates of calcium, magnesium, potash and a small amount of iron.

Cereals contain protein, carbohydrate and fat. Maize is relatively rich in fat and slightly deficient in salts. Rice is very rich in starch but poor in protein, fat and mineral matter. Millets (Bajara) are inferior to wheat in proteins but superior to it in fat. Oat is rich in fat and protein. It is the most nutritive of all cereals. As cereals contain abundant carbohydrates, they should be eaten with foods rich in protein and fat.

Pulses are abundant in nitrogenous substances. They contain the vegetable protein, legumine. Pulses are taken with rice.

Potatoes, sweet-potato, arrowroot, tapioca, sago, carrots, beet-root and radish belong to the class of roots and tubers.

Green Vegetables: They are not nutritious but they contain important mineral elements such as calcium, sodium etc. They maintain the proper alkalinity of the blood by balancing the acid producing tendencies of meat and cereal grains. They contain Vitamins A, B1, B2 and C.

Dietetic Rules

1. Do not overload the stomach. Overloading the stomach will produce dyspepsia.

2. Do not take too cold or too hot food, because it will derange the stomach and produce indigestion.

3. Avoid late dinner.

4. Take rest for half an hour after meals.

5. Eat wholesome food in proper quantity at fixed time.

6. Do not take anything between meals.

7. Excess of food causes overworking of the digestive and excretory organs such as kidneys etc. Dyspepsia, flatulence or windy condition, putrefaction, obesity, auto-intoxication will result.

Calories: A man of average weight doing moderate amount of muscular work must take enough food that can give 3000 calories per day. A man who does sedentary work needs 2170 calories. An Agriculturist who does active work in the fields needs 3500 calories. In finding out the calories, age, sex, height, build, work etc., have to be taken into consideration.

Food Allergy: Some persons are sensitive to certain kinds of food on account of inherent or acquired idiosyncrasy. They exhibit some inconvenient symptoms when they take certain foods. The symptoms may be gastro-intestinal. They may get colic or diarrhoea. They may

have certain urticarial eruptions on the body. They may exhibit symptoms of asthmatic attack.

Food Poisoning: Food should be protected from contamination, from dust, flies and other insects.

Ptomaine poisoning takes place on account of taking foodstuffs which are undergoing putrefaction. The symptoms are vomiting, purging, colic, headache, great muscular weakness and severe collapse. It is generally mistaken for cholera. Collapse should always be guarded against by keeping the heart stimulated by coffee and stimulant mixture which contains sol volatile, spirit etheris, musk and spirit camphor. Hands and legs should be kept warm by hot water bottles and rubbing turpentine liniment.

Botulism: it is a form of food-poisoning. There are no symptoms of gastro-enteritis in this form. Poisoning results from absorption of a specific toxin from the digestive canal. The germ that causes this form of poisoning is clostridium botulinum. Canned, preserved and pickled foods are generally the sources of danger.

Mastication: The appetising food and mastication stimulate the flow of saliva. The increased production of saliva in its turn tends to increase the secretion of gastric juice. This again stimulates the mucous membrane of the duodenum, the first portion of the small intestine and leads to the production of hormone secretion. Therefore mastication of food is most necessary and its neglect is fraught with danger. If you do not masticate the food well, the stomach will be overworked. It will have to do the work of grinding the foodstuffs.

Starchy food is digested in mouth by saliva which is alkaline. This cannot be done unless the food is thoroughly masticated. Hence thorough mastication is very necessary. Food must never be taken in haste because it produces dyspepsia.

The secret of enjoying and ensuring good digestion of food is to masticate every morsel so thoroughly that it glides down the throat in a liquid state. A friend of late Mr. Gladstone asked, "Mr. Gladstone, what is the secret of your long and healthy life?" Mr. Gladstone replied, "I masticate my food well. I bite every morsel of food 35 times". Proper mastication of food prevents and cures dyspepsia. If you thoroughly chew every bit of food, a much smaller quantity gives more nourishment than a large quantity of half-chewed food, better digestion, more rest to the stomach and less amount of excreta.

Give up Meat-eating: Meat decomposes readily in the tropics. Decomposed meat produces irritation of stomach and bowels, colic, diarrhoea, collapse, urticarial rashes, etc.

The flesh of animals suffering from anthrax, glanders, tuberculosis, etc., is dangerous. Tape worm, Toenia Solium, Toenia Saginata, Distomum Hepaticum, Trichinella Spiralis are communicated by eating contaminated meat. Meat-eating is unnatural and dangerous. Therefore meat-eating should be totally abandoned. You can obtain nutrition, strength, vigour, vitality from milk, butter, cheese, almonds, nuts, fruits, green and leafy vegetables. Vegetable diet sharpens and brightens the intellect also. What a great blessing!

Chapter Six

CLOTHING

1. Clothing

You must protect yourself against the extremes of heat and cold. Then alone you can maintain good health and general well-being. Excessive cold and excessive heat are unpleasant and injurious to your health. You must wear suitable clothing. Children in particular should be guarded against the dangers of extremes of climate. Clothing should keep you warm in winter and cool in summer. This is the main object in wearing clothes.

The most important function or use of clothes is non-conduction. In temperate and cold climates they prevent heat flowing away from the body too rapidly. In tropical climates they prevent the heat flowing to body from the sun. Without clothes you cannot pull on in this world. You will lose so much heat from your body that even if you eat enormously, you will not be able to generate enough heat to keep you going.

In the tropics and in very hot weather the skill may get badly burnt from the heat of the sun's rays if it is not protected by clothing. Clothing affords protection to the body against heat and cold and external injuries. It assists in the maintenance of body-heat. It is used for decency and personal decoration or ornamentation. This is of lesser importance.

The protection given to the skin by clothing is an acquired habit of comfort. Had it not been for this acquired habit, man may very largely do without clothing. Agriculturists use very little clothing. Their skin has become more resistant to influences of weather in maintaining the body temperature. There are naked Sannyasins even in the icy regions of the Himalayas. Need for clothing is an acquired habit. All are partially naked. None covers the face even in coldest winter. If the sensitive skin of the face can withstand cold, the skin of other parts of the body ought to bear cold if called upon to do so.

The animal kingdom supplies two of the best materials for clothes, viz., wool and silk. To these may be added fur for special clothing. The vegetable kingdom furnishes cotton, linen and artificial silk.

The cotton and linen sheets always feel much colder than the blankets, because cotton and linen conduct the heat away more rapidly than wool does. Silk does not prevent the loss of heat so well as wool, but it does so better than linen or cotton. The greatest amount of heat will be retained by wool and the least by linen.

The same material will absorb different amounts of heat when dyed with different colours. Black absorbs the solar heat-rays and white reflects them.

Cotton can be boiled without injury and is therefore easily sterilised and may be said to be more hygienic than wool from the point of view of infection.

If a cloth be loosely woven there are many tiny air spaces in its meshes. As air is not a good heat-conductor, its presence in the meshes of the cloth makes the latter warmer than if it were very closely woven. For the same reason, loose clothing is warmer than tight clothing.

Wool does not absorb moisture so readily as cotton. This is the reason why chills more quickly occur with linen or cotton than flannel clothing.

When you perspire the woolen material absorbs and retains this moisture. The fabric remains quite warm to the touch and thus prevents a chill.

Silk is a bad conductor of heat and 8o it gives warmth but it does not absorb moisture nearly so well as wool. It is less liable to shrink than wool and does not irritate the skin as some wools do.

Cotton quickly conducts away the warmth of the body and fails badly as an absorbent. It simply becomes wet and cold when we perspire.

For protection from weather, air in between two folds of cloth is more efficient than two thicknesses of cloth. Where protection is the object it will be comfortable and less costly if clothing be arranged in layers. One coat or shirt over another or one wrapper over another would be more non-conducting and lighter than simple coat or wrapper made of thicker cloth.

All tight clothes should be avoided as they interfere with circulation, respiration, digestion and the action of muscles.

Garters should be condemned as they compress the superficial veins, produce a feeling of heaviness and cause varicose veins.

The dress should not interfere with healthy action of the skin. For this purpose materials which absorb moisture readily should be preferred.

Clothing should be good in quality, strong, durable and light. It should be capable of being easily washed or cleaned. The material should be of an attractive appearance. Such a clothing is an ideal one.

Chapter Seven

PERSONAL HYGIENE

1. Personal Hygiene

Man is a criminal if he suffers from any disease by violating the rules and laws of health and hygiene. The responsibility of maintaining good health rests with every individual. Personal hygiene deals with matters that pertain to the health of the individual. A healthy man only can turn out good and useful work. A healthy man only can serve humanity. A healthy man only can earn money. A healthy man only can meditate well. Therefore good health is a great blessing indeed. He who observes the laws of health and hygiene will be endowed with good health.

Cleanliness: Cleanliness is next to Godliness. Cleanliness bestows good health. You must observe cleanliness with regard to the food you eat, the air you breathe and the water you drink.

You must take bath daily in the early morning. Cold bath is invigorating and highly beneficial. Old people, convalescents and invalids can take hot water bath. Daily cleansing of the skin is of paramount importance. If this is not done the pores of the skin will be blocked by dirt and various skin-diseases will develop. The parts where hair grow must be kept scrupulously clean. The arm-pits give out an offensive smell and so require regular cleaning.

Cleanliness of mouth is very important. Mouth is the gateway for the entry of micro-organisms. The teeth should be thoroughly cleaned twice a day.

Neglect of dental hygiene leads to Pyorrhoea. Deposits of tartar should be removed by the dentist. The food-particles that are lodged between the teeth should be removed. The mouth should be rinsed after every meal or tiffin with a solution of potassium permanganate or hot water in which a little salt is dissolved. This will keep the mouth and teeth sweet and clean and prevent pyorrhoea. It will be useful for those who suffer from pyorrhoea.

The tongue should be cleaned daily in the morning by a tongue-cleaner. The nails should be cut sharp and kept clean, otherwise dirt will accumulate under them and may carry infection.

Wash the hands before taking meals. This will prevent the introduction of infective agents by contact.

Do not use the brushes, combs, bed, clothes, etc., of other persons. Ask the barber to wash his hands, razor, etc., before you take a shave. It is better to have your own razor, soap and brush. Dhobi's itch and other kinds of skin-diseases are communicated through dirty hands of a barber, his brushes and razor. Do not use another man's pillows, bed, clothing etc. Diseases may be communicated through these articles.

2. Hygiene of the Skin

The whole body is covered, protected from injury, kept warm and made beautiful by the skin which covers its surface. The human body is covered by skin, the nature's garment. This garment never grows old, because Mother Prakriti is constantly renewing the skin. New cells are continually forming in the deepest layers of the skin. When they grow they push off the old cells on the surface of the body.

In hot countries much of the work of the kidneys and lungs is done by the skin. The amount of sweat and excretion of solids is very great. Hence the cleansing of the skin is very important in hot countries.

Good food, exercise, fresh air, daily baths are essential if you wish to have a beautiful complexion.

The skin is like a glove or sweater. It fits tightly to the body and covers every part of it. It is an organ of touch or Sparsa Indriya (Tvak). You get the sense of touch from the nerve-endings arranged in it. It is the mind that really feels. It consists of two parts, an outer layer called the epidermis and an inner layer called the dermis or true skin.

It has pores. These are the openings of the sweat glands (or soderiferous glands). Perspiration comes through these pores. There are 3 million pores in the body. There are 1500 pores to half an inch in the palm of the hand.

There are also other pores with fine hair. Sebaceous glands or oil glands open into them. There is a small muscle at the side. It contracts and makes the hair stand on end (goose skin, horripilation).

Epidermis consists of pavement cells, tiny cells which are seen only under a microscope. They are flat and very tightly packed together. The upper layer cells are dry and peel off if you rub well. The under cells then take their place and the same thing happens again.

The sweat glands which are simple tubes and which open on the surface of the skin relieve the body of a portion of the effete material. The amount of sweat given off by a full-grown man in the twenty-four hours is about two lbs or 2 pints in weight. The sweat increases in hot weather and during exercise and running. It decreases in winter. The sweat-glands are numerous in the palm of the hand and not so numerous in the neck or back. The sebaceous glands secrete an oily substance. This lubricates the skin and serves the purpose of a natural pomade. It makes the skin shining and smooth and preserves the delicately sensitive sense of touch. It keeps the skin from getting dry and cracked. If the pores in the skin are blocked by dirt the function of the skin is interfered with. The lungs and the kidneys will have to overwork. Various diseases of the skin will develop. The dirt affords breeding ground for parasites and germs. Hence it is very necessary to keep clean the opening of these glands by daily baths and gentle rubbing of the skin. The sweat glands, the sebaceous glands and hair are in the true skin or dermis.

The dermis or the true skin is full of blood-vessels and nerves. If you prick the dermis with a pin, blood comes out. The nerves send the news or telegraphic messages to the brain and you feel pain. It also contains the root of the hair.

The skin protects all the internal organs of the body. As it is elastic it allows free play to the muscles which are below it. It keeps the body clean by throwing out impurities from it as sweat. Sweat is water with a saltish, acid, organic dead matter. It regulates the temperature of the body. It keeps it from getting too hot or too cold. When the perspiration evaporates it cools the body. It gives beauty.

Remain in the sun and apply mustard oil to the body. Shampoo or massage the body well. The Circulation of blood is quickened. The muscles are exercised well. You will experience an exhilaration and refreshing feeling. It keeps the body cool and makes the skin soft and supple. It entangles the dirt of the body and makes its removal easy during bathing when soap is used.

In India the daily use of soap is unnecessary. It renders the skin thy and hard by removing the grease which is present in the skin. Potash soft soaps are good. Soda soaps are hard. Excess of soda irritates the skin.

3. **Hygiene of the Eye**

The eye is a very important organ. It is the sense of perception. It is one of the five Jnana Indriyas. The external eye-ball is only an instrument to catch the vibrations of colour and light and send them to the centre in the brain. It is one of the five lamps in this body. It is a window in this body for the soul, the Proprietor of this body or the Indweller. The "will to see" or the "desire to see" has become the eye, the organ of sight or perception. The presiding deity of the eye is sun.

It consists of cornea which is a transparent curved window which receives the rays of light. The white part is the sclerotic coat. The space behind it is filled with a transparent watery fluid. There is a coloured curtain next to the cornea. It is called Iris. It has a hole in the middle. This hole can automatically become large or small to receive more or less light. The hole is called the pupil. In a bright light the pupil becomes small; in a dim light it becomes large. The lens is behind the pupil. Behind the lens is the hollow of the eye which is filled with a vitreous body. Light passes through this vitreous humour and strikes the screen or retina behind the eye. Then the optic nerve takes the impression of the object seen from the retina to the brain. If the optic nerve were cut out, sight will be totally lost.

The knowledge of this sense universe is obtained chiefly through the avenues of the eye and ear. All colours and forms are centred in the eye, in the mind and Atman. It is really the brain that sees and interprets the impressions conveyed to the eye from the external universe. To be more correct it is the mind that really sees objects.

The eye is ever wandering and restless. It makes the mind also ever restless. Lust of the eye is very powerful. Steadiness of the eye is steadiness of the mind, Trataka, concentration, Upasana, worship, etc., make the mind steady.

The eye-balls are very safely placed in the bony sockets. They are well protected on all sides by the bony walls. Eyebrows and eyelids prevent foreign bodies or dust from getting into the eyes. Mark how the all-merciful, all-wise Mother Prakriti has given all sorts of protection from external injuries and foreign bodies. The muscles of the eye move the eye up, down and sideways.

Behind the eye-ball there is a soft pad of fat which serves as a cushion and lessens the chance of injury to the eye when it gets a blow. The disappearance of this pad of fat causes the sunken eye of very old and sick people.

A little tear gland (lachrymal gland) is placed in each socket of the eye-ball in the outer corner of the eye. A continued secretion of tears keeps the surface of the eye moist. A little duct opens at the inner edge of each eyelid and carries the tears away into the nose. When dust enters the eyes they water involuntarily. This bathing of the eyes with tears helps to

wash the particles of dust into the corner of the eye. The eyebrows act as little drains to keep perspiration out of the eye. They act as brushes to prevent dust from falling into the eyes.

The tear-gland is easily irritated in women. Women shed tears profusely even when they are excited a bit. They are naturally weak. Tears are their weapon to accomplish their object. This is Maya's play in their lachrymal gland. Beware of false tears. Stand firm. Do not yield.

The eye is like a camera. It is photographing the outside world on the retina. It receives the light rays from the sun. Just as images are printed in the plate of the camera, so also images of external objects are printed in the retinal plate of the eye.

If you are taking a photograph of something near at hand you have to focus your camera differently from the position for a distant landscape view. So also there is adjustment of the eye for seeing near objects. The shape of the lens gets altered. The pupil also adjusts in its size. When you look at near objects the pupil is smaller than when you are looking at the distance.

The eye should always be examined by a doctor in cases of headache or where there is any difficulty in reading the blackboard in the school. Squint is caused by the straining of the eye.

Have sunlight treatment. You will have clear vision. You need not take recourse to glasses. Repeat the 12 names of Surya or sun-god in the early morning before sunrise. You will have good sight.

Sit in the sun. Close your eyes. Slowly move your head a little from side to side. Let the sun shine directly on your closed eyelids for ten to thirty minutes. Let the eye-balls also move with the movement of the head and not against.

Now turn back to the sun or come in the shade. Do not open your eyes. Cover the eyes with palms of your hands for five or ten minutes. Avoid any pressure on the eye-balls. This is palming. Have the sun-treatment in the morning at 7 a.m. and evening at 5 p.m. Let the exposure of the eyes to the sun be gradual. When the eyes get accustomed to the light, you can gradually have strong light.

Do not read in a bad light or in a light that flickers. This is a great strain on the eyes. It will produce eye trouble. The light should come from the left side behind and above. Do not read or work in the petromax light. It will spoil your eye-sight. If you are forced to work, place the light behind your head. Have a green shade. Too much reading and close work such as fine sewing are not good for the eyes.

Good eye-sight is very necessary for success in life. The eye is the most sensitive organ. Do not apply anything and everything which laymen suggest for diseases of the eye. The eye will be spoiled. Always consult an eye-specialist. Do not neglect early treatment in granular lids. The granules should be frequently touched with copper sulphate. Do not remain in the smoke.

The common causes of disease of the eye and defective eye-sight are overuse and straining of the eye by reading in the bad light, reading books printed in too small type on glazed paper, glare, foreign bodies getting into the eye, draughts of cold air, lack of proper food, fresh air and general bad health. Do not read a book when lying down in bed.

Use Brahmi Amala oil. It will cool and refresh the tired eyes. If there is a foreign body under the eyelids use boric eye-wash. Open and shut the eyes within the eye-cup or open the eye under clean water. Put a drop of castor-oil in the eye at night. It will come off by itself in the early morning. If these methods fail, consult a doctor.

The eye is a restless organ. You must give it proper rest. Restless eyes produce restlessness of the mind. Sit calmly, close your eyes and do Japa and meditation. You can give ample rest to the eyes. Do this two or three times a day, morning, evening and night.

He who dwells within this eye, who is within the eye, whom the eye does not know, but whose body the eye is, who rules the eye from within is thy inner Self, Atman, immortal, Amritam. Atman is the Eye of eye. Realise Him through the inner eye of intuition and be ever blissful and free.

Chapter Eight

EXERCISE AND SLEEP

1. Exercise and Rest

Necessity: If any organ or part of the body is not used it gradually becomes smaller and less liable to work. If a broken limb is fixed with splints the limb will be found to be much smaller than the other when the splints are removed at the end of 2 or 3 weeks, because the muscles have wasted for want of use. But if the muscles are much used they increase in size. A gymnast, an athlete, a blacksmith, a labourer in the field have strong, well-developed muscles in the arm, chest, etc. They have a wonderful and beautiful physique.

A well-developed biceps and a chest is a source of great joy to a student. When he wants to show his general fitness, he pulls up his sleeve and says "Feel my biceps. O Ram. It is as hard as a stone." A football player says, "Look at my muscles of the calf. They are like big iron balls. I can walk 30 miles a day without any exertion."

A gymnast shows his developed deltoid muscles and says, "Come along, Krishna, break a cocoanut on my deltoid muscle. I have a very strong deltoid muscle."

Without exercise there will be no health. The whole system will refuse to function. The stomach will refuse to digest the food properly. The intestines will decline to function efficiently. The blood will be loaded with poisonous matter.

Exercise is essential for the different organs of the body to function easily and effectively. It is necessary to promote the repair and formation of tissues, and excite the demand for oxygen needed for utilisation of food.

Heart cannot work efficiently without definite exercise. Sedentary habits and moving about in carriages, rickshaws and cars have deteriorated the health of rich and many other people.

You should have a well-built body without adiposity. Fat hinders work by its extra weight, by giving rise to additional heat during work and by greater fatigue owing to the accumulation of waste. Reduce the fat through regular and systematic exercise.

Benefits: Exercise is very essential for keeping up good health, vim, vigour and vitality. If you do not take exercises, the muscles will waste. You will be lazy and weak. You will have no power of endurance.

Exercise vivifies and purifies the blood. It quickens and deepens respiration. It supplies more oxygen. It quickens and equalises the circulation.

A sick person after a prolonged illness is not able to walk or even stand by himself. As he has been in bed for a long time without using the muscles, the muscles have lost their strength. By doing mild exercises they gradually regain their lost tone and strength.

All the movements of the body are done by muscles. If you have well-developed muscles you can turn out more efficient work. Exercise reduces fat.

If you do exercise regularly the heart will drive the blood more vigorously. The lungs will take in the air with deep breaths. The chest will expand. More waste and used air will be driven out.

Exercise gives a healthy glow all over the body and a rapid supply of blood to the muscles and the internal organs. The kidneys, the lungs and the skin which remove the waste materials are stimulated. They do the function of cleansing more energetically and more efficiently. Muscular exercise has a beneficial effect on the body as a whole.

When the action of the heart is improved by exercise, local congestions vanish. The blood is equally distributed.

Exercise bestows a general efficiency of body and mind with a better social spirit and cooperation with your fellows. You learn to control the weak side of your nature and give fuller freedom to the best spirit that is in you. It checks overgrowth and develops the weak person. It restores quickly convalescent persons to better health. It corrects during growth various deformities. It removes debility and obesity. It preserves the healthy tone of the body.

Exercise quickens the circulation of blood in the lungs. The amount of oxygen inspired and of carbon dioxide expired is greatly increased. The increased output demands increased supply of food and fresh air.

Exercise increases the nutrition of the muscles. This contributes to their growth and energy. Muscles lose water during exercise. Exercise removes constipation and produces a regular action of the bowels. It leads to better mental efficiency and better performance of mental work. It promotes the action of the skin. There is increased perspiration. It reduces and regulates the temperature. After exercise the body should be covered and protected from undue loss of heat.

Regularity and System: Exercise should be regulated and adjusted to the needs and capacity of the body. There should not be any fatigue after performing exercise. There should be exhilaration of spirits after finishing the exercise. Violent exercises should be avoided. It is better to have recourse to graduated exercise.

Exercise is necessary at all periods of life, particularly during childhood and early manhood. Exercise should be systematic. Every muscle of the body should share in the exercise.

Mind and Soul Culture: Some young person’s become too fond of games. They neglect their studies and grow up with big bodies, but little mental culture. Mental culture and spiritual culture should not be neglected. It is the mind that makes the man. It is the soul that makes the superman.

Forms of Exercise: It is best to take exercise in the open air, because you get much oxygen to purify blood.

The forms of exercise are numerous. You should select that form which suits you best whether it be riding, gymnastics, walking, running, swimming, rowing and boating, cycling,

cricket, tennis, badminton, football, hockey, golf, the use of dumb-bells, bar-bells, Indian Clubs, Dand, Baithak, boxing, wrestling or Asanas, Pranayamas and Suryanamaskaras.

In cycling every muscle and nerve is used. The bowels are massaged by the muscles which form abdominal wall and are thus to act naturally.

Gymnastics develops and strengthens the muscles symmetrically. It increases the flexibility of the body and develops greater capacity for balance.

Trapeze has a most excellent effect in shaping arms and shoulders.

No other exercise has so good an effect on the respiration and circulation as running. The outside air is pure and beneficial.

Nearly every muscle is called into play in rowing. The muscles of the back are particularly strengthened.

Swimming exercises all the limbs. It is a pleasant and invigorating form of exercise. It trains the respiratory muscles. It has a marked influence in straightening the back.

Cricket is very interesting. It keeps the players out in the open for hours on the turf. It provides the most varied movements. It educates the hand and the eye to act in union.

Football is a good muscle-forming game. It promotes strength. It develops the muscles of the leg and thigh. It does not fully develop the arm and the chest.

Hockey necessitates much turning about. It is beneficial to the trunk muscles.

Rules for Exercise: 1. Exercise should be taken in the open air. It should be repeated daily about the same hour. It should never be taken just after or before a meal.

2. The amount of exercise should be regulated according to the age, physical development or capacity of the individual.

3. Chills should be avoided after exercise.

4. Exercise should be regular and systematic.

5. Every part of the body should take part in the exercise.

6. After exercise the body should be washed or sponged.

Rest: If you want to enjoy good health you must take enough rest. There is always a cycle in nature. A period of activity is always followed by a period of inactivity. Even the heart has a rest. There is a short pause after each beat. The heart recovers itself during the pause. Sleep is the most perfect form of rest, because it is shared by every tissue in the body.

The muscles are completely relaxed. The heart beats a little more quietly. The brain also takes rest.

As the day and night alternate, so there should be an alternating proportion of work and rest.

During rest the repair and the renewals of the tissues take place.

2. Relaxation and Sleep

Relaxation: Fatigue is due to the overworking of some part of the body. It may be the brain if you study too much or do much mental work. It may be bodily wear and tear when you rush about all day long, because you. Use up nervous energy as well. If something exciting

happens, you get a reaction soon and you are tired when the thrill is over. You must at intervals relax and be restful during the day as well as at night.

When the brain gets tired, the first sign is that you cannot keep your attention fixed on what you are doing, no matter however hard you try. The brain demands rest, relaxation. The attention should be directed to something quite different. Change of work gives rest and relaxation. If you give your full attention to any kind of work or game it will be very interesting. You will have no feeling of tiredness.

Exercise is necessary for health, Relaxation is also equally necessary. You get complete relaxation in sleep. Disturbed sleep or dreamy sleep does not give full relaxation. The person feels tired and exhausted when waking in spite of the sleep.

You can maintain good health by alternating exercise with relaxation. Only then the tissues of the body utilise the blood fully, absorb nutrition, grow, repair and throw off the waste material.

Remember well that laziness or indolence is quite different from relaxation.

When you feel sleepy it indicates that your system is in need of rest. Give the needed rest to the brain and body at once. A few minutes rest and relaxation serve as a great restorer and refresher. You will be quite fit for doing further work efficiently. Develop the habit of sleeping at will at any time.

You can get relaxation even when you are awake or working. All the parts of the body do not work at the same time. When certain parts or tissues are working, you can give rest and relaxation to other parts. You must know well the science of relaxation. The quality of relaxation depends upon the mental poise of the person. A man who has a worrying habit cannot relax well. He always gets disturbed, dreamy sleep. Relaxation comes through discipline. He who knows to relax is in need of less sleep. His organs and tissues get rest by shift.

3. Sleep

Definition: Sleep is called "Nature's Sweet Restorer."

Necessity for Sleep: Sleep is the only form of complete periodical rest of both body and mind. Sleep is really rest of the brain. During work and even when the limbs are resting the nerves have to work. Certain nerve centres undergo waste during work. Hence there is necessity for sleep.

Muscles, limbs, brain and nerves need relaxation. Sleep gives this relaxation. The most important factor for the keeping of health in old age is sleep. You are constantly spending energy during the day both mental and physical. The body and mind need rest. This rest is given by sleep. Sleep is the most perfect form of rest.

Amount of Sleep: The amount of sleep varies with age, occupation and habit. Babies ought to have 14 hours sleep every day until they are two and then 12 hours will suffice. School children need 10 hours sleep. Grown-ups should have 8 hours sleep. Women need 7 hours and men 6 hours of sleep. Old people require more.

Weak, debilitated and sick persons require more sleep and repose than healthy persons. Persons who do brain work are in need of more sleep and rest than those who do physical labour.

It is not the quantity of sleep but the quality that gives you good rest and relaxation. Even two hours of sound sleep will be more sufficient than six or eight hours of disturbed, dreamy sleep. Measure sleep not by hours but by relaxation.

Immediately after birth the baby needs 21-22 hours of sleep, when he is three months old 19 hours, when he is six months old 16 hours of sleep.

Instructions in Sleep: In going to sleep your eye-lids close first. The brain does not receive any message or impression from them. The senses of taste and smell then go and your ears fall asleep. Last of all the skin ceases to feel touch. The whole body is asleep.

A short nap particularly in summer in the afternoon is refreshing and invigorating for those who do very active work in the morning.

Do not cover your head during sleep. It is quite unhygienic. You will inhale again the foul air exhaled by the lungs. Two persons should not sleep together for this reason. Lamps, candles and charcoal fires vitiate the air and should not be kept burning in bed room. Cooking should not be done in bed rooms.

Do not go to sleep immediately after taking a heavy meal. A full stomach interferes with free action of the heart. The use of drugs to induce sleep should be strictly avoided. You will get sound sleep if you sleep in quiet, dark, well-ventilated rooms.

Sleep on the left side so that the Pingala or Surya Nadi (Solar Nadi) may work efficiently and digest the food. This is the practice of Yogic students.

Do not take any food late at night. Late supper makes the brain work and disturbs sleep. The brain is called upon to work the digestive organs vigorously while it should be sleeping restfully.

If nine or ten p.m. is the usual hour for sleep, do not take food after 6 p.m. You will have sound sleep. If you suffer from constipation; if the bowels are loaded take a douche one hour before sleep. You will have sound sleep. Do not develop a douche or enema habit. Massage also induces sleep. Massage diverts blood from the brain to the exercised parts and thus induces sleep.

Do Japa or Kirtan for half an hour and then retire to bed. You will have good relaxation and refreshing sound sleep.

Chapter Nine

MENTAL HYGIENE

1. Mental Hygiene

I

Mental hygiene deals with the conditions and laws of mental health. It aims at conserving and improving the mental health of the individual and the community. It touches many aspects of practical human life. It represents a systematised mass of knowledge which it derived from researches in psychology, Psychiatry, Medicine, Sociology, Biology, child-study and education.

An understanding of the principles of mental hygiene is highly desirable. A careful practice of these principles will lead to great happiness, strength and joy. Everybody should acquire a general knowledge of psychology, psychological medicine or psychiatry and some ideas about the sound principles of education. They should also attend for some time a psychological clinic.

Man is composed of three parts. He has a body, a mind and a soul. In dealing with the health of a complete human being you must remember, (1) the body which is visible and tangible and which is the organ of expression of your invisible and intangible mind and soul, (2) the mind and (3) the soul.

II

If you want to possess good mental health you must be always cheerful. You must cultivate this virtue again and again. Cheerfulness acts as the best mental tonic. Depression, gloom, cheerlessness corrode the mind. There is intimate connection between the mind and the body. Body is a mould prepared by the mind for its enjoyment. If there is any physical ailment the mind reacts and vice versa. If there is depression you do Nat have good appetite, you feel very weak, you cannot walk briskly, you cannot do any work with intense attention and application. If there is pain in the physical body, you cannot think properly, you cannot meditate. This is the common experience of all. Practice of Ahimsa, Satyam, Brahmacharya, is necessary for maintaining good mental health. Truth is an honest endeavour to convey a real expression of what has occurred or of what is intending to those

around you. The truth, the whole truth and nothing but the truth can satisfy God and your own heart. Truth cannot be measured by rods and furlongs, minims and ounces. Thought must totally agree with the speech and the speech with the action. This is truth.

Himsa, falsehood, impurity, fill the mind with restlessness, cares, worries and anxieties. You cannot have peace of mind even for a second. How then can there be good mental health where there is no peace of mind?

According to Yoga Vasishtha the cause for all diseases (Adhi-Vyadhi) is in the mind. If the mind is pure and strong, if the will is strong and irresistible, if the mind is free from cravings and desires and Vasanas, you can enjoy a high standard of mental health.

If you are sulky, irritable, greedy and selfish, these bad traits will produce a deleterious effect on your own physical and mental health and will have a definite influence on others. They are also positively harmful to others.

In many cases both mental and physical troubles are due not to inexorable fate or inevitable misfortune. They are destroyed for want of knowledge and as a consequence of a weak and wrong management of the circumstances of life.

If you wish to have a successful and useful life and good mental health it is absolutely necessary for you to acquire the virtue of self-control. Life will be a long series of futilities, a succession of follies, if the quality of self-control is absent.

Sattvic food, Japa or recitation of Lord's names, Pranayama, regular meditation, Kirtan or singing Hari's names and His praise, study of inspiring, religious books pave a long way for the attainment of good mental health.

Removal of hatred through cosmic love, service, friendship, mercy, sympathy and compassion, removal of greed through disinterested service, generous acts and charity, removal of pride through humility will help you a great deal in the achievement of good mental health. Fortitude, forbearance, patience, endurance, balance of mind, keep the mind in a good healthy state. Therefore endeavour to possess these divine virtues.

If there is mental fatigue in college boys on account of too much strain and the study, if there is mental fatigue in merchants on account of business worries, if there is fatigue in officers on account of overwork they should take proper rest at once. They should go for a change to the hills or seaside. They should do Pranayama or breathing exercise and take light, wholesome, nutritious diet. They should do Japa and Kirtan vigorously and practise easy Asanas such as Sarvanga, Bhujanga, Yoga Mudra, Uddiyana, Agnisara, etc.

They can play on the harmonium and sing devotional songs.

Prevention is the most important factor in all problems of mental Hygiene. Better education, better upbringing of children, better home conditions and better social surroundings and outlook are all helpful measures in preventive mental hygiene.

Physical health is an important condition of mental health. Strain of any organ, excessive fatigue, and mental strain should be avoided. Your life must be well-regulated and disciplined. You must practise Samyama in all things. Excess of any kind should be avoided. You must stick to the happy, golden medium. Rest is necessary.

Avoid all mental conflicts. Do not interfere in the affairs of others. Have perfect tolerance and broad adaptability. Allow the individuals to grow in their own ways. Every man has his own way, his own predilection, his own natural capacity, temperament and outlook. No two men are alike. Endeavour to remove any undesirable and unsocial trait.

III

Children should be properly moulded by the teachers and parents. They are like malleable metal and like plastic clay. They are highly suggestible. They will do what we tell them to do. They are very imitative. Therefore they will copy our doings. They are eager. They are brave. They fear nothing, not even adverse criticism. If we set before them the path of good life, if we can inspire them with the principles of good physical and mental health and high ideals they will turn out to be good citizens and ideal persons. Every good conscientious teacher should promote a healthy outlook and the sense of well-being on the children for whom he is responsible. He himself should be an ideal man. He himself must have the gift of sunshine within if he wishes to make the children brilliant and healthy. He himself must be full of life, light and joy. He must be endowed with divine attributes and high standard of health, vim, vigour and vitality.

An unhappy, worried, sickly teacher who is full of private griefs and woes cannot guide the children and lift them up to a high standard of life. He himself needs teaching and education first.

Chapter Ten

SCHOOL HYGIENE

1. School Hygiene

Need for School Hygiene: School hygiene is very much neglected in India. The progress of civilisation, the welfare of the individual, the general good of society depend largely upon the efficiency of the education imparted to the children in school. A healthy development of the mind can be promoted in children of school-age.

The examination system has increased and heightened the pressure brought to bear on children. Professors, teachers and students work under a new and unhealthy pressure. Hence great watchfulness and care are needed to avert evil results or consequences. Professors and teachers should have a comprehensive knowledge of the principles of the hygiene of children so far as it is affected by the circumstances of school-life.

Physical training in school cannot be efficiently developed without proper medical supervision. Medical inspection of the school is necessary even for the purpose of general education.

Medical Inspection of Students: Students suffer from malnutrition, enlarged tonsils and adenoids, defective vision, caries of the teeth, consumption, enlargement of liver and spleen, pyorrhoea, diseases of the heart. Periodical medical inspection of students is absolutely necessary. The actual health-condition of the whole school-going population, their height, weight, nutrition, mental condition etc., must be ascertained and recorded. The School Medical Officer will be able to find out the physical defects which prevent the student from obtaining a full education. Also he will detect the contagious diseases and thus protect other students and the community at large. The students will learn the principles of hygiene and healthful living. He will find out the capacity of the individual student to acquire knowledge in accordance with his physical and mental states. The School Health Service will try to procure the best possible hygienic surroundings for the students. He will instruct the managing authorities to pay special attention to lighting, ventilation, (pure) water-supply and (good) latrines in order that the health of the students may not suffer.

Teachers should possess a good knowledge of hygiene and practical medicine. They can supply the facts in the life-history of young students. No other observers can glean with an

equal facility and continuity. Though the principles of health must necessarily come from the outside, as the result of the labours of the physiologist and the doctor, details in the practical work of the school must be in the hands of the teacher.

The Headmaster of a school or the Principal of a College must take special account of the kinds of sicknesses which are liable to occur in an epidemic form. A memorandum relating to the closure of schools or colleges or the exclusion of students with a view to prevent the spread of infectious diseases has been issued by the local Government Board and the Board of Education. The School Medical Officer will have to pay attention to the Code requirements.

Efficiency in the prevention of the spread of infection implies active cooperation not only between the Health Officer and the School Medial Officer but also between these officers and the school-teachers, school nurses and attendance officers.

In places where it is not possible to get the services of a doctor, the teacher who must have some training may act in the capacity of an Inspector and refer suspicious cases to a Medical Officer.

The school is generally considered as the source for the spread of infection amongst children, specially measles, whooping cough, mumps, chicken-pox, diphtheria, etc. The infections are carried to the home which forms further sources of infection and danger.

Elementary hygiene, physiology and the science of household remedies should be taught to the students in schools.

School-Rooms and Ventilation: The minimum floor space for each student should be 15 sq. feet. The height of every class-room should not be less than 12 feet. Class-rooms must be freely ventilated. Ample provision should be made for free inflow of fresh air and outflow of vitiated air. There should be cross ventilation. For each student 200 cubic feet of space, and 1500 cubic feet of fresh air per hour are necessary.

(a) **Closets and Urinals:** For every 100 students there should be 6 closets and 6 urinals. They should not be too near the class-room. The well or the tank should be well-protected from contamination through carelessness of the students or servants.

(b) **Indiscriminate Spitting Should Be Condemned:** Students and teachers should be strictly warned against spitting indiscriminately.

2. Don'ts for Students

(a) **Students should not keep their mouths open:** Children who constantly keep their mouths open and who snore at night, probably suffer from growth at the back of the nose, and should receive medical attention.

(b) **Students should not sit in a wrong posture:** The posture of a student is important. Too much stooping posture is unhealthy. It leads to myopia or shortsightedness, contracts the chest and interferes with breathing. It puts strain on the heart and causes curvature of the spine. It is the duty of teachers and School Medical Officers to correct the wrong postures in students.

(c) **Students should not use flat desks:** The desks should be very slightly inclined. An angle of 15 degrees is sufficient. Flat desk has a tendency to make the children stoop. Hence it should be condemned.

(d) **Students should not hanker after harmful dainties:** Tea is harmful for children. Sweets such as toffee or chocolates should be sparingly taken.

(e) **Students should not use tight garters and stiff corsets:** Tight garters are very harmful. Girl-students should never be allowed to wear stiff corsets nor tight garments round the chest or waist, as this interferes with the proper growth and with breathing.

The School Medical Officer: The School Medical Officer should see whether the drainage, water-supply, ventilation, cleanliness, etc., are in proper order. He should note all insanitary conditions and should see after some time if these have been remedied.

Attractive, well-situated, well-ventilated, and well-kept school rooms are in themselves an object lesson and an incentive for the students to live properly.

The School Medical Officer should note the number of seats in a room and should see whether the outhouses, water-closets, urinals, the condition of drainage, etc., are in order. He should investigate the source and purity of water, the way in which the water is stored. He should see whether the filters are in working order. He should examine all the students when they are admitted. The results should be recorded in a register.

Hostels: The hostel should be periodically visited by the School Medical Officer. He should inspect the food. The Medical Officer should see that every student eats at regular hours and takes enough outdoor exercises. He should look to the sanitary conditions of the hostel and its surroundings.

Most of the students are sickly, ill-nourished, and dyspeptic. This is due to underfeeding, lack of exercise, improper diet and bad living conditions.

The hostel drains should be properly flushed and kept clean. There should be four latrines for every 50 students.

Hygienic Instruction in Schools: That education imparted in schools and colleges in this direction is not quite up to the mark, needs no emphasis. The deterioration of general health of the student population and so of the future citizens of our vast Indian Empire is a great problem to be solved by our political economists. The average working capacity of an Indian either physically or mentally compares quite unfavourably with that of an European, Chinaman or Japanese. The cause is not far to seek. While particular attention is paid by both the state and the public to the physical culture of the youths in other countries, we find in India that attention has not been bestowed to this question of such immense import to the proper degrees. In India, a place having a peculiar social history, a Government cannot be expected to do much, especially in the face of the wild cry 'religion is in danger'. Student-fathers are not uncommon. It is really pitiful to see a promising youth of twenty weighed down by anxiety, all his sprightly and pleasant imagination vanished; all these owe their origin to marrying a girl at too early an age to gratify the feelings of an old grandmother or grandfather whose morbid desire is to see her or his grandson married before their death. He has now to attend to household duties and he cannot render full justice to his studies by devoting undivided attention, whereas a youth in Europe or America wishes to prosecute his studies further and improve the knowledge.

For all practical purposes students may be classified under two heads, viz., those that fall below the age of twelve and those that are above this age, for the reason that the former miss homely, i.e., mother's comforts much in new and unaccustomed centres of education, while the latter greatly lack the proper moral check which only makes one mark the future and moulds one's character. The hygienic education of the former should be strictly limited to the imparting of knowledge of differentiation between pure and impure water, wholesome

and vicious atmosphere, good and bad food, the objects and effects of avoiding sojourn in cholera and plague infected houses, how to keep the rooms clean and tidy, the benefits of baths and clean raiment's and such like elementary principles of hygiene. Sanitarians will render useful service by preparing a small text-book of hygiene, completely setting forth in detail its first and elementary principles in a simple, lucid style, avoiding as much as possible all technical expressions. The aesthetic culture of this class of students can hardly be improved by the use of high-sounding and monstrous expressions which rather tend to terrify young minds. The food of this class of students, in many cases, lacks the necessary amount of protein substances, which only build up the growing tissues of the body with the result that the hunger is not appeased and he takes more quantity of the starchy portion of the diet to the great detriment of his digestion and general health. The students should be taught to avoid the use of water subjected to contamination of any kind. The potassium permanganate solution test for organic impurities in water may be made in their presence so that they may understand the harm of drinking water which apparently looks good. The harm of sleeping within closed doors should be clearly impressed on the minds of these infants by asking a student to run in an open field for 5 minutes and then suddenly enter into a closed chamber when he will feel the suffocating and musty odour of the room. Sleep is quite necessary and should be allowed to the extent of complete refreshing at the time of waking. It is a common sight in villages to see an over-anxious father applying stimulus to his weary and dozing son at 9 p.m. on the plea that it is a very bad habit to sleep so early. Sleep should be allowed the moment one feels dizzy. There must not be any exertion of a serious nature on the part of the student to understand the subject as it is a taxing on the nervous system, and the energy spent, when there is no inclination for study, is a sheer waste. The benefits of good and plenty of open-air exercise stopping short of fatigue can hardly be overestimated. The gymnastic instructor should make himself agreeable to the students and on no account allow himself to be regarded as an object of terror. Our ancient systems of exercise will serve the purpose much better than the present day gymnasium, bar exercises, etc. Three hygienic periods in a week are very essential for these students and the subject of the study of sanitary science should be compulsory in their curriculum.

Let us now pass on to the other class of students. The comforts of this class of students are the same as those of the former class but the instruction of this division of students from a hygienic point of view is not only in the direction of their physical culture but with a special view to check them from entering into the paths of moral depravity. It is acknowledged that one of the great factors in the deterioration of the present generation is the growing sin of immorality. In our practice we have come across several sad cases of impaired manhood and stunted youth which originated from this evil. We have also observed several cases of premature loss of sight, debility and sterility which owe their origin to this unfortunate spreading vice. Several appeals were made to us in private by many young person's bitterly complaining of the loss of virile power and consequent sterility. Various forms of sexual depravity occur among youths and it is the onerous duty of the teachers to expound to them, as soon as they attain puberty, the nature of and the dangers to health which attend such malpractices. In these days the seminal fluid of a man is mature at an earlier age and he is unable to hold it for a long period. One can very well realise that the sperm would be mature at a much later age even in these days, provided vicious habits are not contracted. Every one of us, must in all possible ways, preserve the semen, the exquisite product of our diet, for the corruption of that vital fluid begets countless diseases which prove fatal in the long run.

In days of yore, men could hold their semen intact till they were 24 years of age. They also attained their puberty at that age. In modern days the seminal waste commences at the age of 16. The dissipation of immature semen brings about a loss of strength and valour and the

man falls an easy prey to dreadful diseases. Persons who preserve the integrity of the semen are enabled not only to keep their physical powers unimpaired but they also enormously contribute to the well-being of posterity yet unborn. For children begotten of such persons are healthy, strong and long-lived. Parents and guardians should not allow their children beginning from the commencement of their study down to their marriage to come in contact with wicked companions. They should also be prevented from reading novels and plays in which the sentiment of love preponderates. They should also be prevented from seeing the dramatic performances of such plays. In the absence of such precautions being taken, these are deeply impressed upon the tender minds of growing children and the amative propensity being gradually developed, they are led astray and sometimes irrecoverably lost. An ardent desire for sexual union is produced in the minds of students, by reading books and plays in which the sentiment of love predominates or by observing them acted upon the stage. The desire becomes more and more firmly rooted. Many, not being able to gratify their carnal desire, fall into the clutches of onanism. They ejaculate the seminal fluid by manual solicitations and this pernicious habit, the root of all evils, leads to disastrous results in the long run.

The vile habit is contracted in a state of utter ignorance and so extraordinary is the power of this abominable habit that one who has fallen into its clutches cannot be released from it even when he becomes an adult and comes to understand its baneful consequences. This vicious habit destroys not only the physical and mental powers of a man but it also incapacitates him from getting children. By an excessive indulgence in this vicious habit, a man becomes susceptible to seminal diseases such as passing of semen along with urine, seminal discharges in dreams or at an amorous glance at a woman. The seminal fluid becomes very thin and the number of spermatozoa which are the organisms concerned in procreation and which float in the fluid become diminished. The blood becomes deteriorated; the patient is pale, and suffers from digestive troubles. The external organ is quite flaccid. Short-sight in school-students generally owes its origin to this vile habit. Acute pain is felt in the loins. In sexual intercourse, there is an immediate discharge of the semen. He soon gets exhausted; he becomes entirely impotent in the end. Loss of breath, perspiration and weakness during coitus are the foremost symptoms of slow but sure impotency.

The proper devil of mankind is man and it is an admitted fact that our bodily health depends a great deal on the control exerted over the enemy within. Moderation in all matters whether in eating or drinking, business or pleasure is of supreme importance. The work is rather arduous. Good boarding house with effective medical supervision is absolutely necessary. Their lodgings should on no account be allowed to remain insanitary. Healthy and wholesome exercise should be taken to the fullest extent. For want of these comforts many a student is seen to languish from disease and loss of vigour. The so-called boarding houses attached to the present day colleges are not adequately equipped with the necessary comforts. A good deal of improvement is imperative. The arrangements that hold in Lawrence Asylum schools, originated by that eminent philanthropist, St. John Lawrence can fairly be copied and adopted in our Indian schools and colleges. Celibacy during scholastic career should be made compulsory by Government, as is done in Central Hindu College, Varanasi.

Chapter Eleven

MATERNITY AND CHILD-WELFARE

If the expectant and nursing mothers are healthy and strong we will have a healthy and strong nation or race. The object or aim of maternity and child-welfare is to reduce mortality and ill-health and to improve the health and well-being of the mother and child and through them the health of the race or nation. Children are the future citizens of the country. If they are healthy and strong they will contribute much to nation-building and prosperity of the country. Hence pre-natal, natal and post-natal Clinics, maternity and child-welfare centres are needed in every taluk, district and important towns.

The infant mortality rate in India is 150 per 1000 registered births. The maternal mortality in India is 25 per 1000 registered births

Every girl should possess an elementary knowledge of hygiene, medicine, physiology, anatomy midwifery, Gynaecology, household remedies, science of dietetics, domestic hygiene and the knowledge of children's welfare. Then alone she will enjoy a happy home. Then alone she can take care of her children and bring them up properly. She can save unnecessary doctor's bills. She can look after her husband's health and nurse her children properly. She can avoid all complications during the period of confinement.

Living in overcrowded and ill-ventilated houses, poverty, ill-balanced diet affect the general health of the mother and lead to high maternal and neonatal mortality rates. The chief causes of maternal deaths are puerperal sepsis, anaemia, or poverty of blood and toxaemias. If proper pre-natal, natal and post-natal care is taken the maternal mortality can be efficiently controlled.

Nursing and expectant mothers should take abundant nutritious food because they have to provide nutrition for their children. They should take plenty of milk as they have to provide calcium for the development of the bones of their children. If they fail to do so the children will develop rickets. They themselves will suffer from osteomalaria a disease of the bone.

A pregnant woman should be examined thrice, once in the 4th month, for the second time in the 8th month for finding out the nature of presentation of the child and for the third time in

the 9th month to find out if there is any disproportion between the head of the child and the pelvis.

The pregnant condition lasts from 275 to 280 days or 40 weeks. The signs of pregnancy are morning sickness which starts about one month after conception, cessation of monthly flow or menses, enlargement of the breasts, dark appearance of the nipples and the breast, enlargement of the abdomen, quickening or movements of the child felt about the fourth month, pulsation of the child's heart, heard about the fifth month, movements of the child which may be felt externally after the sixth month on placing the hand on the belly and capricious appetite and longing for special and improper diet.

A pregnant woman should not lift up very heavy things. She should avoid sudden strains or shaking of the abdomen, because the womb may be excited.

Miscarriage may take place. She should not sleep in an ill-ventilated room. There is greater demand for fresh air, because there is the growing child in her womb. She should not take drastic, powerful purgatives as they will excite the womb. She should not take any intoxicating drugs such as opium or cannabis indica as they will affect the brain cells of the child. She should not take quinine even if she gets fever as quinine may cause abortion

Castor-oil is the best opening medicine during pregnancy as it is quite harmless and non-irritating. The sights of disgusting objects should be avoided by a pregnant woman. She should study religious scriptures and keep the picture of saints and Gods in her bedroom. A pregnant woman should keep herself in a closed room during the period of eclipses. If she comes out during eclipses the child may suffer from deformity of limbs or may become blind also.

A healthy woman should suckle her child. Suckling the child prevents conception upto the tenth month. It prevents the ruin of the mother's constitution by too rapid child-bearing.

Hand-feeding is the source for infantile diseases and mortality. Hand-fed children are not so strong as breast-fed infants. They are more liable to diarrhoea, convulsions, rickets etc. Further they do not recover from diseases so rapidly as the breast-fed.

Until the first set of teeth appears no other food than milk should be given. After this period some kind of malted food may be given cautiously in small quantities and at first only once daily.

The child should not be weaned until it has attained the age of one year and then only if the child is strong and healthy.

Chapter Twelve

DOMESTIC HYGIENE

Kitchen: The kitchen should not be near a latrine. The smoke and smell of cooking should not get into the rest of the house. It should not be on the side of a busy road and thus be exposed at all times to the dust and the impurities it contains. It should be provided with fly-proof automatic closing doors and windows. The openings for the exit of the smoke should be as near the ceiling as possible. It should have floors with impervious materials such as cement, concrete or brick-on-edge and have proper arrangements for washing.

The kitchen should be large and well-ventilated. Provision must be made for the escape of smoke. Smoke always irritates the eyes and produces diseases of the eye. The kitchen should be fitted with shelves, and everything in it must be kept scrupulously clean. An abundant supply of good water is, therefore, very necessary.

The water should be kept in a covered cistern provided with a tap. The cistern must be kept very clean and the water in it carefully guarded against pollution of any kind.

The cooking utensils must be daily washed and scrubbed. In many families where much is spent on food and cooking, this necessary thing, the daily scrubbing of cooking utensils is not done properly.

Cooking utensils should be cleaned with boiling water both before and after use. Utensils which are used for washing dishes etc. should not be used as cooking vessels.

Brass vessels are best for cooking. But many have to use earthenware utensils. These should better be changed as often as possible. A sanitary way of cleaning earthenware vessels is to burn them. After all food material is scoured off, clean the vessels by burning over a slow fire. After this treatment the vessel becomes like a new one for cooking purposes.

Dirty dish-cloths are most dangerous. Tainted dish-cloths contain germs. They have been known to cause cholera. Therefore, dish-cloths should be kept carefully clean.

Milk should be kept in a cool place. It should always be covered. No flies should be allowed to sit on milk. These are carriers of the germs of typhoid and cholera. They sit on contaminated stools of patients and with soiled feet come and sit on milk and other articles of diet. Polluted milk disseminates cholera and typhoid.

All vegetables that are eaten raw such as carrots, Cucumber, radish, etc., should be properly cleaned before they are eaten. Various kinds of eggs of worms such as ascaries, ankylostomum etc., and the germs of infectious diseases cling to the outer surface of the vegetables. All decayed portions of vegetables should be removed.

Keep just enough water to boil the rice and vegetables. The conjee is highly nutritious. It should be given to the cattle. It can be drunk also by human beings.

Clothes which are kept in boxes and trunks and not aired and exposed to the sun at frequent intervals become mouldy and get destroyed. They are eaten by insects and holes are formed in the clothing. Warm clothing and blankets are particularly spoiled by insects. The bedding also should be exposed to the sun very frequently. The bedding and clothings of sick persons should be daily exposed to the sun. Neglect of these precautions predisposes to the outbreak and spread of infectious diseases.

Food should be eaten fresh after cooking. Boiling kills germs or microbes. Germs enter the cooked food through flies coming and sitting on food or utensils. Water used for washing plates and vessels may contain germs and may contaminate food, where water used is known to be pure and free from contaminated sources. Cold water may be used for washing purposes and also for drinking. Where the source of water is doubtful and during epidemic, great precaution must be taken. All water used for drinking, cleaning of utensils and for washing and cleaning the mouth should be boiled water. Mere warming is of no use.

Cooked food should always be covered so that no flies can sit on it. During epidemics of cholera and typhoid food should be served hot. The hands should be washed free from all dirt. Nails should be pared close and kept free from dirt.

Frequent heating of food is bad. Vitamin A in food is destroyed by heat.

Eating from the same plate is bad and unhygienic. It is indeed a very bad practice. Many diseases like tuberculosis, pyorrhoea, etc., may pass on from one to another by contact through food eaten from the same plate.

During feasts scrupulous cleanliness must be observed. Only clean men free from infectious diseases should be allowed to cook and serve. They should be examined. They should clean their bodies, wear clean clothes and have clean nails and clean hands. They should have clean habits. Perspiring men serve food and drops of perspiration fall on food.

Chapter Thirteen

VALUE OF SUNLIGHT

Sun is a visible manifestation of God. It brings the message that God is Light of lights, Tejomaya or Tejasvarupa. It is an abundant source, of heat, light and energy. It burns without oil and wick. What a great marvel? It is the cause for day and night. It is a silent traveller in the sky. It is Pushan (nourisher of the life of plants and human beings). It is the eye of Virat Purusha. It is the Presiding deity of the eye.

If there is no sun for two or three days on account of clouds man becomes dull and lethargic. He has no good digestion. He is not cheerful. Sunlight is essential to the well-being of all living beings. The value of sunlight for the preservation of health has long been recognised.

The Indweller in the Sun is Brahman or the Absolute. Hindus worship the sun and give Arghya or ablutions of water in the morning, noon and evening. He recites "Asavadityo Brahman." This sun is Brahman. He prays to the sun for Tejas, brilliance, Ojas (spiritual power). Sage Yajnavalkya propitiated the sun and obtained boons. Zoroaster founded worship of the sun. This persists even now amongst the Parsees of today.

The sun is a painter. He makes all the colours in the sky, gardens, lips and cheeks. He is a sculptor too. He builds up form, beauty and power, young bodies and limbs.

For lack of sunlight people die in vast numbers. It has been proved that sunlight creates Vitamin D, the ante-rachitie vitamin in the skin whence it is absorbed for use. After birth the infant needs sunlight and more especially the ultra violet rays.

When you eat orange or tomato, you eat sunlight. All flesh is grass. All grass is sunlight. The flame of life which burns in all living beings is a part of the flame called the sun. The effect of sunlight on human beings and on animals is the same as its effect on plants.

Sunshine is a tonic. Sun bath is a tonic. Sun-bath tones up the system. It is better to take a sun-bath early in the morning. A brisk walk in the early morning braces you up and makes you healthy, cheerful, and happy. Sunlight is a potent germicide.

White light is really a combination of all the other colours. It contains all the beneficial rays from the red heat rays down to the cool violet ones. There are still others invisible beyond the violet known as ultra-violet. These are very invaluable for the healing effect they can give in skin diseases and other maladies. The red heat rays are highly beneficial in Rheumatism.

Sunlight is very essential for maintaining health. The sun is a great nutritional factor. It is not the heat of the sun but the light that acts beneficially on the skin. People living in dark rooms where sunlight does not penetrate develop consumption, rickets etc. The skin absorbs light for the system. If the skin receives abundant light, the circulation of blood becomes vigorous.

Sun's rays make the skin healthy. They get filtered down through the skin to layers beneath and produce highly beneficial effects there which are helpful to the growth and well-being of the person.

Sunlight kills germs which live in the skin. The body should be allowed to receive the necessary sunlight it needs. Loose clothing of white fabrics is preferable for permeating the rays of the sun. Wear as little clothing as possible. This is hygienic. Too much heavy clothing shuts the sun's rays from the skin.

If you provide abundance of fresh air and as much direct sunshine as possible you can avoid consumption and can get rid of it also if you fall a victim to this dire disease. Doctors in Europe and America use sunlight as an antiseptic to kill tubercle germs which had actually invaded the body. The best antiseptic is sunlight. Sunlight is unique amongst antiseptics. It kills microbes directly and fortifies the body to kill them.

The skin does not form vitamin D from the ergosterol in the absence of sunlight. The bones become soft. Rickets develops as calcium metabolism is interfered with. Women who have borne children suffer from osteomalaria if they do not get sufficient sunlight. Rickets is cured if children are exposed to sunlight or ultra-violet rays. If children are rubbed with mustard-oil and then basked under the sun, they will be cured of rickets. They will not develop rickets also.

The children should be regularly given sun-bath daily. They should be anointed with mustard-oil. The effect of sun's rays on oil is specially beneficial. The children are able to withstand changes of atmosphere and also attacks from infectious diseases. Adults also should have sun-bath with rubbing of mustard-oil. Sun's rays are life and energy giving. They kill microbes also.

Sun’s rays keep your body, clothing, bed and room free from various germs. Sun is the great steriliser and life-giver.

He who dwells within the sun, whom the sun does not know, whose body the sun is, who rules the sun from within is Thy won Self, the inner ruler Immortal (Antaryamin, Amritam).

Chapter Fourteen

PARASITES

1. Parasites

Parasites are of two kinds, namely animal and vegetable. They are so called because they live and grow upon or within other animals (their hosts) and vegetables. They have been called also hangers-on.

When anyone is not earning his bread and when he is hanging on another person for his food, he is called a parasite, because he is also behaving like the parasites. Those unreal Sadhus and Sannyasins who simply put on the orange-coloured robe in order to get their food are regarded as parasites by the public.

Round-worms, thread-worms, tape-worms, the insect that causes itch or scabies, lice, etc., are animal parasites. Ringworm is caused by a vegetable parasite.

True parasites live on the blood or lymph of their host. Saprophytic parasites live on dead material. Many parasites are pathogenic or diseases-causing. Some Sarprophytes do not harm their hosts.

Eggs of worms enter the stomach with food and water. Tape-worms, round-worms and hook-worms harm man to a very great extent. If food and water are clean the chance of their entrance into your body is minimised. They are excreted out by human beings or other animals. The eggs of these worms then enter the human body through eating of food or drinking of water which contain the eggs. If you eat unwashed raw foods, fruits and leaves and improperly cooked meat which contain the eggs, the eggs enter the stomach and intestines and multiply. They develop into big worms.

If once these parasites enter the body, it is difficult to remove them. Some of them enter the liver and interfere with its proper functioning. Some enter the gall-bladder and obstruct its

passage. Some interfere with the secretion of pancreatic juice. Some cause serious harm to the body and generate diseases. Some only cause annoyance. They may cause disease in a variety of ways, namely by mechanical injury, by providing inflammation in the tissues by generating toxins, by sapping the blood and the nutriment material. Strict observance of rules of cleanliness, regarding food, drink and bath can protect you from their attacks.

Round-Worm (Acaris Lumbricoides)

It is a long creature. It is sometimes ten inches long. It resides in the intestines and causes great disturbance to health. It causes salivation, itching of the nose, grinding of the teeth during sleep, incontinence of urine, emaciation and swelling of the abdomen or belly, irritation and colicky pain in the bowels.

It inhabits chiefly the small intestine or bowel. It resembles closely earth-worms in appearance. It is sometimes vomited or may escape from the bowels. It is present in large numbers in children between the ages of four and six years. It occurs in dozens and sometimes in hundreds in a single host. It produces often convulsion and faintness in children.

The night-soil should be properly disposed off in such a way as will make the transport of eggs through water and food impossible.

One or two grains of Santonine at night followed by a dose of castor-oil in the morning (2 ozs) will remove the round worms from the bowels. Myrobalam (Harad) also kills the round-worms. It should be given for some days. It removes them with purgations. Fast for a day before taking myrohalam. Ajwain (thymol) also dislodges the worms.

Thread-Worm (Oxyuris vermicularis)

It is a small, white worm 1/6th to 1/4th inch in length. It is present in the large bowel (caecum and colon.) It causes intense itching around the anus. It may exists in thousands. It is found chiefly in children. Water and food tainted with the eggs are the common sources of infection.

Apply a little diluted ammoniated mercury ointment round the anus before going to bed. This will remove itching and kill the eggs.

A teaspoonful of common salt in a quarter of a pint of lukewarm water injected into the bowel will remove all thread-worms.

Hook-Worm (Ankylostoma duoudenale)

It is not easy to detect these worms in the stools as the thread or round worms. They have hooks. They attach themselves to the mucus membrane of the upper part of the small intestine or bowel. The thread and round worms enter the human body through eggs which are swallowed with water or food. But the hook-worms which have been purged out from the excreta develop outside. They attack the feet of persons who walk barefooted. They bore holes through feet and hands and enter the blood. They gain access to the body through the broken skin they are carried by the blood the duodenum where they remain by attaching themselves through their hooks.

This is a minute worm. It inhabits the duodenum (the portion of small bowel) in large numbers. It occurs in all tropical and sub-tropical regions of Asia and America. It is common in the labour forces of a tea estate and mines. It is prevalent in Bengal. Ceylon, Malaya states, Siam. The infection is the direct result of careless and filthy habits The eggs can be very easily detected by examining the stools under the microscope.

It is endemic in certain parts of the country. It sucks the blood and produces severe anaemia if untreated. The number of eggs passed with the stool of a badly infected person is 4,000,000. Even 3500 worms have been taken from a single individual. The usual number is from 60 to 130 per individual.

The victim suffers from indigestion, lack of energy, palpitation, general debility and dropsy.

The practice of the people to pass motions near the houses, open land or on the banks of rivers and tanks should be strictly prevented by sanitary inspectors. The public should be educated in sanitary principles. They should be made to understand clearly that the contamination of the soil with the stools is the cause of this terrible disease. Shoes or sandals should be used by people. The danger of going about barefoot in places where hook-worms prevail must be brought home to the people. People should not eat unwashed fruits or vegetables and should not drink muddy water or water from dirty receptacles. Water for drinking purposes should be boiled. Magic lantern demonstration, lectures and distribution of free tracts on this subject in various languages should be resorted to by the Public Health Department Personal hygiene and the use of properly constructed and well-cared for latrine are very essential for the eradication of hook-worm infection.

Those who pass ova in the stools should be segregated and properly treated with Thymol, oil of chenopodium, Betanapthol or carbon tetra-chloride.

Tapeworm (Toenia solium)

Tapeworm appears like a tape. Hence the significant name. It is caused by eating diseased and under-cooked pork. It exists chiefly in the small intestine. It may be many feet in length. It is flat in shape about one quarter of an inch broad. It is segmented. It attaches itself to the intestine by means of hooks and suckers. It has a minute head about the size of that of a small pin.

The intermediary host of T. Solium is pig. The eggs enter the digestive canal with polluted water or contaminated food. Toenia saginata is caused by eating diseased and under-cooked beef.

It has no mouth and no intestinal canal as it lives directly on the nutriment derived from its hosts. When the worm attains its full size, the segments get detached singly or in chain and pass out with the stools. The presence of a tapeworm is usually found out by finding in the motions the segments which are flat and white. Each segment contains sexual organs of both kinds and gets self-impregnated

The tapeworm produces pain and discomfort. It undermines the health of the individual. The head of the worm should be found. If the head is not found out, the worm will grow again.

Sometimes there is diarrhoea and sometimes constipation. There is sensation of morbid hunger. Itching about the anus, tickling of the nose, excessive salivation, vomiting, headache, convulsions, cramps, gastralgia are other symptoms.

Abstain from food and take a castor-oil purgative Then take a dose of the extract of male fern. Oil of turpentine 2 to 4 teaspoonfuls with an equal quantity of castor-oil is also highly beneficial in removing tapeworm. The root bark of pomegranate kills the tapeworm.

Guinea-Worm (Dracunculus medinensis)

It is found in the tropical and sub-tropical regions of Africa, Persia, Turkistan, Arabia, West Indies, Fiji and parts of South America. It is common in some parts of India particularly Madras, Bombay, Punjab, Mysore, Rajasthan, Maharashtra, Central and Northern India.

The female is a thread-like white worm, measuring 2 to 3 feet in length. It normally lives in the subcutaneous tissue of man. When the head of the worm comes to the surface, it produces itching and burning. A blister forms. It bursts and shows a small round hole in the centre.

The young guinea-worm lives in the water of dirty tanks and wells. These penetrate some crustaceans and live in their bodies. If anyone drinks this dirty water which contains these crustaceans, guinea-worm enters the bowels. From there it moves to various parts of the body. It takes 12 months for the worm to reach the skin after entering the stomach.

The lower extremities (legs, ankles) are commonly affected. These parts of the body come more in contact with dirty water of tanks and pools where the intermediate host cyclops lives.

The worm causes itching, urticarial eruption, nausea, vomiting, diarrhoea, cellulitis, septicemia, fever, etc., may result.

Infection takes place from drinking water which contains infected cyclops. The disease may be prevented by drinking boiled water passed through several folds of clean cloth which removes the crustacea. The drinking water must be protected from infection by a guinea-worm patient. Ten grains of lime in a pint of water kill cyclops. The water is fit for drinking after ten days. Barbel fish devour the cyclops and larva of guinea-worm. These fishes may be introduced in wells and tanks with much benefit.

The end of the worm may be taken hold of by forceps and coiled round a piece of match-stick. A little may be extracted daily by gradually winding the worm round the match-stick. Do not break the worm. Be careful. Keep the worm moist also. If it is dry it will break. Apply a little alum lotion to the extracted portion and dress it with moist cotton. This will prevent breaking. Massage with oil along the line of the worm. This will loosen it. Allow a gentle stream of water to fall on the worm. This will make extraction easy. If the worm is broken, an abscess forms accompanied by fever. The worm then has to be extracted by an incision by a surgeon.

Scabies (Itch)

This is caused by acarus scabies, a small insect which burrows under the skin. The disease is spread from one part of the skin, to another. It is also conveyed from person to person by direct contact. It generally occurs in children. The fingers are affected There is intense itching. The burrows become open sores. They suppurate and form scales on the top. Pus and blood from the sores contain the insects and when they come in contact with the skin of another person they affect him with the disease.

Sulphur ointment is very good. Sulphur kills the insect. The sores should be thoroughly cleaned with carbolic soap and then the ointment should be applied. The ointment should be applied at night. Bowels should be opened by a dose of castor-oil.

No clothing worn by the patient should be again used after the disease is cured until it has been thoroughly boiled. All clothes worn by the sufferer, bed sheets, pillow-cases etc., should be boiled in hot water and dried in the sun.

Ringworm (Tinea Tonsurans)

This is a contagious skin disease caused by the growth of a fungus or vegetable parasite, Trycophyton tonsurans. The disease attacks chiefly the groin, inside of the thighs, armpits, face, scalp, roots of the nails, beard and other parts of the body. It causes intense itching. It is also known by the names Dhobi's itch, washerman's itch. The Hindi name is Dad. Ringworm of the beard is called Tinea Sycosis Tinea Favus attacks the hairy parts. Tinea

versicolar occurs in patches or irregular rings (Themal in Tamil). Chrysophonic ointment is highly useful. It should be well-rubbed into the part at night for several nights in succession. Vinegar is also beneficial. Guava powder and butter will form a good ointment. Acid salicylic-ointment is effective. Acid salicylic dissolved in Methylated spirit will form an efficacious Ring-worm lotion. Mercurial ointment (Unguentum Hydrargi Ammoniate) is also useful. The part may be painted with Tr. Iodine. If there is ringworm in the head, the head should be washed daily with carbolic lotion.

Diseased hair should be removed. Ringworm is highly contagious and infectious. It spreads by direct contact and through air. Separate combs, brushes, towels, soap and washing utensils must be provided for children. Clothing and bedding used by the patient should be disinfected. Personal cleanliness is very essential.

2. Spread of Disease by Insects

Dr. R. Blanchard of Paris, delivered a lecture upon Medical Entomology. The general public, as yet, does not realise the enormous part played, especially in tropical regions, in the distribution of disease by insects. Malaria, that scourge of the lowland countries, was long attributed to the Missma, a hypothetical poisonous emanation from swamps and marshes. It is, however, now known that it is caused by a minute animal parasite which is conveyed to the blood by a mosquito of the genus Anopheles, and if this creature could be prevented from biting men, malaria would cease to be a trouble and danger. The campagna of Rome has been rendered almost uninhabitable by this pest, as have many other districts along the Mediterranean coast, while the ravages of the disease in tropical climates are notorious. Could we but exterminate the Anopheles, which is exceedingly abundant throughout its immense distribution, malaria could be permanently stamped out. The connexion of mosquitoes with yellow fever, the curse of Tropical America, has long been suspected; but although the actual parasite itself is not known, the infection has been traced to another kind of mosquito, Stegomya fasciata; this discovery was the direct result of the American troops in Cuba during the war between Spain and the United States. It is now known that the yellow fever is exclusively transmitted by this gnat and by this gnat alone, and moreover, that this gnat conveys no other disease. The United States Government then set to work to exterminate mosquitoes in Panama; a whole army of soldiers was employed in a vigorous campaign against the tiny but dangerous foe, with the result that disease has been practically stamped out in Panama, and the completion of the canal rendered practical, for more than any other obstacle either physical, financial or political, it was this little grey gnat that rendered impossible this great engineering feat, by slaughtering the workmen in hundreds and thousands.

Sleeping Sickness: The lecturer described the knowledge gained in recent years of the cause of the transmission of sleeping sickness, the scourge that has destroyed millions of human beings in Central Africa. The disease is due to a minute worm, a Trypanosome, that is conveyed to the sufferer by means of a biting fly of the genus Glossina, closely related to the dreaded tsetse fly, which in certain districts in Southern and Central Africa destroys thousands of cattle and domestic animals, not by any actual venomous properties inherent in itself, but by conveying the minute parasite by its bite. It is a striking fact that the tsetse fly has a well-defined area of distribution within which no cattle may enter and live. The fly that transmits sleeping sickness is indigenous in certain districts in West Africa. Its spread to the eastern side of the continent has been traced to the expedition of Stanley, who traversed the interior with hundreds of black porters. In Uganda it found a congenial district, and at once set to work to decimate the population. It was long considered to be fatal only to the black races, but the boasted immunity of the white man has been disproved by the recent death in London of Lieutenant Tulloch, of the Army Medical Department, who contacted the disease

in West Africa while engaged in the task of investigating the plague—a real martyr to science. It is probable that black men are more exposed than the whites to the bite of the fly, owing to their habit of resting and sleeping in the open air under trees, where the Glossina occurs. It is a very striking fact that each particular disease is conveyed by one particular species of fly, so that an accurate knowledge of the identity, habits and distribution of the biting flies, mosquitoes and other pests passes from the domain of mere academic entomology to the realm of practical medicine.

Yellow Fever Mosquito: An accurate knowledge of the mosquitoes was first rendered available to workers by Professor F.V. Theobald, F.E.S., of Wye College, whose monograph of the Culicidae has been invaluable to the students of malaria, yellow fever and kindred diseases. Mr. Theobald gave a lecture on the distribution of Stegomya fasciata, the conveyer of yellow fever. This is essentially a domesticated species that breeds in any receptacle containing water in the immediate neighbourhood of human habitations such as broken bottles, sardine tins, any old pot or can; cisterns are especially favourite breeding place. Owing to its domesticated habits and the remarkable resisting powers of its eggs, this mosquito has been spread by human agency, from its natural haunts in Southern and Central America to practically every quarter of the tropical world where man has penetrated; happily it cannot survive in a temperate climate. There is scarcely a port in Africa and Asia, including also the South of Europe, where the Stagomia has not been recorded. Fortunately the unknown germ of disease which it transmits has not yet extended its distribution to the old world; but it is appalling to think that the completion of the Panama Canal may lead to the pouring forth of the pest in hordes, with the rapid and direct communication between tropical America and Asia, so that the Old World too may become devastated by this awful scourge.

3. Insects

Sand-Fly Only recently, it has been discovered that Kala-azar is caused by a little fly called sand-fly. The disease is infectious. The sand-fly carries it from one infected person to others by its bite. Members of one family fall a victim to it. Oriental sore may be transmitted through the sand-fly.

When disturbed it jumps to one side almost like a flea, a characteristic movement of the sand-fly. Like mosquitoes the male is harmless. The female is a blood-sucker. It is smaller than a mosquito. Therefore it gets inside the mosquito net. It avoids light and bites chiefly at night and in shady places during the day. It bites the wrists and the ankles even through the socks and light clothing. The actual bite is not felt. The pricking sensation is caused by the injection of saliva which takes place a few seconds later.

The parasites that cause kala-azar are introduced into the blood-stream from the bite of sand-flies. They increase in numbers and cause kala-czar. Kala-azar at one time was a wholly fatal disease.

Persons attacked with this disease dragged on for sometimes and afterwards succumbed. The immediate cause of death is any of the complications caused by the disease.

Now in antimony treatment we have found a remedy by which we may easily stamp out kala-azar from an area by course of systematic injections of all affected persons.

Sand-flies are generally to be found in or near bathrooms, near the floor, under bricks and stones, and in damp, shady places. They breed in the droppings of chickens and in places where vegetable organic matter like food refuse is undergoing decomposition, particularly in the drains adjoining kitchens.

Protection against sand-fly is very difficult. Large numbers are killed by fumigation with sulphur or spraying with formalin or cresol. Essential oils, chiefly oils of cassia are effective as long as the smell lasts. Mosquito net with fine mesh (20 holes to the inch) gives real protection. Good walls and doors, painting and varnishing of all doors and windows are beneficial.

The House fly

The tiger, the panther, the cobra kill thousands of people every year. The mosquito spreads malaria from man to man and kills several thousands of people every year. The rat-flea bites human beings, spreads plague and causes the death of several thousands of people.

But the worst and deadliest enemy is the common house-fly. It breeds in decaying refuse of all sorts. It also breeds freely on human excreta and carries the germs of intestinal disease such as cholera, typhoid, dysentery, etc. The female house-fly will lay as many as 150 eggs at a time. The progeny of a single house-fly will number 432,000 in seven weeks i.e., in three generations, taking the time of development from egg to fly in seven days. Each house-fly passes through the four stages viz. the egg or ovum, the larva or maggot, the pupa and the adult fly.

A fly may come straight from a cholera corpse and fly into a room. It may sit on the sores of a leper and then on the lips of a baby. It may sit on the motions of a cholera patient and then on your food. It carries the germs of infectious diseases on its feet.

All food and especially milk should be protected by a covering of muslin or some kind of netting or cloth. Cover the faces of sleeping children with muslin or use mosquito curtains. Remove dirt and stable refuse from the house. Horse manure is the most favourable breeding ground.

Educate the public to dispose of all household and kitchen refuse, properly. The refuse must be burnt or dumped. Adhesive fly-papers, fly-traps, spraying fluids, petrol fumes, fly poisons such as formaldehyde, bichromate of potash, sodium arsenite, paper coated with gum are all used to destroy flies.

Tse-tse fly

Tse-tse fly is found in Africa and the shores of the Arabian Sea. It is found along the banks especially at the foot of mountains. It is a voracious blood-sucker. It bites exclusively during the day. The bite is painful. It becomes infectious thirty days after feeding, and remains infective for 80 days. When it bites a patient suffering from sleeping sickness it sucks up with the blood some of the trypanosomes. The organisms enter the salivary glands. When an opportunity comes they are infected into fresh individuals. Both sexes are blood-suckers.

Rat-Flea

Plague is caused by the bite of infected fleas from plague-infected rats. When rats develop plague their blood is sucked by a kind of fleas which live on the rats. When the infected rat dies, the fleas leave the cold body and bite human beings, in the absence of a better victim.

The rat-flea (Xenopsylla cheopis) much prefers to stay with the rat and live upon it. It goes to the clothing and beds of the people in the house, gets on to their bodies and bites them. The plague germs pass from the flea into the blood of human beings and in a little while the bitten man gets plague. If fleas are excluded healthy rats will not contract the disease even if kept in contact with plague-infected-rats. The infecting material is found in the faeces. Infection takes place by the licking of faeces of an infected flea by the rat.

Rats chiefly eat grains. If, therefore, all grains are kept in closed vessels, not a single rat will remain in the house. Rat traps are helpful in reducing the number of rats. The affected houses should be thoroughly fumigated with sulphur smoke. Attendants must protect themselves from infection by frequent smear of kerosene-oil which prevents fleas from biting.

Sand-Flea

This is also known by the name chigger. This is a troublesome insect found in the West Indies and coasts of Africa. It lives on the ground and is abundant in very sandy soil, particularly near the sea-shores. Dirty rooms, huts and cattle sheds are the favourite abodes of these insects. It sets up much irritation, inflammation and formation of pus under the skin. It causes much suffering, invaliding and indirectly death.

Bedbug

The bedbug has been suspected of transmitting several diseases including kala-azar and plague.

Spraying with gasoline, benzene or kerosene containing pyrethrum is useful. Bug bomb is also useful. Olive oil or menthol allays the irritation caused by the bites of bugs.

Ticks

Ticks are most abundant in warm countries. They are blood-suckers and play an important part in the transmission of a disease, closely stimulating the relapsing or famine fever of India. They can be seen by the naked eyes.

Ticks are nocturnal in their habits like bugs. They live in huts, cracks and holes in the walls. They are carried in mats or beddings.

Destruction of ticks is very difficult. Crude petroleum, solution of sodium carbonates, acid arsenium and tar are useful.

Lice

Dirty habits favour the increase of lice. There are two varieties viz., the body lice and the head lice. Lice act as carriers of typhoid, relapsing fever and trench fever.

Regular washing of underclothing and bed linen, a hot bath with a complete change of clothing followed by thorough disinfection of all garments will remove lice.

The hair should be cut short in girls and women. Shaving is beneficial in boys. Ammoniated mercury ointment 5% or calomel pomade 1 in 20 of Vaseline may be applied with great advantage. This should be followed by brushing with a fine toothed comb. Vinegar, kerosene oil also can be applied.

Clothes should be disinfected in a steam disinfector. Kerosene or petrol is effective for nits. They can be mixed with oil of eucalyptus or cedar wood oil.

4. Insecticides

Formalin, formaldehyde, sulphur, Acid hydrocyaric, carbon-di-sulphide, Petroleum arsenic in the form of Paris green, arsenious oxide, sodium arsenite, pyrethrum, dichlaro-diphenyl-trichlorethane (D.D.T.) are all effective insecticides. D.D.T. is the most effective insecticide yet produced.

Chapter Fifteen

VILLAGE SANITATION

The villages are left in a very neglected state. The sanitation in villages in India must be greatly improved. The public should cooperate with the sanitary authorities. Then alone the sanitary campaign will be quite successful. Then alone the efforts of sanitarians to improve the sanitary condition of villages will be fruitful.

Most of the deaths from preventable diseases are entirely due to the insanitary condition of the villages. The people of the villages are ignorant about the elementary principles of hygiene. Their habits are filthy and insanitary.

The villagers must be educated by organising health lectures, demonstration of lantern slides, distribution of leaflets etc. They should have some knowledge of the elements of hygiene. The harmful effects of overcrowding, polluted water, insanitary surroundings, etc., should be clearly impressed on their minds. An elementary book on hygiene should be introduced in village schools.

Arrangements should be made for a good water-supply in villages. The villagers should get water for drinking and cooking from a pure source. They should avoid drinking water from sources which are not properly protected against contamination.

Wells should not be sunk very near to latrines or drains. The interior of wells should be made water-tight by cement plastering. There should not be any steps in the wells. The people should not get direct access to the water. Water of the wells will be contaminated if they get direct access to the water. Tanks should be well protected from contamination. People should not wash their mouths in the water. They should not bathe in the tanks. They should

not pass urine and stools on the banks. They should not wash their clothes in the tanks. They should not wash their cooking utensils in the tanks. They should not bathe domestic animals in the tanks. People use streams and rivers as public latrines. The water is polluted. Cholera and Typhoid are spread rapidly. The people should be clearly warned of the dangers of such practices. No latrines should be constructed near the tanks.

If funds are available tube-wells may be sunk. These are very convenient. There is less chance of pollution. One or two tanks may be excavated. The water should be used for drinking purposes only. They should be kept under proper supervision. The water can be drawn by a pipe from the centre. Wells sunk in proper places away from latrines and drains and well protected are good sources of water-supply. No private vessel should be used for drawing water. Pumps can be fitted to the well. Cisterns or galvanised iron tanks with taps are highly useful. The water from a well or tank can be raised to a height and then distributed by means of pipes.

Every house should have a small latrine. If this is not possible public latrines should be constructed in suitable places. People should be induced to use them. Latrines should not be constructed very close to tanks or wells. There should be separate latrines for women. If these latrines are not possible bore-hole latrines or trench may be constructed.

The dry refuse should be buried or burnt. The dead bodies should be burnt in some fixed places allotted for the purpose. No one should throw dead bodies into the water. If cremation is done near a tank, the water of the tank should not be used for drinking purposes.

Malaria, cholera, small-pox, hook-worm disease or anthyostomiasis, phthisis or consumption are common in villages. Travelling dispensaries in charge or Medical officers should distribute quinine during the malarial season. In every village, persons who can understand the broad principles of prevention of malaria should be held responsible for the carrying out of the preventive measures. Water should not be allowed to be collected in broken tins or pots. They must be buried. Shallow pools must be filled up. Those who can afford should use mosquito nets.

Cases with enlargement of spleen should be given quinine with iron and arsenic. Drains should be constructed to remove rain-water and refuse water. There should be no cultivation within 100 yards limit around the villages. Jungle and shrubs should be cut down and burnt for a distance of 100 yards around the village.

The faeces and urine of patients suffering from infectious diseases should be disinfected, buried or burnt. Food, milk and water should be properly protected against flies, as they are the carriers of germs. During cholera season water and milk should be thoroughly boiled. Clothes and utensils should not be washed in or near a tank or well. One tank should be set apart for drinking purposes only. The washermen should not be allowed to wash clothes in this tank. Milkmen should not be allowed to use dirty water for cleaning pails and other utensils.

Bleaching-powder should be used to sterilise all suspicious waters of tanks or wells.

The huts should be built in accordance with some definite plan. They should be model sanitary huts. No cattle or domestic animals should be kept in the same room where food is stored and cooked. Each but should contain two rooms, a kitchen and a small courtyard. There should be a verandah round the hut. There should be a plinth at least one foot high. Each room should have two windows with cross ventilation. The latrine should be built in a place away from rooms and kitchen. No water should be allowed to stand around the houses.

Chapter Sixteen

DISPOSAL OF REFUSE

1. Disposal of Human Excreta

Introduction

Disposal of excreta is a matter of great importance in sanitation and nursing. Proper arrangements should be made for the collection and removal of excreta. The health of the people largely depends on the efficient removal and disposal of the human excreta. If this is not done efficiently through organised arrangements the germs of cholera, typhoid and dysentery which are found in the excreta enter the bowels of the healthy human beings and do much havoc. These diseases are disseminated far and wide.

There are no arrangements for latrines in villages and non-municipal areas. People use any open land for answering the calls of nature. This is indeed a source of nuisance and danger.

Children pass stools anywhere in the yard. The stools are allowed to lie indefinitely. The excreta of sick persons are not disposed of properly. They are thrown indiscriminately and left to rot. The flies sit on the excreta and then with soiled feet sit on food when it is not covered. Germs are conveyed by the flies into the human system. After rains the washings often contaminate tanks or any source of water-supply in the vicinity and help dissemination of water-borne diseases like cholera, typhoid etc.

Excreta should not be exposed to flies or allowed to contaminate the water. It should be transported to some distant place and disposed of safely.

Human excreta are a rich manure. In the city of Puri trenching grounds have been brought under cultivation. Abundant crops of cabbages, cauliflower, mustard, Indian corn and other grains are obtained. Crops are always most abundant in fields which are used as latrines.

Constriction of Latrines

There should be thorough and efficient ventilation in the latrine even when the doors are closed. The materials used for the construction of latrines should be non-absorbent in order to prevent pollution of the soil through soakage. There should be a separate passage for the sweeper to the trap-door. There should be such arrangements as to separate excreta from urine and wash-water. The excreta and wash-water should find their way easily into some receptacle without fouling the sides. The pail or receptacle must be a tarred or galvanised bucket fitted with a movable lid. The trap-door must be tarred. The floor should be made of some impervious material, such as brickwork set in cement. The walls may be of either brickwork or corrugated iron. The roof may be either terraced or sloping.

There should be a distance of at least 50 feet from a well or a tank. They should be constructed away from the main building.

Kinds of Latrine

1. **Pit Latrine:** Removable latrines or trenches are useful in the villages. A pit is dug about lye feet in diameter and a foot deep. A small enclosure made up of some sort of mat or reed is made. There is a small door also. The motions are covered with dry earth. When the hole is filled completely, the latrine is shifted a few feet away. This sort of Latrine is not expensive at all.

2**. Trench Latrine:** Trenches may be dug and used as latrines. The trenches should be 2 feet deep and 10 inches wide. When one trench is quite full, a parallel trench can be dug. These are useful in fairs and villages. After use they should be filled up with earth.

3. **Iron latrines:** Small well-built latrines which are made of iron are useful in small towns and villages. The solid and liquid waste matters are kept separate.

4. Well-latrine System: There is no movable receptacle in this system. The motions are passed in a well usually 5 feet to 20 feet deep sunk in the ground. This system is most insanitary. Foul gases emanate. Further there is the risk of contamination of water-supply through soakage.

5. **Bore-hole Latrines:** These are useful in villages and tea-estates. They are like pit latrines. There is a hole 16 inches in diameter and 10 feet to 20 feet deep. The top of the hole is covered by the squatting plate of reinforced concrete. There is a roof also. When the hole is filled dry earth is put into it. The squatting plate is removed and placed over fresh borings.

6. **Water Carriage System:** Night-soil or human excreta can safely be disposed either by water-carriage system at dumping depots or by complete burning or by trenching (burying it in the soil), in a place outside a town which is half a mile away from the nearest dwelling house. In water-carriage system the human excreta and the washing water are carried away through drains and sewers from the houses by the help of water. This cannot be introduced everywhere on account of the heavy expenses incurred in its outlay. Further this system demands abundant supply of water. But it is the cleanest, quickest and most sanitary method of removing human excreta. In the long run it is cheaper.

7**. Temporary latrines:** Movable or temporary latrines are useful in segregation camps and fairs. The partitions are made with corrugated iron sheets. The receptacle to receive the excreta is placed on the ground with bricks for foot-rests.

Fixed or permanent latrines in towns are necessary for railway stations, colleges, theatres and other public places. The floor and walls should be of cement or glazed tiles so that the latrines can be nicely washed and kept clean. The roof may be of angle iron framing with corrugated screens or roof of brick and cement. The flush system of latrines of modern times is very clean and should be highly preferred.

If you do not wish to use latrines, if you like to answer calls anywhere and foul places at least cover up your motions with some earth. This will keep off flies and prevent their breeding on them. Even cats do this. Watch them.

2. Disposal of Refuse

Public health largely depends on the efficiency with which all refuse is collected and removed. Refuse consists of dust, leaves, paper, kitchen waste, rags, cow-dung, human excreta, ashes, cinders, tins, broken bottles and pots, rotten fruits and vegetables.

Organic refuse putrefies when there are warmth and moisture, produces foul odours and serves as a breeding place for flies, mosquitoes etc. Foul odours cause ill-health, depression of spirits, headache and lower the vitality of persons. Epidemic diseases are always very severe in dirty places and amongst dirty people. Therefore the refuse must be removed quickly.

The refuse can be disposed of by dumping and filling. Insanitary tanks can be filled and low lying lands can be reclaimed. The land selected should be far away from human habitation. The refuse can be burnt also.

The refuse should be put in the dustbins with proper covers. It should be removed by the refuse carts or village sweepers. In towns special furnaces called incinerators have been constructed for burning house and street refuse.

3. Disposal of Sewage

The general health of the people depends upon the efficiency with which sewage is disposed of. The sewage should not be allowed to flow into rivers or other water channels, the water of which is used for drinking purposes.

The solid and liquid portions of sewage are sometimes separated by screening and by the addition of chemical substances such as lime, sulphate of alumina and proto-sulphate of iron. This is termed as the precipitation of sewage. The solid part is made into cakes which are sold as manure or burnt. The liquid part is filtered by allowing it to run through cinders in order to purify it.

Filtration of Sewage: Sewage is purified by the action of the soil. The soil acts as a mechanical filter. A porous dry land should be selected for this purpose. The purification is chiefly done by soil bacteria or the nitrifying organisms which exist in large numbers in the superficial layers of all soils. The land should be divided into blocks. Each block is irrigated for 6 hours and allowed to rest and aerate for 18 hours. The soil is prevented from becoming clogged by this means. Re-aeration is also established.

Sewage Farming: Sewage is used for cultivation on a very large scale. This is adopted where suitable land is available in the neighbourhood of a town. The soil should be porous. Sugar-cane, plantain and other vegetables may be cultivated.

Septic Tanks: Another method of purifying sewage is the "Septic Tank System". The sewage flows into settling tanks and then into large filters containing coke, breeze or cinders. The effluent is purified by passing over a weir with a series of large traps. The filling of tanks, resting, discharging and aerating are done automatically. The liquid after filtration is clear and free from smell.

The Anaerobic Liquefaction: This takes place in the septic tank proper, while the aerobic nitrification occurs in the contact beds or sprinkling filters. The destruction of the solid matter and the purification of the dissolved matter are effected by bacteria which grow best when air is shut out (anaerobic). The sewage is first led through one end into a rectangular tank from which light and air are excluded and effluent is let through a discharge pipe at the other end.

Aerobic Nitrification: Here the aerobic organism converts the different ammonia compounds held in solution in the effluent received from the septic tank into oxidised nitrogenous substances of a harmless character. The effluent is passed through percolating continuous filters or contact beds. Nitrates of sodium and calcium are the final products. The effluent of the tanks should not be allowed to flow into rivers near the source of a public water-supply.

4. Water Carriage System

This is the wet method. A water-closet consists of the closet proper, consisting of the basin and a trap and the flushing apparatus. A water-closet is a sanitary installation for the receiving of the human excreta. It has connection with a sewer through soil pipe and house drain and removes the excreta through the agency of water.

Large underground drains or sewers are used for getting rid of sewage in large towns and cities. They are built of bricks or iron or earthenware pipes. They are usually round or oval. These sewers often empty themselves into rivers and sometimes into seas. In order to help the flow of the sewage and to flush and cleanse the sewers an unfiltered water-supply is provided. If an abundant water-supply was not provided, the contents of the sewers would stagnate, decompose and give off evil-smelling gases.

The basin should be of some non-absorbing and indestructible material. The flushing should be of sufficient force to wash the basin clear and remove all traces of excreta with a minimum quantity of water. The water-closet should be flushed immediately after use. Water should be stored in tanks or cistern made of galvanised iron situated near the roof. The water is discharged either automatically or by pedal action or by a pull of the chain which puts the siphon of the cistern in action. The flushing apparatus should supply at least 2 gallons of water each time.

The sewage from houses finds its way into the sewers through small house-pipes which lead from the water-closet or latrine situated inside the house. These house-pipes should, therefore, be well made. They should consist of the best material and have a good flow.

In order to prevent the escape of gas from the sewers into the house-pipes and from the pipes into houses, traps are provided. The traps are bends in the house-pipe or sewers containing water which helps to keep the gas from passing through. Sewer-gas is the cause of many fatal diseases. It is often the cause of ill-health.

It is useful to have a ventilation pipe attached to house-pipes in the outside of the wall of houses extending well above the roof to allow the escape of any gas that may find its way back from the sewers. The sewers also should be ventilated by pipes placed at short distances from each other along the entire length of the sewers. When the water-carriage system is adopted, the sewers, drains, pipes, gully pits etc. must be made of the best

material. They must be carefully constructed, provided with the best form of trap and be well-ventilated. There must be a liberal supply of water for flushing and cleansing purposes.

5. Disposal of Dead Bodies of Human Beings

The ceremonies attending the disposal of the dead are strange in different parts of the world. Disposal of dead bodies plays an important part in sanitation of the village, city and home. The practice of cremating or burning the bodies of dead persons is undoubtedly the most sanitary. This is the practice amongst Hindus.

The crudest mode now prevalent is that of simply leaving the dead body exposed. In West Africa the Wanyamwesis carry their dead into the forests to be devoured by animals. Some of the tribes of Guinea throw the corpse into the sea. The Kamtchadales keep dogs to consume their dead. The Parsees place their dead in a round tower called the Tower of Silence. The bodies of high religious persons in Tibet are preserved by the process of salting and cooking in butter (embalming). Mummification is only mentioned to be condemned. In Judaea the bodies were buried in sepulchres.

Cremation is faultless. No other method can equal it. It is the most satisfactory method of disposal of the dead. Offensive gases come out in burying. Then there is (also) a moral objection. Why should several square feet of ground be occupied permanently by a body for which there is no such necessity? This is a vital point in the philosophy of social economy.

The only objection to cremation is that if bodies are burnt without careful enquiry as to the cause of death, cases of poisoning and deaths from violence may remain undetected. There are, however, strong arguments in its favour.

The compulsory use of death-certificates will, to a great extent, minimise this. The time for detecting crime is not after, but before the body is disposed of. Poisons like copper, arsenic, etc., may be detected from the ashes or unburnt pieces of wood.

The dead bodies of persons, who died of small-pox, cholera or any infectious diseases, should be covered with cloth soaked in some antiseptic lotion. Then the possibility of the spread of infection will be averted.

The dead body can be reduced to a small quantity of ash within 3 or 4 hours. Four or five maunds of fuel are required to consume completely the corpse of an adult. Sometimes the bodies are not properly burnt. Half-charred bodies are often thrown into the river. This is dangerous. The water will be contaminated and will give rise to the spread of infectious diseases.

Some people bury their dead. There is a great danger in this method. The foul products given off from the body during its slow decomposition in the grave find their way into wells and other sources of water-supply and they cause serious outbreaks of diseases. Too shallow a burial should be avoided, as there is the risk of the graves being dug up by jackals or other animals. The place of burial should be protected by strong fencing. It takes about a year for the soft parts to disappear inoffensively.

There should be no graveyards near human dwellings or near any source of water-supply. Graves should be not less than 5 or 6 feet deep. Coffins made of masonry and imperishable material are objectionable, because they delay decomposition. Coffins must be made of light deal wood. Dogs, jackals and vultures eat the dead bodies which are left unburied or covered with a few inches of earth. Human skulls and bones are found on the banks of rivers. The disposal of dead bodies in such a careless and dangerous manner should be stopped at once.

Some people bury their dead in their own compound. This is not good. The water-supply of the house may be contaminated. Offensive gases that emanate from the decomposing body will affect the health of the members of the house. Useless beddings etc., of the dead should be burnt, clothes of persons suffering from infectious diseases should be burnt. Some should be properly disinfected and exposed to the sunshine.

Chapter Seventeen

INFECTIOUS AND CONTAGIOUS DISEASES

1. Infectious Diseases

Diseases are sometimes spoken of as "catching diseases" in the same sense as we speak of catching a cold. Catching diseases are infectious or contagious. A line of demarcation is drawn between infection and contagion. In a broad sense they are much the same, Contagious diseases are infectious. All diseases which are caused by the entrance into the body by a living germ may be classified as infectious. If a disease is easily passed on from one person to another we say it is infectious.

Some diseases like syphilis require close contact for infection to take place. Hence they are contagious diseases. Small-pox and cholera are infectious diseases. Close contact is not necessary. Small-pox is an airborne disease. The contagion is conveyed from person to person through the air. Cholera and typhoid fever are water-borne diseases. The contagion is conveyed from person to person through infected water. Contagious diseases can be spread through food and clothing also.

Most of these diseases are caused by small living organisms called germs, or microbes or bacteria. They are so minute that they can only be seen by the aid of a microscope. These germs live, grow and multiply in test-tubes which contain nutritive media such as sugar, gelatine, etc. They are divided into classes according to their behaviour in different media. Each group behaves differently on different media. Some are like rods. They are called bacilli. Some occur in pairs. They are called diplococci. Some are like chains. They are streptococci. Some are in bunches. They are called staphylococci. The study of these germs is called Bacteriology. The doctors who have made a special study of this branch of medical science are called Bacteriologists.

Some persons are easily susceptible to certain diseases. They readily succumb to certain maladies. They are endowed with low vitality, while others offer some resistance to infection. They possess high vitality. This susceptibility is called predisposition. It is a state of body in which disease is easily excited. The resistance is called immunity.

The term epidemic is applied to diseases which attack at the same time many people living in the same town or village.

Endemic is the term applied to diseases which are always present to some extent in certain places or districts. Endemic diseases sometimes flare up and become epidemic.

Sporadic is the term applied to cases of infectious diseases which occur singly or in very small numbers and at irregular intervals in widely separated parts of a town or district. One case has apparently no connection with another.

When the epidemic is spread over a large area or over the whole world, it is Pandemic prevalence of an infectious disease. We had some thirty years ago a Pandemic prevalence of Spanish Flu or Influenza.

When a disease is not usually present in a locality but introduced from abroad it is exotic.

Period of incubation is the interval which occurs between the time of infection and of the appearance of symptoms. The disease is silently developing in the system during the period of incubation. During this latent period of incubation the individual may maintain perfect health, or may feel a little malaise or feeling out of sorts. The germs have not sufficiently developed in the human host during this period and therefore no characteristic symptoms of the disease are manifested.

The duration of this period varies in each case. It depends upon the amount of poison entering the system at the time of infection and the vitality and power of resistance of the individual. A person who is exposed to an infection should be isolated during the period of incubation.

The following table will roughly give an idea of the period of incubation and the duration of the communicability of some important microbic diseases.

Disease	**Incubation period**	**Infective period**
Chicken-pox	10 to 12 days	3 weeks
Cholera	A Few hours to 5 days	2 weeks
Dengue	3 to 6 days	2 weeks
Diphtheria	1 to 8 days	6 weeks
Enteric fever	5 to 20 days	6 weeks
Influenza	1 to 4 days	2 weeks
Measles	8 to 15 days	4 weeks
Mumps	12 to 22 days	4 weeks
Plague	3 to 10 days	3 weeks
Small-pox	3 to 12 days	6 weeks
Whooping cough	4 to 14 days	8 weeks

One kind of germ can only cause one kind of disease. Tubercle bacillus can only produce Tuberculosis or consumption. Typhoid bacillus can only produce Typhoid fever. Infection of the body by the germs does not occur every time the body is exposed.

You may be infected by germs by breathing the infected air into the lungs as in small-pox, tuberculosis, by swallowing infected food as in typhoid fever and cholera, by drinking infected water, by the skin-surface if there is cut or wound, by the lining membrane of the mouth, nose, throat or eye and the contact with infected clothing.

2. Story of Germs

I

Microbes or germs are minute living creatures. They are small masses of protoplasm. They are your unseen enemies. They are so small that you cannot see with your eyes. But they can be seen very clearly under the microscope. Bacteria, Microbe, germs, Bacilli, Virus are all more or less synonymous terms.

Overwork, improper feeding, impure air weaken your resistance and make you fall a ready prey to diseases caused by germs. These are the powerful friends of disease-germs.

Fresh air contains far fewer germs than the air in rooms. This world abounds with these minute germs. Thirty-thousand of them placed side by side will only measure one inch. Four hundred million put close together will not cover a square inch.

Germs multiply very quickly. One can reach its full size and can divide into two within twenty minutes. One germ can produce 18,000,000 microbes in 24 hours.

There are microbes everywhere. They are in the air, in water, on the ground, in the food, in your body, in your clothes, the furniture etc. When you inhale you take hundreds into your lungs and when you exhale you breathe hundreds out. All microbes are not dangerous. There are beneficial, harmless germs also, just as there are beneficial harmless beasts such as dogs, cows, horses etc.

Many germs that live in the air or water are harmless. Some bacteria purify the sewage. Some build up nitrogen for the use of plants. Even if you breathe them in or swallow them, they do not do any harm. If your health is good, if you have high vitality, your blood will destroy those germs which cause disease. If you watch a meeting between white blood-cells and some microbes you will notice that the white corpuscles or cells of the blood gradually surround and envelop the germs and quickly dissolve them. They are your soldiers to combat against disease germs. Mark how Mother Nature is kind, beneficial and loving!

One germ is shaped like a rod. Some are straight rods, such as the germ of consumption. There is one rod with clubbed ends. It does not like to live in the air. It buries itself in the earth. If a little earth gets into a wound it may contain this germ and cause lock-jaw. It is the bacillus of tetanus. One germ is the simple round one. It is the most common of these germs. If it gets into skin it produces inflammation and abscesses. If it enters the weak throat, it produces serious throat trouble.

Some bacteria or germs appear like full-stops; some are like commas. Many of them are little rod-shaped bodies. Some look like spirals; some are branched.

The dangerous germs are the germs of such diseases as cholera, typhoid fever, plague, dysentery, small-pox, consumption etc.

When the spit of a consumptive patient dries, the tubercle bacilli will be carried into the air with the dust. Consumption is spread by the tubercle bacilli getting into the air of rooms and then being breathed by healthy people. If ventilation is bad the risk of infection is considerably increased. Therefore people should never be allowed to spit on the ground. If

you wish to keep healthy, live in the open as much as you can. Always keep open the windows of your room. Keep the air in your room as fresh as possible.

Dust and moisture encourage the presence of microbes in the air. Germs cling to dust. They like to live in moisture. Germs thrive best and increase if the rooms are dark and ill-ventilated.

When the towns were filthy 'in Europe, India and other countries, the inhabitants suffered from plague and other microbic diseases. The death rate was very high. Several millions died of consumption, plague, cholera, small-pox, dysentery and malaria. Seventy out of every hundred deaths were caused by diseases due to microbes. Microbe-disease can be prevented if people observe the rules of health and hygiene. Plague vanished from Europe when people began to observe the rules of health. India is more healthy now, because many are observing the rules of hygiene.

At school a boy sneezed out some germs and several more boys contracted measles within two weeks. Catarrhal germs in the throat or nasal passages can be coughed or sneezed out to a distance of some feet from an affected person. Hence it is very, very important, whenever you have a cold, to use a handkerchief to guard the cough or sneeze.

II

Sunlight, oxygen and heat will kill the microbes. The pathogenic or disease-causing germs will disappear if food is well-cooked, if the water is boiled well, if the rooms are filled with pure fresh air and if the clothes, carpets, bedding and furniture are put in the sunshine. Sunlight is a potent antiseptic and germicide.

Breathing impure air lessens your vigour and causes diseases. The windows in the bedrooms must always be kept open. Have fresh air in the room as much as possible.

Ventilate not only your rooms but also ventilate your lungs. Practise deep breathing. Cultivate the habit of deep breathing. Running, climbing and swimming ventilate the lungs and make you breathe deeply and quickly. Practise deep breathing or Bhastrika for five or ten minutes in the morning. Slowly and steadily expand the chest by inhaling fresh, pure air. Inhale as much as possible. Hold the breath for a few seconds, or as long as it is comfortable for you. Slowly exhale till all the air is completely expelled out of the chest. Practise this deep breathing or Bhastrika in the open air. There should not be any draught. If there is draught practise in the room. Open all the windows

Meat, milk, orange or an apple, or a piece of bread and other foods go bad, because the putrefactive germs in the air get into them and then they multiply quickly and generate gases which have a bad odour. The spot of moulds on bread and stale fruits is a collection of millions of microbes.

Some germs form a big army of scavengers. They help in removing the earth of life's debris, the dead bodies of plants and animals. They break them down into simple compounds.

Germs are killed by being boiled for five minutes. They are paralysed by intense cold. They flourish best at a particular temperature. The body temperature is favourable for the flourishing of many germs. The different varieties vary in their susceptibility to heat. The spores are not killed as early as the bacteria themselves. They do not succumb so readily to heat. They can survive being frozen. When conditions become favourable they begin to grow and multiply.

If you keep the foodstuffs, milk etc., in a cool place in summer, they will not be spoiled.

Dead matter is the best soil for microbes. Nearly all love the dead body of an animal. Some prefer rotten fruits and decaying vegetable matter. Others like the earth. Stale food, filth, dirt, refuse are a good soil for microbes. Deprive the germs of their homes by throwing away stale things, refuse and dirt. Keep the house very clean, you will have no germs.

Germs enter the body through the mouth in food, and water, through the nose in the air you breathe and through the skin. Germs can enter through the scratch. Therefore clean the scratch with some antiseptic lotion, carbolic, mercuric chrome, or acriflavin or boric acid or perchloride of mercury or formalin and put on some antiseptic dressing. Or paint it with a little Tr. Iodine. Or apply Burnol, cover it with a bandage to prevent the entry of disease germs. A germicide is a drug that kills the germs. An antiseptic is a substance which prevents sepsis. A disinfectant is a substance which removes foul odours. Potassium permanganate is a disinfectant.

Bacteria or germs generate in the body powerful poisons called toxins. The injection of vaccines produces antitoxins which neutralise the toxins.

If all the disease-causing germs and microbes of the world were to have unfailing effect on the constitution of each individual, there would have been the extinction of the entire humanity. The Lord is very merciful. He has set up defensive forces in the body which counteract the forces of these germs. Sunlight, air, fire—all these kill regularly a host of these germs. It is only due to one's Prarabdha Karma, one's own actions that a man gets an attack of these infectious diseases like cholera, consumption, leprosy etc

Be regular in your spiritual Sadhana, Japa, Sankirtan, Svadhyaya. Be good and do good. Ever remember that you will reap the fruits of Karma. As you sow, so you reap. This is an infallible Truth. Do not consciously harm anyone. Wish good for all. Follow the rules of health and hygiene. You will have unfailing health and long life of unalloyed happiness.

3. Immunity

Immunity is the power of resistance against microbic diseases. He who has immunity is not susceptible to maladies caused by germs. He does not become a victim to infectious diseases.

When the microbes enter the body they may be destroyed or they may flourish and multiply into enormous numbers. One microbe can rapidly multiply into a million. The white blood-cells in the blood or the white corpuscles try to drive away the germs. The persons get fever when the internal fight is going on between the microbes and the white blood-cells. The white blood-cells are endowed with a power of movement (phagocytosis). They envelop the germs and crush them. Certain substances called "anti-bodies" are formed in the blood during the fighting. These antibodies have the power to overcome or destroy the microbes. The patient is less liable to get another attack. He has got immunity and is able to resist the disease.

When a rusty nail goes right into your foot, germs enter the blood at once. An army of white corpuscles rush to the spot immediately to attack the invading germs. If the invading force is weak it is at once overcome and the wound heals very quickly. If the force is powerful, then a tough pitched battle ensues between the white cells of the blood and the invaders. The affected part gets swollen as many white cells collect there. The white cells envelop the germs and destroy them. During the fight the defending soldiers (white cells) perish. A small abscess is formed. There is formation of pus. This pus consists of the defeated invading army of microbes and of the dead bodies of the defending soldiers (white corpuscles). Eventually the abscess bursts naturally by the application of hot poultices or boric

fomentations or is opened by the surgeon. The pus comes out. The battle is won. There is victory. White corpuscles ki jai ho.

But if the invading army of microbes is very powerful, if the victim has low vitality, some of the germs may enter the blood and cause blood-poisoning or septicaemia and general constitutional disturbance. The victim gets shivering and very high fever, delirium etc. He may die. The germs have won the battle. They have become victorious.

There is another way of acquiring immunity by having a modified and mild form of the disease through a vaccine. This is artificial, acquired immunity. The "anti-bodies" are generated in the blood through the injection of a vaccine. During epidemic of small-pox and cholera healthy persons are vaccinated in order to keep them free from an attack. The blood is prepared to attack the germs of the disease when one is exposed to the infection.

Jenner made great research in small-pox vaccination, Pasteur in Hydrophobia, Koch in Tuberculosis, Leoffler in Diphtheria, Haffkine in Plague and Wright in typhoid fever.

If you suffer from an attack of an infectious disease such as small-pox, plague, typhoid fever, etc., you acquire a certain amount of natural immunity from a second attack, but you do not acquire any immunity in influenza, pneumonia, gonorrhoea etc.

The degree and duration of acquired immunity vary considerably in different cases. Small-pox vaccination confers immunity for several years; vaccination for typhoid cholera and plague for several months only; vaccination for influenza pneumonia for a very short time only. Natural immunity confers better and more lasting protection to a person than artificial immunity. Injection of vaccine during epidemics of cholera, plague, typhoid etc., is highly beneficial in the prevention of disease.

Some persons are more liable to be attacked by certain disease than their neighbours. Just as some soils are favourable to the growth of certain plants or trees, so also some human bodies are most favourable to the growth of certain microbes than others. Some persons are endowed with the power of preventing the growth of these germs while others lack this power. This is called natural immunity. Some persons possess this natural immunity from their birth. During an epidemic all persons who are exposed to infection do not contract the disease. Even among those who contract it some persons suffer more severely than others. This is due to individual immunity.

4. Small-pox

Small-pox is caused by a virus, a minute organism which can be seen only by a microscope, and which can pass through the finest filter. Small-pox is generally an epidemic disease. It is most fatal in children.

Small-pox or Variola is an acute, specific disease. It is a contagious, eruptive fever which generally occurs only once in life. The period from exposure to infection to the appearance of the disease (period of incubation) is ordinarily 12 days. It is attended on the third day of illness by characteristic eruption of the skin, first papular and finally pustular.

Fever is very distressing in small-pox. The temperature rises suddenly from 102 degrees to 104 degrees F. with rigor or severe shivering, nausea, vomiting, drowsiness, headache, backache. There are delirium and convulsions in children. There are two attacks of fever. When the eruptions mature the first attack of fever ends. The fever recurs when the pustular stage begins.

Small-pox is a dreadful disease. It is one of the most infectious diseases. Hundreds of thousands of people die annually. It attacks people of all classes and races, but the people of the East and Africa suffer more severely than those of Europe.

The disease is most contagious from the period of the formation of pus till the skin has become quite free from scales. A person may convey the infection upto ten weeks after the first symptoms appear. Infection may be conveyed by clothing, bedding etc.

Small-pox in man resembles a cattle disease known as cow-pox, an eruption which occurs on the udders and teats of milch cows and which is sometimes conveyed to the fingers and hands of the milkers. Cow-pox is also a virus disease. It is of a very mild nature. When small-pox was very prevalent in Europe, it was found out that those who had suffered from cow-pox did not get small-pox. This made Sir William Jenner to think seriously. He studied and investigated the subject thoroughly. He published his results of investigation in 1798. It is he who introduced the practice of vaccination.

Infection takes place through the respiratory passages. It may be direct or indirect. The infection may spread by direct contact through carriers. Even air may carry the infection. Small-pox is an airborne disease. Air is the medium through which the contagion is chiefly transmitted. If anyone suffers from one attack of small-pox, he attains immunity for several years.

A rash appears on the third day on the face and neck, then on the body and lastly on the arms and legs. The mouth, nose, eyes and throat become affected. This later on develops into pocks or sores from which the disease gets its name.

Variola minor is a mild form of small-pox. It is less severe and is protected by vaccination.

The rash assumes the form of clear small vesicles with a depression in the centre. The central depression is characteristic. It helps to distinguish small-pox from chicken-pox. During the stage of maturation the vesicles become turbid and opaque. A red ring forms round them. The last stage is the stage of desiccation. The pocks dry up. Scabs form and gradually fall off leaving scars.

About the tenth day the pustules begin to dry up. They form scabs on the fourteenth day. These fall off from the twelfth to the twentieth day. Scars or pits are left by the healing of the pustules.

In very bad cases the pustules join together. The disease is then said to be confluent. Some become deaf or blind.

Treatment

The patient should be isolated. Those who attend on the patient should avoid inhaling the breath of patients. The eyes should be carefully washed and bathed daily with warm boric lotion.

Treatment should be as in the case of ordinary fevers. If the temperature is high it should be brought down by sponging with lukewarm water. Bowels should be kept moved. Plenty of water should be given to drink. Cocoanut water is good. Diet should be confined to liquids. Milk, curd or whey is beneficial. The lesser the diet the better. There is no medicine for small-pox. Each distressing symptom should be attended to. The patient can mix with others only after he has taken several warm bathings after the falling off of scabs.

The virus is found in the breath of the patient and in the scabs. Disinfection should be strictly carried out, because small-pox germs retain vitality for a long period, not only in clothing and

bedding, but even in the paper and holes in walls. Useless clothing should be burnt. Sulphur fume is a good disinfectant both for rooms and clothing.

The infected house and its contents should be thoroughly disinfected with formaldehyde vapour. Rooms should be disinfected with 10% solution of formaline. Formaldehyde vapour is useful for disinfecting silk, fur and books.

Vaccination

Vaccination is the accepted preventive. Experience and statistics indicate that vaccination gives protection to the individual. It also greatly diminishes the amount of small-pox in the com-munity. It certainly lessens the severity and fatality of the disease. Vaccination may cause small-pox in a very mild and harmless form. It gives immunity. It makes the blood uninhabitable for the virus or germ.

Vaccination is the introduction into the human system of cow-pox vaccine in order to prevent small-pox. In 1798 Jenner first pointed out that the inoculation of man with cowpox vaccine gives immunity for subsequent attacks of small-pox just as an attack of small-pox does to a patient.

The protective effect does not last beyond seven years. Therefore it is advisable to have vaccination after seven years.

The operation is harmless and painless. A few slight scratches are made on the arm. A small quantity of vaccine lymph is spread on these scratches. Small blisters form on the arm three days after vaccination. When these small blisters heal a scab forms on each of them. The scab falls on the fourteenth day. It leaves a vaccination mark.

A small red spot is noticed at each scratch of the lancet on the 2nd day after vaccination. There are circular pearly vesicles containing a limpid fluid on the fifth day. These are fully developed on the eighth day. The centre of each is depressed with an inflamed red ring. There is slight fever and enlargement of the glands in the armpits. The pustules burst on the twentieth day, leaving permanent scars or pits. If these symptoms are not present, if the red zone is not formed around the vesicles the operation is not successful. It will not confer any protection.

Four good marks are sufficient to give protection for five or six years. Every child should have four good pocks. Revaccination should be done every six years. Every child should be vaccinated if small-pox is prevalent. Every child should be vaccinated before it is six months old, whether small-pox is epidemic or not. If it is suspected that a person is about to develop small-pox he should be vaccinated at once. The disease may be averted by vaccination. What may otherwise have been a very bad attack, may turn out a comparatively mild one. Vaccination will destroy the small-pox infection even when it has had a start of two or three days. If the vaccination is done too late, small-pox may appear but it will be of a mild type. If small-pox breaks out in a house, all the other members of the family should be at once vaccinated.

If persons exposed to small-pox are not vaccinated they should be placed under quarantine for 16 days from the date of last exposure.

5. Measles (Or Morbilli)

Definition

This is an acute infectious febrile disease of a highly contagious character attended by an eruption and catarrh of the upper air passages.

Direct contact with a previous case of measles is the most important factor in the spread of the disease. Its propagation may be effected indirectly through the agency of infected articles. It is highly contagious in the pre-eruptive stage.

In measles there is the danger of complications. Pneumonia, Broncho pneumonia, whooping cough and Tuberculosis may develop out of an attack of measles. Measles itself is not a dangerous disease, but its complications are serious.

Symptoms

The incubation period varies from 10 to 15 days. One attack does not confer complete immunity but second attacks are very rare before adult life. Measles is especially a disease of childhood. The cause is a living organism, not yet identified. The organism is conveyed chiefly by the breath and nasal mucus. Measles is as contagious before as after the eruption has appeared. Its infectivity disappears more rapidly. Children under the age of five are mostly affected. It occurs generally in an epidemic form. It is infective from the very beginning. The onset is usually abrupt with smart fever.

The disease commences with chillness, feverishness and cold in the nose. There is a sudden rise of temperature to 104 degrees F. Then it falls and again rises. The eyes are red, sore, watery and the throat may feel sore. The glands under the jaw may be enlarged. There will be sneezing, running from the nose, cough and pain in the limbs. The eyes and face get puffed. There is photophobia or fear of seeing light. The rash appears on the fourth day. Very small pinhead-like eruptions in patches appear and after a short time scale off the skin on the sixth or the seventh day of fever. The rash appears on the fourth day at the roots of the hair and on the forehead and face. It extends to the neck, trunk and limbs and fades in about three days. In simple cases convalescence is usually complete in 18 days.

A running cold, red eyes and sore throat in children must be considered suspicious especially when there is an epidemic.

Treatment

The earlier cases should be removed to the hospital. The suspicious cases should be easily isolated without waiting for the rash to appear. Infected clothing, bedroom etc., should be properly disinfected. The schoolmaster should promptly notify to sanitary authority the occurrence of any case among the students and the members in their homes. This will exercise considerable control over the spread of the disease.

As measles is very infectious the patients should be kept segregated for about 3 weeks. Those who have been in contact with measles should be kept under observation for two weeks.

There is no specific cure for measles. The bowels should be attended to. The patient should be confined to bed during the fever, with light diet. Greatest care should be taken to avoid chill till all catarrhal symptoms have passed away. The room should be darkened as the eyes are sensitive. The patient may drink milk and water, toast-water, lemonade, whey. Sago is useful.

A simple cough-mixture is needed. The patient will get well within a fortnight. The general health should be attended to.

By observing the general rules of health in sickness the attack may be got over without medicine. The eyes should be bathed several times with boric lotion. The nose and mouth should be washed with antiseptic lotion such as Borothymol etc. A hot bath may be given at the onset.

6. Chicken-pox (Varicella)

Definition

Chicken-pox is an acute eruptive infectious fever of a mild nature, which occurs principally among children mostly in an epidemic form and which is characterised by the rash, at first papular, but rapidly becomes vesicular, which appears on the first day, and is repeated in successive crops, during the next two or three days.

Chicken-pox and small-pox are separate and distinct diseases. An attack of one does not give protection against an attack of the other. Vaccination does not give protection against chicken-pox. The virus of chicken-pox and that of herpes zoster are closely related or possibly identical,

The disease is contagious. One attack confers immunity. Each crop requires from 5 to 6 days to complete itself and thus the disease lasts over a week. The eruption may appear on the palate, tongue, mouth. Mortality is nil.

Symptom

The period after exposure to infection or incubation period is ordinarily ten to sixteen days. During twenty-four hours there is slight fever and often catarrh, then an eruption of red pimples appears first on neck/chest, then on the face and other parts of the body. There is slight itching. There may be only one crop or there may be a succession of crops of such pimples daily for 3 or 4 days. There is increase of fever. The fever declines after the spots appear.

The pimples contain a clear fluid on the third day. The vesicles break on the fourth day and disappear on the sixth day. The thin scabs fall off without leaving any mark or scar. The vesicles are seen in all stages at the same time. They are not pitted or depressed as in small-pox. The vesicles may contain pus only in bad cases. The initiatory and accompanying fever is always much slighter than in small-pox.

The rash is generally the first sign noticed, though it may, have been preceded by malaise, head-ache, backache and feverishness. The papule becomes vesicular in the course of 12 or 24 hours. Some of the papule do not become vesicles at all. The essential feature of this eruption is that it comes out in successive crops. Therefore we see different stages of the rash on the same area of the skin. Sometimes the disease is so trivial as to pass unnoticed by the patient The temperature rarely goes above 103 degrees F. After the scabs have separated the cases cease to be infectious. There is usually no danger of infection three weeks after the first appearance of he eruption.

The rash differs from that of small-pox in, (1) not being umbilicated or depressed, (2) having no inflammatory areola around the vesicles, (3) appearing on the first instead of the third day, (4) being almost vesicular almost from the beginning, (5) the vesicles usually beginning to dry up as brownish scabs on the fourth day, leaving no scarring or pitting, (6) in small-pox the fever declines when the eruption appears, not so in chicken-pox. There are three days of fever at the onset of small-pox and fever again when suppuration occurs about the ninth day.

Treatment

The patient should be confined in the room in bed till all scabs have completely fallen. The patient should be given a bath in tepid water in which neem leaves have been boiled after the scabs have fallen.

All clothes, bedding etc. used by the patient should be disinfected either by steam or boiling.

The room and bed etc., should be disinfected. The room should be fumigated with sulphur. The mattresses etc., should be put in the sunshine.

The bowels should be kept moved by a gentle saline purge and the skin kept clear. Tepid baths are beneficial. Irritation of the skin may be relieved by warm boric bath and by mild boric dusting powder.

Barely water, glucose water, fruit-juice and plain water should be given during the acute stage of the malady. During convalescence an easily digestible diet should be given.

7. Malaria

Cause

People are terribly afraid of plague. Far more persons die of malaria than of plague. Besides the millions who die, millions more who escape death are weakened and debilitated by malaria. Malaria can be prevented if people use mosquito nets, take a light diet, keep the bowels open, take quinine and do not allow stagnant water near the house. Warmth, abundant vegetation, stagnant surface-water, low-lying and marshy districts favour the development of malaria.

Malaria is caused by the bite of mosquitoes of a particular kind (anopheles) infected with malarial parasites. The cause of malaria is a living parasite in the red corpuscles of the blood. It was Sir Ronald Ross who first found out the parasite, Plasmodium malariaoe, which reaches the blood direct through the bites of the female mosquitoes which belong to the genus Anopheles or indirectly through infected water or air.

Malarial fever has a tendency to relapse. The parasite attacks the red cells and causes anaemia or poverty of blood. The spleen gets enlarged.

Malaria is the greatest single destroyer of the human race. In India it causes one million deaths every year. It causes much debility in the patients.

The Anopheles sucks the blood from a person who is suffering from malaria. The blood contains the malarial parasites. These parasites undergo development for ten days in the salivary glands of the mosquito. The mosquito injects the parasites through its proboscis into the blood of a healthy person. The parasite enters the red corpuscles in the blood and undergoes further development. It destroys the red corpuscles. That is the reason why the patient becomes anaemic. Many of these parasites enter the spleen and cause its enlargement. The parasite completes the sexual part of its life history in the stomach of the mosquitoes of the genus Anopheles. It is only the female mosquito that sucks the blood and injects the malarial parasite.

Malaria is a seasonal disease. In India it is most prevalent in the autumn months from August to November. It is not present in high altitudes. Some are more susceptible to the malarial infection. Some acquire a sort of partial immunity on account of repeated attacks of malarial fever.

Varieties

Plasmodium vivax produces benign tertian malaria or the third day ague with an interval of one clear day. Plasmodium falciparam causes malignant tertian malaria (a dangerous type which resists treatment and causes caehexia or malignant anaemia). Plasmodium malarioe produces the Quarantan malaria or the fourth day ague with an interval of two clear days. The quotodian malaria oecurs on every day. It is the daily ague. This is due to a double infection of tertain or quarantan fever.

Malaria presents the following varieties (1) periodically recurring paroxysms of intermittent fever, (2) continued fever with well-marked remissions, (3) certain pernicious, rapidly fatal forms and (4) a chronic caehexia with anaemia and enlarged spleen.

Three

Stages As a rule the fever comes on suddenly without warning. A typical paroxysm has three characteristic stages. First there is cold stage. The patient gets a rigor or shivering. It lasts from one to two hours. It is followed by the hot stage. Now the temperature rises up to 103 to 106 degrees Fahrenheit. It is attended by headache, pains in the back and elsewhere. It lasts three or four hours. It is followed by the sweating stage. There is a profuse perspiration. The clothes may be drenched with sweat. This stage lasts one or two hours. There is fall of temperature after perspiration. The spleen enlarges during the attack on account of overwork. Sometimes the patient passes into a state of coma or unconsciousness. It is a type of pernicious malaria. There is the hyperpyrexial type of pernicious malaria. The temperature rises suddenly to 107 or 112 degrees F. Death occurs in a few hours. Black-water fever in which the patient passes bloody urine is also another type of pernicious malaria or malignant tertian malaria.

Treatment

If the bowels are not in good order a purgative should be given. Quinine is a specific in malaria. It can be given hypodermically. Atebrin and plasmoquin are other useful remedies. It may be given by tablets or powder. In very bad cases it may be injected. Cinchona febrifuge in the form of tablets is also useful. If malaria recurs a change of locality and climate is necessary. Euquinine or tasteless quinine can be given to children. Iron and arsenic tonic is beneficial to improve the blood. Dilute red iodide of mercury ointment will reduce the spleen.

Prevention of Malaria

A mosquito net should invariably be used in any place where there is malaria. There should be no holes in the net. Oil of citronella (lemon grass oil) and oil of cassia may be applied to the exposed parts of the body.

Windows and doors should be screened with wire gauze. The rooms should be sprayed with pyrethrum. Stagnant pools should be sprayed with kerosine oil. All shrubs and plants which are in the vicinity of houses should be cleared as they afford good hiding places for the mosquitoes. The neighbouring jungle also should be cleared. Broken cups, pots and tins should be buried. There should be proper drainage.

If you can prevent the breeding of mosquitoes you can exterminate malaria. The mosquito breeds in damp marshy places and in stagnant water. The larvae or the young of the mosquito float just under the surface of the water. They can be destroyed by spreading a thin film of oil on the surface. No water should be allowed to stagnate around the houses. No vessels or cisterns used for storing water should be kept uncovered. All pools should be filled up.

Those who live in malarious districts should take 5 grains of quinine a day during the malarial season as a preventive measure.

8. Plague (Pestis)

Cause

Plague is an acute infectious disease caused by a specific bacillus or germ; the bacillus pest was discovered first by Kitasato and characterised great virulence and rapid course of inflammation of glands, sometimes by Pneumonia or Seplicaemia.

Plague is also known by the name, Black Death. The disease is liable to become epidemic in the presence of insanitary conditions, filth and overcrowding. Previous to an outbreak the disease usually appears in rats and mice. Rats die of plague in large numbers. It spreads among them and from them to man through the fleas with which they are infested. In pneumonic plague the infection occurs through the respiratory passages. In other cases direct infection from man to man is not common.

Plague is a highly infectious and extremely fatal disease. It is caused by the bite of infected fleas from plague infected rats. When rats develop plague their blood is sucked by a kind of fleas which live on the rats. The fleas bite human beings and inject the plague germs into their blood.

Rats are the homes of the plague germs. The fleas are the distributors that carry the germs from the rats to human beings.

Symptoms

The average incubation is from three to five or eight days. The most characteristic appearances are those of bubo. Usually the onset is sudden, with shivering and fever which rises to 103 degrees or even to 107 degrees F. The spleen and liver get enlarged. There are prostration, vertigo, staggering gait and lethargy, redness of the eyes, lassitude etc. Buboes appear in the groin or armpit in one to five days, usually within twenty-four hours. They may suppurate about the seventh day. In favourable cases convalescence occurs from the sixth to the tenth day. In the pneumonic plague there are no buboes. The mortality varies in different epidemics from 50 to 95 per cent.

High fever with septic symptoms in a place where rats are dying will indicate that the patients are suffering from plague.

Varieties

There are six principal varieties of plague. 1. The bubonic type: this is the most common variety. 2. The septicaemic type is very fatal. 3. The abortive form. 4. A fulminate form. 5. A pneumonic form. 6. An ambulant or mild form.

Treatment

Immunisation is obtained by inoculation of serum if commenced early in the course of the disease. Vaccine injections are also used as a preventive treatment in affected districts.

Rigorous isolation must be carried out and continued for a month after recovery. All excreta, all clothes and utensils must be disinfected.

Attendants and relatives should be inoculated with Haffkines' prophylactic vaccine. Rats should be exterminated. Their bodies must be burnt.

There is no specific medicinal treatment. The treatment is symptomatic. Careful nursing is necessary. The food must be nutritious. The strength must be supported. Cold sponging, wet packs and ice bags to the head are beneficial. Stimulant mixture is very useful. Early operation of suppurating buboes helps recovery.

Serum-therapy, Yersin's and Lustig's serum have been chiefly used in the treatment of plague.

The affected houses should be thoroughly fumigated with sulphur smoke.

Application of kerosine oil to the body prevents fleas from biting. In pneumonic plague the attendants should wear cloth, masks or several layers of gauze and cotton over the face and neck to protect themselves from droplet infection.

We can get rid of this dire malady only by strict attention to sanitary laws.

If men are careful and clean in their habits, if every house is clean, and every room airy, plague would disappear and never be seen again.

Fear predisposes to an attack of plague Those who fear a disease very much and are always thinking about it and worrying over it are far more likely to get it than people equally healthy, who never think of it after taking proper precautions. Therefore annihilate fear. Be courageous, bold and cheerful.

9. Cholera

Cause

This is a specific infectious disease occurring in epidemic form and characterised by violent purging and vomiting, pain, cramps in the legs, suppression of urine and intense collapse. It is caused by the comma bacillus of Koch. The bacillus looks like a comma (,). Hence the significant name comma bacillus. The period of incubation is usually three to six days.

Cholera is a most dangerous and deadly disease. Seventy-five out of a hundred people who develop cholera die of it. The purging is so violent that the victim dies of weakness or collapse in a few hours. The motion is called "rice water stools." This is a characteristic sign of cholera. One attack of cholera does not give immunity for a second.

The germ of cholera enters the body through contaminated water or milk or any form of uncooked food. The germs rapidly multiply in the stomach and bowels. If everybody boils the water and milk they drink there will be no cholera.

The disease is not directly contagious like small-pox. Contagion is conveyed by stools, contaminated water and vegetables or other foodstuffs washed in it. It breaks out principally in summer and autumn. The germ has sometimes been found in the motions of healthy individuals, who may act as "carriers". Flies also spread the disease. They sit on the stools or vomit of cholera patients and then sit on the food with infected feet.

If there is a cholera case in a village and if the clothes of the patient are washed in the village tank, the whole village may be infected if the people drink the contaminated water of the tank.

Fatigue, exhaustion, sleeping in overcrowded places, damp and filth, fear, destitution will predispose to the disease.

Three Stages

There are there well marked stages. (1) Stage of evacuation. This stage lasts from two to twelve hours or longer. The stools are colourless. They resemble rice-water. There are severe cramps in the fingers, toes and abdominal muscles, severe exhaustion, small and weak pulse and coldness of the body. (2) The algid stage or stage of collapse. It lasts for a few hours to a few days according to the severity of the case. The patient becomes like a corpse. The eyeballs are sunk in. the fingers and toes become blue and wrinkled. The pulse cannot be felt at the wrist. The surface temperature goes down. The skin becomes a deadly livid hue. It is covered with a cold, clammy sweat. The purging ceases but the vomiting and cramps persist. There is suppression of urine. The voice is husky. There is restlessness.

The death may take place in a few hours or the patient may pass into the third stage. This stage may last not more than twenty four hours. The duration of the stage of reaction is les definite.

The gradual cessation of vomiting and purging, the skin becoming warmer and the pulse fuller, the voice regaining power, the passing of urine are the favourable symptoms.

(3) The stage of reaction. The pulse returns, the temperature rises, the urine reappears.

No certain cure has been discovered. Yet many lives are saved by careful nursing.

Opium, dilute sulphuric acid may be acid may be given at the onset of the preliminary diarrhoea, but never after the characteristic rice-water stools have set in.

No food should be given. Thirst can be relieved by sucking ice. For vomiting mustard should be applied to the abdomen and ice given to suck. Cramps are to be relieved by friction with any liniment and morphia. In the collapse stage intravenous injection of warm saline solution is beneficial. Apply hot water bottles and bags to the feet, and side of chest. Rectal saline is also useful. Dry cupping and fomentation over the loins will relieve suppression of urine.

Prophylactic vaccine gives immunity for four months. The more the inoculation is carried out, the less virulent will epidemics become. Potassium permanganate grains 2 is given by the mouth every half hour as an oxidising agent. This destroys the toxins of the cholera germ. Kaolin and charcoal are useful in cholera.

The patients must be promptly isolated. All excreta and vomits must be disinfected. When cholera is epidemic milk and drinking water should be boiled. Irritating foods must be avoided. All cases of diarrhoea must be checked as rapidly as possible by opium, chlorodine or other astringents.

The excreta and vomited matter should be burnt and buried deep in the ground far away from a well, tank or river. Those who serve the patients should wash their hands with a disinfecting lotion such as carbolic lotion, perchloride of mercury lotion, etc. The room in which the patient lives should be thoroughly disinfected.

When cholera is prevalent it is not advisable to eat fruits. Unripe fruits may cause diarrhoea. He who is suffering from diarrhoea is in a very favourable state for developing cholera. Raw fruits are very dangerous, because the fruit-sellers very often handle them with dirty hands. They place the fruit-basket on the roadside. Dust falls in the basket. Further flies with soiled feet which contain disease-germs may sit on the fruits and thus spread the infection of cholera. All foodstuffs must be protected from flies. They should always be covered.

Great care should be taken with regard to diet during convalescence. Sago and arrowroot may be given with much advantage. No solids whatever should be given until the stools are of a natural colour, the urine is secreted freely and all other symptoms have vanished.

10. Typhoid Fever

Definition

Typhoid is also known by the name Enteric Fever, This is an acute specific infectious fever characterised by diarrhoea and a rose-coloured rash which appears in successive crops and runs a prolonged course of about twenty-one days and ends by lysis or gradual fall of temperature. It is accompanied by characteristic ulcerations of the small bowels or intestines and by enlargement of the spleen and mesenteric glands.

Cure

It is due to a specific microbe, called typhoid bacillus of Eberth. It is always a serious disease on account of the numerous complications, prolonged course and its exhausting nature. The incidence of typhoid in a community is a fair index of the purity of its water supply. The period of incubation is usually about ten days. The onset is insidious.

Typhoid, like cholera is caused chiefly by polluted milk and water. It is a water-borne disease. If you are careful about the purity of water and milk, if you drink boiled water and milk, you will not get typhoid. Attendants on the patients develop typhoid through soiled hands.

The germs are found chiefly in the stools. If the stools are thrown about carelessly anywhere they dry up and get blown about by the wind. They enter the water ad milk. The germs may remain in an active state in the form of dust for a long time. Stored water should be protected against contamination by dust and flies.

Typhoid fever is often connected with inefficient conservancy arrangements such as a water-closet out of order or escape of sewer gas into a house. It also arises from drinking water contaminated from sewers and particularly from severs into which the motions and urine of typhoid fever patients have been thrown. Milk also has conveyed the disease, after dilution with contaminated water. The contagion may also be conveyed by clothing soiled by the stool of a typhoid patient or which has been washed in contaminated water.

The poison is conveyed also by uncooked vegetables grown on infected soils, direct contact with stools of patients, soiled linen of patents in public laundries (stools or urine) and typhoid carriers.

Flies are a great source of danger. They sit on the excreta of patients and with soiled feet sit on the food.

Symptoms

The most important early symptom is headache, otherwise there are simple malaise, lassitude,

Constipation, bleeding from the nose (epistaxis), cough, slight abdominal pain and looseness of the bowels.

The typhoid microbe attacks particularly the small intestines and exert a toxic influence generally on the body. It causes wounds or ulcers in the intestine which produce thinning of the walls of the intestines. The walls eventually give way on account of perforation and the patient dies.

Typhoid is not spread by touch or odour. It is spread by germs swallowed with contaminated food water or milk. It is most infectious during the third week.

In certain cases, after recovery, the germs may persist for years in the intestine or gall bladder and sometimes in the kidney or bladder whence they pass out in the urine. The stools or urine of such persons, who are known as “typhoid carriers” may be constant sources of infection.

The onset of typhoid fever is usually gradual. It is insidious. The patient gets feelings of malaise, aching in the limbs, headache, loss of appetite, chillness, nausea, vomiting, bleeding from the nose, slight abdominal pain. There is an increase in the pain, fever in the afternoon and a slight remission or diminution in the morning. There is diarrhoea. The stools are thin, of a yellow colour resembling pea-soup. The abdomen becomes tense and resonant.

There is an eruption of rose-coloured spots on the chest, abdomen and back between the seventh and twelfth days. It comes in successive crops.

The typhoid chart is one of the most characteristic features of the disease. In the first week it is a ladder-like or staircase like gradually rising with diurnal remissions. It rises two degrees in the evening and falls one in the morning. It reaches the highest point 103 to 105 degrees about the end of the first week. During the second stage which lasts for a week or more it remains continuously high. Defervescence usually takes place about the fourth week. The morning temperature first gradually becomes normal and then the evening temperature also gradually becomes normal.

The spleen is generally tender and enlarged throughout the disease. There is lympantic distension of the abdomen.

Thee small bowel has numerous ulcers. The bowel becomes very thin on account of the ulcers. The ulceration causes bleeding at times.

The fever may last from 21 to 40 days. Relapses are common on account of injudicious feeding.

In favourable cases there is a diminution of the fever after the appearance of the eruption. The patient will improve about the beginning of the third week. The diarrhoea lessens, the tongue becomes clean, appetite returns. In more severe cases delirium comes about the middle of the second week. The “typhoid state” comes in. The patient is in a state of collapse. He becomes unconscious. He picks at the bed clothes.

The duration of typhoid fever is from there to four weeks. The temperature gradually becomes normal in the fourth week. There may be relapses. The mortality is one in every seven cases attacked.

Bleeding from the bowels, nose or mucous surfaces, perforation of the bowels, peritonitis, extensive distension of the belly on account of too much gases, pneumonia, bed sores, inflammation of the kidneys are complications.

Types of Typhoid

There are four types of typhoid, (1) the ambulatory type in which the patient may be able to move about during the entire illness, (2) cases with sudden onset marked nervous symptoms, (3) cases in which termination of the fever takes place by crisis (sudden fall of temperature) in the second week (abortive type) and (4) cases where defervescenee is delayed till the fifth or sixth week.

Diet

Wheat, butter-milk, barely water, green cocoanut water, fruit juice are beneficial. Add barely water or lime water to milk or add sodium bicarbonate, or sodium citrate 2 grains to an ounce of milk. This will prevent the formation of curds. No solids should be taken until at least one week after the temperature becomes normal. Nothing which wold not readily pass through a fine sieve should be given to the patient. Milk, if it agrees can be given at regular intervals and in definite quantity. No food which will increase the risk of perforation should be given. Arrowroot and corn flour are permissible.

Eating of an orange or a piece of potato or drinking soda or lemonade may produce distension of the bowel and rupture particularly during the third and fourth weeks. Many typhoid patients die on account of the ignorance of their friends and relatives. They give them biscuits and fruits with stones etc., which cause rupture of the thin bowels.

Treatment

In typhoid fever the patient has at once to be prepared for confinement to bed for 4 weeks without practically any food.

The strength of the patient must be kept up. Bleeding or perforation must be prevented by absolute rest and suitable diet. The poisonous effects of the germ must be counteracted by vaccination. The toxin of the germ must be neutralised by serum therapy. The patient should not be allowed to sit or raise himself. He should not be allowed to sit or raise himself. He should not be allowed to lie continually on his back as this will tend to congestion of the bases of the lungs and formation of bed sores. He should lie on his side. He should be carefully turned every two hours on either side alternatively.

The stools must be burnt or immersed in phenyl or izal. All linen must be first steeped in lysol or izal for several hours and then boiled. All utensils must be disinfected.

If constipation is troublesome give enema. No purgative should be given after the first week. If there is bedsore use water bed, spirit lotion. If there is high fever give tepid sponging. During convalescence the diet must be increased with great caution. The possibility of relapse must be remembered.

Those who attend on the patients should be inoculated with the Anti-typhoid vaccine, (Wrights). This is an established success. The vaccine which is injected contains the dead typhoid bacilli, the presence of which increases the strength of the white blood cells. They acquire fresh power to destroy the living bacillus, just as a soldier can kill more enemies if he is equipped with better guns.

When the temperature is high ice pack to the head, cold or tepid sponging is highly beneficial.

More help is done in typhoid by careful and good nursing than by medicine.

Inoculation, improved sanitation of the kitchen, control of flies and water supply, tracking down of typhoid carriers pave a long way to eliminate the disease to a very great extent.

Treatment by drugs is chiefly symptomatic. All food should be protected from dust and flies.

Slight movements do positive harm to ulcerated surfaces of the bowels.

11. Mumps

Definition

This is known also by the name acute Epidemic Parotitis. This is an acute, febrile infectious disease characterised by inflammatory swelling of one or both parotid glands situated behind the jaw, below and in front of the ear.

The period of incubation is from one to three weeks.

It generally occurs in children, but sometimes in adults. It seldom attacks the same person twice. In males the testes and in females the breasts are occasionally affected.

Cause

The specific organism has not yet been positively identified but the virus is a filter passer and is conveyed by the saliva.

One side is first affected and is succeeded by the other in about 24 hours or a day or two later. Sometimes the submaxillary and sublingual glands are also involved. Mumps is almost always bilateral (i.e., comes on both sides).

It is almost entirely confined to children and young persons between the ages of five and twenty-five. It is rare in the very young and very old. It is often epidemic. A patient remains infectious as long as there is any definite swelling in the glands.

Death from this disease is very rare. The patient is generally well in 10 or 12 days. It is a trivial disease. The disease is infectious 2 or 3 days before the swelling appears.

Symptoms

Pain is felt under one ear with stiffness or soreness of neck and jaw. This is usually accompanied by smart fever 101 F. to 103 F. or 104 F. The fever subsides on the third or fourth day. A swelling often of almost stony hardness is noticed on the cheek and under the ear. This lump is extremely painful. It lasts for 4 or 5 days and gradually disappear the swelling extends all-round the jaw in the form of a collar. It is severely contagious and sometimes runs through a whole family or school. Swallowing and mastication are very painful. The breath is foul and the tongue is very furied. Saliva may trickle out of the mouth. The glands seldom suppurate.

Treatment

A simple saline purge (mag sulph or sodium sulphate or citrate of magnesia) hot fomentations and an antiseptic wash for the mouth (Listerine or Glychothymoline or boric lotion) are all that is usually required. Flannel wring, one of hot poppy-head decoction is the best application. Fluid food may he given.

Patients should be kept in bed for ten days until the liability to orchitis or inflammation of the testicles is passed. They should be isolated for three weeks from the onset. The isolation should be continued for one week after the subsidence of the swelling.

Treat complications as they arise.

Diaphrotetics are useful. Application of leeches is beneficial.

12. Dysentery

Definition

Dysentery is a term which designates various forms of intestinal flux characterised by the frequent passage of slimy or bloody stools Tormina (griping pain in the bowels) and

tenesmus (frequent tendency to answer the calls of nature and sense of weight in the rectum) inflammation and sometimes ulceration of the large intestine or bowel.

Cause

There are two forms of dysentery viz., amoebic and bacillary. In the amoebic form vegetable parasites (Entamoeba histolytica) are found in large numbers in the bowel discharges, whereas bacilli (Shigas or Flexner's bacillus) are found in the bacillary dysentery.

In dysentery the mucus membrane of the large intestine gets inflamed and ulcerated. The disease is propagated by contagion and infection. Certain climatic conditions help the prevalence of dysentery.

It is met with in two forms viz., acute and chronic. Both are characterised by diarrhoea, the passage of blood and mucus form the bowels.

This disease is most prevalent in India and other tropical climates. The principal predisposing causes of dysentery are exposure to sudden changes of temperature, irregularities in diet, badly cooked food, raw vegetables, a tropical climate, drinking water containing mineral or vegetable impurities, lying on the damp ground, residence in ill-ventilated, imperfectly drained and badly located habitations. The actual exciting cause is a specific germ (bacillus) or amoeba.

Infection is conveyed by the stools, soiled clothing, flies and contaminated water or soil. Convalescents may act as carriers.

Bacillary infection enters the alimentary canal by the drinking water and by food contaminated by flies.

The incubation period is usually two to three days but may extend to eight.

Symptoms

Acute dysentery may be of sudden onset. The patient wakens in the early morning with a griping pain and tenesmus. During the day there may be from ten to sixty scanty discharges from the bowel, containing blood and mucus.

There is more fever and toxaemia in the bacillary than in the amoebic form. In a favourable case the disease ceases after a week or ten days.

The first symptoms of dysentery are feelings of griping about the navel. Next there are frequent calls to stool with irregular loose motions. The symptoms in bacillary and amoebic dysentery are more or less the same. They can only be distinguished by microscopic examination of the stools. Patients after recovery very often remain in poor health. Amoebic dysentery is one of the most common causes of abscess of the liver.

The rectum is often affected and the disease may extend beyond the caecum into the lower part of the ileum.

Passage of stool gives no relief. Straining continues. There are slight fever, great thirst, dirty tongue, dizziness and dry skin. The patient loses strength.

Diet

Curd and rice, butter-milk and rice, plain butter-milk, whey are highly useful. Isabgol soaked in curd is a valuable remedy.

Prevention

Be careful about what you eat and drink. Avoid chillies. Have abundant fresh air. You can avoid an attack of dysentery.

Treatment

Absolute rest in bed is very essential with no food except barley water. Emetine is the best remedy for amoebic dysentery. Emetine hydrochloride ½ ¾ grain is injected once or twice daily and continued for a week or ten days. Dr. Rogers successfully popularised this form of treatment in place of Ipeacacuanha. Subsequently Kurchi has been given a very high place.

The offending and toxic matter should be removed from the intestines. The pain should be relieved or alleviated. The healing of the ulcer should be promoted.

Small doses of castor-oil in the form of emulsion are highly beneficial. This helps quick removal of offensive matter, minimises the strain during motion and also acts as a lubricant to the ulcerated surfaces.

Emetine may be given by mouth.

For bacillary dysentery a saturated solution of sodium sulphate (half an ounce following every 2 to 4 hours by 1 to 2 drachms) is given until there is no more blood and mucous and no fever.

Hot fomentations are given for the abdominal pain. Opium and adrenalin in starch enema relieve the tenesmus.

A dose of castor-oil with ten drops of tincture of opium can be taken as soon as the symptoms and signs of dysentery manifest.

A, combination of Bismuth Salicylate, salol and Dover's powder is highly useful. Salolisan antiseptic. It kills the germs. Bismuth is very soothing. Dover's powder relieves pain and stops bleeding and the motions.

In chronic cases two or four pints of the warm solution of nitrate of silver, or albargin gr. One to the ounce are allowed to flow slowly through a long tube into the bowel. The patient lies on his back with the buttocks raised on a pillow.

The polyvalent anti-dysenteric serum is useful in bacillary dysentery.

Kurchi and bael are highly beneficial. If emetine and Kurchi fail to act, the case may be a bacillary dysentery.

In every case of dysentery there is danger of the liver becoming affected and of liver abscess forming as a secondary consequence of the dysentery. Therefore prompt, careful and efficacious treatment should be resorted to.

During recovery the appetite often increases before the digestive organs recover their tone. You must be very careful about your diet. You should avoid overloading the stomach. Otherwise a severe relapse may take place.

13. Leprosy

Definition

This is a chronic infectious, constitutional disease due to the Bacillus Leproe characterised by pigmentary, sensory and nodular changes in the skin, by the appearance of granulomata in the skin and mucous membranes, or by infiltration of nerve trunks leading to anaesthesia

(loss of sensation in the skin), paralysis and tropic changes. This is a disease of great antiquity.

Cause

The cause of leprosy yet remains undetermined. It is transmitted by contagion. The bacillus or germ is found in the discharges from the skin and mucous membranes and very abundantly in the nasal discharge. Prolonged exposure is necessary for such transmission. Children below five years of age rarely suffer. Persons of any age and either sex are liable. Heredity, contact, bad surrounding, overcrowding, poverty, insanitary conditions and poor feeding are predisposing factors.

It is still endemic in Norway, parts of Russia, Turkey, China, India, West Indies, etc. Its infectivity is feeble. It is communicated through an abrasion of the surface. It is communicated by close contact.

Dr. Hutchinson thinks that leprosy originates with the use of tainted fish under special circumstances and spreads by commensal communication or by taking of food or drink contaminated with lepra bacilli.

The actual number of lepers in India is from a half to one million. The lepers of the world are about two millions.

The bacillus of leprosy was first described by the Norwegian leprologist Hansen in 1874.

Leprosy may be communicated through a leprous mother's milk or breast. Lepers should not marry.

Symptoms

Leprosy appears in three forms: (1) Nerve or anaesthetic leprosy: There are circular spots or blotches of irregular size and coppery hue on any part of the body. It may occur on the fingers or toes or on some part of the face or body. There is loss of sensation in the affected skin.

(2) Nodular Leprosy: There is a gradual growth of solid prominences or tubercles varying in size from that of a pin's head to a walnut. These give the patient a leonine aspect in course of time (facies leonis). Ultimately the affected parts ulcerate. The ulcers gradually eat away the flesh and bones. The fingers and toes are lost.

(3) The third form is a mixed leprosy showing both types.

The course of the disease is extremely prolonged.

There may be hypersensitiveness for a short time before all sensation is lost. The skin is thickened with a shiny, smooth, scaly appearance.

The earliest stage is the most amenable to treatment. The second stage is the most virulently infective stage and also difficult to treatment. The third stage is difficulty curable. The disease ceases to be infective in the advanced third stage.

A thickening of the lobes of the ears and of the skin of the forehead is often the first manifestation of the disease. Leprosy is principally a disease of the skin and the peripheral nerves.

Treatment

There is no cure for the disease, but its progress may be delayed by good diet, fresh air and tonics. Early cases are almost wholly cured.

Chaulmougra oil 10-40 (even to 300 drops) in capsules daily arrests the progress when given in gradually increasing doses. It is given hypodermically also. Sodium gynocardate 4 in 1 c.c of water is also given hypodermically, or intravenously gr. 1/10th to 4/5 th twice a week. The oil can be rubbed also on the body (inunction). Vaccine made from the modules has given good results.

Gurjon oil is also much recommended. The dose of oil is 2 drachms twice daily with an equal quantity of lime-water. One part of it with three of lime-water must also be rubbed into the body and limbs in the sun.

14. Kala- Azar

Definition

This is a chronic infection of tropical countries due to a protozoon and characterise by fever, anaemia. Bleeding, wasting and enlargement of the spleen. This is also known by the name Leishmaniasis.

Cause

In 1903, Sir William Leishman first described the parasite of Kala-Azar. About the same time Donovan found out similar bodies in the spleen of patients dying of chronic fever in Madras. These parasites have been named after them and arc known as “Leishman-Donovan bodies.”

Kala-Azar may be mistaken for typhoid in its early stages for malaria in its later stages. If there is one patient in a family, others also get the disease. Children are most affected by it. Both sexes and persons of all ages are affected by Kala-Azar. The disease occurs chiefly in India but also in Ceylon, China, Syria, Arabia and Northern Africa.

The parasite Leishmanaia-Donovani is transmitted by the bed bug or the sand fly and by the dog-flea in the Mediterranean basin. The sand-flies by their bite carry the infection from one infected person to others. It is found is found in the spleen, liver, bone, marrow and mesenteric glands.

The disease is a lingering one. The mortality is very high. The patient rarely dies directly as a consequence of Kala-Azar. Complications such as Broncho-pneumonia, Sepsis, Diarrhoea, dysentery, cancrum oris take away the life of the patient.

The diagnosis is made by finding the parasite by liver puncture.

Symptoms

The great enlargement of the spleen is a prominent feature. The liver also is enlarged. There are long continued, irregular fever, anaemia or poverty of blood, transitory oedema or swelling, bleeding from mucous surfaces and great emaciation.

The temperature shows two or even three distinct rises and falls in every 24 hours.

Treatment

The fever is not controlled by quinine.

Formerly the specific drug was antimony. It was given by intravenous injection in the form of a two per cent solution of tartar emetic, twice a week. Gradual improvement follows and

often permanent cure. Urea stibamine gives better results now by intravenous injection. Neostibosan is now also in use.

Kala-Azar is essentially a house infection. Repeated number of cases occur in the same house. It can be controlled by removing the infected persons to a new place in new houses.

The infected houses or localities should, as far as possible, be avoided for permanent residence. This measure is efficacious in dealing with outbreaks in certain districts.

15. Beri-beri

Definition

This is an endemic multiple neuritis, characterised by paralysis and dropsy (swelling or oedema). This is a disease caused by deficiency of Vitamin B, in the diet, Beri is the Singhalese term for weakness. The repetition of the word implies great weakness.

Cause

Beri-beri is not due only to the insufficiency of vitamin but there is co-existent toxic condition also. It occurs in epidemic form. A particular variety, having nearly the same series of symptoms, is called epidemic dropsy. It occurs mainly among rice-consuming peoples. Therefore the relationship of rice to its production was first investigated. When white or polished rice forms the main ingredient of the dietary, Beri-beri frequently develops, whereas it is rare when the whole grain is use. The pericarp, aleurone layer, and germ of the rice grain contain the vitamin and these are all removed by milling. When the whole grain is used Beri-beri is rare. If an extract of the millings of rice is given, the disease is cured.

Beri-beri attacks persons living together in the same house and also in the same locality. The disease attacks both sexes.

Beri-beri is found in Burma, Ceylon, Japan, Malaya, Madras Presidency and Brazil, Overcrowding, warmth and moisture are predisposing causes.

Symptoms

The patient feels weak. There may be slight fever or there may not be any fever. There is gradual swelling in the legs. The heart becomes weak. The onset may be sudden or gradual.

There are two types of Beri-beri: (1) the paralytic type, (2) the cardiovascular type. In the paralytic type, there is no oedema or swelling. The patient is thin and emaciated. It is called “dry Beri-beri”. The first symptom is a difficulty in walking. There is the characteristic high-stepping gait of foot drop. The knee jerk is soon lost. There is tenderness on pressure over the calves.

In the cardiovascular type there are dyspnoea or difficulty of breathing and oedema or swelling in the legs. When dropsy is extreme the condition is called “wet Beri-beri”. The heart is enlarged.

Treatment

Treatment is symptomatic. Prophylactic treat-ment consists in the avoidance of polished rice. Alteration of the faulty diet is the essential measure. The dietary should be mainly nitrogenous. Extract of the millings, yeast or marmite should be given when polished rice has been the cause for the disease. The use of undermilled, instead of polished rice, is the chief prophylactic measure.

Generally rice is boiled in excess of water and the water is thrown away. This is unhygienic and unhealthy. By the time the rice is ready for eating, it becomes destitute of all vitamin B. Rice should be boiled in water just sufficient to absorb completely.

The heart must be supported by digitalis or other cardiac stimulant.

All forms of the disease will be controlled with certainty if the use of rice is strictly prohibited and if a diet is provided containing a sufficient amount of all the necessary Vitamins and other nitrogenous ingredients. There should be an increase in the quantity of wheat, milk, and fresh vegetables in the diet.

As the heart becomes weak abundant rest should be taken. A weak patient should not even sit up, for the risk of heart failure. Change of place is beneficial.

16. Influenza

Definition

This is an acuter specific infectious disease attended by fever, considerable prostration and usually by catarrh, a tendency to the development of local inflammation, and by symptoms affecting mainly the respiratory digestive and nervous system.

Cause

It is a contagious disease due to a minute bacillus (Bacillus Influenza) or Bacillus of Pfeiffer (discovered by Pfeiffer in 1892) found in sputum.

Cold and chill, a weak state of health, overcrowding and insanitary surroundings are predisposing causes.

The duration of the disease may be from four or five to ten or twelve days. Convalescence is often protracted and is characterised by debility, troublesome cough, neuralgic pains, loss of taste or various other nervous affections.

The incubation period is from one to six days. One attack confers no immunity. Relapses are common.

The first appearance of the disease in Spain caused it to be known as “Spanish Influenza. There was Russian Influenza in Russia also previously. In 1918 there was a severe epidemic which affected the people of every continent. Five millions of people died in India alone.

Symptoms

It has symptoms very much like common cold. It begins as an attack of cold in the nose. There is heaviness in the head with a feeling of discomfort. The infection spreads from the nose to the throat, larynx, trachea or windpipe, bronchi and lungs.

Pains in the limbs and body are present.

The onset is sudden. There are severe frontal headache and backache, pains in the bones and marked weakness. The temperature rises briskly to 102 or even 104 degrees F.

There are three types of this disease. (1) Respiratory type in which bronchitis, bronchi-pneumonia develop, (2) Gastro-intestinal type. Pain in the region of the stomach, vomiting, diarrhoea, distaste for food, jaundice are the common symptoms. (3) Nervous type. The initial pains are more severe. There is sometimes anginoid pain over the heart. There are great depression and sleeplessness. There may be coma or delirium.

There are redness and watering of the eyes, running in the nose, sore throat, sneezing and tightness of the chest. The tongue is furred, loaded and pasty. The tonsils get swollen.

Treatment

Rest in bed is essential. There is no specific medicine.

Inhalation of eucalyptus oil is very soothing. A few drops in the handkerchief inhaled off and on prevents an attack. The patient should be segregated. Every person should wear a mask during an epidemic. This must be made compulsory.

Sodium salicylate, antipgrin, aspirin, phenacture and quinine are useful. These relieve the general pains and headache of the early stage and control the fever. During epidemics those exposed to infection should use a disinfectant gargle such as listerine, glycothymoline.

A curative vaccine of streptococcus, pneumococcus and Bacillus influenza has been advocated for use during the disease or prophylactically during an epidemic.

All sheets and clothings used by the patients should be disinfected,

17. Consumption

Consumption is perhaps the most widespread of all infectious diseases. Unlike plague and cholera which have a periodical incidence and affect only in a localised area, consumption is present at all times and in all places. It is the greatest enemy of mankind and kills one person out of every eight born in this world. About 6 lakhs of people die every year from this dire disease in India. There are 60 lakhs of consumptive patients in India.

Definition

Consumption is known by the names Pulmonary Tuberculosis or Phthisis. It consists in the decay of the lungs, arising from the formation in their texture of a material called "tubercle".

Cause

It is caused by the human form of Koch's bacillus and is spread by direct contact. It has been shown that droplets of sputum sprayed from the mouth of a tuberculosis subject contain enormous numbers of bacilli or germs.

The tubercle bacillus is found in human beings and cows. Tuberculous cows are a very serious source of infection particularly to children. The bacilli are present in the milk of the affected cows. When such milk is taken by children without proper boiling. The children are affected.

The causative organism was first demonstrated by Robert Koch in 1882. The bacilli can enter the body by inhalation of droplets expelled by open cases of pulmonary tuberculosis through coughing, sneezing and loud speaking, or of dust containing sputum and other infected discharges deposited on the floor, walls, furniture, clothes, books, etc; through the ingestion of food, drink and other materials contaminated with tubercle bacilli, and by inoculation into the skin or mucus membrane. Direct sunlight kills the tubercle bacilli in sputum.

Bad sanitation, overcrowding, undernourishment, lack of ventilation are conducive to the occurrence of tuberculosis bacilli.

Careless spitting, purdah system or seclusion of women in homes, eating and drinking from common utensils, frequent pregnancy are some of the unhygienic habits and social customs which predispose to tuberculosis. Diabetes, frequent attacks of malaria and debilitating diseases may activate a dormant tuberculosis lesion.

The disease is spread directly by kissing, by using an infected utensil, tumbler, cup, spoon, etc. and by smoking the same hookah or indirectly through sputum, of the patient either .by inhaling the germs floating in the air along with dust from dried up sputum, or the use of earth for cleansing feeding utensils contaminated with the sputum or by eating foodstuffs contaminated by the germs alighting on these from the air or through flies.

The tubercle bacilli grow favourably in moisture and darkness. The sputum may be thrown on the floor or walls near about affected persons. The bacilli may live on till carried by wind or by further direct contact to other places. Children play on the floor and have the dangerous habit of putting their fingers in the mouth. From infected spots on floor the bacilli get entry into the child's stomach.

In civilised areas 10 per cent of total deaths are due to tuberculosis. Tuberculosis affects more people of the towns than village people.

Symptoms

The first symptom noticed is a short dry cough most troublesome on rising in the morning. The patient is easily fatigued and experiences difficulty in ascending heights or stairs. Then expectoration of mucus occurs and spitting of bright-coloured frothy blood. The spitting of blood is often the first symptom.

Because of the variations in resistance, the course of the disease is very variable. It may cause death in a few weeks, or it may spread in successive areas so slowly as to cause little or no disability over a long life-time.

The patient gets fever and cough. His strength diminishes. His body wastes away.

The tubercle bacilli (T.B.) may affect the bowels and cause persistent diarrhoea. They may cause swelling of the joints and destruction of the end of the bones. They may attack the glands.

The disease is essentially a chronic one. Its onset is sometimes insidious. It is always amenable to treat in the early stage. Among the earlier general symptoms which should make us suspect the invasion of tubercle are unexplained debility, attended by langour and anaemia, loss of weight, dyspepsia and slight elevation of temperature in the evening (hectic fever). The type of fever is distinctive. It is intermittent. It is normal in the morning and raised in the afternoon or at night. Night sweats are a characteristic feature.

When the tubercle bacilli attack the lungs it is called pulmonary tuberculosis, consumption or phthisis. When other organs of the body are affected it is called tuberculosis of that organ such as tuberculosis of the bones, glands, joints, intestines, etc.

In the second stage of the disease the cough grows worse, the expectoration more profuse and becomes of a yellow colour formed in globular masses which float in water (mummular sputum). The patient may lose his voice. There are sharp, cutting pains in the side and the chest. There may be diarrhoea. These point out that the disease has spread to the throat and the bowels. A large quantity of blood may be passed by the mouth on account of the giving way of a large blood vessel in the lungs.

There are two main varieties of pulmonary tuberculosis, (1) Acute tuberculosis or galloping consumption. The onset is gradual. The emaciation is rapid. Death takes place in a few months after the onset. (2) Chronic pulmonary tuberculosis. An area of lung tissue infected by the tubercle bacilli passes through three main stages: (a) the stage of invasion: The tubercle bacilli enter the lungs. (b) The stage of consolidation: Inflammatory changes take place. (c) The stage of softening of excavation: The tissue breaks down. Cavities in the lungs are formed.

Treatment

There are so far no means of rendering the human body immune to tuberculosis.

Fresh air and sunshine are the enemies of tubercle bacilli (T.B.)

It is always advisable to have the chest examined by a doctor at the earliest opportunity.

The sputum must be repeatedly examined under the microscope for T.B. A radiogram of the lungs should be taken (X-ray photograph). The presence of tubercle bacilli in the sputum is diagnostic of pulmonary tuberculosis. The early morning sputum should be examined as it is the most likely to contain the bacilli. However, the absence of bacilli even after several examinations does not always indicate the absence of the phthisis. X-ray examination by an expert is absolutely essential in all cases of haemophysis or bleeding from the lungs or of cough which is more than three weeks.

Regular chest expanding exercises in the open air, breathing exercises or Bhastrika Pranayama are highly beneficial. Strict cleanliness in the home, ventilating all rooms, daily airing of bedding in the sun are useful. People should be educated in sanitation and hygiene. They should know the importance of personal hygiene, of free ventilation, the dangers of spitting etc. Then alone we can hope to win the war against tuberculosis.

The patient should be taught only to spit into a special vessel containing an antiseptic such as phenyle.

Milk is a source of infection. Cows suffer from tuberculosis. Therefore all milk should be boiled before use. This avoids the danger of T.B.

It is better that cases of T.B. should be treated in sanatoriums where more specialised methods of treatment are available and when the patients themselves are not a source of danger to their relations.

There is no specific remedy for this disease. More may be done to prevent than to cure this disease. The disease must be combated by preventing the spread of infection and by building up the health of the body so that it can resist any likely infection to which it may be exposed.

Remain in the open air as much as possible. Sleep in well-ventilated rooms. Have well-regulated life. Avoid exposure to cold or damp. Consumptives should never swallow their sputum. The sharing of a bed or even a bedroom with consumptive patients is not allowable.

Cod-liver oil, Fellow's Syrup, Kepler's Extract of Malt, and tonics as iron and quinine, gold salts are beneficial.

The dry atmosphere and absence of fog found at certain mountain resorts are desirable in the early stages of the disease.

The food should be sufficient, varied and nourishing.

In the third stage there is not much hope of recovery. Even in the worst cases we can ameliorate the symptoms and so ease the passage to the cremation ground or grave.

The rooms in which consumptives have lived must be thoroughly disinfected.

The patient should spit into paper or rags which should be at once burnt.

Sea voyage is beneficial in early phthisis.

Rest with graduated bodily exercise is beneficial. Direct rest to the lungs by artificial pneumothorax is resorted to. Only a skilled surgeon can undertake collapse of the lung. The lung stops its action, when outside air is admitted inside.

During recent years medical researches have found that the new antibiotics e.g., P A S, I N H, etc. are a great success in the treatment of tuberculosis. Also, as a preventive measure B.C.G. vaccination has done much in reducing the morbidity and mortality from tuberculosis. Not only this, X-ray plays a great part in the detection of the disease and thus helps in the treatment of tuberculosis.

18. Whooping-Cough

Definition

This is an acute specific infectious disease that affects the respiratory organs. It is attended with a peculiar paroxysmal cough and whoop, a kind of long noisy inspiration or crowing noise. This is also known by the name Pertussis, kink-cough and chin-cough. This usually attacks children and appears in an epidemic form. It is of a very distressing nature. The period of incubation is from 3 to 14 days, usually nearer the latter.

Cause

The disease is contagious from person to person and may also be spread by fomites. It is caused by a microbe the Bacillus pertussis which breeds on the membrane of the throat and nose. The virus or microbe is chiefly disseminated in the sputum.

Whooping-cough is most infectious in the first week and becomes gradually less so. One attack procures future immunity.

Symptoms

There are three stages of the disease. 1. Stage of invasion. The onset is either insidious or abrupt. The temperature in the latter case rises smartly to 100 degrees to 102 F. The symptoms are merely those of bronchial catarrh with coryza. This stage lasts from 7 to 10 days.

2. The second stage! Is the spasmodic or whooping stage. There are a series of short coughs or expiratory puffs with no intervening inspiration. Fifteen or more expulsive efforts are made in a short space of time. Then comes a deep prolonged inspiration attended with the characteristic whoop. There may be as many as 80 attacks in the twenty-four hours. This stage lasts three to six weeks.

3. The third stage is the period of deadline. This is marked by a gradual decrease in the number of paroxysms.

The disease lasts from six weeks to two months or more. Convalescence is slow and may be protracted over several months. Death from this disease is very rare.

The paroxysm consists of a series of rapid coughing, expiratory efforts followed by a long drawn loud whooping inspiration. During a single paroxysm there may be several expirations and inspirations. In the end a quantity of thick tenacious mucus is thrown out. Sometimes the patient vomits on account of the violence of the paroxysm.

In bad cases there may be twenty paroxysms in a day. The average duration of whooping-cough is about six weeks. The danger of infection lasts six weeks after recovery.

The onset is marked by a preliminary catarrh or running from the nose and sometimes the eyes. There is paroxysmal dyspnea or difficulty of breathing. The paroxysms of coughing are very characteristic. The force of the cough may cause blood-shot eyes, bleeding from the nose or from the ears and sometimes rupture of the drum of the ear and hernia.

Treatment

The patient should be isolated. Notification of all cases of whooping-cough should be insisted upon. This will prevent the spread of this disease. No drug is a specific. Good ventilation is necessary. Cold draughts should be avoided. Children exposed to infection should be isolated for at least three weeks.

Warm anodyne fomentations may be applied to the chest and back. Diaphoretics and purgatives are useful. The patient should be kept warm and get plenty of fresh air. A change of air, preferably to the seaside is often of great value.

Vomit and sputum should be carefully burnt. Bed sheets, clothing and bedding must be washed and exposed to sunshine.

The attack can be shortened if a vaccine is given in the early stage. The vaccine prevents infection among persons who have been exposed to it.

Antispasmodics like Belladonna chloral are useful. Creosote, carbolic-acid, vaporised in the sick-room have been proved useful. If recovery be tedious, change of air, cod-liver oil and Easton Syrup are beneficial.

The chest and the back should be daily rubbed with mustard oil or turpentine liniment or soap and opium liniment.

19. Tetanus or Lock-Jaw

Definition

This is a specific infectious disease due to the inoculation into a scratch or wound of the Bacillus Tetani whose chief habitat or abode is the earth and characterised by severe, toxic spasms of the muscles especially those of the jaw. Tetanus is caused by a wound, however trivial, into which the tetanus bacillus has entered.

Causes

Tetanus bacilli are found in decomposing fluids, in manure and dust, particularly in stable sweeping. The bacilli thrive in the soil, especially in the soil that has been contaminated by stable manure or horse droppings which form the most favourable breeding ground for it.

The natural habitat of the tetanus bacillus has been proved to be richly manured soil, specially the contents of dung.

Tetanus is most frequent after contused or punctured wounds of the hands or feet, but may result from the most trivial scratch. The organism multiplies in the wound only. The systemic effects are due to the absorption of the poison manufactured is the wound. This is a very virulent toxin which travels to the central nervous system.

The incubation period is from 2 to 20 days.

Symptoms

The disease usually commences with stiffness of the neck and about the jaws (Trismus) which are opened and closed with difficulty. There is often difficulty of swallowing. In some instances the disease does not proceed further and the patient may recover. But in other cases, in the course of a few hours or days, the jaws become firmly closed, constituting `lock-jaw'. There are spasms of the limbs and body. The patient is bent like a bow. He rests on his heels and the back of the head (opisthotonos). The body may be bent to either side (pleurothotonos). There may be bending forward of the body (emprosthotonos).

The spasms are set up by the slightest irritation, strong light, a mild touch, a sound, a movement in the room.

The eyebrows are elevated. The angles of the mouth are drawn out (risus sardonicus).

Acute cases usually die within a few days. More chronic and milder cases may recover. Tetanus may be local and confined to the muscles of the wounded limbs only if a prophylactic injection is given to the patient.

During the spasms the breathing is laborious, the skin is hot and bathed with perspiration. The patient may die from suffocation on account of spasm of the top of the windpipe (glottis) or prevention of breathing on account of the spasms of the muscles of the chest. Or he may die from exhaustion.

Treatment

Local treatment of the wound is necessary by excision, cautery or antisepsis. Chloroform, bromides, chloral hydrate are given for the spasms. The tetanus antitoxin gives good results. It is valuable both in removing an anticipated attack and in curing an actual attack. It must be given promptly. The anti-toxin unites with toxin and renders it harmless. The intravenous and intra-thecal methods (lumbar puncture) are the best.

The room must be darkened and all sources of irritation must be excluded. Food must be given by the rectum when spasm of the jaws is marked.

Hyoscine hydobromide gr. 1/100 is beneficial. Morphia is usually required for sleep.

20. Hydrophobia (Rabies)

Definition

This is an acute. Specific infection usually transmitted by the bite, of a rabid animal. It is due to inoculation by the saliva of an animal suffering from rabies.

Cause

The rabid dog is the chief transmitter of the disease by its bite or by licking an abrasion. The cat, wolf and fox may also transmit it. The Virus (Negri body) is in the saliva. The incubation

period is about six weeks. It does not follow that every one bitten by a mad dog must suffer from hydrophobia.

Symptoms

There is slight irritation in the wound. There are feelings of uneasiness with irritability of temper. Sometimes there is twitching of the muscles of the face. There are stiffness of the neck and difficulty of breathing. There is suffocative spasm when the patient tries to drink water. The spasms extend to the muscles of the whole body.

Wounds on uncovered parts are the most dangerous. The wound by which the poison was introduced rapidly heals and for a time nothing happens to attract the patient's attention to the scar. In about 6 to 8 weeks or so, the scar may become painful and nervous disturbances appear.

The patient is sleepless. Though the patient is very thirsty he is afraid to drink, as any attempt at swallowing brings on the spasms at once. Even the sound of running water will excite the attacks. Hence the name Hydrophobia. There is generally fever. The patient dies of exhaustion in 2 to 10 days after the development of the characteristic symptoms.

Treatment

The wound should be well washed. Caustic (carbolic acid, silver nitrate) should be applied to the wound. The patient should go at once to the Pasteur Institute, Kasauli or any general hospital for antirabic form of treatment. Any person bitten by a rabid animal can be saved if treatment within seven days is done after being bitten. The patient gets 7 to 14 injections in the abdomen.

21. Venreal Diseases

Syphilis, Gonorrhoea, soft sore or soft chanere come under this heading. Syphilis and gonorrhoea are widely prevalent throughout the world. They produce serious consequences. About six to eight per cent of the population of the towns are infected. They cause physical, mental and social degradation of the infected persons. They sap their health and vitality. They cause abortion, miscarriages, sterility and diseases of the heart, blood-vessels and the nervous system. Every public health scheme must include a campaign against venereal diseases. Venereal diseases are certainly preventable.

Those who suffer from venereal disease should take recourse to medical treatment immediately. They should not hide their disease on account of shame. Many suffer in silence for a long time and seek the aid of doctors only when the disease has become deep-rooted. This is a sad and terrible mistake indeed. No one should have intercourse with his wife till he is completely cured of the disease. It is a heinous unpardonable sin and crime to transmit the infection to innocent partner and offspring. A man with syphilis should not think of marriage without first consulting a medical man.

Syphilis

This is a specific infective disease of slow evolution and long duration due to the Spirochoete Pallida. It is transmitted by inoculation whether in sexual intercourse or otherwise (acquired syphilis) or inheritance (congenital syphilis).

Hunterian or constitutional syphilis is a constitutional disease. This starts as a superficial ulcer (hard chanere) at the seat of inoculation and runs a prolonged and indefinite course. It

is liable to break out anew during the whole life time of the patient without fresh infection even after many years of quiescence.

The incubation period varies from 3 to 5 weeks. The hard chanere is felt like a button embedded in the tissues. Shortly after the appearance of the hard chanere the lymphatic glands of the groin become enlarged, hard or shotty. A syphilite bubo does not usually suppurate.

Infection may be direct (sexual intercourse, finger of the accoucheur, tattooing, etc.) or mediate through contaminated instruments or drinking vessels, infected clothing, towels, razors, pipes, etc.

There are four stages in syphilis. The first stage is the development of hard chanere. In the secondary stage there are cuteneous lesions. There may be macules, papules, pustules etc. at the same time (polymorphism). They are symmetrical and are of a copper colour. The papules mature and pass on to pustular form. The undergoing tissues are eroded or ulcerated. The secretion dries to a crust and gets heaped up by deposit of successive layers forming what is known as a rupia.

Syphilis eruptions are not itching. The outline is circular. The tertiary stage (third stage) is characterised by the presence of gummata. There is marked anaemia or poverty of blood. There are deep ulcers which leave well-marked scars.

The bones are often affected. Periosteal nodes are common on the long bones. Profound arterial changes occur. Aneurysm, atheroma, cerebral thrombosis develop. Internal organs are affected. Bones, testicles, liver, heart, nose and larynx are affected. Locomotor ataxia is a manifestation of a quaternary stage of syphilis.

The secondary stage lasts for six months to a year. The tertiary or third stage follows it from a year to three or four years after infection. Tertiary lesions are obstinate and tend to relapse after treatment.

Treatment: The earlier the treatment, the better is the prospect of recovery. The most successful results are obtainable when treatment is commenced before the secondary symptoms appear.

Mercury is the sheet anchor in the treatment of syphilis. If the gums are affected, if salivation appears, mercury should be stopped for some time. Calomel ointment is useful in syphilitic primary sore. Salvarsan (606), Neosalvarsan (914), Sulfarsenol injections are highly beneficial. Blue ointment is rubbed into the skin daily.

The blood should be tested every six months for two years and courses of injections given if the Wassermann reaction proves positive.

Potassium iodide is useful in the later secondary and tertiary stage of syphilis.

Gonorrhoea

Definition: Gonorrhoea is an infectious inflammation of the urethra and in the female of the cervix also.

Cause: It is due to the presence of the gonococcus, a small bean-shaped diplococcus (germ) known as Neisseria gonorrhoea which was discovered by Neisser in 1879.

Gonorrhoea is a venereal disease due to gonococcus which enters the system through sexual contact. It is a very serious disease and causes great suffering. Women suffering from gonorrhoea may communicate the disease to children during child-birth. Accidental

contact of the discharge of a gonorrhoeal patient may occasionally also cause the disease. In man the urethral discharge, and in woman the urethral, vaginal and cervical discharges are infective. The infectivity may persist for a number of years.

Symptoms: Gonorrhoea is an acute infectious disease characterised by inflammation of the urethra, painful micturition, discharge of pus and a liability to certain complications such as opthalmia, endocraditis and arthritis.

The incubation period is 1 to 3 days. It may occur in either the male or female. It commences usually from the third to the sixth day after exposure with itching and redness of the opening of the urinary passage (the meatus) accompanied by a thin whitish discharge. In two or three days there are swelling of the private parts, severe scalding pain in making water, and a copious discharge of thick, yellowish coloured matter.

The disease is transmitted by sexual contact. New born children may suffer from opthalmia, neonotorum. The conjunctiva is infected by the maternal vaginal discharge.

The disease may spread. Inflammation of the ovaries, (Salphingitis), uterus (endometritis) and bladder (cystitis) ureters and kidneys may occur. The penis becomes hard and is painful (chordee). The testicles ache and become tender. The acute stage of gonorrhoea lasts about two or three weeks.

Gonorrhoea is a very obstinate and very persistent disease. Rarely persons die as a direct result of gonorrhoea. The infection lasts for years. Chronic ill-health and sterility are frequent consequences of the disease. Gleet or the last discharge of gonorrhoea may remain and ultimately cause stricture of the urethra.

Treatment: The patient should drink plenty of barley water, or potash water, to flush the urethral canal. All alcohol, spiced dishes and coffee must he avoided. Rest in bed is essential. The urethra should be irrigated with potassium permanganate in 8000 or flavine, or protagol. Pain may be relieved by fomentation or hot hip baths and chloral. Santal oil or copaiba or cubeb produces a soothing effect. Vaccine therapy is beneficial.

Control of Venereal Diseases

There should be a venereal disease division in the Ministry of Health. Those patients who suffer from venereal diseases should be treated in free venereal disease public clinics which are under the supervision of the venereal disease division. Then alone venereal diseases can be efficiently controlled. There should be free laboratory facilities for diagnosis and treatment.

The public should he educated. They should have a proper understanding of the nature and consequences of the venereal disease. Free tracts on this subject should be widely distributed. There should be frequent lantern-slide demonstrations and public lectures by the medical men. Good public health laws should be actively administered. Prostitution should be checked. Brothel houses should be abolished. Clandestine prostitution should be vigilantly watched, and checked. Prostitutes must be examined and efficiently treated. Certificates should be issued to them.

Prostitutes should be persuaded to give up this disgraceful profession and find out some occupations in which they can earn a decent living.

The public should have a knowledge of personal hygiene. The moral sense of people should be awakened. The moral fibre of people should be improved. People should know the importance and benefits of Brahmacharya, chastity, self-control or self-restraint and their responsibilities to society.

Hospitals should contain venereal experts. There must be a post graduate course in venerealogy for medical students. Women doctors should be equipped with sufficient knowledge in venerealogy in order to treat purdah women. There should be venereal clinics in all hospitals.

Every man or woman should understand through lectures given by doctors and women physicians the dangers of venereal diseases, the method of disinfection and the use of prophylactic methods.

Advertisements of quack medicines, treatment by quack doctors and publication of obscene books should be checked by legislation.

By the above methods venereal diseases can be checked and eradicated. The spread of infection can be successfully controlled. Medical prophylaxes will reduce the occurrence of venereal diseases to a very great degree.

22. Deliverance from Disease and Wretchedness

Poorly developed, emaciated, pale young men are increasing in number. They are assailed by diseases which plunge them under the dark waves of depression and wretchedness which make them reap bitter harvests of regrets and woes and they cry out for deliverance from this havoc-working disease and forlornness. A harmonious living, a joyful life of perfect happiness is possible only by maintaining good health and right thinking: abundance of joy can be radiated to others and strength can be added to the Nation by so doing.

To be virile and cheerful, to be free from disease, to have fullness of life and to laugh at illness, to build a healthy Nation of joyous and prosperous citizens, the public should be educated by imparting, in simple intelligible language, the nature and consequences and treatment of diseases. Every avenue of dissemination of this type of knowledge should be fully utilised. Knowledge of the diseases, their nature, their cure should be imparted through public lectures by medical men of rich practical experience. Movies also help very much in this direction. Good public health laws should be actively administered.

Many people are victims to the venereal diseases like gonorrhoea which is due to gonococcus which enters the system through sexual contact, and sometimes due to accidental contact of the discharge of a gonorrhoeal patient. Every man and woman should understand through lectures given by doctors and women physicians the dangers of venereal diseases, the methods of disinfection and the use of prophylactic methods. The public should have the knowledge of personal hygiene and they should live the ethical principles with a civic consciousness.

You should know the importance of Brahmacharya, chastity, self-restraint and your responsibilities towards the society. Your moral being should be awakened; your nature should be transformed and your living should be improved. You should harmonise your thoughts; you should hate none and love all; you should brood over nothing and be cheerful always; let nothing shake your inner peace and may you know the Lord of Bliss in your own heart, thereby, you shall see all the outward disorders and physical and mental diseases disappearing like mist before the sun.

Above all, if you truly desire your well-being, happiness and prosperity then enter into tune with the workings of the laws of nature and direct your thoughts towards God who is All-health, and All-strength. Daily concentrate your forces of mind upon God who is the Existence itself, who is the One Homogeneous Life of Perfect Harmony. Raise your arms towards the Divine Healer, the Physician of physicians, and He will deliver you from every sort of disease and lift you up into the realms of Radiant Health.

Even little faith in the Divine Being is quite enough to have your afflicted body soothed, to have your bruised soul healed and to save yourself from all kinds of ailings and sufferings. Know this for certain that the Divine Care is surrounding you on all sides and it is guarding you from all ills, evils and sins. Surrender yourself to the Divinity and lead a carefree life of longevity and felicity. Live the exhortation contained in this article and you shall have deliverance from disease and wretchedness and a diseaseless and deathless world of Plenum of Pleasure shall be revealed to you in this very world.

Chapter Eighteen

DISINFECTION

Disinfection means destruction of the specific germs of infectious diseases and their spores. Disinfectants or germicides are substances which destroy the germs which cause communicable diseases and prevent them from spreading.

Some chemical agents like boric acid, lime, etc., merely restrain the growth of disease-germs but do not destroy them. These are called antiseptics.

Deodorants oxidise products of decomposition and absorb or destroy bad odours. They fail as disinfectants. They simply conceal smells. They only act by overpowering one odour by the substitution of another. They are pleasant as deodorisers. Charcoal, camphor, Condy's fluid, potassium permanganate, eucalyptus, tar, vinegar, acetic acid, ammonia, etc., are deodorants.

There are some agents which act both as deodorants and as disinfectants. Condy's fluid, carbolic acid, chlorine gas, chloride of aluminium, nitrate of lead, izal are examples.

Fresh air and sunlight are the best natural disinfectants. They kill most germs. Sunlight is a potent germicide. The blue-violet or ultra-violet rays are powerful disinfectants. Direct sunlight will kill typhoid germs within half an hour. Tubercle bacilli are killed by the sunlight within a few minutes.

Disinfection is done in three different ways (1) by fumigation, (2) by the use of chemicals, (3) by heat.

Fumigation

Fumigation with sulphur is largely employed in India. This is an important method for disinfecting rooms, outhouses, railway carriages. The doors and windows should be closed. Joints and window cracks should be sealed with paper. The doors should not be opened until after at least six hours. Formaldehyde, chlorine gas and carbolic acid vapour have also been used.

Chemical Disinfectants

An efficient disinfectant must be a powerful germicide. It should not have any injuring effects on human tissues and materials submitted for disinfection. It should possess great power of penetration. It should neither be toxic nor caustic. An ideal disinfectant is not known.

Carbolic Acid

In the pure state it is a white or pinkish crystalline solid. The commercial acid is a thin tarry liquid. When the commercial acid is diluted with 5 parts of water, it may be used for washing furniture. It may be put in water in the proportion of half a pound to the gallon. This solution is used for steeping infected clothing. The solution is used in vessels for receiving the discharges of the sick. It is also useful for disinfecting urinals, latrines etc.

Lime

This is one of the cheapest and powerful disinfectant. Quick lime freshly burnt must be used. It can be used to purify water, to disinfect stools, floors etc. One part of small pieces of quick lime is added to two parts of water. One pint of this solution is added to a gallon of water. This milk of lime is used for disinfection.

Coal-tar Disinfectants

The coal-tar disinfectants are fifteen times more powerful than carbolic acid. They are cheaper and less poisonous. Phenol, Phenyl, Izal, Cyllin, Hycol, Creolin, Lysol are coal-tar preparations. They are efficient disinfectants.

Potassium Permanganate

It is a powerful oxidising agent. This is useful for the cleansing of cooking vessels and plates. Raw vegetables, salads, etc., should be washed in permanganate solution before being eaten raw. It is largely used for wells.

Formaldehyde

This is used as a vapour. This is a powerful disinfectant. It has a greater power of penetration. It does not bleach textiles or act on metals. Formaldehyde vapour is useful for disinfecting delicate articles such as fur, books, brushes, combs, woollen articles, etc. After fumigation all the doors and windows should be opened out to allow the gas to pass away.

Formalin Spray

This is a valuable disinfectant. It is useful for disinfecting cabinets, water closets, wardrobes, etc.

Heat

Heat is the best disinfectant. All clothing and bedding can be disinfected by heat. Boiling in water destroys all germs. Steam disinfections are highly useful. These are large air tight metal chambers. The articles are put in them. Steam is then forced into them under pressure till it permeates all the articles. Then steam is withdrawn. The articles are allowed to dry in the heat of the chamber. Then they are taken out. Now they are sterile and dry.

Chlorine kills germs within five minutes. Spores are killed within one hour. Chlorine is usually used in the form of chlorinated lime or bleaching powder. Bleaching powder is used for disinfecting rooms. Chlorine is liberated by the action of an acid (dilute sulphuric acid) on bleaching powder. The bleaching powder is moistened with water in a saucer, Chlorine is liberated in small quantities. Shut all doors, windows and ventilators when you disinfect a room.

Useless clothing and articles of little value used by patients should be immediately burnt. Other clothings should be immersed in solution of corrosive sublimate (1 to 2000) or carbolic lotion for 3 hours. Then they should be boiled for an hour in clean water. Afterwards they should be thoroughly washed with soap and then exposed for three days to the sun and air. If disinfectants are not available the time of boiling and exposure to the sun and air should be doubled.

All furniture should be well scrubbed with soft soap and hot water or washed with a mercuric chloride solution 1 in 1000 or chloride of lime 1 in 100. The walls should be treated similarly. Spraying with a hand pump or bamboo syringes will suffice.

Value of Practical Disinfection

Disinfection is the scientific, sanitary process of disinfecting by means of disinfectants, which destroy the disease-causing or pathogenic bacteria or germs.

The question of disinfection in diseases like typhoid fever, wherein it may arise that the case will have to be treated in a dwelling house seems to be all the more important. In addition to the ordinary precautions which should be observed in all cases of infectious disease—as (1) the isolation of the patient in room at top or in an isolated portion in the house, (2) the removal of carpets, curtains, bed linen, etc., from sick room, (3) the ventilation of house, (4) the keeping of a disinfectant saturated sheet suspended outside the door of sick room, (5) disinfection of cups, glasses, spoons, etc., used in a sick room, (6) the disinfection of bed and body clothing within the sick room before removal for washing, (7) instead of handkerchiefs the use of rags which can be burned when soiled, (8) the necessity for nurses or those in attendance on sick person besides wearing dresses made of cotton or other washable materials, performing no other duties in the house, (9) the exclusion of visitors, (10) the keeping of the children from school where that is desirable as a means of preventing the spread of the disease-will be necessary to impress upon those in attendance upon the patient, the great necessity for thoroughly disinfecting all faeces and urine with some reliable disinfectant before discharging the same in the water closet. Solution for use in above cases is half an ounce of corrosive sublimate, one fluid ounce of hydrochloric acid, and five grains of aniline blue in a bucket of water for disinfection of stools, urine, saturation of clothing etc., before removing to steam disinfector. Cyllin is an effective disinfectant and is devoid of any injurious effects on clothing, metals, etc. It is used in two strengths, viz., one part of disinfectant to 160 parts of pure water, and 1 part of the disinfectant to 320 parts of water The excreta and vomit of a cholera patient which contain the cholera vibrios, must not be

indiscriminately thrown about. They should be received in a bed pan containing some disinfecting lotion as Carbolic 1 in 20, corrosive lotion 1 in 1000, and then buried in a place far from contamination of a water supply or mixed with saw dust and burnt afterwards.

Consumptive patients should not be allowed to spit indiscriminately. They should be taught the danger of such infection. The sputum gets dried and is thrown about as pulverised atoms in the air and anyone who swallows these pulverised atoms which contain the tubercle germs of consumption is quite prone to contract this fell disease. It is by the careless action of ignorant consumptive that lives of many others are endangered. To obviate this difficulty sputum should be carefully collected in a spittoon containing some disinfectant carbolic or corrosive lotion and dealt with either by burial or burning after treating with saw dust.

Small-pox Disinfection

The disinfection of bedding, books, harness, saddlery, etc., after small-pox should be considered next. The bedding etc., should be removed to the disinfecting station, if one is provided by the health authorities and the mattresses, bedding, etc., disinfected by means of steam. Blankets are placed in a tank containing a solution of disinfectant, as steam has a tendency to fix indelibly any stain which may be present and also to alter the colour and texture of the blankets. After being steeped for from 15 to 30 minutes they are removed and taken to the laundry, where they are washed and dried. Books, unless valuable, should be destroyed. Valuable books may be disinfected by being subjected to formalin vapour generated by means of an alformant lamp, books, harness and other leather goods are well washed in a 5 per cent solution of formalin. Blankets should never be boiled. Books cannot be disinfected with any degree of efficiency or certainty. If every leaf could be separated from each other formalin vapour would be very effective. Harness and saddlery cannot be subjected to steam or wetted with any disinfectant solution without causing damage to it. They should be exposed to the action of formalin vapour generated in a small close chamber.

Disinfection of an infected room can be effectively managed with sulphur fumigation. The quantity of sulphur required will be 1 lb. for every 1000 cubic feet of air. Prior to fumigation, all the windows, and doors should be closed very tightly. The necessary quantity of sulphur is placed in a sauce-pan or some iron vessel which should be placed in a large bucket of water to avoid the risk of a conflagration. The sulphur should be lit and the person who ignites it must immediately leave the room after closing the door. The room should be left undisturbed for hours and afterwards the doors and windows should be kept open for 24 hours.

Nature's Disinfectants

It will not, doubtless, be out of place to mention here about the action of disinfectants found in nature. Sunshine is the most marvellous health-imparting and healing power in the world, and the sun's rays are destructive to all kinds of germs when exposed directly. Bedding, bed sheets, pillows and all soiled clothing can be efficiently disinfected after washing by prolonged exposure to the direct rays of the sun. If you turn to the other side, the atmosphere itself is a potent disinfectant by its power of oxidation. Then comes water, which is an equally efficient natural disinfectant. Every shower of rain, every river and stream removes from the land certain amount of substances which are undergoing putrefaction.

Chapter Nineteen

CLIMATE AND METEOROLOGY

Climate

The climate of a place or region is the sum total of all the meteorological conditions in their relation to animal and vegetable life. It is the average condition of the atmosphere. Weather is a single occurrence or event in the series of conditions which make up climate. The climate and temperature in the tropical and subtropical regions are governed largely by the amount of humidity in the air, the altitude, distance from the sea, prevailing wind, nature of the soil, proximity of mountains and hills, rainfall, presence of marshes, tanks and presence or absence of forests.

The climatic conditions have an important effect on health. Climate is an important factor in finding out the characteristics of the races of mankind. A dry climate and the incessant struggle between man and nature have produced a race, brave and hardy, with good physical development.

Meteorology

Meteorology is the science of the phenomena of the atmosphere. It includes atmospheric pressure, humidity and temperature, winds and their causation, velocity and direction and rainfall.

Various meteorological conditions have an important influence on climate and health. Of that atmospheric pressure, humidity and temperature demand special consideration.

(a) Atmospheric Pressure: The atmospheric pressure is determined by means of a barometer. The mercury in the tube will fall when the pressure is diminished as in mountain ascents and will rise with an increase. The pressure is 15 inches on a mountain 15,000 ft. high.

(b) Humidity: There is always in the air a great or less amount of moisture. This is the humidity of the atmosphere. The amount of moisture which the air can hold varies considerably with the temperature, with the season and with the elevation and position. A hot atmosphere can hold much greater quantity than a cold one. When the atmosphere at a given temperature contains as much moisture as it can hold it is said to be saturated.

The amount of moisture in the air varies greatly in different countries and even in the different parts of the same countries and very remarkedly so in India. In some districts of India the air is saturated. In some dry sandy deserts the air is very dry and the skin even cracks. Dry climates are preferred. Some delicate people enjoy better health in hot, moist climates. Moist climates are less healthy than dry ones, as moist air favours the growth and development of microorganisms. Putrefactive changes take place more readily in moisture than in dryness.

The temperature at which air begins to deposit its moisture is known as dew point. Hygrometer is an instrument by which the amount of moisture in the atmosphere is ascertained.

(c) Temperature: The temperature of the atmosphere varies greatly in different countries. It also varies with the season of the year and time of day. In spite of these variations the temperature of the human body in a state of health is maintained at an almost constant level (98.6 degrees F). If the temperature of the atmosphere rises, the temperature of the body rises to a small extent. Perspiration is the chief means by which the temperature is kept at its normal level. Radiation and conduction of heat also help considerably. Temperature is recorded by a thermometer. Temperature has an important bearing on the production of certain infectious diseases. The malaria parasite ceases to undergo development in the stomach of the mosquito when the mean temperature remains permanently below 16 degree C.

The temperature of the air of a particular place varies. The principal causes which modify the temperature are latitude of the place, its height, direction of the wind and proximity of the sea.

Thermometers which are specially constructed to record the lowest temperature of the atmosphere in a given period of time are called minimum, and those constructed to show the highest temperature in a given period of time are called maximum thermometers. There are thermometers for ascertaining the temperature of hot water used for bathing and other purposes. There are also shade and sun thermometers.

The most vigorous races are produced in places where the temperature is changeable and the difference between hot and cold seasons is great. In places where there is equable temperature weak and languid races are found.

(d) Winds: Wind is the effect of disturbance of equilibrium constantly proceeding in the freely mobile atmosphere. The causes of these disturbances are differences in atmospheric pressure brought about by changes in temperature and moisture, helped by physical and other factors. Hot air is light. Therefore it rises up and escapes. Heavy cold air rushes in to take its place and thereby causes strong draughts. Winds are caused in the same way. The chief agency is the sun's rays which heat the temperature of certain portions of the earth's surface during its rotation, while other portions are unaffected by them and remain comparatively cold.

The velocity of the wind depends upon the differences in the atmospheric pressure and varies from a scarcely imperceptible movement to a velocity of 70 miles amounting to what is called a hurricane.

Anemometers are small instruments by which the velocity of the wind is determined.

The north-east and south-west trade winds are set in motion by the movement of the earth and are due to the constant movement of cold air from the poles, replacing the heated air of the tropics. The south-west monsoon is a season of winds of oceanic origin of high humidity and of frequent and heavy rain over nearly the whole of India. This monsoon lasts from July to October. The north-east monsoon is of continental origin and is therefore dry.

(e) Rainfall: The distribution of rain is an important factor in regulating the climate of a place. A fair conception of the general character of the climate can be made from the amount of rainfall.

Rain is caused by currents of cold air coming in contact with warm, moist air or when the warn. moist air comes in contact with the tops of cold mountains. The heavy rain during the south-west monsoon in India is caused by condensation of the moisture in the hot moist winds blowing from the Indian Ocean coming in contact with the cold mountains along the west coast.

The rainfall varies greatly in the different countries and parts of the same country. The rainfall in some parts of India may not exceed 60 inches in the year, while on the Assam hills 600 inches may fall yearly. There may be no rainfall at all in certain places throughout the year. The quantity of rain decreases with the distance from the sea and increases with the height above sea-level.

The level of the ground water depends largely upon the amount of rainfall and the health of the people to a very great extent upon the depth of the ground water level.

The amount of the rainfall is ascertained by collecting the rain in rain-gauges and measuring the quantity collected in a given time.

(f) Clouds: A cloud is a mass of vapour condensed into minute water particles which float in the air. A mist is a cloud near the ground. A fog is a cloud which rests on the earth. A cloud is a fog at greater height, one to four miles above the surface of the earth.

Chapter Twenty

VITAL STATISTICS

Statistics is a collection of facts and figures regarding the condition of a people, class etc. Vital statistics is the science of numbers applied to the life history of communities. It treats of population, birth, marriage, sickness, death, etc. A complete enumeration of the population and also the registration of causes of births and deaths, according to age, sex form the basis of vital statistics.

The registration of births and deaths should be kept correctly. Then alone the vital statistics can be efficient and accurate. The authorities should take suitable action if people fail to send a report of births and deaths in their houses. People hide the real cause of diseases in

order to escape sanitary measures. All cases of death accompanied by a rise of temperature are ascribed to fever. Hence the statistics of the cause of diseases are not correct and very accurate.

Statistics of incoming and outgoing registers, V.P.s, parcels and money orders are taken in a Branch Post Office before it is raised to the status of a sub-office. This statistics will clearly show the income of the branch office. Even so the vital statistics indicate the health of the nation, the rate and extent of mortality and its causes, of infants, children and adult males and females, whether the population of the country is increasing or decreasing etc., in a series of years. Infantile mortality gives an index of the sanitary condition of the place and also of the density of population.

Statistics are kept in all Government offices and meteorological stations. This helps the comparative study of conditions in the past years. Statistics give the index of growth and harmony of the State and institutions.

Deaths must be registered within three days. The certificate of death must be issued by a registered medical practitioner or the attending doctor. Births should be notified within 36 hours.

In India the first census was taken in 1872.

The birth rate is found out as follows: The number of births in one year is multiplied by 1000 and divided by the population. Suppose there are 500 births in a year and the number of population is 20,000. The birth rate is 50 x 1000 divided by 20000. The birth rate is 25 births per 1000. Death rate is also calculated in the same way as the birth rate.

Book Two

ANATOMY

ANATOMY

Anatomy refers to the structure of the body. It is divided into the following branches:

Osteology is the anatomy of bones.

Syndesmology is the anatomy of the joints.

Myology is the anatomy of the muscles.

Angiology is the anatomy of the vessels.

Neurology is the anatomy of the nerves.

Splanchnology is the anatomy of the internal viscera.

Adenology is the anatomy of the glands.

Dermatology is the anatomy of the skin.

Genesiology is the anatomy of the generative organs.

GENERAL STRUCTURE OF THE BODY

The human body is separable into head, trunk and limbs. In the head the brain-case or skull is distinguishable from the face. The head consists of the skull and the face and is connected to the trunk by the neck. The trunk is naturally divided into the chest or thorax and the belly or abdomen. Of the limbs there are two pairs: the upper or arms and the lower or legs. Legs and arms are again subdivided by their Joints into thigh and upper arm, leg and forearm, ankle and wrist, fingers and toes.

The arm, the forearm and the hand of a forelimb correspond to the thigh, the leg and the foot of a hind-limb.

The larger, hinder or lower part of the trunk called the abdomen is soft. The smaller front or upper part of the trunk between the forelimbs called the thorax is firm. In the sides of the thorax, bones, the ribs, passing from the back towards the front can be distinctly felt. In the front of the thorax, in the middle, is the firm bone, the sternum to which the ribs pass. The vertebral column or spinal column. A chain of bones which can be bent to a small extant in various directions runs down the middle from the head to the coccyx. The ribs pass from the vertebral column to the sternum. The intercostal muscles are attached to the ribs.

There is a muscular partition called the diaphragm between the thorax and abdomen.

The liver with its gallbladder, the stomach, the small and large intestines, the pancreas and the kidneys and the spleen are found in the abdomen.

The heart and the two lungs, are contained within the thoracic cavity.

A white soft spinal cord runs along inside the vertebral column. The spinal cord is continuous above with the brain. From the brain and spinal cord the nerves which go to all parts of the body arise.

The cranial cavity contains the cerebrum, cerebellum or hind brain, pons varolii and the medulla oblongata.

The pelvic cavity contains the bladder or reservoir for urine, rectum and the generative organs in the female (uterus, ovaries, the fallopian tubes).

The bones represent the bricks and stone of a house. Flesh, fat, correspond to the small pieces of stone and broken bricks. The connective tissues represent chunna or lime. The skin corresponds to the final cement coating. The Immortal Soul or the Indweller is the Proprietor of this house.

The arteries and veins are connected with the head. Aorta is the largest artery which carries the blood from the heart to the different parts of the body.

The inferior vena cava brings the impure venous blood from the lower limbs and lower part of the trunk through the diaphragm back to the heart. Above the heart there is another large vein which brings the venous blood back from the head and upper limbs. This is the superior vena cava.

The muscles are fixed to the bones by tendons. Between the muscles are blood-vessels and delicate white cords called nerves. The muscles, blood-vessels and nerves are lightly bound together by a delicate tissue called the connective tissue.

The mouth, the pharynx or the throat, the oesophagus or gullet lead to the stomach, the reservoir for food. The larynx or wind-box, trachea or windpipe and the two bronchi lead to the lungs.

The human body is the most marvellous, most astounding and the most delicate machine in this world. No scientist can manufacture such a body in his boasted laboratory. You are struck with wonder and become dumbfounded if you think for a while seriously in silence about the harmonious functioning of the different organs, its structure.

The Creator of this wonderful machine is the Lord. This body is His moving temple. Glory to the Lord! Adoration to the Lord! Prostrations unto the Lord, the Wonder of wonders! Inexpressible, ineffable, unthinkable, unimaginable, incomprehensive, Supreme Being and yet the most simple, direct Truth, who dwells in the chambers of your heart, who is closer to you than your nose or the jugular vein. May His blessing be upon you all.

THE SKELETON

The bones are the principal organs of support, They are the passive instruments of locomotion. They form a framework of hard material, afford attachment to the soft parts and maintain them in their due position. They protect the internal organs and other tissues of delicate structure, give stability to the whole fabric and preserve its shape.

The entire skeleton in the adult consists of two hundred distinct bones. They are:

Cranium	8
Face	14
Hyoid	1
The vertebral column	26
Sternum and ribs	25
Upper extremities	64
Lower extermities	62
Total	200

The Patellae or knee caps are included as separate bones. The smaller sesamoid bones and the small bones of the middle ear, namely, malleus, ineus and stapes are not included.

Bones of the Head

Occipital bone	1
Parietal bones	2
Frontal bone	1
Temporal bones	2
Spheroid or wing bone	1
Ethmoid or sieve-like bone	1
Total	8

Bones of the Face

Nasal	2
Lachrymal (tear)	2
Malar (cheek)	2
Palate	2
Maxilla (upper jaw)	2
Mandible (lower jaw)	1
Vomer (plough share)	1
Inferior turbinated (scroll-like)	2
Total	14

Bones of the Upper Limb

Collar bone	1
Humerus (arm bone) Fore arm	1
Ulna	1
Radius	1
Scapula	1
Carpal (wrist bones)	8
Meta Carpal (or fingers)	5
Phalanges	14
On each side	32
Total	64

Bones of the Loweer Limb

The pelvic girdle	1
Thigh bone (femur)	1
Knee cap or patella	1
Shinbone or tibia	1
Buckle bone or fibula	1
Ankle bone or tarsus	7
Instep bone or Meta tarsus	5
Phalanges or toe bones	14
On each side	31
Total	62

The Vertebral Column

The vertabral or spinal column is the bony axis of the body. It consists of distinct bones, called vertebrae placed one upon another. The vertebral column is divided with regions as follows:

(1) The cervical region or region of the neck, consisting of seven vertebrae.

(2) The thoracic region or region of the thorax, consisting of twelve vertebrae.

(3) The lumbar region or region of the loins, consisting of five vertebrae.

(4) The sacral region, consisting of five vertebrae united together to form a single bone, the sacrum.

(5) The coccygeal region, consisting of four imperfect vertebrae often united together into one bone called the coccyx.

JOINTS

The various bones of which the skeleton consists are connected together at different parts of their surfaces. Such connections are called articulatias or joints. The bones are joined to each other by muscles, tendons and ligaments. Joints are immovable, slightly moveable and freely moveable. Immovable joints are in the skull where the bones are immovably interlocked with each other.

Moveable joints are of four kinds. (1) Gliding joint allowing a slight amount of movement such as the joint of vertebrae. (2) Hinge joint allowing backward and forward movement as in elbow, knee, fingers, toes and ankle. (3) Ball and socket joint allowing movement in all directions as between scapula and humerus (shoulder joint) and also in hip joint. (4) Pivot joint allowing movement of rotation only as atlas on axis or radius on ulna. The joint is moist with a fluid called the synovial fluid which makes easy movement possible.

The various joints are the shoulder joint, the hip joint, the knee joint, elbow joint, wrist joint, neck joint.

THE MUSCLES

The chief use of the muscles is to cause movement of the body. You work through the muscles. Muscle is more highly specialised than connective tissue. Muscle constitutes the fleshy parts and forms a large proportion of the weight of the whole body. The skeleton of an adult forms 28 pounds; muscles 62 pounds; blood 12 pounds; organs with skin, fat etc., 48 pounds.

Muscular tissue is irritable. If you irritate or stimulate it, it will respond. It will show its response to the stimulation by contracting. This power of the muscle to contract is called muscular contractility. All muscular tissue consists of fibres. Influences which irritate or stimulate muscle fibres, are called stimuli and are usually of nervous origin.

The function of the muscles is to contract so that their two ends are drawn together, and a movement is thus produced which by various systems of levers can be converted into the particular form of motion required. For example, the contraction of the muscles of the calf draws the heel upward, and in this way causes the whole body to be elevated on the toes.

In order to bring about a muscular contraction the muscle must be stimulated. The way in which a muscle is normally stimulated is through its nerve, which conducts the nerve impulses from the central nervous system to the muscle fibres. Arriving at the latter, the nerve impulses bring about the complex chemical changes upon which the contraction of the muscle depends. When the nerve impulses cease, the muscle relaxes again:

The muscles are of two kinds, voluntary and involuntary. Voluntary muscles; are those which obey your will. Involuntary muscles are those over which you have no control. You may raise or lower your hands at will. The muscles of the hands obey your will. But you cannot make the heart or lungs or the stomach act as you may like to direct. The heart and the stomach are made of involuntary muscles The muscles of respiration are both voluntary and involuntary.

The voluntary muscles are attached to bones. They are striped or striated. The heart muscles though involuntary are also striated. The plain or non-striated is often termed involuntary muscle.

The striped muscles are saturated with a thick semi-fluid substance which can be squeezed out of living muscles and are called muscle plasma. This fluid clots like blood outside the body. It contains a substance called myosin. This substance becomes hard on the death of the muscle. Therefore, the body becomes stiff after death. This condition is called rigor mortis. After some time decomposition sets in. The muscles become soft and the stiffness of the body goes away.

Muscles may be classified according to their functions. A flexor is a bending muscle which bends the limbs. For example a flexor biceps pulls the forearm to the shoulder. An extensor is a straightening muscle which extends or straightens the limbs. The triceps is an extensor, that extends the arm. An adductor draws two parts together such as the one bringing the upper arm close to the trunk. The extensor muscles of the arm lie on the outer and posterior sides of the upper arm and the flexor muscles on the inner and front sides. The muscles of the inner side do the bending of the hand and fingers, those of the outer side extend and straighten them. The functions of the muscles of the lower limbs are also similar.

The Pronators turn the palm of the hand backward and when the elbow is flexed, downwards or prone. The supinators turn the palm of the hand forward and when the elbow is flexed upwards or into the supine position.

The ends of the muscles are attached to the bones by ligaments. Tendons are narrow, strong white glistening fibres. They look like strong jute ropes which form the terminals of muscles before they end in a ligament attachment with the bone.

Some Important Muscles of the Body

The total number of voluntary muscles may be stated as about five hundred. We may conveniently classify these in four groups.

1. Chief muscles of the head, face and neck.

2. Chief muscles of the trunk.

3. Chief muscles of the upper extremities.

4. Chief muscles of the lower extremities.

The chief muscles of the head are the occipital and frontal muscles. By contraction of the frontal muscles the eyebrows are elevated, the skin of the forehead is thrown into transverse wrinkles and the scalp is drawn. Forward.

There are about 30 facial muscles. They are chiefly small. They control the movements of the eye, nose and mouth.

Six Muscles of the Eye-ball

They are the four straight or recti and the two oblique muscles. These muscles turn the eye-ball in various directions.

Muscles of the Neck

Sterno-cleido-mastoid is the most prominent muscle of the neck. It flexes the head androtates the face to the opposite side. If this muscle is abnormally contracted or paralysed, you get the deformity called wry-neck.

Muscles of the Back

The two largest muscles ale the trapezius and the latissimus dorsi. They elevate the shoulders, move the arms and assist to draw the body in climbing.

Muscles of the Chest

The pectoralis Major and the Pectoralis Minor which is underneath the pectoralis major are the important muscles of the chest. These muscles move the arm.

Muscles of the Thorax

The muscles of the thorax are chiefly concerned with the movement of the ribs during respiration. They are the intercostals which fill the space between the ribs and Ievatores costarum.

The action of the external intercostal is to pull the ribs upward, thereby increasing the chest cavity the action by the internal intercostal is to depress the ribs. The action of levatores costarum (lifters of the ribs) is to elevate the first ten ribs and to draw the lower ribs backward with other muscles.

Diaphragm

The diaphragm is a thin musculo-fibrous partition placed obliquely between the abdominal and thoracic cavities. It is dome-shaped. It has three large openings for the passage of the aorta, the large artery of the body, the inferior vena cava, one of the largest veins of the body and the oesophagus or gullet. The diaphragm supports the heart and the lungs. The action of the diaphragm modifies considerably the size of the chest and the position of the thoracic and abdominal organs. It is essentially the great respiratory muscle of the body. It is an expulsive as well as the chief respiratory muscle of the body.

Muscles of the Abdomen

External oblique, internal oblique, rectus abdominis and transversalis are the muscles of the abdomen. Rectus abdominis is a long flat muscle extending along the whole length of the abdomen. It is this muscle that the Hatha Yogi brings in front in the Nauli Kriya and uses it for churning the abdomen.

Muscles of the Upper Extremities

They are Deltoid, Biceps and Triceps.

Deltoid is a coarse triangular muscle that covers the top of the shoulder. It raises the arm from the side so as to bring it at right angles to the trunk. It gives to the shoulder a rounded outline.

Biceps: When you fold your arm it is the biceps which contracts. It occupies the whole of the anterior surface of the arm. When the biceps contracts the forearm is raised. It is divided above into two portions or heads. Hence its name biceps.

Triceps: This is situated on the back of the arm. It is divided above into three heads. Hence its name triceps. It is the great extensor muscle of the forearm, and is the direct antagonist of the biceps. For bringing the arm to an extended position the triceps is contracted and the biceps relaxed.

Muscles of the Buttocks

Gluteus maximus, gluteus medius and gluteus minimus form the muscles of the buttock. These muscles support the trunk upon the head of the femur. They bring the body into the

erect position when the trunk is bent forward upon the thigh. They serve to move the thigh and in conjunction with other back muscles help to hold the body erect.

Psoas Magnus is the great loin muscle. Its action is flexion and external rotation of the thigh.

Muscles of Thigh

Hamstring muscles: They cover the back of the thigh. These muscles are the biceps. The semitendionsus and the semimembranosus. The biceps is somewhat analogous to the biceps covering the front of the arm. The action of these muscles is to flex the knee and to extend the thigh. It acts in opposition to Quadriceps.

Quadriceps: This is a four headed muscle that covers front of the thigh. It is analogous or similar to the triceps covering the back of the arm. Rectus femoris, vastus externus, vastus internus and vastus intermedius constitute the quadriceps. Each head is described as a separate muscle.

The quadriceps is the great extensor muscle of the leg.it straightens the leg. It also flexes the thigh and antagonises the action of the hamstring muscles.

Biceps femoris: This is an important muscle of the thigh which serves to flex the knee.

Sartorius: Sartorius or tailor's muscle is a long ribbon like muscle. It is the longest in the body. It is supposed to be the muscle principally concerned in producing the posture assumed by the tailor in sitting cross-legged, and hence its name.

Internal femoral: The internal femoral or adductor muscles occupy the internal portion of the thigh. They are all adductors of the thigh.

Muscles of the Leg

The gastrocnemius and the soleus, the flexors and the tibialis posterior cover the back of the leg.

Gastrocnemius and soleus form the calf of the leg. The muscles of the calf possess considerable power. They are constantly called into use in standing, walking, dancing and leaping, therefore, they usually present a large size.

The gastrocnemius and soleus are inserted into a common tendon, the tendon of the heal (Tendo Achilled). Which is the thickest and strongest tendon in the body, which ends in the heel bone, Osalcis. The action of the tibialis anterior and one of the three peroneal muscles (peroneus tortious) is to flex the ankle, while the action of the tibialis posterior and the other peroneal muscles (perones longus, peroneus brevis) is to extend the ankle. The flexors and extensors act the toes.

CAVITIES OF THE BODY

The cavities of the body are: (1) Thoracic cavity, (2) Abdominal cavity, (3) Cranial cavity, (4) Pelvic cavity, (5) Buccal cavity, (6) Nasal cavity.

Thoracic Cavity

Thoracic cavity or chest contains the trachea or wind-pipe, lungs, oesophagus or gullet, heart and the great vessless springing from and entering into

Abdominal Cavity

The abdominal cavity contains the stomach, liver, gall-bladder which is the reservoir for bile, pancreas, spleen, kidneys, small and large intestines, etc.

Cranial Cavity

The cranial cavity contains the cerebrum, the cerebellum, pons varolu and the medulla oblongata.

Pelvic Cavity

The pelvic cavity contains the bladder which is the reservoir for the urine, rectum and in the female the generative organs (the ovaries, the uterus and the fallopian tubes, etc.)

Buccal Cavity

The buccal cavity is the mouth which contains the tongue, teeth, salivary glands, etc.

Nasal Cavity

The nasal cavity contains the organ of smell.

TISSUES OF THE BODY

A collection of cells of like substance arranged together forms a tissue. There are several kinds of tissues in the body.

(1) Epithelial or covering tissue; (2) Connective or binding tissue; (3) Muscular tissue or flesh; (4) Nervous tissue or message carrying tissue; (5) Blood and blood vessels or liquid tissue and (6) Bony tissue.

Some organs are formed of a combination of several of the above tissues. Others contain only one or two. Thus the muscles are made up almost entirely of muscular tissue with only a small inter-mixture of connective tissue, blood vessels and nerves. The ligaments or sinews are composed wholly of a variety of connective tissues.

Epithelial Tissue

This is composed of layers of cells placed in close apposition. It is found in the outermost coating of the skin, in the lining membrane inside the windpipe, gullet, stomach and the intestine. It lines the ducts of glands also.

Connective Tissue

This tissue serves to connect and support the other tissues of the body. It lies underneath the skin between the skin and the muscle. Bones and cartilages, blood and blood vessels are included in the connective tissue. Fat of the body is only connective tissue, the cells of which are full of fat.

Areolar tissue, fibrous tissue, elastic tissue adipose tissue, reticular tissue, lymphoid tissue, cartilage, bone or osseous tissue are all connective tissues only.

Muscular Tissue

This tissue lies underneath the skin. It is separated from the skin by fatty and connective tissue. It fills the space over or between the bones and helps articulation and motion. It is fixed to the bones by tendons. It is thick in the middle and tapers at ends.

Nervous Tissue

There are delicate white cords between the muscles. They are called nerves. They serve the purpose of carrying messages or sensations from and to the brain.

Blood

This contains a fluid called plasma. It contains minute bodies called corpuscles which are red and white. It builds up the body.

Bony Tissue

It is the hardest tissue matter in the body. It contains in its hollow cavity a substance called marrow which produces red blood corpuscles.

Book Three
PHYSIOLOGY

PHYSIOLOGY

Physiology is the science which deals with the functions of the various parts of the body. It teaches us to what use the organs are put. It shows what an organ does. It can be studied only upon the living creature.

The human body is composed of different kinds of tissues viz., muscular tissue, nervous tissue and bony tissue. When a tissue is examined under a microscope, it is found to consist of a number of units called cells. A cell consists of a living substance called protoplasm, nucleus, etc. A protoplasm is endowed with the power of movement, power of assimilation, power of growth, power of reproduction and power to excrete. Albumin, sugar, fat, common salt, water are contained in the tissues. The chief elements found in the body are oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, chlorine, sodium, potassium, calcium, magnesium, iron, etc.

THE CIRCULATORY SYSTEM

This is made up of a powerful muscular pump called the heart and a series of tubes called blood vessels. The heart contracts and drives the blood into the aorta the biggest artery. Aorta divides into smaller and smaller vessels. The blood is carried to every part of the body. The vessels or tubes which carry the blood from the heart are called arteries. The arteries carry pure oxygenated blood for nourishing the tissues. Another series of vessels called veins carry the blood back to the heart. The arteries and veins are connected in the tissues by a very fine network of the finest blood vessels called capillaries.

The blood supplies the nutriment to all the organs and tissues. It takes from them their waste products and finally returns by the veins, to the heart loaded with useless and injurious excretions viz., carbonic acid, urea, etc.

The heart contains four chambers, two on the right side and two on the left. There is no communication or connection between the two sides. The left side of the heart pumps blood into the limbs and all over the body except to the lungs. This blood is returned to the right side of the heart by the superior vena cava and inferior vena cava the biggest veins. The superior vena cava takes the venous blood from the head, neck and upper extremities. The inferior vena cava takes the venous blood from the lower extremities and trunk. The venous blood is driven from the right ventricle to the lungs for the purpose of aeration, oxygenation and purification. From the lungs it flows back to the left side of the heart. The pure oxygenated blood is returned by the pulmonary veins to the left auricle. The left auricle now contracts and forces the blood into the left ventricle. It is ready now to be sent to the limbs again. A drop of blood takes twenty-two seconds to make this circuit. During each contraction the ventricles pump about six ounces of blood.

THE HEART

The heart is a hollow muscular organ, situated in the thorax between the lungs, behind the sternum. It is conical in shape and muscular in nature and contains four chambers. The side of the heart is usually roughly estimated as equal to that of the closed fist of the person to whom it belongs. Its base is directed upwards, backwards and to the right. The apex points downwards, forwards and to the left. The beating of the heart is felt in the space between the fifth and sixth ribs, a little below and to the inner side of the left nipple.

If you put your ear or the stethoscope to the chest of a person you will hear sounds like "lupp dupp". It is the sound of the beating of the heart. The heart drives the blood into the great blood-vessels with each beat. The heart is the central pump in the circulatory system. It has no piston. The thick fleshy walls of the heart contract, meet one another and squeeze every drop of blood out of it.

The interior of the heart is lined by a delicate smooth membrane called the endocardium. The heart is covered by a membranous sac called the pericardium. The main substance of the heart is composed of muscular tissue and is called myocardium.

The Cavities of the Heart

The heart is divided from the base to the apex by a fixed partition into a right and left half. The right always contains impure venous and the left side pure arterial blood. Each half is subdivided into two cavities, the upper called auricle and a lower ventricle. These cavities communicate with one another by means of constructed openings, the auriculo-ventricular orifices which are protected and guarded by valves. Tricuspid valve guards the right auriculo-ventricular opening. It has three cusps or flaps. The bicuspid valve with two cusps

or flaps guards the left auriculo-ventricular openings. These valves allow the blood to pass only from the auricle to the ventricle, but not in the opposite direction.

The pulmonary artery arises from the right ventricle. It takes the impure blood from the right ventricle to the lungs for purification. The aorta, the biggest artery arises from the left ventricle.

The left side of the heart is a much more powerful pump than the right side. It has much thicker walls as it has much harder work to do. The left side of the heart has to pump the blood uphill. It has to send the blood to every part of the body up into the head and neck also.

The Beat of the Heart

So long as life lasts the muscular tissue of the heart contracts and relaxes unceasingly with a short interval of rest. The heart is a muscular pump. At first there is a simultaneous contraction of the walls of both auricles. Immediately following this there is a simultaneous contraction of the walls of both ventricles. Then comes a pause or state of rest. After this the auricles and ventricles contract again in the same order as before. Their contractions are followed by the same pause as before. The state of contraction of the auricle or ventricle is called its systole. The state of relaxation during which it undergoes dilation is called diastole.

Listen to the beat of the heart of a person by putting the ear against the chest in the region of the heart. Two sounds are heard. The first is dull and long, the second short and sharp. The two sounds may be likened to the syllables "lupp dupp". The first sound is caused by the contraction of the ventricles and the closure of the auriculo-ventricular valves. The second sound is caused by the closure of the semilunar valves of the aorta and the pulmonary artery. These sounds in certain diseases of the heart become changed and obscure and are replaced by various distinctive and characteristic sounds called murmurs.

The heart beats about 72 times a minute. The rhythmical succession of the systole and distole constitutes a cardiac cycle and occupies 0.8 of a second.

LYMPHATIC SYSTEM

Part of the plasma of the blood passes through the thin walls of the capillaries. The walls of the blood capillaries are exceedingly thin. The fluid which exudes from blood-vessels is called the lymph it bathes the tissues and brings the nutritive material actually to the cells.

Lymph is a colourless fluid. It is like blood plasma in composition. When shed, it clots like blood plasma. It consists of water containing proteins, salts and other substances in solution. It contains colourless corpuscles like those of the blood, but no red ones.

The lymph lies in spaces between the cells of the tissue drained by a net-work of delicate vessels called the lymphatic vessels which unite with one another to form a few main lymphatic vessels. The lymph is carried away from the tissue or the organ by these main vessels. The walls of a lymphatic vessel are very delicate and thin. The lymphatic vessels in the body are connected with each other. The main vessel lies in the abdomen in front of the vertebrae. This is the thoracic duct. These various ducts ultimately open into the vena cava so that the lymph that exudes from the blood capillaries is turned to the blood when it has discharged the functions of supplying nourishment to the cells. The plasma that comes out of the capillaries nourishes the tissues with what is necessary and the excess passes through the lymphatic glands and ducts.

Along the lymphatic vessels and the thoracic duct are numerous valves. These valves allow the flow of the lymph in the right direction only.

Lymphatic Glands

Along the course of the lymphatic ducts, small bean-shaped bodies are found. The lymphatics enter into them by one side and leave them by the other. These are lymphatic glands. The colourless corpuscles of the blood are manufactured in these glands. The glands play a very important part in working of the several systems.

From the blood in the capillaries and by means of the lymph, the tissues obtain all they require for their life. The tissues return their waste products to the blood by means of the lymph and one of these is carbonic acid.

THE RESPIRATORY SYSTEM

The respiratory system consists of the two lungs, the wind-box or larynx, the windpipe or trachea, the right and left bronchi, bronchioles or bronchial tubes and the air sacs. The vocal cords are located in the wind-box. All sounds are produced by the vibration of the vocal cords. The vocal cords are short in females. Hence they have a sweet voice. A blast of air driven by an expiratory movement out of the lungs throws the two elastic vocal cords into vibrations. These impart their vibrations to the column of air above them and produce voice. The glottis is an aperture or opening that opens into the larynx. It is covered by a sort of lid, the epiglottis.

The trachea or wind-pipe passes into the thorax and there divides into two branches, a right and a left which are termed the bronchi. Each bronchus enters the lung of its own side and then breaks up into a great number of smaller branches which are called the bronchioles or bronchial tubes. The bronchiole in the end is divided into a large number of little sacs or air cells.

As the chest expands air rushes into the little sacs, dilates them and is forced out again when the chest contracts. The wall of each air sac is a network of the finest blood vessels. The blood that is charged with carbondioxide gives up the carbondioxide to the air and takes back in exchange some of the oxygen of the air. The blood is oxygenated or aerated and rendered pure.

The two lungs occupy almost all the cavity of the thorax. The right lung is the larger and the heavier. It is broader than the left. The right contains three lobes, upper, middle and lower.

The left lung has only two lobes upper and lower. Each lung is enclosed in a serous sac called the pleura. The sac has two layers. There is serous fluid in the sac. This fluid prevents the friction that could otherwise occur between the lungs and the walls of the chest with every respiration.

Respiration is the main process by means of which the body is supplied with oxygen and relieved of carbondioxide. Other waste products are also partly eliminated by the act of expiration. The act of respiration includes inspiration and expiration. In an adult there are 18 respirations per minute. The ratio to the pulse is about 1 to 4 in health.

When the air is inhaled or taken into the lungs it is called inspiration; when air is exhaled or driven out of the lungs it is called expiration.

Respiration is controlled by the respiratory centre situated in the spinal bulb or medulla oblongata of the brain. Impulses arise in this centre, pass down the spinal cord and finally reach the various muscles by whose contractions the movements of respiration are produced. The respiratory muscles contract only when they receive these impulses. All the movements of respiration depend upon the activity of this centre. If the respiratory centre in the spinal bulb is injured all the movements of respiration will stop at once.

During inspiration the size of the thorax is increased by the movements of the intercostal and other muscles and by the raising of the ribs from back to front and from side to side. The size of the thorax is also increased from above downwards by the flattening of the diaphragm, a great muscular partition between the thorax and abdomen. Air is drawn now into the lungs. This is called inspiration.

During expiration the external intercostal muscles relax. The diaphragm ceases to contract and rises to its former position. The abdominal organs push the diaphragm up. The force of gravity also lowers the ribs. There is elastic recoil of the lung: and the tissues of the chest wall which were stretched during inspiration. Air is now driven out of the lungs. This is called expiration.

Altered Respiratory Movements

Various emotions can be expressed through the respiratory apparatus.

Coughing is a violent expiratory act. It is a strong expiration which suddenly bursts upon the closed glottis. The strong respiration is preceded by a deep inspiration. The glottis is completely closed after a deep and long drawn inspiration. The glottis suddenly opens by a forcible and sudden expiration. A blast of air is driven through the mouth.

Crying consists of the same respiratory movements as laughing. The rhythm and the accompanying facial expressions are however different.

Laughing consists of an inspiration followed by a series of short, spasmodic expirations. The glottis is freely open during the whole time. The vocal cords are thrown into characteristic vibrations.

Hiccough is caused by a sudden inspiration, due to a contraction of the diaphragm. The glottis is suddenly closed. The column of air strikes on the closed glottis and produces the well-known and characteristic sound.

Sighing is a deep and prolonged or long-drawn inspiration, followed by a sudden expiration.

Sniffing is a rapid, inspiration. The mouth is kept shut and the air is made to pass through the nose.

Sneezing consists of a deep inspiration, followed by a sudden and forced expiration, which directs the air through the nasal passages. The cavity of the mouth is shut off from the pharynx by the approximation of the soft palate and the base of the tongue. The air is forced through the nasal passage.

Sobbing is a series of convulsive inspirations during which the glottis is closed. Little or no air enters the chest.

Speaking consists of a voluntary expiration and the vibration of the vocal cords when the air passes over them.

Yawning is a deep and prolonged inspiration drawn through the widely open mouth. This is accompanied by a peculiar depression of the lower jaw. This is due to increase of Tamas or inertia in the mind.

OXIDATION AND EXCRETION

The essential characteristics of living tissues are that they are constantly undergoing oxidation and constantly building up their substance anew. Oxidation is the process of the

element, oxygen, combining chemically with other substances, heat and light being evolved in the process. The blood supplies them with oxygen.

The oxidation which the tissues are constantly undergoing is a process of waste. The living substance takes up oxygen and the oxygen unites with the elements or groups of elements of which the living substance is composed and is given off again in union with them in the waste products. The chief of these waste products are carbonic acid, water and urea. These substances which are made in the tissues pass from the tissues into the blood. The tissues take all their nutrient matter and oxygen from the blood and return to the blood their waste products. These substances are injurious to the tissues. Therefore, they must be removed from the blood and be discharged from the body.

Excretion is the removal from the blood of substances which are to be discharged from the body. The lungs, the kidneys and the skin are the three chief excretory organs. Carbonic acid, urea etc., are the chief waste products. The carbonic acid is removed from the blood by the lungs, the urea and other nitrogenous waste substances by the kidneys, and water with other substances by the skin, lungs and kidneys. The lungs supply oxygen to the blood while the kidneys and the skin supply nothing.

ENDOCRINE SYSTEM

Hormones are the products secreted by the endocrine glands. They are internal secretions. The endocrine glands are ductless glands which discharge their several products or internal secretions directly into the blood stream and thereby influence all the regions of the body. These secretions affect every function of the body both physiological and psychological. The administration of the extracts of these glands in the treatment of diseases is called organo-therapy.

These endocrine glands are small wonderful chemical factories which manufacture very potent substances called hormones. These hormones regulate the chemistry of our lives. They markedly influence our structure, our health and our whole personality.

The most important advance in Medical Science made during recent years is the discovery of the inner glands of the body and their importance to life. It has been proved that the glands control our entire life, energy and mental and physical activity.

The body is a very intricate and complex machine. Hormone regulation is very important in the normal functioning of the human organism. Height, stature, the shape of the face, the appearance, intelligence, bodily development, the complexion, colour, and the characteristic differences between men and women, such as the temper, the voice, the growth of the hair, mental and physical capacity, the formation of the body and even the emotions are regulated by the functioning of these mysterious glands. Even the individual, radical characteristics of every man, woman and child are attributed to the varying amount of hormones manufactured by the endocrine glands of their bodies. How wonderful is this magical machine—the human body, the moving temple of God or the chariot for the soul. Mother Prakriti has exhibited her marvellous skill and maximum dexterity in constructing this marvellous machine. If you seriously ponder over for a while over the structure and working of this wonderful machine that is our body you will be struck with awe and wonder.

The cells of these glands are endowed with marvellous intelligence. There are many endocrine glands and they all work in perfect unison and harmony with each other and thus the normal functioning of the body is maintained. If the function of one gland is disturbed a vicious circle will be formed. These internal secretory glands pour directly into the blood stream, their secretions in such quantities as are necessary to keep up a balance of bodily activity.

The various ductless glands of the body are the pineal, the pituitary, the thyroid, the parathyroid, the thymus, the adrenals or the supra-renals, the gonads or the generative glands and the islets of Langerhans. Chemists are now manufacturing some of these glandular products artificially from lower animals. Doctors administer these extracts or solutions to patients either by means of injections or by mouth to replace the secretions of the patients' glands when they are not functioning properly. Pituitrin, the active principle of the pituitary gland, pancreatic extract known as insulin for the treatment of diabetes, adrenalin the active principle of the adrenal glands, thyroxin, the active principle of the thyroid gland and Para-thormone from the para-thyroid have been prepared by the chemists.

Pineal Gland

It is located in the base of the brain in a tiny cave near the Pituitary body. It produces several kinds of hormones. It has two lobes, viz, the anterior lobe and the posterior lobe. This gland has much to do with the development of our height, weight and general contour, the character of the hair, the texture of the skin and the cast of features. This is a small body weighing six grams. Research workers are not in agreement regarding the number of hormones produced by the anterior lobe of the pituitary, but in general four are recognised, viz, the growth, gonadotropic, lactogenic, threotropic principles. The anterior lobe of the pituitary body promotes skeletal growth. Hyperactivity of the anterior lobe is a cause for premature sex-development. The important functions of the posterior lobe are stimulation of the nonstriated muscle fibres and control of the carbohydrate metabolism. Any deficiency in the secretion of the posterior lobe causes muscular weakness and a slowing up carbohydrate metabolism with greatly increased sugar tolerance. Excessive functioning of this gland causes gigantism or unusually large hands, feet or nose, aggressiveness and persistence. Any deficiency produces a normally intelligent, obedient, good natured and fickle-minded man. It also leads to dwarfism, excessive obesity and retardation of sexual development.

The secretion of the pineal gland causes development of the sex organs at puberty. It changes the voice, develops thought and speech. It causes also shyness and excitability, the characteristics of adolescence. The gland is practically dormant in middle and later life.

Pituitary Gland

It is of the size of a pea. The pituitary gland functions more vigorously after the removal of the thyroid. But it does not take over all the duties of the thyroid. If the function of the pituitary gland is impaired or lost, the thyroid gland begins to function more vigorously. This is a balancing action on nature's part. Similarly when the kidneys are in a diseased condition the skin works more vigorously and vice versa. In summer the skin functions more energetically and so we perspire more profusely. In winter the activity of the kidneys is accelerated and we pass more urine. Micturition is more frequent also. This sort of balancing work in the harmony of nature is done by the intelligent Prakriti under the direct guidance of the Lord of all nature. The Sattva Guna of the Prakriti is characterised by intelligence.

Pituitrin, the secretion of this gland keeps up the normal blood pressure, the tone of the tissues and all contracting organs such as the stomach, the heart, the bladder, the intestines, the uterus, etc.

Thyroid Gland

It contains a gelatinous substance with a high percentage of iodine. This is an energy producing gland. It helps in increasing the activity of certain cells of the eyes, skin, hair, nail, teeth, etc. The thyroid is responsible for the normal growth and development of the organism. The physical and mental growth is stunted if the thyroid does not function, if it fails

to secrete. It regulates the mental activity, the temperature of the body and respiration. The secretion of the thyroid is endowed with antitoxic properties. It bestows resistance against the microbes which disseminate the infectious diseases.

The thyroid gland consists of two lobes which are attached to the sides of the portion of the larynx. In a normal individual it weighs from 20 to 45 grams. The secretion of this gland plays a very important part in keeping up a proper balance over nutritional and growth process in human beings. The active principle of the secretion of this gland is called thyroxin. The general effect of thyroid hormone on metabolism is a regulation of the rate of oxidation in the body. A lack of thyroid secretion results in dwarfism, deficient muscular activity, lower bodily temperature, slower breathing rate, a depressed activity and under-developed and functionally deficient sex-gland. Goitre is a morbid enlargement of thyroid gland. This is due to complete absence or marked deficiency of the iodine necessary for the normal functioning of the gland. Regular consumption of foods rich in iodine will help in preventing goitre. Children who suffer from cretinism Show considerable improvement if they take thyroxin. Excessive functioning of the thyroid induces rapid physical development and sex-changes, increased restlessness and irritability.

The para-thyroids are closely attached to the thyroids. They are four in number. They weigh in all not more than two grams. The secretion from the para-thyroid controls the calcium content of the blood. The proper functioning of the glands is of paramount importance. Calcium helps the clotting of blood, and the muscular tone and the formation of the skeleton. An insufficiency of calcium in the blood is shown by the appearance of certain diseases. Complete removal of these glands results in a condition known as tentany which is characterised by painful spasmodic contractions of the muscles of the extremities, i.e., hands and legs. The calcium content of the blood is considerably diminished. The heart, lungs and the temperature of the body are also affected. The patient dies if proper treatment is not given. Administration of an extract of para-thyroid promptly restores the sufferer to a normal condition.

The thymus is situated in the upper region of the chest along the trachea or wind-pipe. Removal of the thymus in human beings induces disordered development of the skeleton and results in defects like ricket, etc. Thymus is particularly important in childhood as it helps the physical and mental development. Early decline of thymic activity results in sexual precocity, whereas persistent thymus activity causes delayed puberty.

Supra Renal or Adrenal Glands

The secretion from these glands (adrenalin) plays an important part in the development of the sexual organs and certain mental growth. The glarids serve as a storehouse of energy of the sympathetic system. If adrenalin is injected the heart beats more rapidly, the blood pressure rises high, eyes and ears function more clearly, temperature is raised and the rate of respiration is increased.

The adrenal glands are of yellow colour. They are two in number. Each weighs about four grams. Each is situated above the kidney. They produce two major hormones viz., adrenalin and cortin. The secretion from the medullary portion of the adrenal gland is called adrenalin. This is widely used as a drug. It stops bleeding by inducing contraction of the arteries and capillaries and maintains muscular tone. A deficiency of adrenalin causes lowered blood pressure, lack of muscular tone and loss of strength. The secretions of the cortex control sexual maturity. Over-activity of the cortex portion of the adrenal causes precocious sexual development. Morbid affection of the cortical portion causes Addison's disease. When cortical extract is injected, the patient shows signs of improvement. The adrenal glands

assist in sexual development, especially in early life, maintain muscular tone, including arterial tension and exert a protective influence against bacterial infection.

Gonads or Sex-glands

The testes produce an external secretion, the semen. The ovaries produce an external secretion, the ovum. The internal secretion of these glands gives the respective physical and mental character. The internal secretions from testes and ovaries play a vital part in the development of sex character. The absence of these secretions induces absence of manliness in man and womanliness in woman.

If the testes are removed the generative organs do not grow, moustache and beard do not appear, voice becomes shrill like that of children and women, muscles become weak and mental condition becomes dull and indifferent. The individual becomes lethargic and loves male characteristics. He assumes effeminacy.

If the ovaries are removed in females, the Pelvis does not grow, breasts do not develop, hair come out on the face like males, voice becomes hoarse, mental condition becomes dull and inert. The woman loses female characteristics. She becomes masculine.

The pancreas is a gland that secrets a digestive juice called pancreatic juice which is poured through the pancreatic duct into the small intestines. In the midst of the lobules which secrete the pancreatic juice there are small tissues known as the islets of Langerhams. These tissues secrete a substance called insulin which is directly absorbed in the blood. This hormone plays a very important part in the metabolism of carbohydrates. If there is any deficiency of this hormone insulin through disease of the islets of Langerhams, diabetes mellites is produced. The chief symptom of diabetes is increase of sugar in the urine. Doctors inject insulin prepared from the pancreas of healthy animals for the treatment of diabetes mellites.

A hormone does not influence directly the endocrine glands from which it originates. On the contrary the active principles secreted by a gland may strikingly influence certain other endocrine glands. For instance, the ovarian follicular hormone does not affect the ovary directly, but exerts its effect upon the secondary sex organs. The ovarian hormone exerts a restraining effect on the anterior pituitary.

The internal secretions or hormones play a very important role in influencing the structure of our body, health, complexion, personality. Each endocrine gland must play its part in perfect tune and harmony with its companion. Then only will there be physiological harmony. Then only will the internal administration or government within the body run smoothly. Then only will you enjoy perfect health and peace.

REPRODUCTIVE SYSTEM

I

In a male the reproductive system consists of the two testes (testicles) or seeds, the penis or the external organ of generation, the scrotum or the bag in which the testes are located, the seminal vesicles or the small bags which serve as reservoirs for the semen, and the spermatic duct or tube which conveys the semen or the vital fluid from the testicles to the seminal bags, and the ejaculatory duct which throws the semen from the seminal bags into the prostatic portion of the urethra or urinary canal. The prostatic gland throws also its prostatic juice into the urethra which mixes with the semen.

The real generative organ is not the penis. The testes are the real generative organs. The testes secrete the semen from the blood.

The testes secrete substances which give manliness to a man. If the semen is wasted then man loses manliness.

II

The female generative organs consist of ovaries, the two glandular organs in which the ova are formed; the fallopian tubes, two canals through which the ova reach the uterus or the womb; the uterus, a hollow, pear-shaped organ which receives the ovum; and the vagina, the sexual canal which extends from the uterus to the vulva.

The ovaries are two small almond-shaped bodies situated one on each side of the uterus. The ovaries measure about one and a half inches in length and three fourths of an inch wide. Their function is to produce, develop and mature the ova and to discharge them when fully developed from the ovary. The ovaries contain Graffian follicles. The follicles mature and burst. The ova escape. The ova are received by the fallopian tubes and afterwards conveyed to the uterus.

The ovary produces an internal secretion out of the blood which produces a marked and profound influence on the temperament of the woman. It gives womanliness to a woman.

The real generative organ in a female is the ovary.

The fallopian tube or oviduct is about four inches in length.

The uterus is situated in the pelvis between the bladder and the rectum. Its length is three inches, width two inches and thickness one inch. At the end of pregnancy its length is one foot and width is 10 inches. It resumes its original condition after six weeks. During pregnancy it rises into the abdominal cavity.

The vulva includes Mon veneries, cushion of fat over the pubic bone, the labia majora (the greater lips), the labia minora (the smaller lips), clitoris, glands of Bartholin and urethral glands. Clitoris is an erectile organ. It corresponds to the penis in a male.

Ovulation and menstruation are closely associated with the child bearing period of a woman's life. They are closely associated together. Ovulation or discharge of ovum from a grafian follicle occurs in a few days before the beginning of the menstrual period.

The physiological cessation of the menstrual flow is called menopause or climacteric. The woman's functional activity is over. The ovaries become smaller. No more Graffian follicles are developed. In temperate climates the average period for the coming of menopause is at the age of 45 years.

The spermatozoa or the male sperms are minute things that are contained in the semen. They are shaped like tadpoles. They can make their way in fluid with the help of the tails. The spermatozoa try to meet an ovum. If they chance to meet, then the two combine. The spermatozoa enter the ovum and then shed their tail, because there is no more necessity of travelling up. The fertilised ovum gets attached to the wall of the uterus and transforms itself into an embryo when the embryo gets further developed, it is called a foetus. After about 280 days the foetus is delivered out as a new born child.

SPLEEN

The spleen is the largest of the ductless glands. It is oval in shape. It is directly beneath the diaphragm. It is behind the stomach. It is on the left side of the abdomen. It weighs usually

from 6 to 8 ounces. It is a dark purplish red organ about five inches in length. The Malpighian corpuscles are factories for leucocytes. The size of the spleen is increased during and after digestion. It is soft and spongy in texture. In the meshes of the sponge work is a soft pulpy tissue called the spleen pulp.

In typhoid and malarial fever a temporary enlargement takes place. In prolonged or chronic malaria a permanent enlargement of the spleen occurs and forms "ague-cake". It is extremely big and occupies the whole of the abdomen.

During malaria the spleen does more work. It manufactures large number of white corpuscles to kill malaria germs and disposes red cells which are destroyed by malarial parasites. Hence it gets enlarged.

The leucocytes multiply in the nodules of the spleen. A leucocyte divides into two which grow and in their turn divide. The spleen like the lymphatic glands supplies colourless corpuscles to the blood. Some of the red corpuscles of the blood, which are old and worn out, in their passage through the spleen are entangled in the spleen pulp, where they undergo change and gradually break up. The colouring matter of these broken up red cells is carried away from the spleen in the blood to the liver and is used by the liver to make the colouring matter of the bile.

THE URINARY SYSTEM

The organs of the urinary system are the two kidneys which form the urine from materials supplied by the blood, the two ureters, ducts which convey the urine away from the kidneys into the bladder, the bladder a reservoir which is situated in the pelvic cavity behind the tubes in which the urine is stored, and the urethra, a tube or canal through which the urine passes from the bladder and is finally eliminated from the body. The kidneys are situated in the abdomen, one on each side of the lumbar region of the vertebral column. They are dark red organs 4 inches long and 2y2 inches across and one inch in thickness. The inner edge is concave and the outer edge is convex.

The function of the kidneys is to secrete urine. The function of the ureters is to conduct the urine from the kidneys to the bladder. The function of the bladder is to store the urine and to discharge it at intervals. Each ureter is of the diameter of a goose-quill and from 12 to 18 inches long.

Urine is a clear yellowish fluid. It is acid in reaction due to the presence of the acid phosphate of sodium. It contains organic and inorganic substances. The chief organic substance is urea. There is a small quantity of uric acid also. The chief inorganic salts are sodium chloride, sulphates and phosphates of sodium, potassium, calcium and magnesium.

To test the reaction of urine litmus paper is used. Acid urine turns blue litmus paper red; alkaline urine turns red litmus paper blue. The specific gravity of urine varies from 1010 to 1030 in health. It is considerably increased by the presence of sugar in diabetes mellitus.

An average healthy man excretes 50 ounces or 2 ½ pints of urine daily. This contains more than one ounce of urea. The amount of salts is about half that of the urea. The larger part of the salt consists of sodium chloride.

When the body is exposed to cold in winter the blood vessels in the skin are constricted. Perspiration is checked. But the blood vessels of the kidneys are dilated. There is an increased flow of urine. On the contrary, when the body is exposed to heat, in summer, the blood vessels of the skin are dilated. The skin perspires freely. But the blood-vessels of the kidneys are constricted. The secretion of urine is very scanty.

The kidney is a peculiar and delicate kind of filter which allows certain substances together with a large quantity of water to pass through it, but refuses to allow other substances to pass through.

The Malpighian capsule is a funnel as it were. The membranous walls of the glomerulus serve as a very delicate and peculiar filtering paper into which the blood is poured. A large quantity of the water of urine with some inorganic salts is filtered by the Malpighian capsules.

DERMATIC SYSTEM

Skin (Tvak) is the organ of touch. It is the (Integumentary) organ for sensations of temperature and pressure also. It is one of the five Jnana Indriyas or organs of perception.

The skin consists of two parts, epidermis or the outer layer and dermis, the inner layer.

Cutisvera (dermis) or the true skin contains the terminations of nerve-fibres in the shape of little bodies called tactile corpuscles. It contains also looped blood vessels.

The skin throws out twelve ounces of impurity every twenty-four hours. There are seven million pores in the skin, which if measured would cover thirty miles in length. They eliminate twenty-five percent of water each day. There are two sets of glands in the skin viz., sebaceous glands which secrete sebum or fat which keeps the skin soft and sweat glands which excrete sweat.

The skin is an excretory organ through the pores of which waste products from the blood are thrown out. Some carbondioxide also passes through the skin. We breathe through the skin and the lungs. From each of its pores constantly flows a stream laden with poisonous products of disintegration. When the perspiration evaporates, it leaves behind it the waste products which are deposited as a thin film over the whole surface of the skin. If the dirt of the skin is not removed, the accumulation continues to increase. It undergoes decomposition. It putrefies and emits a stinking odour.

The unclean accumulation chokes the mouths of the millions of pores on the skin and stands in the way of the proper functioning of the skin. The waste matter that accumulates in sickness is more abundant than in health and is more poisonous.

The skin is the great gateway through which nature tries to throw off the waste materials and poisons collected in the system through errors in diet, unhygienic living etc.

The skin is a most wonderful and intricate piece of bodily mechanism designed by nature for various purposes. It is part of the whole organism. It gives beauty and protects the inner organism. It regulates the temperature of the body and throws out cell waste, poisons or toxic matter and bodily refuse. The skin, the kidneys and the large bowels represent the sewers of the body. If the skin is clogged various diseases of the skin develop and the functioning of the whole system seriously suffers.

If the kidneys are in a diseased condition, the skin works more vigorously and tries to throw out the poison as quickly as possible.

The whole external skin is a breathing organ. It is continually discharging impurities from the body. Worn out matter of the system is thrown out through the medium of the skin. The skin holds very near and powerful relations to the lungs, stomach and other internal organs in its anatomical structures and functional character. It behoves everyone, therefore, to see that the skin is kept in a healthy condition to enable it to perform its function in a vigorous manner. Hence daily bathing is a sine-qua-non.

The skin should be kept clean by daily bathing. Bath in cold water followed by friction with a towel cleanses the skin and invigorates the body.

THE SKIN

The skin is the organ for sensations of temperature, touch and pressure.

A peripheral organ for the receipt of an impression, a nerve for its conduction, and a centre in the brain for the perception are the three fundamental parts of a sensory apparatus. The mind has its seat in the brain. It is able to control the body and perceive the external universe through the impressions received by the peripheral organs and transmitted by the nerves to the brain.

The special senses are ear (hearing), skin (touch), eye (sight), tongue (taste) and nose (smell).

Varieties of Touch: They are (1) sense of touch, (2) sense of temperature or sensation of heat and cold (3) the sense of pressure or weight (4) muscular sensation.

Some sensory nerves end in the dermis or the true skin in 6mall oblong or rounded bodies called tactile corpuscles which are especially designed for the sense of touch.

The sense of touch is most delicate at the tips of the fingers and on the face and tip of the tongue. It is less delicate in other parts of the body, such as back, back of the palm of the hand etc., owing to a thicker epidermis or outer skin and a less abundant supply of sensory nerve endings. The tactile corpuscles are abundant in the tips of the fingers, palm of the hand and the under surface of the toes.

We acquire knowledge of the size, figure, solidity and other external peculiarities of bodies by means of the sense of touch.

The more numerous the tactile bodies, the more acute the sensibility of the part. The thickness of the skin has marked influence in finding out the tactile ability. The hand is endowed with acute sensibility. Hence it is of great value as an organ of touch. It is capable of forming impressions of bodies owing to its power to grasp them and to test them as to weight.

The Sensations of Heat and Cold

Besides the end organs of the sense of touch, there are also structures in the skin which are only stimulated by changes in temperature. In addition to the sensation of touch which arises from the contact of a body from pressure on the skin you may have sensations of heat and cold.

The skin has got distinct spots of sensations distributed all over it. There are 30,000 spots for reception of sensation of heat and 20,000 spots for reception of sensation of cold. There are half a million spots for registering touch and pressure.

The feeling of heat or cold is due to the excitation of sensory nerves distributed in the skin which are different from those which cause the sense of touch. The sensation of heat and cold is relative. The change of temperature of the skin caused by the hot or cold body produces the sensation.

Place your right hand in a basin of ice cold water, and the left in a basin of hot water. Now place your right hand in a basin of lukewarm water. You will have sensation of warmth. Place your left hand in the basin of lukewarm water. You will experience sensation of cold. The change of temperature acts on the endings of the sensory nerves. The sensations of heat

and cold can be excited by changes in temperature through the peculiar end organs of the nerves, because heat or cold applied directly to the nerve causes only pain.

Like the sense of touch, the sense of warmth varies in delicacy in different parts of the body. It is delicate on the palms of the hands. The palms are more sensitive to heat than their backs. The cheeks are very sensitive, more so than the lips. That is why a washerwoman holds her flat iron near her cheek to test the temperature, to tell if it is too hot. He who is suffering from cold spreads the palms of his hands over the fire.

Some points in the body respond to heat but not to cold; others to cold but not to heat. Therefore there are `heat spots' and 'cold spots' in the body.

The Sensation of Pressure

Contact of an object with the skin exerts a pressure on it. You become conscious that something is touching you. If weight is added to an ordinary touch, you feel the sensation of pressure and by it you can judge with great accuracy the amount of the pressure. You can also find out the comparative pressure of two weights. This is known as the sense of pressure. The sensitiveness of the various regions of the skin in responding to pressure varies. The sense of pressure is very acute on the skin of the forehead and on the back of the hand. It is less acute in the skin of the tips of the fingers. Thus there are 'pressure spots' just as we have 'heat spots' and 'cold spots'.

Muscular Sensations

If your hand is resting on the table and a weight is placed in the palm you exercise a sensation of touch and you feel the pressure of the weight also. You can have an idea of the weight of the body without moving the hand from the amount of the pressure, on account of the sensations which are connected with the contraction of the muscles by which the weight is poised. Therefore these are called muscular sensations. The end organs of the muscular sense are located in the tendons and between the fibres of the muscles. They convey to you the sense of resistance in the muscles when you try to lift anything. You learn to adjust the force exerted to the weight of the object to be lifted. The function of the muscular sense is to enable you to estimate weight or resistance. It also helps in maintaining equilibrium and coordinating muscular action.

The muscular sensation is something quite different from the feeling of touch or even of pressure. It is the feeling of resistance which arises when any kind of obstacle is opposed to the movement of the body or its any part. Those who deal in articles sold by weight form very exact estimates of the weight of such articles by balancing them in their hands. They depend upon the muscular sense. The muscular sense forms the basis of your knowledge of the position or of the movements of the parts of your body when you walk with closed eyes.

Sensation of Pain

It is due to an excessive stimulation of any of the nerve endings which are concerned in giving rise to sensations. It also is due to stimulation of the trunks of the nerves leading for those endings to the central nervous system. The sensation of pain is distinct from other sensations. If the nerves of the skin are unduly stimulated by severe pressure or by exposure to extremes of heat and cold, the sense of touch and of temperature is lost in the sense of pain. If the nerves are too freely exposed, as when the epidermis is removed by blistering, or in some other manner and the skin is left raw, pain results.

BODY HEAT AND TEMPERATURE

The temperature of the human body is a little warmer than the average temperature of the atmosphere. In a hot day or in a cold day, the temperature is the same being 98.6 degrees Fahrenheit. This may be ascertained by placing a thermometer in the armpit or in the mouth, or in the anus in case of children, for a few minutes.

It is necessary for the body to maintain a certain temperature in order that the functions of the body may be properly performed. The plants are killed by frost or withered by the heat of the sun. So also your tissues die if the temperature of the body falls below or rises above a certain limit. The body generates and regulates its own temperature and possesses the power of adjusting itself to extremes of heat and cold without necessarily suffering any vital injury. If you are to remain in a sound state of health the temperature of the body must be kept at an average standard of 98.6° F (37° C). Slight variations are compatible with health. The temperature normally is a bit higher after eating and in the late afternoon and lower late at night or in the early morning. This corresponds to the usual temperature ranges in fever, when the maximum is in the late afternoon and the minimum in the early morning.

The body is constantly losing heat. Heat is lost from the skin by the evaporation of the sweat, by radiation and by conduction. A considerable amount is also lost by the breath in warming the air expired and a very little also is lost in warming the urine and the faeces leaving the body. To make up for the heat lost heat must be produced in the body. The amount produced and the amount lost must be equal to each other, as the temperature of the body does not change.

In every 100 parts, 88 per cent of heat is lost by conduction and radiation from the surface of the skin and the evaporation of perspiration; 9 per cent is lost by warming the expired air and the evaporation of the water of respiration; 3 per cent is lost by warming the urine and faeces,

The body is like a steam engine, because it produces heat from the burning of its fuel—the foodstuff. When the weather is cold you need bigger fires in the house than in warm weather. The same thing holds good within the body. When it is cold you eat more food than when it is hot, and you eat more of those foods such as fat which generate most of the heat. Most of the heat is produced in your muscles which form a large part of your body. You get very hot when you run quickly or when you use your muscles energetically in any other way. The temperature will be several degrees higher after violent exercise. In fever also the temperature of the body is high and may be as much as six or seven degrees above the normal. This is because the internal fires are burning far too quickly and they are using their own substance as fuel. In protracted fevers all the fat that has been stored in the body is burnt and the patient becomes very thin. The muscles too begin to waste, because they also are used as fuel.

Source of Heat

Heat is produced in the body by oxidation. The quantity of heat produced depends upon the sort of food taken. A given weight of fat will produce twice as much heat as the same quantity of carbohydrates or proteins. The tissues all over the body, muscle, brain-substance, gland cells, etc., are continually undergoing oxidation. The living substance of the tissue, built up out of the complex proteins, fats and carbohydrates is by means of the oxygen brought by the arterial blood, oxidised and broken down into simpler more oxidised bodies, which are ultimately reduced to urea, carbonic acid and water. Whenever life is being manifested these oxidative changes are going on. It is more energetic in some tissues and in some organs than in others. Every tissue is thus a small fire-place in which heat is being evolved. The chief heat of this heat-production is in the muscles. The liver and the other secreting glands are the next great heat-producing organs of the body.

Distribution of heat

When one organ of the body exercises there is rush of blood there. There is then more combustion and more heat-production. The temperature of the blood is raised. But this blood is swiftly hurried away into other regions of the body and rapidly gives up its excess heat to them. Thus the temperature of the whole body remains normal or constant. The blood which is carried to the vessels in the skin on the surface of the body, begins to have its temperature lowered by evaporation, radiation and conduction. It is quickly taken before it has time to get thoroughly cooled into the deeper organs. It becomes warm by contact and the oxidation processes that are going on there. Thus the blood vessels and their contents may be compared to a system of hot-water pipe through which the warm water is kept constantly circulating by a pump. In this way, the temperature of the body is kept uniform in its several parts.

Regulation of Heat

This normality of the temperature is chiefly controlled by the skin. You feel warmer when you are working, because the skin is warmer owing to the greater quantity of blood sent to it. When the skin is warmer the excess heat is given off readily by conduction, radiation and perspiration.

The loss of heat from the body will be much greater on a cold day if the same quantity of blood is sent to the skin as on a hot day. But it is not so. Cold causes the blood vessels of the skin to contract and allows less blood to be supplied to the skin. Perspiration is checked and heat is conserved. The loss of heat from the body on a hot day due to radiation is little, as the surrounding temperature is high. But the blood-vessels of the skin dilate and allow more blood to the skin.

There is greater perspiration and the heat of the body is got rid of by this means. In winter a little more heat is lost than in summer, but this is made up by an increase in the production of heat. Cold increases the production of heat; warmth decreases it. This regulation of the blood-supply to skin and also of the increase and decrease of heat production is carried out by the nervous system. The thermogenetic or heat-producing centre lies in the medulla oblongata.

You can aid the functions of the skin and the maintenance of heat by clothing. The object of clothing in winter is to prevent conduction, radiation and evaporation of heat from the skin and in summer to promote it. Linen is a good conductor. Calico or muslin is not quite good. Wool, silk fur al e all bad conductors.

Substances which allow the heat to flow through them much more quickly than others are said to be good heat-conductors. Metals are good conductors of heat. The handle of a silver tea-pot or of a metal kettle becomes very hot when the vessel is filled with boiling water. The vacuum is the most perfect non-conductor. A vacuum-flask can be used equally for keeping ice-cream cool or for preventing hot tea from cooling.

To aid the nervous system in controlling the oxidation going on in the body certain substances are produced in special glands. These glands have no ducts. Therefore they are called ductless glands. The secretion they produce passes directly into the blood. The thyroid in the neck and the two suprarenal glands near the kidneys are ductless glands which increase the oxidation when we are exposed to cold. In the pancreas there are small islands of special tissue which produce a substance called insulin, which is necessary for the

oxidation of sugar in the body. Another ductless gland, the pituitary situated at the base of the brain, is also important for our growth and well-being.

Fever

In fever the rise of body temperature is due to causes which increase the metabolism of the tissues beyond the normal and so there is a marked increase in the production of heat. At the same time there is an increase in heat elimination but the elimination is not increased in proportion to the heat production. The result is a rise in temperature.

The rise in temperature is due to the disturbance of the mechanism by which heat is lost to the body. Diminution in loss of heat leads naturally to a rise of temperature. This is the most common cause of rise of temperature. The abnormally high temperature is also due to an overproduction of heat.

By sponging, baths, packs, etc., we try to cause the arteries all over the body to dilate, the skin to perspire and thus raise the heat elimination to such a point as nearly to balance the heat production, and thus bring about a fall in body temperature. If a very high temperature persists for a very long time, every organ works with feverish activity the heart and lungs increase their actions, the pulse and respiration become more and more hurried and consequently more and more feeble. Eventually the patient dies of exhaustion, if relief is not obtained.

In some disease the temperature falls distinctly below the normal. This is chiefly due to diminished metabolism. In cases of starvation the fall of temperature is very marked, particularly during the last days of life. The diminished activity of the tissues first affects the central nervous system. The patient becomes languished and drowsy, and finally unconscious. The heart beats more and more feebly, the breath comes more and more slowly. Eventually he dies.

THE DIGESTIVE SYSTEM

I

Digestive Apparatus

The digestive apparatus consists of the alimentary canal and the accessory organs (1) the salivary glands, (2) the tongue, (3) the teeth, (4) the pancreas and (5) the liver.

The alimentary canal is a musculo-membraneous tube extending from the mouth to the anus. It is twenty-eight feet long.

The secretions from the glands in the mucous membrane with which it is lined and also secretions from the accessory glands, which lie outside the canal and are connected with its interior by ducts are poured into the interior of the alimentary canal. It contains gas which

serves to keep the opposite walls separated from each other and prevents the injury which may result from their rubbing together.

The alimentary canal consists of Pharynx, or throat, oesophagus or gullet, stomach, small intestines which consist of duodenum, jejunum, ileum and large intestines which consist of caecum, colon and rectum.

The salivary glands are the three pairs of glands viz., the Parotid, the sub-maxillary and sub-lingual. They secret the saliva, an alkaline digestive juice which acts on the starchy portion of food.

The pharynx or throat cavity is about four and a half inches long and lies behind the nose, mouth and larynx.

The oesophagus or gullet is a straight tube about 9 inches long. It extends from the pharynx, passes through the diaphragm and terminates in the upper end of the stomach.

The stomach is a hollow pouch placed obliquely in the left side of the upper portion of the abdominal cavity. It has two openings, the one leading into the oesophagus and the other leading into the small intestine. It has a capacity of about one quart. When distended it increases about 15 inches from end to end and about 5 inches antero-posteriorly.

The small intestine is a convoluted tube about 20 feet in length. It is divided into three portions viz, the duodenum, the jejunum and the ileum.

The large intestine is about 5 feet. It extends from the ileum to the anus. It is divided into 3 parts viz., caecum with the vermiform appendix, colon and rectum.

Peristalis is the term used to describe the alternate contractions and dilatations of the segments of the intestine. It produces a wave-like motion (worm like) along the intestinal tract. By the peristaltic movement the food is passed from one portion to another portion. If the peristaltic movement is dull or weak constipation results.

The Liver is the largest gland in the body. It measures ten to twelve inches side to side. It is located in the upper right and middle portion of the abdomen. It has 5 lobes. The liver is a wonderful laboratory, the most wonderful in the body. The cells of the liver manufacture bile from the blood. The cells of the liver take from the blood a substance called dextrose which is derived from the carbohydrates eaten. This is stored in the liver in the form of glycogen. When the system needs more dextrose the liver cells reconvert the glycogen into dextrose and pour it into the blood.

The gall-bladder is a sac that serves as a reservoir for the bile. It is located in a depression on the under-surafce of the right lobe of the liver.

II

Digestive Juices

Saliva contains a ferment or enzyme called Pyalin, which does not act on proteins or fats but which turns the starch into maltose, a kind of sugar.

Gastric juice is a clear acid fluid. It contains hydrochloric acid and a ferment or enzyme called Pepsin. Gastric juice dissolves proteins and converts them into peptones. Peptone is extremely soluble. Rennin, another ferment, turns milk into curds. Gastric juice has no direct action on fats and carbohydrates.

Pancreatic juice is a somewhat viscid fluid. It is alkaline. It contains three soluble ferments. Of these Trypsin is the chief ferment. It is like pepsin. It converts proteins into peptones. The second ferment Amylopsin is like the ptyalin of saliva. It converts starch into sugar. The third ferment Steapsin has no action on either proteins or carbohydrates but it acts on the ordinary fats. It splits them up into glycerine and a fatty acid. It saponifies and emulsifies the fats. Diabetes is due to disease of the pancreas. The islets of Langerhans of the pancreas are affected.

Bile is the fluid secreted by the liver. The quantity secreted in 24 hours is from 40 to 60 ounces. It is stored in the gallbladder. It has by itself no direct chemical action on foodstuffs. It neutralises the acidity of the chyme (the partially digested food that comes out of stomach) as it leaves the stomach and thus prepares it for the action of the pancreatic juice and facilitates their absorption. It helps the ferments of the pancreatic juice to act more effectively and rapidly. It is an antiseptic. It prevents putrefatic changes in the bowels. It is bright yellow in colour. It is due to the pigment called bilirubin.

The Succus entericus or the intestinal juice helps digestion. It is the secretion of the intestinal glands. If Peptone is absorbed into the blood it will act as a deadly poison. A ferment erepsin breaks up the peptone into a number of much simpler bodies known as amino-acids. Succus entericus acts as a diluent and supplies a loss of fluid.

III

Process of Digestion

The food that you take is first digested, then absorbed into the blood and then assimilated. Through digestion, the proteins, carbohydrates, fats are converted into proper assimilable form and are rendered capable of absorption and assimilation. They are brought in the form of solution. The wall of the alimentary canal is richly supplied with blood vessels and lymphatic vessels. The food materials pass into these vessels. The blood carries the food materials to the tissues of the body.

The changes in the food are chiefly brought about by the action on the food of the digestive juices which are secreted by the glands and are poured into the cavity of the alimentary canal. There are five digestive juices viz., the saliva in the mouth secreted by the salivary

glands, the gastric juice secreted by the glands of the stomach, the pancreatic juice secreted by the pancreas, the bile secreted by the liver and the succus entericus or intestinal juice secreted by the glands of the small intestines.

The food is masticated in the mouth and mixed with saliva. It is swallowed and taken to the stomach. It undergoes gastric digestion and then passes into the intestine. Here the bile, pancreatic juice and intestinal juice act upon the food. The whole nutritive constituents of the food are extracted. The residue is mixed with certain secretions of the intestines and leaves the body as the faeces or stools. Gastric juice acts on the proteins and converts them into easily soluble peptones. This is done by the ferment pepsin. The semi-digested food is called chyme.

Food is first masticated in the mouth by the teeth, and tongue. Then comes insalivation. The saliva is mixed with the food. The amount of saliva that is secreted is from one to 2 quarts. Saliva softens and moistens the food and thus assists in mastication and deglutition (swallowing).

Then comes deglutition or swallowing. The epiglottis prevents the food from entering into the air-passages. By peristaltic action it is carried onwards into the stomach.

The digested food that remains in the small intestines is now absorbed from the interior of the intestines into the blood vessels and lacteals that are situated in the walls of the intestines. The water is absorbed in the large intestines. The finely divided fat what is called chyle enters the lacteals and thence through the lymphatic vessels and thoracic duct into the blood.

Amino-acids and sugar are taken up by the capillary blood vessels of the villus.

From the capillaries of the villi they are then carried along the portal vein to the liver. Finally they are thrown into the general bloodstream.

Carbohydrates are used for the production of force. The fats are stored in the body and used as fuel. The proteins do all that can be done by the fats and carbohydrates and in addition form the basis of blood, muscles and all the connective tissues. The adipore or fatty tissue and glycogen are reserve forces of the body. During starvation or fasting they supply material for heat and energy.

The faeces consist of the undigested and ill-digestible substances of the food viz., the elastic fibres of connective tissue, the cellulose of vegetables, mucine of mucus and some water and some excretory substances found in the various secretions poured into the alimentary canal.

TASTE

The organ of taste is the mucous membrane of the mouth and specially that of the tongue and palate. The organs of the sense of taste are scattered over the fauces pharynx or throat, tonsils, tongue and palate. The tongue is covered by a layer of mucous membrane. It is very thin on the tongue.

The tongue is full of papillae or protuberances. There are three kinds of papillae viz., filiform, fungiform and circumvallate. The filiform papillae are fine threadlike projections spread all over the tongue. Their function is not really tasting but carrying the sensation of touch. They are coarse in animals. They are sharp and horny in carnivorous animals. They supplement

the teeth in the bruising and crushing of food. The sense of touch is highly developed on the tip of the tongue. It serves to guide the tongue in its variable and complicated movements.

The fungiform papillae are larger than the filiform ones. They are found principally on the tip and sides of the tongue. They carry within their core extremely thin blood vessels and nerves which carry the sensation of taste.

The circumvallate (walled in) papillae are the largest. They are about 8 to 10 in number. They form a V-shaped row near the root of the tongue with its open angle turned towards the tips. They are circular elevations of a twelfth to a twentieth of an inch in diameter.

On the circumvallate and on many of the fungiform papillae the epithelial cells at the sides of the papillae are arranged into special groups called taste-buds. Each taste-bud consists of a number of epithelial cells, Which lie together somewhat like the leaves in a bud. Hence their name.

The taste-buds are the essential end-organs in which the sense of taste arises. The bases of these cell-clusters or taste-buds are supplied with nerve fibre. The nerve-fibres are derived from the glosso-pharyngeal or ninth cranial nerve. A branch of the fifth cranial nerve is also concerned with taste. The former supplies the back of the tongue and section of it destroys taste in that area. The latter is distributed to the front of the tongue and section of it deprives the tip of the tongue of taste.

Different portions of the tongue are suitable for judging different tastes. Sweet is best tasted by the tip, acid by the sides and bitter at the root of the tongue.

If you put a small piece of sweetmeat on the tongue the taste-buds are influenced by the contact of the sweetmeat. It causes the epithelial cells of the bud to send impulses along the nerve-fibres to the brain. These impulses make you aware of the sweet taste.

The substances which excite the special sensation of taste act by producing a change in the terminal filaments of the glosso-pharyngeal nerve and this change furnishes to it the required stimulant.

The sense of touch is very highly developed in the tongue and with it the sense of temperature, pressure, pain, etc. The accuracy of the tongue in many of its important uses such as speech, mastication, deglutition, sucking etc., depends to a great extent upon these tactile and muscular senses.

The cells in the taste-buds, the sense organules of taste and the terminations of the glosso-pharyngeal and gustatory nerve form the essential parts of the organ of taste. The tongue which by its movements brings the sapid substances into immediate contact with the cells is the accessory part.

You often confound taste with smell. Substances which have a strong odour, such as onions, are smelt as you hold them in your mouth. If your sense of smell is temporarily suspended by a bad cold, you may eat onions and not taste them. Hence the philosophy of holding the nose when you want to swallow a nauseous dose.

The sensations of taste are really complex sensations. Smell, touch and the temperature sense as in the sensation of cold produced by peppermint or ice, largely enter into the sensations of taste. If the nose is held tightly pinched and thus if the sense of smell is obstructed it is difficult to distinguish the taste of various objects. An onion may be confounded with an apple if the eyes are closed. The so-called tastes which are thus affected by the absence of smell are rather flavours than tastes They are distinctly due to the

aromatic particles the substances emanate. Flavours of meats and drinks are really sensations of smell.

Taste does not arise entirely in the mouth. It is a combined sensation of smell. The sense of taste can recognise only a few characteristics of soluble substances placed in the mouth. All foods taste flat and lose their flavour when the sense of smell is rendered blunt on account of catching cold.

True taste is independent of smell as in the case of sugar or quinine. The sense of taste is most acute at medium temperatures such as 65-90° F. Very high or very cold temperature deadens the sense of taste. Substances to be tasted must be in solution.

The tastes may be mixed with other sensations in addition to those of smell, such as pungent, smarting, tingling or similar sensations.

There are six kinds of tastes viz., the sweet, the bitter, the sour, the salt, the astringent and the pungent. The taste-buds are concerned with these tastes. Things which are insoluble in water and saliva and also without smell are tasteless.

The substances come in contact with the nerve ending on the tongue in a soluble form and give rise to the different tastes.

ORGAN OF SMELL

I

The nose is the organ of smell. The mucous membrane lining the upper part of the cavity of the nose carries the sensation of smell through the nerves.

The first essentials for smelling are a special nerve and nerve centre, the changes in whose condition are perceived as sensations of odour. No other nerve structure is capable of such sensations, even when acted on by the same cause. The special organs for this sense must be in their normal condition and a stimulus (odour) must be present to excite them.

The olfactory or first cranial nerve enters the nose from its roof through a perforated plate of bone called cribriform plate. In each nasal chamber there are three scroll-like bony projections covered by mucous membrane. The upper part of this chamber is the olfactory and the lower part—the respiratory. Most of the air taken in through the nose passes through the respiratory portion only. A small part enters the olfactory portion carrying the sensation of smell. The odorous particles must be presented to the nerves in a gaseous form in order that they (the nerves of smell) may be affected.

The nostrils or anterior nares lead into the nasal chambers, which are separated from each other by a median partition. The floor of the nasal chambers is formed by the hard and soft palate, which separates them from the mouth. The nasal chambers open behind by the posterior nares into the upper part of the pharynx. The roof of the chambers in its front part between the eyes is formed by a plate of bone, the cribriform plate, which separates them from the cranial cavity in which the brain lies. Through this plate of bones which is perforated by numerous holes, the branches of the olfactory nerves stream from a part of the cerebral hemispheres called the olfactory bulb.

The margins of the nostrils are provided with a number of stiff hairs which arrest the passage of dust and other foreign substances carried in with the inspired air.

The pituitary membrane is the mucous lining of the nose. It contains numerous mucous glands which secrete mucous for the purpose of keeping the membrane moist, a condition which is essential to perfection of the sense of smell. It gets much thickened and swollen in

some nasal trouble and obstruct the nasal passages to such an extent as to fore You to breathe through the mouth.

The olfactory nerves are the special nerves o the sense of smell. The nerves which ramify over the lower part of the lining membrane of the nasal cavity are branches of the fifth or trigeminal nerve. These nerves furnish the tactile sense and enable you to perceive by the nose, the sensation of cold, heat, tickling, pain, and tension or pressure.

The organ of smell is placed in a space of about half an inch inside the nose in the upper part of the nasal passage.

II

Odours or smells are caused either by minute particles or solid matter or by gases which are in the atmosphere. They must be capable of solution in the mucous of the pituitary membrane. Odorous particles in the air pass through the lower, wider air-passages, pass by diffusion into the higher, narrower, nasal chambers, fall on the membrane which is provided with olfactory nerve-endings, produce sensory impulses, which reach the brain and give rise to the sensation of smell.

This place is filled with nerve endings sensitive to smell, to which the substance should be presented in a volatile form. Nonvolatile substances have no smell.

All odorous substances lose weight. It has been demonstrated by means of delicate instruments that odoriferous substances pass into a state of vapour when exposed to the air. Continual inhalation of a particular odour blunts the olfactory sense of that odour. This is a peculiar characteristic of the organ of sense.

When the stimulus is repeated, the sensation very soon dies out, the sensory terminal organs quickly becoming exhausted. Foul odours are quickly noticed by anyone coming into a sick room from out of doors. but a nurse who is in the sick room constantly gets accustomed to such odours. Her olfactory sense of that foul odour has become blunted.

The sense of smell is extremely delicate. The most minute amount of odoriferous matter such as musk, ammonia, asafoetida etc., serves to excite it. Dogs and rats are endowed with a powerful sense of smell. Through smelling they can reach their original abode even if they are taken to a very great distance. Beasts and dogs search their food through smelling. Hence they are endowed with a strong sense of smell.

The loss of smell that takes place in the attack of severe cold is due to the swollen state of mucous membrane which covers the interior turbinal bones, hindering the passage of odoriferous air to the olfactory chamber.

Very little is known of the physiology of smell. Smells have been classified as agreeable or disagreeable. A much more detailed classification is possible.

By sniffing more air is drawn into the upper part of the nasal chambers than is the case in ordinary inspiration. You sniff when you wish to detect a faint smell. Any odorous particle in the air acts on the delicate rod-shaped cells and impulses pass from them along the olfactory nerves to the brain.

III

As the nose is the channel for inhalation of air, it should be clean and free from bacteria or germs. The nose may be occasionally cleaned by drawing up an alkaline antiseptic lotion and throwing that off through the mouth. Certain diseases like influenza are checked by such

antiseptic wash of the nose in early stage. This is beneficial in cold. Drawing cold water through the nose in the early morning is a Hatha-Yogic practice. It removes catching cold.

The habit of breathing through the mouth must be avoided. The air contains some impurities. The nose acts as a, kind of filter. The mucous membrane of the nose is kept constantly moist by the mucus secreted by the little cells it contains. The air drawn over this moist surface is warmed and moistened and at the same time freed from impurities such as soot and dust. The dust frequently contains micro-organisms. It is neglecting one of the nature's safeguards to breathe through the mouth. Breathing through the mouth is sometimes merely a bad habit. It is not due to any obstruction. Correct this bad habit at once.

Sometimes there is an obstruction called an adenoid growth at the back of the nose which prevents a person breathing through the nose. The growth should be removed by a surgeon. Consult a doctor if your child is not able to breathe through the nose.

THE EAR AND HEARING

The ear is one of the avenues of communication with the external universe. It communicates the messages of sound to the brain where they are explained and utilised. Through the organ of hearing you communicate freely with others and enjoy music. The ear or organ of the sense of hearing is very much more complex than the other sensory organs.

The auditory apparatus consists of (1) the external ear, (2) the middle ear, (3) the internal ear and (4) the auditory nerve.

External Ear

The external ear consists of what we see namely the fanlike projection called the pinna or auricle and a canal leading inward (the external auditory canal) about an inch in length. The central depression or the concha in the pinna collects sound waves and conducts them into the auditory canal. The glands outside secrete a sort of wax (cerumen) which protects the interior organs from dust and water. The wax is bitter and therefore repels ants and insects that may try to approach in the tympanum or the drum or drum-membrane. The middle ear begins from here. The drum separates the middle ear in the external ear. A narrow bony canal leads downwards and inwards to the drum of the ear. The drum is a thin membrane stretched tightly across the bony canal.

Middle Ear

This is a flattened drum-like cavity in the temporal bone. The Eustachian tube which is about 1 y2 inches long leads from the inner side of the cavity to the upper part of the pharynx. There are two other openings in the bony wall of the cavity of the middle ear. These openings are closed by the membranes. One is oval and called the fenestra ovalis and the other is round and called the fenestra rotunda. They lead to the internal ear.

The middle ear is separated from the external auditory canal by drum-membrane (tympanum) and from the internal ear by a bony wall in which there are two small openings covered which membrane—the oval window or fenestra ovalis and the round window or fenestra rotunda. The cavity of the middle ear is so small that probably 5 or 6 drops of water would completely fill it.

To the inner side of the tympanum is attached a series of three bones viz., hammer (malleus), anvil (the incus) and stirrup (stapes) which serve to communicate the vibrations of the tympanum to the membrane of the oval opening. These bones are very delicate and are called the auditory ossicles.

The malleus is firmly attached to the drum-membrane, and the stapes is fastened into the oval window also covered by membrane leading into the inner ear. The incus is placed between the malleus and stapes and attached to both by delicate articulations. These little bones are set in motion with every movement of the drum-membrane. Vibrations of the membrane are communicated to the malleus taken up by the incus, and transmitted to the stapes, which rocks in the fenestra ovalis and is therefore capable of transmitting to the fluid in the cavity of the labyrinth the impulses which it receives.

The Internal Ear

This is the essential part of the organ of hearing. This is the real organ of hearing. The auditory nerve ends here. This is a tiny bag with three handles and a spiral like the shell of a snail. It is filled with fluid and is embedded in the bone. In the spiral there are series of strangely shaped cells which receive the vibrations of sound and communicate with the nerves which transmit the messages to the brain. The sound wave travels to the drum and sets the tympanic membrane in motion. This throws the little chain of bones in turn into vibration and by means of the stirrup and ' he membrane of the round window the vibration is communicated to the fluid of the internal ear.

The bag lies in a cavity of similar shape in the bone of the temple. The cavity of the inner ear is a completely closed one. The cavity and round openings from it to the middle ear are closed by membranes. There is a very thin space between the membranous bag and the walls of the cavity. The space is filled with a few drops of lymph-like fluid called pedilymph. This membranous bag is attached to the cavity in some places and loose in some other places. The central part of the bag is an oval sac called the utricle.

Three semicircular canals (hooplike canals) spring from this. They lie in corresponding canals of the bone. Near the utricle and in round about communication with it is another small sac called the saccule. The two sacs together form the vestibule. The canals and the vestibule together form the membranous labyrinth. The membranous labyrinth contains a fluid called endolymph. The auditory nerves enter the bulb-like portions of the semicircular canals and also pass on to the membrane.

The Cochlea

Just as the utricle gives off the semicircular canals, so also the saccule gives off a canal containing also endolymph, called the canal of the cochlea. It is coiled in the form of a spiral of two and a half turns, forming a small cone called the cochlea. It lies in a spiral canal in the bone and is fixed to the bony cavity. Within the cochlea there are partitions and on them rest microscopic hairlike cells supported on the rods of corti which are like strings of a piano and vibrate in response to a particular note which reaches the ear.

Organ of Corti

It consists of a series of special nerve organs placed in a row. Each end-organ responds to a give number of vibrations, thus covering all the range of sound. These end-organs are continuous with the fibres of the eighth or auditory nerve which carries the sensations of hearing back to the brain.

Eustachian Tube

This opening in the throat is kept closed except at the time of swallowing when it opens. This tube keeps the atmospheric pressure in the middle ear same as that of outside. If this tube is clogged by secretions during an attack of cold then temporary deafness results.

Sound

Sound from the outside strikes the ear drum or tympanum and vibrates it. This vibration is communicated to the inner ear through the medium of the middle ear.

All bodies which produce sound are in a state of vibration and communicate their vibrations to the air with which they are in contact and thus the air is thrown into waves, just as a stick waved backwards and forwards in water throws the water into waves.

When air-waves set in motion by sonorous bodies enter the external auditory canal, they set the drum-membrane vibrating. These vibrations are communicated to the chain of tiny bones stretched across the middle ear. Their oscillations cause the membrane leading into the internal ear to be alternatively pushed in and drawn out. Vibrations are in this way transmitted to the perilymph. Each vibration communicated to the perilymph travels as a wave over the vestibule, semicircular canals and cochlea and is transmitted through the membranous walls to the endolymph. The vibrations of the endolymph stimulate the nerve-endings of the organ of corti. Nervous impulses are conveyed by the auditory nerve to those parts of the brain, stimulation of which gives rise to the sensation of sound.

The semicircular canals are of service in enabling us to form judgments of the equilibrium of the body and of its movements in various directions. It is the function of the semicircular canals that gives us a knowledge of the position of the head when at rest.

Anything that causes a sound either vibrates bodily itself or some of its particles vibrate. Consequently the air around it is thrown into waves. If these waves are of sufficient intensity and frequency, they produce the sensation of sound when they reach the ear.

The sound vibrations called sound waves travel in the air at the rate of 1100 feet per second. When the vibrations are regular and rhythmic the sound is called musical. Hence there is the feeling of harmony or melody. Sometimes there are no regular repetitions of vibrations. The sounds consist of vibrations which fall irregularly on the ear. Such sounds are called noises. They do not give rise to feelings of melody or harmony.

The lowest audible note is 30 vibrations per second. The highest audible note varies very much with individuals. Some can hear even 30,000 vibrations per second. Some cannot hear the squeak of a bat or mouse or the chirp of a sparrow, which are much lower notes. Many insects make sounds which are not heard by us.

Sound is also transmitted through liquids and solids.

A musical sound or a noise may be loud or feeble. This depends on the strength with which the vibrations affect the ear. A musical sound has a high or a low pitch. This depends on the rapidity with which the vibrations are repeated. When they are repeated slowly the pitch is low, when rapidly high. Besides pitch and loudness a musical sound has quality. The same note struck on a piano and on a violin seems to us in some way different. This difference is due to the fact that very many musical sounds consist not of one set of vibrations only, but of several, of a main set of vibrations called the fundamental tones, and of others called partial tones or over tones.

If you hear musical sounds you will find that each set of regularly repeated vibrations produces in the central end-organ a particular kind of sensation, called a tone. The simultaneous or successive production of different tone-sensations produces the feeling of harmony or melody. When you hear a noise the vibrations produce sensations. You call the noise slight or great, low or loud according to the intensity of sensations. The sensations

have certain characters by which you recognise the kind of noise. But the sensations have not the qualities of tone sensations. They do not produce the feeling of harmony or melody.

The effect produced by a sonorous vibration continues for a short time after the cessation of its cause. Usually the interval between two different impulses is sufficient to allow the first impression to disappear before the second is received, and the ear distinguishes them in succession. But if they allow each other at equal intervals, with a certain rapidity, they produce the impression of a continuous sound. This sound has a higher or lower pitch according to the rapidity of its vibrations. Sound waves following each other with a rapidity of less than 16 times per second are separately distinguishable. Above that frequency they are merged into a continuous sensation. When the sound waves recur at irregular intervals the only characters perceptible in the sound are its intensity and quality. But if they succeed each other at regular intervals, the sound produced has a position in the musical scale as a high or low note. But a limit is at last reached at which the ear fails to perceive the sound. An excessively high note is therefore inaudible. Sonorous vibrations perceptible as musical notes range between 16 per second for the lowest notes and 38,000 for the highest.

Injury to the Ear

Blows on the ear are dangerous. They have been known to rupture the drum. Therefore the ear should never be boxed.

Foreign bodies may get into the ear. Children sometimes stuff peas or beads into it. No attempt to remove them should be undertaken by anyone but a medical man. On account of the shape of the bony canal attempts to remove them usually push them still further. In the case of insects, which cause great pain and alarm, a little warm oil or water may be poured into the ear and the insect will be floated out.

When you get earache or discharge from the ear do not neglect it. Consult a doctor or ear specialist.

VOICE AND SPEECH

The larynx is a short tubular box opening above into the bottom of the pharynx and below into the top of the trachea or windpipe. Its frame-work is supplied by certain cartilages more or less moveable on each other. These are connected together by joints, membranes and muscles. Adam's apple which can be seen and felt in the neck is the upper part of the windpipe or the larynx. In this are placed the vocal cords, two thin folds of membrane which are stretched tightly across it and open wider when we take a breath. The voice is produced by air passing through these vocal cords.

Voice is produced in the larynx or voice box. This organ is at the top of the trachea or windpipe and suspended from the hyoid bones by ligaments and muscles. Voice is produced by the vibrations of the fringe of two folds of mucous membrane called the vocal cords.

A blast of air, driven by an expiratory movement out of the lungs, throws the two elastic folds (vocal cords) into vibration. These impart their vibrations to the column of air above them, and so give rise to the sound which we call the voice.

The musical note will be low or high accordingly as the vocal cords are relaxed or tightened. This again depends upon the relative predominance of the contraction of the crico thyroid and thyro-arytaenoid muscles. When the thyro-arytaenoid muscles are fully contracted, the thyroid cartilage will be raised, relatively to the cricoid, as far as it can go and the vocal cords will be rendered relatively lax. When the crico thyroid muscles are fully contracted the thyroid

cartilage will be depressed relatively to the cricoid, as much as possible, and the vocal cords will be made more tense.

The first ring of cartilage which forms the voice-box (larynx) is the thyroid cartilage. This cartilage shapes the "V" like projection in the trachea which rises up and down in the act of swallowing. The next ring is the cricoid cartilage. It is a complete ring. Sitting on the back of the cricoid cartilage are two pieces of cartilage resembling the pyramid, called arytaenoid cartilages. There is a broad band of muscle called thyro-arytaenoid muscle. When the arytaenoid cartilages are wide apart, the aperture between the vocal cords, has the form of a "V" with the broad part behind. When at rest, the vocal cords take their position. When the voice is produced the arytaenoids are drawn together. The vocal cords become parallel and the aperture narrows down to a mere slit. The vocal cords are tightened at the same time by the crico-thyroid muscles from the arytaenoids. By adjustment of the slots and tension of the vocal cords with the help of the muscles, proper note is obtained when air is forced through. In this way sound comes out of the mouth. With the help of the lips and tongue, the voice arising in the larynx is modified to articulated speech.

A good songster can accurately adjust the different muscles so as to produce the proper tension of the cords, so that their vibration will give the note he wishes. In women and in boys the vocal cords are shorter and the whole larynx smaller than in men. Therefore higher notes are produced. Tenor and bass voices, or alto and soprano voices depend on small differences in the construction of the larynx.

Speech is produced by modifying the voice arising in the larynx by changing the form of the cavity of the pharynx and mouth, by means of the tongue and lips.

There is no vibration of the vocal cords in whispering. A faint noise is produced by the friction of the air as it passes through the glottis. The sound is modified to a feeble speech by movements of the tongue and lips. Voice may exist without speech and speech may exist without voice as in whispering. In whispering there is a sort of voice produced by the vibration of the muscular walls of the lips, which replace the vocal cords. A whisper is a very low whistle.

ORGAN OF SIGHT

The eye teaches you a greet deal about the world In which you live. It receives the light rays which are continually streaming from the sun. The eye-ball is an organ sensitive to light. It is suspended in its bony cavity in the skull. The cavity protects the ball on all sides except at the front where it is guarded by the eyelids. The eye-ball is attached behind by the optic nerve.

I

Protective Appendages of the Eye

The eyelids are folds of skin containing thin plates of cartilage. They are fringed at the edges with hair, the eyelashes and contain a series of small glands called Meibomian. glands. The secretion of these glands is provided to prevent adhesion of the eyelids. The eyelids are covered internally by a mucous membrane, the conjunctiva which is reflected from them over the globe of the eye.

The eyelashes are arranged in a double or triple row at the margin of the lids. The upper lid is attached to a small muscle which is called the elevator of the upper lid (levator palpebrae superioris). The muscle orbicularis palpebrarum is sphincter around both lids. This muscle shuts the eyelids. It is the direct antagonist of the elevator of the upper lid.

The slit between the edges of the lids is called the palpebral fissure. The size of this fissure causes the appearance of the large and small eyes but not the size of the lobe itself. The size of the lobe varies but little.

Conjunctiva is a delicate mucous membrane which lines the interior of the eyelids and the front of the eye-ball. Inflammation of the conjunctiva is called conjunctivitis or sore-eyes.

The eyelids are provided for the protection of the eye. They are movable shades which by their closure exclude light, particles of dust and other injurious substances.

Eyebrows

They are composed of two arched eminences of the thickened skin. They are connected with three muscles which by their action control to a small extent the amount of light admitted into the eye. They are furnished with numerous short thick hair.

Lacrymal Apparatus

This apparatus consists of (1) the lacrymal gland, (2) canaliculi, (3) lacrymal sac and (4) nasal duct. The lacrymal gland secretes tears. It is placed at the upper and outer angle of the orbit. Seven to twelve minute ducts lead from the gland to the surface of the conjunctiva of the upper lid.

The secretion (tears) is usually just enough to keep the eye moist. It passes over the surface of the eye-ball and is sucked into two tiny canaliculi through the punctae and is conveyed into the lacrimal sac which is the upper dilated portion of the nasal duct.

The nasal duct is a membranous canal about three-quarters of an inch in length. It extends from the lacrymal sac to the inferior meatus of the nose into which it opens by a slightly expanded orifice or opening.

The tears consist of water containing a little salt and albumin. They are ordinarily carried away as fast as they form. But under certain circumstances, as when the conjunctiva is irritated by pungent vapours, or when painful emotions arise in the mind, the secretion of the lacrymal gland (tears) exceeds the drainage power of the lacrymal duct. The fluid accumulates between the lids and overflows in the form of tears. It runs down the cheeks.

II

The Muscles of the Eye-ball

The muscles which move the eye-ball are six in number Four muscles are straight (recti) and two oblique. The recti muscles are the superior rectus, inferior rectus, the external rectus and the internal rectus. The eye-ball is completely imbedded in fat behind and laterally. These muscles turn the eye-ball as on a cushion. The superior rectus turns the eye upwards, the inferior downwards, the external outwards, and the internal inwards. The action of the oblique muscles is complicated. They roll the eye-ball on its axis and pull it a little forward

and inward. The eye-balls can be turned and moved in any desired position or direction. If the eye-balls are not endowed with such a movement, you will have to turn the whole head frequently in your vision of objects. It will be a great nuisance, trouble and difficulty. Mark here the grace of the Lord and His wisdom in creation!

III

The Eye-Ball

The visual apparatus is the eye with its accessory organs and the optic nerve. Eyebrows eyelids, lacrymal apparatus, and muscles of the eye-ball are accessory organs of the eye. The eye-ball is really a minute camera which is constantly photographing the outside world on to the retina. It is covered with a strong white coat and is filled with a transparent jelly. There is a transparent curved window in front through which the light rays enter. Behind this, there is the lens of the camera. It is a little clear oval body, shaped like two watch glasses placed together, the edges touching. Iris, a coloured curtain is stretched between the lens and the window. It has a hole in the middle known as the pupil. The iris contains a delicate ring of muscle fibres which makes the opening in the curtain smaller when they contract. This iris is the diaphragm of the camera.

The eye-ball is contained in a cavity, the orbits. Seven bones assist in the formation of each orbit, namely frontal malar, maxilla, palate, ethmoid, sphenoid and lacrymal. Each orbit is nearly two inches in depth. It is padded with fat and lined with a membranous capsule—the capsule of Tenon which is a serous sac. Thus the eye-ball is isolated from surrounding structures. It can freely move without friction. The eye-ball is protected from injury by the bony wall, the eyelids and the eyelashes.

The eye-ball is composed of three coats or tunics and contains three refracting media or humours. The three coats are (1) sclera and cornea, (2) choroid ciliary processes and iris and (3) Retina. The three refracting media are (1) aqueous humour, (2) crystalline lens and capsule and (3) vitreous humour.

Six striated muscles connect the eye-ball with the wall of the cavity or orbit. Four of these muscles are straight or recti-muscles and are called superior, inferior, external and internal recti-muscles. There are two slanting muscles, the superior and inferior oblique muscles. The eye can be directed or rotated to any direction and at any angle with the aid of these six muscles. The movement of the eye-ball is really a very complicated one.

The optic nerve has its root in the brain. It leaves the skull by a hole at the back of the orbit and enters the back of the globe of the eye. It spreads out into a very delicate membrane which lines the hinder two-thirds of the globe or the eye-ball and is termed the retina. This retina is connected with sensory nervous fibres. It gives rise to the sensation of light.

Sclera

The sclera covers the posterior five-sixths of the eye-ball. It is opaque, white and smooth. Behind it is pierced by the optic nerve. It is a thick fibrous outer coat of the eye-ball. It selves to protect the delicate structures contained within it. It is the protective, the choroid, the vascular or nutritive and the retina is the visual or perceptive layer of the eye-ball.

Cornea

This covers the anterior sixth of the eye-ball. It is directly continuous with the sclera or sclerotic coat of the eye-ball. It is composed of fibrous tissues. This is the "window of the

eye". It is perfectly transparent but appears dark, as dark internal structures are seen through it. Just beyond the edge of the cornea there is a thin shining membrane, called the conjuctiva. This is attached to the eye-ball all round. This is kept well-lubricated by the secretions of the eye. It gives the eye-ball its peculiar shining and glossy aspect.

Choroid

The eye of a man appears black in the centre with a variously coloured ring round the centre. The ring is variously coloured. It is a circular curtain attached to the edge of the cornea all round. There is a hole in the centre which appears dark. The curtain is called iris. The hole is called the pupil. The colour of the iris may be black, brown or blue. The colour is due to the varying amount and distribution of granules of black pigment in it.

At the edge of the cornea the iris is continuous all round with a second coat which lines the hinder three-fourths of the eye. This coat is called the choroid. It is loosely attached to the inner surface of the sclerotic upto the edge of the cornea where it leaves the outer coat and juts out across the eye forming the iris. The choroid is much thinner than the sclerotic. It is abundantly supplied with blood vessels. Its inner surface is black as it is lined by a layer of cells full of granules of black pigment. The back of the iris is also covered by a similar layer or cells filled with granules of black pigment. The choroid is thrown into a number of folds arranged in a radiating manner all round, just before it becomes continuous with the iris. These folds are known as ciliary processes. They like the choroid, are covered by a layer of black pigment cells.

IV

Iris

The iris is like the diaphragm of a camera. The pupil is like the aperture or hole of the diaphragm. The size of the pupil is variable. It can be regulated by the muscles of the iris or the diaphragm. In shade the pupil enlarges by taking in more light in the eye through the enlarged hole. In direct light of the sun the pupil contracts to a pinhole so as to shut out all unnecessary light.

Iris (rainbow) is a coloured, fibro-muscular curtain hanging in front of the lens and behind the cornea. It hangs free in the interior of the eye-ball. The light is admitted into the eye-chamber through the pupil. The sphincter muscle is the contractor of the pupil. Another set of muscle is the dilator of the pupil. The posterior surface of the iris is covered by a thick layer of pigment cells designed to darken the curtain and prevent the entrance of light. The anterior surface of the iris is also covered with pigment cells. It is particularly these latter which produce the beautiful colours seen in the iris. The different colours of the eye are chiefly due to the amount and not to the colour of the pigment deposited.

Iris cuts off the rays which would otherwise pass through the outer parts of the crystalline lens and be brought to a focus too soon.

Pupil

If you look at the pupils of any one's eyes when the sun is shining brightly, you will notice that they are small. The curtain (iris) has contracted and has shut a great many light rays. But if you shade the eyes or if the person turns away from the light the pupils will at once become larger. The eyes of the animals are glowing like lamps in the dark, because some rays of light are reflected back from the retina. In animals the pupils are very big in the dark to enable them to catch as many light rays as possible.

When you look at near objects the pupil is smaller than when you look at an object which is at a distance, because it is easier to focus clearly for near objects when the external rays reflected from them are cut off.

The pupil is larger when the light is dim and also when you look at distant objects. It is smaller when the light is strong and when you look at near objects. The sphincter muscle that is placed near the margin of the pupil contracts and the pupil becomes smaller. When this muscle relaxes the pupil becomes again larger.

V

Lens

A transparent, glass-like double convex body is situated at the back of the pupil immediately behind the iris. This is the crystalline lens. It is kept in place by a sheet of transparent tissue called the suspensory ligament. It passes off from its edge and attaches it all round the ciliary processes. It forms a ring all-round the lens. It is composed of a jelly-like substance placed in layers like those of onions. The large cavity between the crystalline lens in front and the retina behind is filled with a matter called vitreous humour, which is a clear semi-fluid substance. It supports the retina which lies upon its surface and preserves the spheroidal shape of the eye-ball. The space between the cornea and the iris, is called the anterior chamber of the eye. It is filled with a fluid called the acqueous humour which is thin and watery.

Its refractive power is much greater than that of the acqueous or vitreous humour. It acts by virtue of its double convex form as a converging lens, bringing parallel or diverging rays to a focus on the posterior surface of the retina. The function of the crystalline lens is to bring to a focus all the rays of light emanating from each separate point in the objects seen, so that all the light from each point falls on and stimulates a corresponding point on the retina. If the eye consisted only of a sensitive retina impressions of light could be received, but the form of objects would not be distinguished.

Perception of the figure of external objects depends upon the action of the crystalline lens in converging all the rays emanating from a given point to a focus on the retina. The lens is enclosed by a transparent membrane called the capsule of the lens. The suspensory ligament is attached to this capsule.

VI

Retina

The Retina is the seeing part of the eye. It is spread out in the form of a delicate membrane on the inner surface of the eye-ball. It is connected with the brain by a large nerve which enters the back of the eye-ball. At the back behind the lens is the retina which is the sensitive portion of the eye. It is almost entirely composed of the nerve terminations of the optic nerve. This is the innermost coat of the eye-ball. It is the most essential part of the organ of sight, as it is the only one directly sensitive to light.

The retina lines the interior of the eye. It is placed between the choroid and vitreous humour. It consists of eight layers. The eighth layer or layer of nerve-fibres is the internal layer. The seventh layer is the layer of nerve-cells. The first layer or the layer of rods and cones is the external layer.

The fibres of the optic nerve pierce the sclera and choroid at the back of the eye and spread out and form the eighth or innermost layer of the retina. The fibres pass peripherally through

the other layers and terminate in the layer of rods and cones. Rays of light do not produce any effect on the optic nerve without the intervention of the rods and cones.

Rods and Cones Light excites rod-like processes of cells in the retina and impressions pass from these to the optic nerves. These cells lie in the retina in a definite layer, called the layer of rods and cones. There is a connection between the fibres of the optic nerve and the rods and cones. The rods and cones are the essential nervous elements of the retina.

The layer of rods and cones is at the outer surface of the retina, that is the surface next to the choroid coat, while the layer of nerve-fibres and of nerve-cells is next to the vitreous humour. The light which comes through the vitreous humour has to pass through the retina itself, before it can excite the rods and cones. Therefore the whole retina is transparent.

VII

Vision or Seeing

The rays of light excite in the optic nerve impulses which reach the brain and produce the sensation of sight. In the act of seeing the rays of light fall on the eye-ball, pass through the transparent portion of the cornea, penetrate the aqueous humour and enter the lens through the aperture of the pupil. The pupils cut off side rays in order to give a clear image.

The aperture is also regulated by the amount or light required. Light from the object then enters the lens, passes out of it and strikes the retina. The lens is biconvex. The image framed on the retina is a reversed image of the object. The actual seeing is done by the visual centre in the brain. The brain corrects the inverted image to an upright one. The lens of the eye focuses the rays of light for us on the retina. It is shaped exactly like the magnifying glass. It is placed at just such a distance from the retina that all the rays of light coming from distant objects are focussed there.

Visual Sensation

The impression made by light lasts for a certain time after the light is taken off. This is about one eighth of a second. If two flashes follow each other at a less interval of time than this, their impressions catch each other up and produce one sensation only. The eye sees a continuous flash. That is the reason why the spokes of a rotating wheel are not seen separately and why a lighted stick moves quickly at night gives the idea of a circle of fire. The projection of cinema pictures is based upon this. Separate pictures are flashed before the eyes very quickly. The eyes join the separate units and get a moving picture.

The sensibility of the retina is easily tired. If you look at a bright light for some time, and then look at a sheet of paper a dark spot or dark image of the bright light is seen on the paper. The reason is this. The retina is in a state of fatigue after looking at the bright light. And so the light rays from the paper cannot excite the sensation of light.

Ordinary light or white light can be split up into a number of rays which fall on the retina and produce the different sensations called colours. The retina may similarly be fatigued for one colour only that is for one portion only of white light. If you look at a piece of red paper lying on a sheet of white paper steadily for some time and if the red paper is re moved suddenly you will see a green patch where the red patch lay. The reason is this. The part of the retina on what the image of the red patch fell got tired of red rays. After the red patch was removed, there was no effect on the retina by the red rays which were present in the white light now coming from the same spot. It is as if the white light coming from the spot contained no red rays. But if you take the red rays out of white light, the result is green. Red and green light mixed together make white light. Red and green are complementary colours.

When the eye is fatigued for one the other is seen, the same is the case with yellow and blue.

Some suffer from colour-blindness. They are not able to see the differences between some colours. They are not able to see red and green as distinct colours. They cannot tell the difference between red and green objects except by their shade and brightness. This is a very important matter in the selection of engine drivers and sailors. A few persons are totally colour-blind. Everything appears to be of the same colour to them.

Firm pressure on the eye produces a bright image or light (phosphene). A blow on the eye or a fall on the head produces flashes of light. In these instances there is no falling of light on the retina. These effects have their origin in the retina itself. They appear to you as sensations of light.

Colour Vision

When you look at a rainbow you behold seven distinct kinds of colour-sensations. They are VIBGYOR (violet, indigo, blue, green, yellow, orange and red). When ordinary white light is passed through a prism and then allowed to fall into the eye, you experience the same seven-coloured sensations. These are called colours of the spectrum. Each colour is characterised by certain qualities as in the case of sounds. There are: (i) Hues such as red, green, blue, yellow etc. This depends on the wavelength of the ethereal vibrations. This corresponds to the pitch of a sound. (ii) Intensity or brightness. This depends on the amount of light which falls on the retina in a given time. This corresponds to the loudness of a sound. (iii) Saturation or the amount of admixture with white light. A colour is pale if it is mixed with much white, deep, rich or full if highly saturated i.e., unmixed with white.

The colours of objects depend on the power they possess of absorbing some of the constituents of ordinary white light and allowing others to pass or to be reflected. Thus a piece of glass is blue if it allows the blue rays to pass to the eye and stops the others. The colour of an opaque blue object is due to an absorption of the spectral colours other than blue by the superficial layer of the objects and the reflection of the unabsorbed blue rays from its internal parts.

There are several pairs of colours such as red and green, orange and blue, yellow and blue, greenish yellow and violet, which when mixed in the right proportions give rise to the sensation.

These are called as complementary colours. Every colour has some other colour which is complementary to it. If we mix the colours in threes, then it becomes still more easy to produce white. An excellent white colour is obtained if we mix red, green and blue in proper proportion and intensity. Also these three colours and their mixtures produce all the several kinds of colour-sensations which we get from a spectrum. By suitable mixture of these colours with white or black we can produce the other colours which we see in natural objects around us, but which are wanting in the spectrum. Thus purple can be made at once by mixing red and blue. Therefore these three colours are regarded as primary colours.

VIII

Accommodation

The lens like all ordinary lenses forms the image of the object at its focus. The place where the image is formed behind the lens depends upon the distance of the object and also upon the curvature of the lens. In the case of the eye the place of image is fixed at a definite place. The image must fall on the retina. The curvature of the lens is varied by means of the

ligament attached to the lens in order to accomplish this. The lens becomes flat for distant object. It becomes more convex for nearer object. The power of the lens to adapt its curvature according to the distance of the object is termed accommodation.

When you take a photograph of something near at hand you have to focus your camera differently from the position for a distant landscape view. In a camera this can be done by altering the lens or by altering the distance of the screen. In the eye the distance between the lens and the retina remains the same, but the shape of the lens is changed.

The lens is elastic. If its surface is made flatter by pressure, it recovers its original curvature and shape when the pressure is relieved.

In accommodation for near objects, the lens becomes more convex and the pupil of the eye likewise contracts. This convexity is brought about by the action of the ciliary muscle, and is always more or less fatiguing. The accommodation for distant objects is a passive condition, the convexity of the lens being unaltered and the pupil of the eye dilated and it is on this account that the eye rests for an indefinite time upon remote objects without fatigue.

IX

Blind Spot

The optic nerve pierces the eye-ball not exactly at its posterior point but a little to the inner side of it nearer the nose. This point where the optic nerve enters is called the blind spot. There are no rods and cones at this spot. Light falling on the spot produces no effect. It is therefore called the blind spot. This is a proof that the sensation of light cannot arise without either rods or cones.

Yellow Spot

There is one point of the retina that is of great importance. This is the yellow spot (macula lutea). It is the exact centre of the retina. It is situated about one-twelfth inch to the outer side of the exit of the optic nerve. In its centre is a tiny pit—fovaea centralis. This is the centre of direct vision. This is the part of the retina which is always turned towards the object looked at. From this point the sensitiveness of the retina grows less and less in all directions. At this point (fovaea centralis) no fibres of the optic nerve are found. But there is a great increase in the number of cones as well as in their size. It is in the yellow spot that vision is most distinct. In the central part of this yellow spot all the parts of the retina except the layer of rods and cones are extremely thin. Light can here most easily pass to the cones. When you wish to see a thing distinctly you look straight at it so that its image falls on the yellow spot. You see the other things around, but not so distinctly, as their images are falling on the other parts of the retina.

X

Care of the Eyes

The eyes are very delicate organs and extremely useful. Hence you will have to take very great care of the eyes. Injudicious use of light causes harm to the eyes and produces shortsightedness in boys. When you read or write light should be allowed to fall on the object preferably from behind and above or from the left side and above. Do not read in a bad light or in a light that flickers. If you read in a bad light or a light that flickers there is great strain on the eyes. You will get eye trouble. Too much reading and close work such as fine sewing is not good for the eyes. Children should spend as much of their time in the open air as possible because the eyes are not looking at objects close to the type.

Protect the eyes from smoke. Smoke irritates and injures the eyes. Do not exhaust the eyes by too much reading and reading in the twilight or insufficient light.

The eyes get inflamed by exposure to light, abrasions, dust or from bacterial diseases. Pus forms in the corners of the eyes. The pus becomes a source of spreading contagion to others. Flies sit on the eyes and carry infection. Beds, towels and pillows once used by infected persons spread the disease to other people who use these articles.

You handle many contaminated articles. When you enter a train or bus you catch the handle or push the knob or hold the railing. All these may have been used by others and got polluted with pus from their fingers, hands etc. Other people who catch such handles etc., may use their fingers or palms for rubbing their eyes when there is any irritation in the eyes. Their eyes will get contaminated.

Sometimes particles of dust or charcoal or mosquitoes may enter the eyes. They cause much discomfort and pain. a s the eye is very sensitive. They cause a rapid secretion of tears which helps to wash the foreign body into the corner of the eyes. You can remove them easily with the corner of a pocket hand-kerchief.

Use the eye-cup or open the eye under water. The foreign body will be removed. If there is a foreign body under the upper lid, hold the lid firmly between the finger and thumb and ask the man to look down. Pull the lid down over the lower lid and then release it. The particle of dust may then be rubbed off by the lower eyelashes. This may be repeated several times.

As the eye is a very delicate and sensitive organ, it is always better to seek the aid of a doctor. Any injudicious and rough handling may injure the eye. Cover the eyes with a folded handkerchief till you see the doctor. By so doing you can give the eyes as much rest as possible. The eye can never be at rest if the light is not excluded.

Short Sight and Long Sight

Myopia is short sight. Presbyopia is long sight. It is difficult to see objects nearer than 5 or 6 inches from the eye, because the lens cannot be made convex enough to bring the image on the retina. Short-sighted persons or those who suffer from Myopia cannot behold distant objects clearly, for the flatness of the lens is not enough. The image strives to form past the retina. However much this lens is flattened by the suspensory ligament, it brings the rays from a distant object to a focus in front of the retina. The lens of the eye has to be flattened more in order to bring the image on the retina. The retina is farther behind the lens in short-sighted persons than in the ordinary eye, the eye-ball being longer. That is the reason why the short-sighted eye brings the rays to a focus in front of the retina. It is not due to the lens being naturally more convex. To correct this concave spectacles have to be used.

Similarly old men who are long-sighted cannot see near objects clearly. The defect is removed by adding to the curvature of the lens of the eye by wearing convex spectacles.

In a long-sighted person the eye-ball is shorter than usual and the retina lies too near the lens. H sees distant objects very well, but the rays from near objects are brought to a focus behind the retina and so the image on the retina is indistinct. The power of accommodation for near objects has more or less failed. The ciliary muscle does not contract so well or the elasticity of the lens is impaired so that when they look at near objects they cannot make the lens convex enough.

Cataract

Cataract is a fatty degeneration of the lens which makes it opaque and gives it a milky appearance. The only remedy is to remove the lens. The use of a convex lens of glass in

front of the eye acts as a fair substitute. In many cases this gives a very good degree of vision.

The eyes should always be examined by a doctor in cases of headache or where there is any difficulty in reading the black board in school.

THE NERVOUS SYSTEM

Introduction

The brain and the spinal cord with the nerves proceeding from them constitute the nervous system of the body. The brain and the spinal cord are the central organs, and so they form the central nervous system. The central nervous system includes the spinal bulb or medulla-oblongata and the cranial and spinal nerves which are connected with this axis. The central nervous system is also known by the name cerebro-spinal system.

The sympathetic system consists of the chain of sympathetic ganglia, the nerves which they give off and the various cords by which they are connected with one another and with the cerebro-spinal nerves.

The nervous system is a collection of nervous tissues set apart as a special apparatus for inception, reception and transmission of nerve impulses. It is the great controlling and regulating mechanism of the body. The nerves travel to every part of the body. They resemble the telegraph wires. They are always carrying messages to and from the various parts of the body. The brain is the central station. It represents the head office where complaints and requests are received and from which commands are issued.

The nerves finally terminate in minute structures called nerve-endings. Here and there along their course the nerve-fibres are connected with partially discrete aggregations, of nerve-tissue called the nerve-ganglia. The nervous system is made up of tiny microscopic elements called neurones.

I

NEURONES

The anatomical and physiological unit of muscular tissue is muscle-cell and that of connective tissue is connective tissue-cell even so the anatomical unit of nervous tissue is the neurone. The activity of the nervous system as a whole is the sum total of the activities of its neurones. The neurones vary considerably in size and in form. The neurone is more complex than the muscle cell or connective tissue cell. The neurone consists of the nerve-cell proper, the nerve-fibre and the nerve-endings. The entire nervous system is only an aggregation of these neurones.

Structure of Nerves

A nerve consists of nerve-fibres. A nerve-fibre consists of a central strand of soft semi-solid protoplasmic substances called the neuraxis cylinder. This is covered by two sheaths. The inner sheath, the one next to the axis cylinder is formed of a peculiar substance of a fatty nature and is called the medullary sheath. External to the medullary sheath is a thin membrane completely enveloping the nerve-fibre and forming its outer covering called the neruilemma.

On some nerves usually not far from their origin from the central nervous system, or near their ending in the various organs, there is a small knot-like swelling. This enlargement is called a ganglion.

Nerves serve to connect the distant parts of the body with the central nervous system.

Ganglia

The spinal ganglia contains the cells of origin of all pherephral nerve-fibres. The sympathetic ganglia may serve occasionally as a centre for reflex action. They distribute motor and collect sensory impulses.

Afferent and Efferent Nerves

Some nerves carry impulses from the skin or organs of special sense to the central nervous system. These are called afferent nerves. Some nerves carry impulses from the brain to the muscles of the limbs etc. These are called efferent nerves. The afferent nerves which carry to the central system impulses from th^ skin or from the organs of the special senses such as the eye, the ear, etc., are sensory nerves, because the impulses arouse in you the sensation of touch, sight, hearing, smelling and taste. The efferent nerves which carry impulses from the central nervous system to the muscles are motor nerves because they cause muscles to contract.

Nerve Impulse

What is the nature of a nerve impulse is difficult to answer. When a nerve is irritated, a something—what is called a nervous impulse—is communicated along the nerve-fibres. If a motor or a sensory nerve is irritated at any point, contraction in the muscle or sensation in the central organ immediately follows. But if the nerve is cut or tightly tied at any point between the point irritated and the muscle or central organ, the effect at once ceases, just as cutting a telegraph wire stops the transmission of the electric current or impulse.

The speed at which an impulse travels along an afferent nerve-fibre is about 145 feet per second. The efferent impulses travel 115 feet per second.

II

CEREBRO-SPINAL SYSTEM

Cerebral Hemispheres

The brain is the most complex and largest mass of nervous tissue in the body. It is contained in the bony cavity formed by the bones of the cranium. It is a semi-soft mass of white and grey matter. It is divided into four principal parts viz., the cerebrum, the cerebellum or the hind brain, and the medulla oblongata. The brain consists of two halves or two hemispheres. The chief lobes of the brain are the frontal lobe, the occipital lobe and the temporal lobe.

The brain is enveloped by three membranes the dura mater, arachnoid and the pia mater. Pia mater is in close touch with the brain. Arachnoid is between dura mater and pia mater. Dura mater is close to the bony wall. These membranes and the cerebro-spinal fluid contained in the sub-arachnoid space protect the brain and the spinal cord from external injuries. How marvellous is the delicate structure of the brain and the spinal cord! Can any human scientist manufacture a brain or a nerve in his boasted laboratory? Glory to the Lord, the creator and the Indweller, whose power and wisdom baffle description even by Goddess Sarasvati and the thousand tongued Adisesha.

The surface of the cerebral hemispheres is thrown into folds called convolutions with deep fissures between them.

The brain is composed of white and grey matter of the same nature as the white and grey matter of the spinal cord. In each cerebral hemisphere the grey matter forms a layer at the surface called the cortex.

The surface of each cerebral hemisphere is sub-divided into 6 lobes by 3 fissures. These fissures are fissure of Rolando, fissure of sylvius and parieto-occipital fissure. The five lobes are frontal lobe, parietal lobe, tempero-sphenoidal lobe, occipital lobe, central lobe or Island of Reil.

There are chambers in the brain. They are called ventricles. These ventricles are filled with cerebro-spinal fluid. The fourth ventricle is in the medulla oblongata. The other ventricles are the 3rd ventricle, the 5th ventricle and the lateral ventricles.

The anterior portion of the parietal lobe and the posterior part of the frontal lobe are the motor areas.

The posterior portion of the parietal lobe is the area of common sensation. The hearing centre is in the tempero-sphenoidal lobe. The speech centre is in the lower part of the frontal lobe. The seat of memory is in the occipital lobe. The centre of vision is assigned to the region about the posterior branch of the fissure of sylvius.

The cerebral cortex is involved in all conscious perception or sensations, in memory and in the voluntary movements. Different parts of the cortex have different functions. There are areas for visual and auditory sensations. There are areas which control the voluntary movements of various parts of the body. The legs, the arms, the hands, etc. have their own separate area.

The cerebral hemispheres are two large masses, one on each side, separate from each other by a median fissure. They are connected to the other parts of the brain chiefly by the crura cerebri and the optic thalami. The two corpara striata are special structures which lie, one on each side of the base or under-surface of the hemisphere.

The brain is composed of white and grey matter of the same nature as the white and grey matter of the spinal cord. In each cerebral hemisphere the grey matter forms a layer at the surface called the cortex. Inside the brain is the white matter which consists chiefly of nerve-fibres.

Functions of the Cerebral Hemispheres

They are the seat of the perceptions, intelligence and will. They originate voluntary movements. The other parts of the brain can produce complicated and well-balanced movements.

Cranial Nerves

The cranial nerves are twelve in number on each side. They arise from the base of the brain and medulla oblongata and pass out through openings is the base of the skull. They are as follows:

1. Olfactory (sensory)
2. Optic (sensory)
3. Oculomotor (motor)
4. Trochlear (motor)

5. Trigeminal (mixed but mainly sensory)
6. Abducens (motor)
7. Facial (motor)
8. Auditory (sensory)
9. Glossopharyngeal (mixed)
10. Pneumogastric or vagus
11. Spinal accessory (motor)
12. Hypoglossal (motor)

The olfactory nerve (the first pair) is the special nerve of the sense of smell. Its origin is in the olfactory bulb. It is really a lobe of the brain. The optic nerve (the second pair) is the special nerve of the sense of sight. It is also a lobe of the brain. The third pair called motor oculi is the mover of the eye. They are distributed to all the muscles of the eye except the superior oblique and the external rectus.

The trochlear nerve (fourth pair) supplies only the superior oblique muscle of the eye. The trigeminal nerve (fifth pair) is the largest of the cranial nerves. It has two roots, a motor and a sensory. It supplies the skin of the face and muscles of the jaws. It has three chief divisions. Hence the name trigeminal. One branch contains sensory fibres and supplies the forepart of the mucous membrane of the tongue and is called the gustatory.

The sixth pair is the abducens. It supplies the external rectus muscle of the eye. The muscles of the eye receive their nervous stimulus by three distinct nerves. Facial nerve (seventh pair) supplies the muscles of the face with motor nerve.

The auditory nerve (eighth pair) is the special nerve of the sense of hearing. The glossopharyngeal nerve is distributed to the tongue and pharynx. It is a nerve of taste. It supplies to the back part of the mucous membrane of the tongue. It is a motor nerve for the pharyngeal muscles.

The vagus or pneumogastric nerve (tenth pair) has a more extensive distribution than any of the other cranial nerves. It passes through the neck and thorax to the upper part of the abdomen. It contains both motor and sensory nerves. It supplies the larynx, the lungs, the liver and the stomach. Its branches are connected with the heart. It supplies the pharynx, oesophagus, stomach and heart with motor fibres (cardiac inhibitory).

The spinal accessory nerve (the eleventh pair) is a motor nerve that arises by many roots from the upper part of the spinal cord. It supplies certain muscles of the neck. It consists of two parts, one, the spinal portion and the other, accessory portion to the tenth nerve.

The first two nerves are not nerves like the others but in reality processes of the brain. The optic, motor oculi, trochlear, abducens and the ophthalmic branch of the fifth are distributed to the eye. The tongue has two special branches nerve of taste, the lingual, a branch of the fifth and the glossal, a branch of the ninth. It has also its own motor nerve, the hypoglossal.

Cerebellum

The cerebellum or "little brain" occupies the lower and back of the cavity of the skull, overhanging the medulla oblongata. It measures 4 inches transversely and 2y2 inches from backwards. It communicates freely with the entire cerebro-spinal system. It is divided in the middle line into two lateral halves or hemispheres and a median lobe by a central depression. In the medulla, the grey matter is placed in the interior and the white on the exterior; in the cerebellum the grey is on the outside and the white within.

The one great function of the cerebellum is to play a most important part in the coordination of the actions, nervous and muscular, by which the movements of the body are carried on. Motion is itself not destroyed by disease or destruction of the cerebellum, but coordination is so interfered with that movements of one part of the body cannot be adapted to other parts. The intelligence and the function of the special senses, such as sight or hearing, are not affected. All movements are now clumsily performed. There is a lack of orderliness or coordination.

The cerebellum is a great coordinating centre for impulses passing from the cerebral cortex to the voluntary muscles.

Medulla Oblongata

The medulla oblongata is continuous with the spinal cord and is somewhere like it in structure. The cerebellum springs from the sides of the upper part of the medulla, oblongata. It overlaps the medulla downwards. It is connected to the medulla by a large bridge of tissue consisting mostly of bundles of nerve-fibres, called the pons. Just above the pons, the bundles of nerve-fibres appear as two columns, called crura cerebri, one on each side at the base or lower side of the brain. On the upper side of the crura cerebri the brain-substance is raised up into two pairs of rounded masses called the corpora quadrigemina. In front of the corpora quadrigemina is a small structure called the pineal gland. In front of these are two larger masses, one on either side, called the optic thalami.

Functions of the Medulla Oblongata

It gives rise to many cranial nerves. It is a very important part of the brain. The respiratory movements of the chest are not only regulated but originated by nervous impulses arising in a part of the bulb called the respiratory centre. Injury to the medulla oblongata stops the respiration and causes death. The beat of the heart is regulated by nervous impulses sent from the medulla. The size of the small arteries is regulated by impulses sent along the vaso-motor (vessel moving) nerves from a part of the medulla called the vaso-motor centre. Further, the act of swallowing, vomiting, the secretion of saliva and other processes are governed by centres in the medulla. It forms the path through which all impulses from the brain or cerebral hemisphere pass on their way to the spinal cord and spinal nerves, and also the path for all impulses from the spinal nerves and spinal cord to the brain or cerebral hemispheres. On account of decussation of fibres in the medulla oblongata disease or injury of one side of the brain affects the opposite side of the body. If a blood vessel gives way in the right cerebral hemisphere, the left arm, and left leg and left side of the body are paralysed.

It contains cardiac centres to control the rate and force of the action of the heart. It controls the amount of blood furnished to the part. It contains the heat-controlling centre also. As the medulla is the seat of such important centres as those of controlling respiration and heart's action, death will result if the medulla is seriously injured.

Hanging does not strangle the criminal. It dislocates the atlas bone the axis and causes the odontoid process crushing the medulla, which is brought about by the sudden jerk the criminal receives when he is dropped.

The Spinal Cord

This is a column of soft substance that extends from the brain downwards along the spinal canal to about the level of the second lumbar vertebra in man. Then it tapers off into a filament. It is about 18 inches long in a man of average height and about half an inch in thickness. A white substance lies on the outside of the cord and grey substance lies on the inside. Reverse is the case with the brain.

Spinal nerves are given off in pairs from the spinal cord at intervals along its length. There are 31 pairs of spinal nerves. Each nerve springs by two roots, the anterior (front) and posterior (behind). Some of the spinal nerves carry impulses from the skin to the spinal cord (sensory nerves) and some carry impulses from the spinal cord to the muscles (motor nerves). All the sensory fibres pass into the cord by the posterior root and all the motor fibres by the anterior root.

If the posterior root of a spinal nerve is injured, no sensory nerve impulses from the nerve can reach the spinal cord and the brain. There is no feeling in that portion of the skin to which the nerve goes even if burning charcoal is applied to the part. But the motor impulses along the anterior roots can be transmitted. The muscles will contract. If the anterior root is injured, the motor impulses cannot pass and the corresponding muscles cannot contract. They are paralysed. But the sensory impulses can pass from the skin to the spinal cord and the brain.

If the spinal cord of a man is injured in the middle of the back, he will not be able to move his legs. All parts below the level of the injury will be paralysed. He will not feel a pin prick or a burning charcoal applied to his legs. The sensory impulses cannot pass upwards to the brain. The motor impulses cannot pass from the brain to the legs. He cannot move his legs.

Functions of the Spinal Cord

(1) Conduction of impulses and sensations between the centres and the periphery. (2) Transferring of impulses from one set of fibres to another. (3) Coordination or the adjusting of the workings of different parts of the body to one another. (4) Reflex action i.e. the origination of an impulse or action in response to a stimulation from the periphery without involving the brain in the act or even without consciousness of the reflex act on the part of the individual. (5) Inhibition of reflex acts. If an external stimulus is allowed in its full effects to set up reflex acts, the body will be jumping all the time. This overactivity is checked by the cells of the spinal cord.

A central canal runs through the centre of the spinal cord throughout its entire length. It is a minute canal. The internal hollow of the brain is directly continuous with the hollow or central canal of the cord.

The spinal cord, medulla and pons act as centres for the more simple reflexes.

III

THE SYMPATHETIC NERVOUS SYSTEM

The sympathetic system consists of a double chain of a ganglia placed on each side of the spinal column and united to each other by longitudinal filaments. It extends from the base of the skull to the coccyx. The term "Sympathetic system" designates a group of nerves and

ganglia that differ somewhat in their functions from the other nerves and ganglia of the cerebro-spinal system.

From the sympathetic chain on each side nerve-fibres pass in large numbers to the organs of the abdomen and thorax. The sympathetic nerves are distributed to the organs and blood vessels the movements of which are involuntary. They form networks or plexuses upon the heart about the stomach and other organs Li the trunk. They also enter the cranium, and send branches to the organs of special sense. They influence the pupil of the eye in particular.

Sympathetic system supplies sensations and motion to the organs of nutrition. The peristaltic movements of the stomach and intestines, the contraction of the gall-bladder together with the sensory stimuli of the organs are caused by the sympathetic system.

The sympathetic nerves chiefly carry impulses which govern the muscular tissue of the organs and the muscular coat of the small arteries of the various tissues. They regulate the degree of contraction and dilation of the blood vessels, particularly arterioles or the small arteries. Those that dilate or expand the vessels are called vaso-dilators; those that contract, the vaso-constrictors. Collectively the nerves that contract and dilate the arteries are called vasomotor nerves (vessel moving nerves). The tone of the blood vessels is kept up by the sympathetic nerves through the action of the vaso-motor centre in the medulla oblongata. The sympathetic derives from the nervous system the impulses which it distributes itself. They do not arise in the sympathetic. Secretion by the various glands of the body are regulated by the sympathetic.

Other fibres (cardiac accelerator) go to the heart to hasten its activity. The cardiac inhibitory are derived from the pneumogastric. Irritation of the sympathetic fibres increases the beat of the heat, while irritation of the pneumogastric stops the heart.

The sympathetic is not a separate nervous system. It is in reality merely an outlying pal t of the cerebro-spinal system, an outlying chain of ganglia through which the fibres of a part of the trunk of each spinal nerve pass on their way to the organs.

Many of the nerve fibres which run in the branches of the sympathetic chains are non-medullated fibres.

IV

REFLEX ACTION

Reflex action is usually confined to those actions which are involuntary and of which you are not conscious. There is no play of will in these actions.

Many movements you perform are brought about by reflex action. If a strong light is flashed across the eyes they are instantly closed. This is an instance of reflex action carried out by the brain alone. Here the afferent nerves are the optic, the efferent is the facial. When a foul odour produces a grimace, there is a reflex action. The olfactory nerve is the afferent nerve and the facial is the efferent. When you hear a sudden loud noise you are startled. The afferent auditory nerve generates an impulse which passes to the medulla oblongata. An impulse from the brain affects the great majority of the motor nerves of the body.

You already know how simple impulses arise in brain cells, pass along nerve-fibres, terminate in the end-organs and produce a muscular contraction (motor impulse) and also how an outside stimulus applied to the skin will generate vibrations in suitable end-organs to be transmitted along sensory nerve-fibres to end in sensory brain cells and make the mind conscious of the stimulus that has been applied.

If your finger is pricked with a pin, the finger is at once pulled back. This is a reflex action. The act is done before the person is conscious of the pain. The sensory impulse of the pin-prick passed to the spinal cord, produced the motor action necessary to withdraw the finger and then passed on to the brain.

Many movements of ordinary life which are started by the will and which are voluntary are often continued reflexly. Walking is an exceedingly difficult accomplishment to learn. It is acquired in childhood only after very great effort. When you are erect, you are in an extremely unstable state of equilibrium. Constant contraction and relaxation of groups of muscles are necessary to keep the balance. The sensory impulses of being out of the balance generate motor impulses in first one set of muscles, then another to restore balance. At first this is only done through will. Later on it is done by reflex activity without a moment's thought. You go on walking without thinking about it.

Every step is properly placed. The necessary muscles contract, because they received impulses from the central nervous system, regulated in accordance with sensory impulses received by the central nervous system, from the eye, or the ear, or due to the contact of the legs with the ground.

Stimulation of the nerve of taste in the mouth induces reflex secretion of the salivary glands. When food passes into the upper part of the intestine it stimulates the sensory nerve there. The impulse is communicated to the spinal cord and reflected from this centre towards the periphery. The motor impulse passes along the motor nerve and stimulates to contraction the appropriate muscular mechanism which causes a flow of bile into the intestine.

When you read loudly different muscular actions are going on. You are not at all conscious of these acts. You hold the book in your hand at the right distance from the eyes. You move the eyes from side to side over the line and up and down pages. The movements of the muscles of the lips, tongue, throat, the wind box and respiratory muscles are rapidly and delicately adjusted. And yet you are perfectly unconscious of these muscular acts. These are all reflex acts.

The typist and the player on the harmonium or violin do many reflex acts. In the beginning the fingering needs all their attention, volition or will. But by frequent repetitions the movements of the fingers become automatic. They need not see the fingering. The movements are done without volition or even consciousness.

In the performance of the drill the soldier or the student is conscious of the movements of the limbs. He exerts to put himself in the pose of attention when the word of command is, given. But after some practice the sound of the word "attention" gives rise to the act whether the soldier is thinking of it or not. On one occasion a soldier was passing in the road with a tumbler of milk on his head. A student who was coming behind him suddenly called out "Attention". The soldier brought his hands down and the tumbler of milk fell down on the road. The effects of the drill had become part and parcel of the soldier's nervous structure.

The nervous system is endowed with a power of organising conscious actions into unconscious or reflex acts through education or constant repetition.

APPENDIX —A

SIMPLE HOUSEHOLD REMEDIES

Ammonium Carbonate: This is known by the name smelling salt. It is useful in cold or catarrh of the nose. Tie a small piece in the handkerchief and smell it frequently. When one becomes unconscious, when there is shock or collapse, soon keep the bottle near his nose. He will come to his consciousness. Ammonium Carbonate is a heart stimulant. Put 5 grains in 2 table-spoonfuls of water and give this mixture. It is an expectorant, i.e., it brings out the sputum from the bronchial tubes.

APC Powder: This contains in equal parts 2 grains each of aspirin, phenacetin and caffeine citras. This is useful in headache, neuralgia and fever, rheumatic pains in joints and muscular pain all over the body (myalgia). Take one teaspoonful of powder with a little hot water, milk or tea or cocoa. Aspirin and phenacetin possess the same properties viz., anodyne or pain-relieving. Aspirin produces free perspiration and brings the temperature down. Cover yourself with a warm blanket after taking the powder. You can get aspirin and phenacetin in tablet form also. Aspirin and phenacetin have got a depressing effect on the heart, and so caffeine citras is added to correct the depressing influence of aspirin and phenacetin. Caffeine is the alkaloid or active principle of coffee. It has a stimulating influence on the heart. Do not repeat aspirin or phenacetin very frequently. Use your common sense always.

Borax: It is useful in ulcers of the mouth and tongue. It can be mixed with potassium chlorus. It is used as a gargle or mouth wash. Put 10 or 20 grains in a tumblerful of warm water. Add a tea-spoonful of glycerine or honey and use it as a gargle. It can be mixed with honey in a mortar and rubbed over the ulcers in the mouth and the tongue. It has soothing and healing properties.

Boric Powder: It is a soothing powder. It can be used as a dusting powder in ringworm, wounds, discharge from the ears etc. It is used as boric lotion 10 grains to 1 oz., of warm water in washing the eyes. It is used as Boric ointment in ulcers, wounds etc. It is a mild antiseptic. It is mixed with salicylic acid, etc., in making other ointments for the skin.

Cathartic Vegetable Tablets: It is used as night pill to relieve constipation. Take one or two or three tablets at bedtime. Do not take it frequently and form a habit.

Chlorodyne: This is a dark coloured thick fluid. It contains morphia, chloroform, Indian hemp, hydrocyanic acid and peppermint. It is agreeable to the taste. It is very useful in wind in the stomach, cholera, diarrhoea, dysentery, intestinal colic, stomach spasms, griping pain in the bowels, asthma, influenza, colds, cramps, seasickness and simple bronchitis. It may be taken in water or tea. It can be repeated in diminished doses every 2 or 3 hours. The dose is 5 to 30 drops. You can give 3 drops to a child one year old. The bottle should be kept well-corked and be well shaken before use.

Easton Syrup: This is an iron tonic. It increases the quality and quantity of blood. It is useful in general debility, anaemia or poverty of blood, post-malaria debility. Dose: % to 1 teaspoonful in a table-spoonful of water after food. It should not be taken when there is diarrhoea or irritation in the bowels.

Essence of Ginger: Strong tincture of ginger is known as essence of ginger. The dose is from 5 to 20 drops for an adult; for a child one year old, from 1 to 4 drops. It helps digestion and increases the digestive fire. It is useful in diarrhoea, flatulence or wind in the bowels, colicky pains, dyspepsia. Essence of peppermint has the same properties as those of essence of ginger.

Mag Sulph: This is an aperient. It is not drastic. It produces soft motions and removes mucus and serum from the bowels. Take one or two table-spoonfuls in a small glass of warm water in the early morning.

Oil of Citronella: This is also known by the name lemon-grass oil. It is obtained from the lemon-grass which gives the sweet aroma of lemon. It is useful in warding off bites from mosquitoes. Rub the feet, hands and exposed parts of the body with this oil in the evening.

Parrish Chemical Food: This is also known by the name Syrup Feri Phosphus Co. This is useful in children. It is a good iron tonic for them. Give % to 1 teaspoonful in a table-spoonful of water after food. It is sour and sweet.

Salicylic Ointment: This is useful in Ringworm. Mix 20 grams of salicylic acid with 1 oz. of white vaseline. Boric acid can be added with salicylic acid when you make the ointment. Ten or twenty grains dissolved in 1 oz. of Methylated spirit will form the ring-worm lotion. Salicylic acid, boric acid, zinc oxide with vaseline 10 grains each will form a good ointment for eczema.

Tr. Benzoin Co.: This is known by the name Friar's blasms. It is highly useful in cuts and wounds with bleeding. It stops the bleeding at once. Soak a small, thin layer of cotton wool in the tincture and put it over the cut. It will serve the purpose of plaster also. It will stick to the part firmly. Do not remove it. You can keep it for 24 hours. If it sticks very hard apply a little bit of methylated spirit over it; you can remove it very easily. Benzoin inhalation is beneficial in consumption, sour throat etc. It is an antiseptic. Drop one or two teaspoonfuls of the tincture in a kettle containing steaming water and allow the vapour to touch the mouth and throat. Keep the mouth wide open. Benzoin is an antiseptic.

Tr. Quinine Ammoniata:This is very useful in nasal catarrh, cough with fever. Dose y2 to 1 drachm in 2 table-spoonfuls of water. Make the dose fresh.

Turpentine Liniment: This is a white liniment. It contains camphor, soft soap, oil of turpentine etc. It is a very useful and potent liniment. It is better than Iodex, Sloan's liniment, ABC Liniment. Iodex is sticky. The other liniments keep the parts dry. But turpentine liniment is not sticky. It keeps the parts soft. It relieves pain in rheumatism, swelling, chest pain, sprain, contusion etc.

APPENDIX—B

FOOD FOR THE INVALIDS

Bael Fruit: The pulp of the ripe fruit is mixed with some water and strained. Add some sugar to sweeten it. Bael is an aperient. It moves the bowels. It is useful in diarrhoea and dysentery. This is a cool drink. It softens hard stools.

Barley Water: Wash two ounces of pearl-barley with cold water and throw away the washings. Then boil in a pint of water for 20 minutes in a covered vessel and strain. You can add some sugar or salt to taste. You can add some milk if you like. It may be flavoured with thinly cut lemon-peel. When the liquid is boiling you can add the lemon-peel.

Bread and Milk: Boil the bread in the milk for a minute. Add sugar to taste. Or cut slices of bread and put them in a basin and pour boiling milk over it. Add sugar and cover the basin for a minute or two and then serve.

Gruel: This is a favourite drink for a feverish cold. You can make gruel out of oatmeal or barely flour. A table-spoonful of oat-flour is mixed into a paste with water. Add half a pint of water or milk and boil at least for five minutes. Add salt and sugar to taste. Barely gruel can be made in the same way.

Imperial Drink: Take half an ounce of cream of tartar, the juice of one lemon and two table-spoonfuls of white sugar. Put the whole in a jar and pour over them one quart of boiling water. Cover till it becomes cold. This is a useful drink in fevers.

Isafgul Water: Put half an ounce of Isafgul seeds in a tumblerful of water. Clean the seeds first. This may be sweetened and drunk. This is a very good demulcent drink in dysentery.

Junket: Junket is really a partially digested milk. It is made into a semi-solid form by adding rennet. Heat the milk first to about the level of body temperature, 98.4° F. Then add the rennet and put the milk in a cool place to set. The solid part or curd is surrounded by a clear liquid, the whey. Whey is also nourishing as it has a little sugar, fat and salt dissolved in it.

Milk Pudding: Rice or sago or tapioca or arrow-root or corn-flour may be used. They are cooked with milk, and a little sugar and salt added. A few drops of the flavouring essences of lemon or almond or vanilla may be added.

Oatmeal Porridge: Mix a large table-spoonful of oatmeal with 2 table-spoonfuls of cold water. Stir well and pour in it a pint of boiling water in a sauce-pan. Boil and stir well for 10 minutes. Add salt or sugar. Milk may be used instead of water.

This is useful in constipation. This is a nourishing food. This should not be taken when there is a tendency to diarrhoea.

Rice Water: Wash well one ounce of rice with cold water. Boil slowly for one hour in a quart of water and then strain. Add a little salt. This is a useful drink in fever, diarrhoea and dysentery.

Tamarind Whey: Boil a pint of milk and while it is boiling add two table-spoonfuls of tamarind. Strain and sweeten to taste. This is a cooling and slightly laxative drink.

Whey: When a patient cannot tolerate fat and also proteins as in Typhoid fever, he may be given milk which is free from fat and proteins. Whey contains the sugar of milk and the vitamins. This is the most harmless diet. It possesses great sustaining properties. Boil some milk. Add a few drops of juice of a lemon when it is boiling. Milk will suddenly separate out

into a clear greenish liquid. You can add a little alum also when you cannot get lemon juice. Strain the whey through a clear cloth.

APPENDIX—C

DANGEROUS DRUG HABITS

Alcohol: Alcohol, liquor or wine is one of the most dangerous and devastating drug habits and is, therefore, universally condemned. Yet this habit is widely prevalent among highly educated and intellectual classes. Once this habit is acquired, it is very difficult to get rid of it. You should, therefore, be very cautious and never touch alcohol, unless of course, in extraordinary cases when it is prescribed by the doctor in very small doses.

Prolonged usage and large doses of liquor result in alcohol poisoning. The mental balance is completely upset. There is nausea and frequent vomiting. The gait becomes unsteady. There is tremor in the fingers. The speech is faltering and indistinct. One is not aware of his actions when under the influence of alcohol. He presents an awful and ignoble replica of a cranky and a lunatic. In the long run, the liver is affected with the results of acute hepatitis and ultimate degeneration and fibrosis. Then comes total insensibility and narcosis, palpitation of heart, difficulty in breathing, paralysis of extremities and finally death from respiratory failure.

Alcohol is a great social evil indeed. It not only ruins the health but brings personal disgrace and financial bankruptcy. It is really detestable and a great shame indeed to see educated and cultured people of high social reputation rolling in the gutter and behaving in a very ignoble manner. If you wish to prosper in life, you must shun ruthlessly liquor or alcohol or wine of any kind.

Betel Chewing: No distinct benefit of health is attained by this. On the contrary, diseases of the mouth and tongue are often caused by it. The habit like tobacco chewing is a very filthy one. That betel chewing helps digestion is also a delusion and illusion. A little practice of Agni-Sara, Paschimottanasana, Bhastrika will give you wonderful digestion. Why to waste money in satisfying this bad craving? Wise people will never indulge in this even once. The red tongue, the thickly coated teeth, the stained saliva which often trickles from the mouth and the constant spitting in public thoroughfares, on floors, walls, verandahs, make those who indulge in this bad habit objects of disgust, and ridicule to clean persons.

Cannabis Indica: Ganja or Bhang are forms of Cannabis India (Indian hemp). Ganja is known as Bhang. It is a kind of hemp. The misuse of Ganja has caused great misery in India and other countries. It is usually smoked, but may be eaten or drunk. It acts chiefly on the brain. It is a stimulant and an intoxicant. It is called the bootie or herb of Lord Siva. Lord Siva never drinks Bhang, but some ignorant pseudo devotees of Lord Siva satisfy their craving under false pretext.

It is mixed with thandai or almond drink. Persons who take Bhang are often highly excited. They are quarrelsome.

Its use is unnecessary and harmful. The habit of using it should, therefore, never be formed. Shun the company of Bhang drinkers and Bhang smokers.

Cocaine: This is an alkaloid obtained from the leaves of the cocoa tree. Those who are addicted to cocaine suffer from sleeplessness, decay of all moral and intellectual power, emaciation and eventually, death. The habit of cocaine eating is more prevalent in Bengal. Cocaine is sold in the form of a pattei or rolled betel leaf with catechu paste (kattha), some

slaked lime and few pieces of betel nut. Cocaine habit is a dangerous one. It is a great danger to health, like all other drug habits, that of cocaine eating grows upon its victim.

It produces sleeplessness and great depression. The person becomes a slave to the habit and the health is undermined. The black teeth is a characteristic feature in the cocaine eater. The victim becomes emaciated. He gets paralysis of the throat and tongue.

Opium: If you develop the opium habit, it is very difficult to break it. Opium produces mental and physical deterioration. It has a deleterious effect on the health of opium eaters and opium smokers. When the habit of using opium is acquired, it is almost impossible to break it off. The evils that result from its use are greater than those arising from the use of tobacco. Opium is, therefore, called the main reason for the degeneration of the Chinese nation, and that of many other countries too, where it is universally patronised.

The confirmed opium eater soon becomes a complete wreck mentally and physically when the drug is taken in excess. The use of opium in any form should be given up entirely. Its use in sickness should be stopped as soon as possible. Patients are apt to acquire a craving for the drug and often continue to use it after they are well and thus become habitual opium eaters. The craving is very intense. Once an opium eater took the perspiration dirt even given by his friend when he had no stock of opium, because of intense craving. The perspiration dirt is also black. Anything black will give him satisfaction if you say "this is opium" when his stock is exhausted.

Tobacco: Tobacco ruins the digestion, the heart and the whole nervous system. It produces nicotine poisoning, tobacco amblyopia, a kind of disease of the eye and tobacco heart (irritable heart). The chewing of tobacco is a dirty and unhealthy practice. The fashionable practice of snuff taking is horrible and abominable. It should be condemned.

When the habit of smoking and taking tobacco is formed, it cannot be broken off, although the health may be considerably undermined by continuing it. The risk of becoming an inveterate smoker and the evils resulting from the use of tobacco in excess are so great that its use even in moderation should never be indulged in.

Boys who are addicted to smoke have got a poor physique and weak intellect.

Tobacco blackens the teeth and gives a very bad smell, to the breath and acts injuriously to the whole system. Sleeplessness and depression of spirit, head-ache, unsteady hand, and shaky legs indicate the effects of tobacco on the nervous system. The heart beats become irregular. Smokers are often pale and unhealthy looking on account of the poor quality of their blood. Smokers get severe pain in the region of the heart and breathlessness in climbing stairs. Smoker's sore-throat is very troublesome. The throat is always in a state of irritation and a thick phlegm accumulates in the throat. There is constant cough.

A smoker loses his appetite. He cannot properly digest his food. The tongue is dry and foul. The vision becomes dim. The sight may be entirely lost on account of the disease of the optic nerve. The evils are intensified when smoking is indulged in the company of other smokers in a crowded, ill-ventilated room.

That smoking helps digestion and the movement of the bowels, study, writing and thinking is a great delusion and an illusion. There is terrible depression after a slight exhilaration of spirit. This slight exhilaration also is not experienced after some time. The number in the tins consumed increases daily.

Abandon the habit of smoking at once. Do not remain in the company of smokers. Strong tea drunk in excessive quantity is very bad indeed for the stomach and the nerves. It produces tannin poisoning. So is coffee, too.

Thanks

TWENTY IMPORTANT SPIRITUAL

INSTRUCTIONS

By H.H. Sri Swami Sivanandaji Maharaj

1. BRAHMA-MUHURTA: Get up at 4 a.m. daily. This is Brahmamuhurta which is extremely favourable for meditation on God.

2. ASANA: Sit on Padma, Siddha or Sukha Asana for Japa and meditation for half an hour, facing the east or the north. Increase the period gradually to three hours. Do Sirshasana and Sarvangasana for keeping up Brahmacharya and health. Take light physical exercises as walking, etc., regularly. Do twenty Pranayamas.

3. JAPA: Repeat any Mantra as pure Om or Om Namo Narayanaya, Om Namah Sivaya, Om Namo Bhagavate Vasudevaya, Om Saravanabhavaya Namah, Sita Ram, Sri Ram, Hari Om, or Gayatri, according to your taste or inclination, from 108 to 21,600 times daily.

4. DIETETIC DISCIPLINE: Take Sattvic food, Suddha Ahara. Give up chillies, tamarind, garlic, onion, sour articles, oil, mustard, asafoetida. Observe moderation in diet (Mitahara). Do not overload the stomach. Give up those things which the mind likes best for a fortnight in a year. Eat simple food. Milk and fruits help concentration. Take food as medicine to keep the life going. Eating for enjoyment is sin. Give up salt and sugar for a month. You must be able to live on rice, Dhal and bread without any Chutni. Do not ask for extra salt for Dhal and sugar for tea, coffee or milk.

5. MEDITATION-ROOM: Have a separate meditation-room under lock and key.

6. CHARITY: Do charity regularly, every month, or even daily according to your means, say six Paisa per rupee.

7. SVADHYAYA: Study systematically the Gita, the Ramayana, the Bhagavata, Sri Vishnu-Sahasranama, Lalita-Sahasranama, Aditya Hridaya, the Upanishads or the Yoga Vasishtha, the Bible, the Zend Avesta, the Koran, the Tripitakas, the Granth Sahib, etc., from half an hour to one hour daily and have Suddha Vichara.

8. BRAHMACHARYA: Preserve the vital force (Veerya) very, very carefully. Veerya is God in motion or manifestation—Vibhuti. Veerya is all power. Veerya is all money. Veerya is the essence of life, thought and intelligence.

9. PRAYER SLOKAS: Get by heart some prayer-Slokas, Stotras and repeat them as soon as you sit in the Asana before starting Japa or meditation. This will elevate the mind quickly.

10. SATSANGA: Have Satsanga. Give up bad company, smoking, meat and alcoholic liquors entirely. Do not develop any evil habits.

11. FAST ON EKADASI: Fast on Ekadasi or live on milk and fruits only.

12. JAPA MALA: Have a Japa Mala (rosary) round your neck or in your pocket or underneath your pillow at night.

13. MOUNA: Observe Mouna (vow of silence) for a couple of hours daily.

14. SPEAK THE TRUTH: Speak the truth at all cost. Speak a little. Speak sweetly.

15. PLAIN LIVING: Reduce your wants. If you have four shirts, reduce the number to three or two. Lead a happy, contented life. Avoid unnecessary worry. Have plain living and high thinking.

16. NEVER HURT ANYBODY: Never hurt anybody (Ahimsa Paramo Dharmah). Control anger by love, Kshama (forgiveness) and Daya (compassion).

17. DO NOT DEPEND UPON SERVANTS: Do not depend upon servants. Self-reliance is the highest of all virtues.

18. SELF-ANALYSIS: Think of the mistakes you have committed during the course of the day, just before retiring to bed (self-analysis). Keep daily diary and self-correction register. Do not brood over past mistakes.

19. FULFIL DUTIES: Remember that death is awaiting you at every moment. Never fail to fulfil your duties. Have pure conduct (Sadachara). 20. SURRENDER TO GOD: Think of God as soon as you wake up and just before you go to sleep. Surrender yourself completely to God (Sharanagati).

Om Santih Santih Santih!

This is the essence of all spiritual Sadhanas. This will lead you to Moksha. All these Niyamas or spiritual canons must be rigidly observed. You must not give leniency to the mind.