COMMUNICABLE DISEASES

These are the diseases which may pass or carried from one human or animal to other.

Communicable diseases are illness caused by germs such as bacteria, viruses and spread by an infected person, animals or object to other persons.

Viral Diseases

Viruses are parasitic and causes a number of diseases.

Bird Flu (H_5N_1)

Bird flu (Avian influenza) is a disease caused by an influenza virus-A, that primarily affect birds.

The following persons may be on higher risk for developing the bird flu

- Farmers and others, who work with poultry.
- Travellers, visiting affected countries.
- Those who have touched an infected bird.
- Those who eat raw or undercooked poultry meat, eggs from infected birds.

Symptoms

Fever, cough, sore throat, muscle aches and eye infection (conjunctivitis).

Treatment

Treatment with the antiviral medication oseltamivir (tamiflu) or zanamivir (relenza) may make the disease less severe. Oseltamivir may also be prescribed for persons, who live in the same house as those diagnosed with avian flu.

Severe Acute Respiratory Syndrome (SARS)

It is a serious form of pneumonia. It is caused by a virus that was first identified in 2003. Infection with the SARS virus causes severe respiratory distress (severe breathing difficulty) and sometimes death.

Symptoms

Cough usually starts 2-3 days after other symptoms like Fever, headache and muscle pain.

Treatment

Antibiotics to treat bacteria that cause pneumonia. Antiviral medications. High doses of steroids to reduce swelling in the lungs. Oxygen, breathing support (mechanical ventilation) or chest therapy.

Hepatitis

Hepatitis is a swelling and inflammation of the liver. It is not a condition, but is often used to refer a viral infection of the liver.

Hepatitis can be caused by

- Immune cells in the body attacking the liver and causing autoimmune hepatitis. Infections from viruses (such as hepatitis-A, B or C), bacteria or parasites. Liver damage from alcohol, poisonous mushrooms or other poisons.
- Medications, such as an overdose of acetaminophen, can cause harm or death also.

Symptoms

Abdominal pain or distention. Breasts development in males. Dark urine and pale or clay coloured stools. Fatigue general itching, fever, usually low-grade jaundice (yellowing of the skin or eyes) and loss of appetite nausea, vomiting and weight loss.

AIDS

Acquired Immuno Deficiency Syndrome (AIDS) is a disease of the human immune system caused by the Human Immunodeficiency Virus (HIV). AIDS was first recognised by the Centres for Disease Control and Prevention (CDC) in 1981.

HIV Infection

AIDS is a condition caused by HIV infection. The condition gradually destroys the immune system, which makes it harder for the body to fight infections.

Transfusion

HIV can be spread by the following

- Through sexual contact i.e. oral, vaginal and anal sex.
- Through blood transfusions, accidental needle sticks or needle sharing.
- From mother to child: A pregnant woman can transmit virus to her foetus

through their shared blood circulation or a nursing mother can pass it to her baby through breast's milk.

Test for AIDS

- Enzyme Linked Immunosorbent Assay/ Enzyme Immuno Assay (ELISA/EIA)
- Radio Immuno Precipitation Assay/ Indirect Fluorescent Antibody Assay (RIP/IFA)
- Polymerase Chain Reaction (PCR)
- Western Blot Confirmatory Test.

NON-COMMUNICABLE DISEASES

There are various kinds of non-communicable diseases, which affect the health of human beings. *Some of the common non- communicable diseases are*

Diabetes

Diabetes is a long-term condition caused by too much glucose (sugar) in the blood. *There are two main types of diabetes*

Type 1

Diabetes occurs when the body doesn't produce enough insulin to function properly or the body's cells don't react to insulin. This is known as insulin resistance.

Type 2

Diabetes is far more common than type 1 diabetes, which occurs when the body doesn't produce any insulin at all.

Symptoms

Symptoms common to both types of diabetes include

(i) Feeling very thirsty.
(ii) Urinating frequently, particularly at night.
(iii) Feeling very tired.
(iv) Weight loss and loss of muscle bulk.

Cancer

It is uncontrolled growth of abnormal cells in the body. Some diseases cause emergence of tumours in body. These are called neoplastic diseases. This includes from a minor role to a lethal cancer.

Causes of Cancer

- Cancer is induced by physical, chemical and biological factors agents. These are called carcinogens cancer causing agents. Ionising radiations such as X-rays, γ-rays non-ionising radiations such ultraviolet (UV) damage the DNA leading to neoplastic transformation.
- Tobacco smoke contains chemical carcinogens that causes lung cancer. Viruses also cause cancer. These are called oncogenic viruses as they have genes called viral oncogenes.

Cancer Detection and Diagnosis

Leukaemia or blood cancer can be detected based on biopsy and histopathological studies of the tissue and blood and bone marrow tests for increased cell counts. Cancers of internal organs are detected using techniques such as Radiography Computed Tomography (RCT) and Magnetic Resonance Imaging (MRI).

Cancer Therapy

- **Cryo Surgery** It is the technique of using extreme rapid cooling that freeze tissues, thereby destroy them. Rapid cooling to temperature below freezing point produces irreversible cell damage and cell death occurs at 20°C to – 90°C.
- **Proton Therapy** It is a type of particle therapy, which uses a beam of protons to irradiate diseased tissue, most often in the treatment of cancer.
- **Radiation Therapy** Radiation therapy is a cancer treatment. Its goal is to kill cancer cells and shrink tumours.
- **Stem Cell Transplantation** Stem cell transplants can be an effective treatment for people with certain forms of cancer such as leukaemia and lymphoma.
- **Peripheral Blood Stem Cell Transplantation (PBSCT)** It is also called peripheral stem cell support. This procedure restore stem cells that have been destroyed by high doses of chemotherapy.

Heart Diseases

Some heart diseases are as follow

Angina Pectoris

Human with angina, experience pain in the centre of the chest. The chest can feel constricted and tight, but the pain can also be oppressive, as if something is crushing your chest. Pain starts in the centre of the chest behind the breast bone (sternum) or on the left side of the front of the chest. It can spread out to other parts of your body like your arms and stomach.

Myocardial Infarction

- It is commonly known as **heart attack**, results from the interruption of blood supply to a part of the heart, causing heart cells to die.
- This is most commonly due to occlusion (blockage) of a coronary artery following the rupture of a vulnerable atherosclerotic plaque, which is an unstable collection of lipids (cholesterol and fatty acids) and white blood cells (especially macrophages) in the wall of an artery.
- The result is ischemia (restriction in blood supply) and ensuing oxygen, if left untreated for a sufficient period of time, can cause damage or death (infarction) of heart muscle tissue (myocardium).

Heart Arrest

It occurs when the heart is unable to provide sufficient pump action to distribute blood flow to meet the needs of the body. Heart arrest can cause a number of symptoms including shortness of breath, leg swelling and exercise intolerance.

The condition is diagnosed with echocardiography and blood tests. Treatment commonly consists of lifestyle measures such as smoking cessation, light exercise including breathing protocols, decreased salt intake and other dietary changes and medications.

thritis

affects the musculoskeletal system, pecifically the joints. It is the main cause of sability among people over 55 years of age in dustrialised countries.

heumatoid Arthritis (RA) It is a long-term sease that leads to inflammation of the nts and surrounding tissues. It can also ect other organs.

Osteoarthritis

It is a joint inflammation that results from cartilage degeneration. It can be caused by ageing, heredity and injury from trauma or disease. The most common symptom of osteoarthritis is pain in the affected joint(s) after repetitive use.

Gout

Gout is a kind of arthritis. It can cause an attack of sudden burning pain, stiffness and swelling in a joint, usually a big toe. These attacks can happen over and over unless gout is treated. Overtime, they can harm your joints, tendons and other tissues. Gout is most common in men.

Sexually Transmitted Diseases

- **Gonorrhoea** It is caused by bacteria *Neisseria gonorrhoeae*. Anyone who has any type of sexual contact can catch gonorrhoea. The infection can be spread by contact with the mouth, vagina, penis or anus.
- **Syphilis** It is a sexually transmitted infection caused by the spirochete bacterium *Treponema pallidum* sub-species *pallidum*. The primary route of transmission is through sexual contact; it may also be transmitted from mother to foetus during pregnancy or at birth, resulting in congenital syphilis.
- **Genital herpes** It is a Sexually Transmitted Infection (STI) caused by the Herpes Simplex Virus (HSV).
- **Trichomoniasis** It is a sexually transmitted infection caused by the parasite *Trichomonas vaginalis*.

Mental Disorder

A mental disorder or mental illness is a psychological pattern or anomali, potentially reflected in behaviour, that is generally associated with distress or disability and which is not considered part of normal development of a person's culture. This may be associated with particular regions or functions of the brain or rest of the nervous system, often in a social context.

research.

9.4.4 Medical Education

The number of medical colleges were few and far between when India became independent.[10] The ***All India Institute of Medical Sciences*** (AIIMS), established by an Act of Parliament in 1956, is an institution of national importance and a centre of excellence in modern medicine. The ***National Academy of Medical Sciences,*** New Delhi, was established in 1961 to promote the growth of medical sciences. The ***Medical Council of India*** (MCI), established under the Indian Medical Council Act, 1933, was replaced by the Indian Medical Council Act, 1956. The MCI serves as a watch dog of medical education. A number of ***National Councils*** in the fields of medicine, pharmacy, dental care, nursing etc were established by the Union Government. Ayurveda, Siddha, Homeopathy and Unani systems of medicine were revived.

Biotechnology

It deals with technique of using live of micro-organisms, their parts or processes for the manufacture of useful or commercial substances. It has two core techniques *i.e.*, genetic engineering and technique to facilitate the growth and multiplication of only desired microbes. In genetic engineering (also called recombinant DNA technology) restriction endonucleases are very useful. They cleave the DNA at specific locations called restriction sites.

- Vectors are organisms or their parts used to transfer the desired DNA from one organism to another. The common vectors are bacteriophage, **cosmids**, phagemids, plasmids etc.
- **Polymerase Chain Reaction** (PCR) developed by **Kary Mullis** (1983) can clone or amplify the small amount of DNA. It involves denaturation, primer annealing and polymerisation in the definite sequence.

Applications of Biotechnology

A number of transgenic plants, medicines, acids are produced through genetic engineering.

Bt Cotton

It was developed to reduce the heavy reliance on pesticides. The bacterium *Bacillus thuringiensis* (Bt) naturally produces a chemical harmful only to a small fraction of insects.

Bt Brinjal

It is a transgenic brinjal (also known as an egg plant or aubergine) created by inserting a crystal protein gene (*Cry* IAc) from the soil bacterium *Bacillus thuringiensis* into the genome of various brinjal varieties.

Bacillus thuringiensis (*Bt*)

It is Gram positive, soil-dwelling bacterium, commonly used as a biological pesticide. The *Cry* toxin found in the bacterium is extracted and used as a pesticide. It also occurs naturally in the gut of caterpillars of various types of moths and butterflies, as well as on the dark surfaces of plants.

Golden Rice

- It is a variety of *Oryza sativa (rice)* produced through genetic engineering to biosynthesise beta-carotene, a precursor of pro-vitamin-A in the edible parts of rice. Golden rice was developed as a fortified food to be used in areas, where there is a shortage of diet having vitamin-A.
- **Golden Rice 2** produces up to 23 times more beta-carotene than the original variety of golden rice. Golden rice was created by Ingo Potrykus of the Institute of Plant Sciences at the Swiss Federal Institute of Technology, working with Peter Beyer of the University of Freiburg.
- Carotene impart orange colour to carrots and is the reason why genetically modified rice is golden. For the golden rice to make beta-carotene, three new genes are inserted: two from daffodils and the third from a bacterium.

Flavr Savr

By the use of antisense RNA technology the enzyme polygalacto-uronase, which causes damage to pectin is deactivated and the tomato is kept fresh for longer duration.

Canola

It is either of rape seed (*Brassica napus* L) or field mustard (*Brassica campestris L* or *Brassica rapavar*). Its nodes are used to produce edible oil suitable for consumption by humans and livestock. The oil is also suitable as biodiesel.

Dairy Products

- Cheese is prepared by the coagulation of casein and other minor milk proteins (curdling of milk) by an enzyme rennin extracted from calf gastric mucosa.
- *Streptococcus* and *Lactobacillus* species are involved in the manufacture of most cheese.

- In cheese manufacture, micro-organisms are important in both souring and ripening processes.
- Semisoft blue **Roquefort cheese** of France is produced using the mold *Penicillium roqueforti*.
- **Yoghurt** is a preserved milk product having a distinct taste and a thick texture than milk.
- Yoghurt is made by fermenting whole milk with a mixture of *Lactobacillus bulgaricus*, *Streptococcus lactis* and S. *thermophilus* at 40° to 46°C.

Vitamins

- **Vitamin C was the first vitamin to be produced** by a fermentation process using *Acetobacter*, a wild bacterium.
- Bacteria used for industrial production of **vitamin-B_{12}** are *propionibacterium shermanii*, *P. freundenreichii* and *Pseudomonas denitrificans*.
- Vitamin-B_2 (Riboflavin) is synthesised by many micro-organisms including bacteria, yeasts and fungi. The fungus, *Ashbya gossypii* is **used for the microbial production of vitamin-B_2**.

Biotechnologies in Human Health

- **Monoclonal antibodies** are made outside the body by the hybrid cell cultures known as **hybridomas**.
- Monoclonal antibodies (mAb) are antibodies that are identical because they were produced by one type of immune cell and are all clones of a single parent cell.
- **A biochip** is a discrete collection of gene fragments on a stamp-sized chip that can be used to screen for the presence of particular gene variants.
- Biochips allow rapid screening of gene profiles, a tool that promises to have a revolutionary impact on medicine and society.
- Biochips can **help in identifying precise forms of cancer**.
- **Gene therapy** is the treatment of disease by replacing, altering or supplementing a gene whose absence or abnormality is responsible for the disease. Gene therapy is unique as it employs the genetic material, i.e. DNA, itself as the means of treatment.

  DNA finger printing is the technique, in which the banding pattern of DNA fragments is compared and can be used in many species, including human, to indicate relativity. (used for rape victim, paternity, other criminals).
- **Human insulin** or **humulin** is the first genetically engineered pharmaceutical product, developed by Eli Lilly and company in 1982.
- **Genentech**, a California-based company, have produced **human growth hormone** (hGH) from genetically engineered bacteria.
- **Somatostatin** is the first polypeptide, which was expressed in *E coli* as a part of the fusion peptide.
- **BST** or **Bovine Somatotropin** is produced in a large quantity from milk production in cows.
- In 1997, a transgenic cow **'Rosie'** produced human alpha-lactalbumin protein enriched milk (2.4 grams per litre).
- It is possible to cure **phenylketonuria** disease by using recombinant DNA techniques in early period of pregnancy.
- **Urokinase** is involved in dissolution of blood clots. It has been synthesised in huge quantity by using genetically engineered bacteria with urokinase genes.

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o be avoided to prevent skin ca

21.12 AIDS (Acquired Immunedeficiency Syndrome)

AIDS is a severe viral disease and caused by Human Immunodeficiency Virus (HIV). It is a condition in which immune system fails and **suppress the body's disease fighting mechanism**. They **attack the lymphocytes** and the affected individual is prone to infectious diseases.

Dr. Suniti Solomon, pioneered HIV research and treatment in India. She set up the first voluntary testing and counselling centre and an AIDS Research group in Chennai during 80's. Her team was the first to document evidence of HIV infection in India in 1985 (First Indian AIDS patient in Chennai).

21.12.1 Transmission of HIV

AIDS virus has been found in urine, tears, saliva, breast milk and vaginal secretions. The virus is transmitted by an infected patient who comes in contact with blood of a healthy person. HIV/AIDS is not transmitted by touch or any physical contact. It spreads through contact of body fluids or blood.

HIV is transmitted generally by

(i) Sexual contact with infected person

(ii) Use of contaminated needles or syringes especially in case of intravenous drug abusers

(iii) By transfusion of contaminated / infec blood or blood products

(iv) From infected mother to her ch through placenta.

21.12.2 Symptoms and Treatment of AIDS

Symptoms: Infected individuals becom immunodeficient. The person becomes mo susceptible to viral, bacterial, protozoan ar fungal infections. Swelling of lymph node damage to brain, loss of memory, lack of appeti and weight loss, fever, chronic diarrhoea, cough lethargy, pharyngitis, nausea and headache.

Diagnosis: The presence of HIV virus can b confirmed by **Western Blot** analysis or **Enzym Linked Immunosorbent Assay** (ELISA)

Treatment: Anti-retroviral drugs and immunostimulative therapy can prolong the life of the infected person.

21.12.3 Prevention and Control of AIDS

The following steps may help in controlling and prevent the spreading of HIV infection

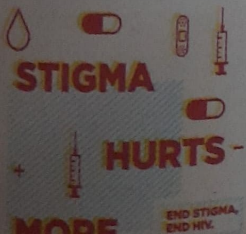
(i) Screening of blood from blood banks for HIV before transfusion.

(ii) Ensuring the use of disposable needles and syringes in hospitals and clinics.

(iii) Advocating safe sex and advantages of using condoms.

(iv) Creating awareness campaign and educating people on the consequences of AIDS.

(v) Persons with HIV/AIDS should not be isolated from the family and society.



More to Know

Many people are ignorant about AIDS and it has been said that – "don't" die of ignorance". In our country NACO (National AIDS Control Organization) and other NGO'S (Non- Governmental Organizations) are educating people about AIDS. Every year December 1st is observed as the "World AIDS Day".

20.5.2 Gene Cloning

What reminds to your mind when you hear the word clone? Of course, 'DOLLY' the cloned sheep. The carbon copy of an individual is often called a **clone**. However, more appropriately, a clone means to make a **genetically exact copy of an organism**.

In gene cloning, a gene or a piece of DNA fragment is inserted into a bacterial cell where DNA will be multiplied (copied) as the cell divides. A brief outline of the basic steps involved in gene cloning are:

i. Isolation of desired DNA fragment by using restriction enzymes
ii. Insertion of the DNA fragment into a suitable vector (Plasmid) to make rDNA
iii. Transfer of rDNA into bacterial host cell (Transformation)
iv. Selection and multiplication of recombinant host cell to get a clone
v. Expression of cloned gene in host cell.

Using this strategy several enzymes, hormones and vaccines can be produced

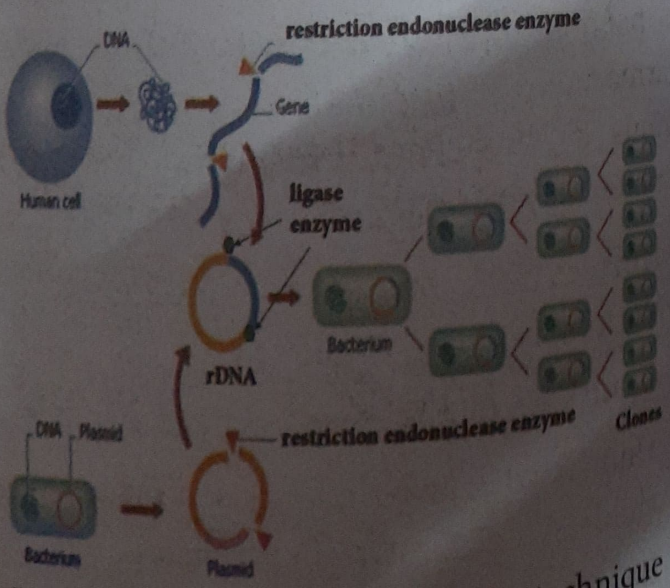


Figure 20.7 Genetic engineering technique (Gene cloning)

Development of Dolly

Dolly was the first cloned female sheep, developed by Dr. Ian Wilmut and his colleagues at the Roslin Institute, Scotland in July 1996. She was created by somatic cell nuclear transfer technique. She lived for 6.5 years and died in 2003 because of lung disease.