REVIEW OF LITERATURE

Cancer is older than the literature of medicine (Bett WR, 1957). The word carcinoma is derived from Greek, and meaning is crab. Its latinised form is cancer. Cancer might have well started with the creation of life itself in this universe. The earliest document known to mention about the occurrence and treatment of cancer are medical manuscript of Chinese and Sumerian origin. Medical literature describes about ostogenic sarcoma occurring in the Egyptian mummy of the 5th dynasty (2500 BC). Cancer is mentioned in the writings of ancient India and also theories on its nature of origin were propounded by Hippocrates. It was Hippocrates (C 460-C 370) who first describe cancer by the term 'carcinoma' and 'carcinos' and its grave prognosis (Newelt GR et al, 1977).

The history of fossilised bones made by famous radiologist professor DG Rokhlin tried to diagnose the disease from which they are suffered during their life time. Professor Rokhlin succeeded specially in defining a number of tumourous lesions of the bone.

Marco Aurelio Severino (1580-1656 AD) classified benign and malignant
tumours. Round about 1600 AD the word cancer was used in the medical literature to replace the term canker. Bernard Pyrilhe (1735-1804), was the first to conduct a systematic experimental investigation on the aetiology of cancer.

Classical observation made by Pott (1775), "carcinoma of the lips occurs most frequently when men indulge in pipe smoking; the lower lip is particularly affected by cancer, when it is compressed between the tobacco pipe and the teeth". Subsequently, Levin et al (1950), Wyndes and Graham (1950), Doll and Hill (1950) suggested a link between smoking and lung cancer. These were some of the early reports that stimulated the very extensive research efforts in experimental tobacco carcinogenesis during last few decades.

Twenty century research day by day is bringing newer aspect of cancer to the surface including its immunological aspects, but it seems there is still a long way to cover.

Cancer and its causes:— The cancer is an abnormal mass of tissues, which is characterised by :-

i) Abnormal growth of cells.

ii) Ability to invade adjacent tissues and even distant organs.
Cancer can occur at any site or tissue of the body and may involve any type of cell. There is no reason to support that there is a single overriding cause of cancer producers or carcinogen, and these may be presumed to operate by diverse biochemical routes, at least initially. Now, perhaps it is justifiable at present to speak about exogenous and endogenous carcinogenic agents and also about initiating and promoting carcinogenic agents. The exogenous agents are - irradiations, tobacco, viruses etc, and endogenous agents are like sex hormones etc. Again the initiating agent starts the process while the promoting agent carries it to maturity.

The health of human being are probably a reflection of life style and the environment. Throughout the world dramatic differences in culture and life style factor result in equally differences in the health problems, including cancer (Magrath et al, 1993). The world health organisation (WHO) says that 80% of all cancers among men are
environmental in origin. Epidemiological observation of cancer prevalence in various geographic areas and its relationship with life style helped to outline risk factors for cancer development. Cancer occurs in all climates, places and races, but its distribution is not uniform.

More peculiarities of cancer distribution are coming to light throughout the world, some cancers are not seen in some parts of the world where as these cancer are very common in some other parts of the world. Such variations are believed to be related to people's life styles. Keeping all other aside, a salient life style factor associated with cancer, besides other health hazards is tobacco use. There is a close relation between tobacco use and cancer of upper aero-digestive tract (Blot et al, 1988). Again the use of tobacco has area specific peculiarities, which in turn causes different types of cancer. For example, in some states of India like Andhra pradesh, peoples mostly the women smoke a country made cigar i,e, chutta with the burning end inside the mouth. Cancer of the hard palate i,e, roof of the mouth is very much prevalent among such tobacco smokers. Similarly in Bihar and neighbouring districts of Uttar Pradesh of India, people mix tobacco and lime
and place this mixture under the tongue or in between lip and gum. Such people are prone to cancer of those parts of the mouth. Some people specially in West Bangal and Assam have the habit of keeping a quid of tobacco rolled up in a betel leaf in their mouth even while sleeping, those are prone to have mouth cancer. A recent study in USA, showed that current smokers had a nearly 4 fold increase in risk of cancer compared with non-smokers, with risk increasing to 6.4 among those who smokes more than 2 packets daily. After adjustment for age and number of cigarette smoked, risk were inversely associated with age at starting of smoking, with the highest risk observed among those who started smoking before the age of fifteen (Chow et al, 1993).

Here, I like to quote some examples from developing countries of the world. In Algeria, an African country, there are high frequency of oral cavity cancer (4.1%) is probably associated with the habit of tobacco chewing. Tobacco smoking is also prevalent among Algerian males and laryngeal cancers are very common amongst them (9.2% of all cancers) and sex ratio is 10:1 (apx). Other common cancers are lungs, nasopharynx etc. In an neighbouring country of us the Bangladesh, an Asian country chewing of tobacco and betel nut is common amongst men and women and oral and oropharyngeal cancer
is 15.4% in male and 14.6% in female. Cancer lung, larynx and oesophagus are also common in Bangladesh. In another neighbouring country the Pakistan tumour lung, oral cavity and pharynx are common amongst male population (Parkin, 1986). About 48% of all adults male in Pakistan were tobacco smokers, with an average consumption of 14 cigarette per day; the prevalence of smoking in adult female was 1.7% (Mahmood, 1982). Geography of cancer is another interesting subject, as we have seen that incidence of different forms varies greatly in different countries and even in different parts of the same country. Cancer in Africa provides one of the most exciting and challenging examples of the geographic pathology of cancer. It is challenging because the pattern of cancer in that continent differs profoundly from rest of the world. Perhaps the most dramatic feature of the exciting story of cancer in Africa is the Burkit lymphoma. This is a disease of children in Africa but not of African children.

Dietary factor may also takes an important role in carcinogenesis. Here we can sight an historical example, when dimethyl azobenzene (i.e., butter yellow) is given to rats along with its diet (i.e., rice) liver cancer usually develops, but when this mixture is also added with vitamin B complex then
no cancer develops (Sigura and Rhoads, 1941). This is for the first time that it was prove experimentally that deficiency in dietary factor act as conditioning factor for cancer formation. After this report in the year 1941, much more research has been going on the subject, but the result on their own are not definite, but promising findings stimulate further research to clarify the potential benefit of micro-nutrients. A recent report (Bolt WJ et al, 1993) from China says that people of Linxion Country of China have one of the world's highest rates of oesophageal and gastric cardia cancer and a persistently low intake of several micronutrients. After trial of several combination of micronutrient they observed that a combination of beta carotene (15 mg), Vitamin E(30 mg) and Selenium (50 mg) reduce the risk of dying from cancer. Epidemiological evidence indicates that diet high in fruits and vegetables are associated with reduce risk of several cancers as vitamin and micronutrients in these food may contribute to reduce cancer risk. Dietary fibre has been suggested as another important factor in cancer prevention. It is also important to note here that, the fruits and vegetables are the major dietary source of fibre. In their study Sandler et al (1993) found that dietary fat significantly associated with increase risk
of colorectal adenoma. Again, one most popular beverage consumed by human being worldwide is tea. The relationship between tea consumption and human cancer incidence is an important concern. This topic has been studied in different population by many investigators, but no clear cut conclusion could be drawn. Some studies have shown a protective effect of tea consumption against certain types of cancer, other studies have indicated an opposite effect (Yang CS et al, 1993).

The study of age incidence is also very important. There was less number of cancer cases 200 years ago, this may be because average life expectancy was less in those days or facilities for diagnosis of cancer was less and many cases died without diagnosis. It is also noted that in the families with a marked cancer predisposition, the age of onset is much earlier.

The possible role of heredity in the genesis of cancer has seldom or even reluctantly been admitted by the medical profession. Again there is no primary gene for cancer in general, but a few human tumours show so marked familial tendency that every member of the family may die of the disease if he lives long enough. The historic example of familial tendency is
that of Napoleon, who dies of cancer stomach, his father, 
grandfather, brother and his three sisters all of them 
died of the same disease. In the light of our knowledge 
a 'oncogene hypothesis' is postulated. This hypothesis 
defines what cancer is and predicts that our genetic 
material carries all the elements necessary for malignant 
transformation and the carcinogenic agents like 
ultraviolet light, ionizing radiations, tobacco, viral 
infections, dietary practices etc. stimulates those 
onchogene and their are mutation in the cells leading to 
continuous cellular division and then to cancer 
formation.

There are also examples where 
chronic irritation is associated with cancer. A very 
good example is stone and cancer of gall bladder. An 
irritation usually causes inflammation, not cancer, but 
prolonged destruction of tissue demands constant 
replacement, and it is possible that when this is 
continued over an extended period the regulating 
mechanism may became upset resulting neoplasm. This may 
also be seen in the ulcers of mouth, tongue and 

gastro.

The pollutants exhausted from 
automobiles have their biological effect on human
beings. Hydrocarbons cause objectionable odour and also a carcinogenic substance (i.e., carcinogen) and they cause cancer mainly in the respiratory tract. Oxides of nitrogen get transformed in the lung to nitrosamines, which are also carcinogenic and they may cause other lung disease like pneumonia, bronchitis etc. This way rapid industrialisation in an unplanning way produce various types of chemicals or gases which may have carcinogenic effect.

Our living environment has been polluted by abundance of chemical emitted by factories, pesticides and fertilizers and our food is painted with additive and adulants. All these and stress prone life style, increased use of tobacco and alcohol cause concern to our health including cancer. Much more chemicals and gases may be identified in near future as carcinogen, which are either bi-products of our day to day use machineries or factories or from agricultural habit or biological waste products or solid garbages etc.

So, it is now clear that environment and life style play an important role in determining the risk for development of a number of human cancers.
Developmental anatomy of laryngopharynx: The mouth is derived partly from the stomatodeum and partly from the foregut. The pharynx develops from the ectodermal layer of the cranialmost part of the foregut along with the part of nasal cavity, submandibular and sublingual salivary glands, larynx, trachea, bronchi, oesophagus and stomach. At about fourth week a small diverticulum appears on the ventral wall of the foregut and its junction with the pharyngeal gut, and that pharyngeal part later on develops to laryngopharynx.

With the establishment of the palate and the mouth, the pharynx shows a subdivision into nasopharynx, oropharynx and laryngopharynx. The muscles forming the wall of the pharynx are derived from the third and subsequent pharyngeal arches.

Surgical anatomy of the laryngopharynx: The laryngopharynx or hypopharynx extends from the lower limit of the oropharynx down to the opening of the oesophagus at the lower border of the cricoid cartilage, where it continues with the oesophagus. Its anterior wall presents from above downwards, the inlet of the larynx, the posterior surface of the arytenoid cartilage and cricoid cartilage. Posteriorly the laryngeal part of the pharynx is supported by the bodies of the third (lower part), fourth, fifth and
sixth (upper part) cervical vertebrae. The larynx projects into the laryngopharynx from the front so that grooves are formed on either side of it which are known as pyriform fossae or sinus or recesses. These are shallow above and separated from the valleculae by the pharyngo epiglottic folds. Lower down, the pyriform fossae become deeper and more cleft like. The upper shallow part of the pyriform fossae is bounded laterally by the thyrohyoid membrane and medically by the aryepiglottic fold. The deeper lower part of the fossae is in relation laterally to the thyroid cartilage and medially to the cricoid cartilage. The post cricoid portion of the laryngopharynx is as its name implies, that segment on the anterior wall which lies directly behind the cricoid cartilage and for that reason the mucosa there usually appears slightly paler than elsewhere. The laryngopharynx is completed by its lateral and posterior mucosal wall.

Although, anatomically, the laryngopharynx ends at the oesophageal opening at the lower border of the cricoid cartilage there is no change in the mucosa at that level and growth spread readily across the junction. A large portion of carcinoma in this part of the alimentary canal are pharyngo-oesophageal and there would be merit in tumour
classifications incorporating the cervical oesophagus into the 'pharyngo-oesophageal region' in the same way that the UICC (International Union Against Cancer) incorporating the posterior third of the anatomical tongue into the oropharynx for onchological classification. It is certainly much more common for carcinoma to spread from the cervical oesophagus into the laryngopharynx than into the thoracic oesophagus. So, for all practical purpose (onchological purpose) the laryngopharynx is classified into three anatomical parts:-

a) Posterior pharyngeal wall.
b) Pyriform fossa.
c) Post cricoid region.

Cancer of the laryngopharynx:—The malignant growth of the laryngopharynx are usually squamous cell carcinoma. Other malignant tumour like adenocarcinoma, malignant lymphoma, mesodermal tumours, metastatic deposit from elsewhere are very rare.

The squamous cell carcinoma are most often moderately differentiated and microscopically present as either exophytic or ulcerative growth. The exophytic forms seen mostly in the pyriform sinuses and aryepiglottic fold and the ulcerative type seen in remaining areas of the
laryngopharynx. Carcinoma in this region are usually classified under the anatomical sites from where they originated as follows:

1. Marginal or epilaryngeal
   a) Posterir surface of suprahoid epiglotis.
   b) Aryepiglotic fold.
   c) Arytenoid.
2. Pyriform fossa.
3. Postero-lateral wall of posterior pharyngeal wall.
4. Post cricoid region.
5. Cervical oesophagus or epi-oesophageal.

Some other systems of classification place the marginal zone carcinoma with the laryngeal carcinomas but the behaviour, symptomatology and mode of spread of these cases are such that they are like laryngopharyngeal carcinoma. The upper oesophageal i.e., cervical oesophageal carcinoma are also difficult to separate from post cricoid growth and often grouped with post cricoid carcinoma. The combined group sometimes renamed as "epi-oesophageal" carcinoma (Lederman M, 1962).
The cases of the laryngopharyngeal carcinoma usually come late for diagnosis and in the meantime it grows to such an extent that it becomes difficult to diagnose the adjacent site of origin.

Spread of cancer laryngopharynx:— The ability to spread, both locally and to a distance is one of the most important characteristics of a malignant tumour, and this is one of the barrier for successful treatment of cancer. The power and method of spread constitute the main feature of the natural history of the tumour. There are six methods by which a tumour may spread. These are:

a) By infiltration to the neighbouring tissues.

b) By lymph vessels to the draining lymph nodes.

c) By blood vessels to the distant organ.

d) Through natural passages such as bronchus, bowel, ureter etc.

e) Spread by serous cavities i.e., transcelomic cavity.

f) Implantation during handling of the tumour.
In case of cancer laryngopharynx, both the exophytic and ulcerative forms spread submucosally well beyond the macroscopic limit of the growth, specially in the poorly differentiated lesions, but the ulcerative form has a greater tendency to infiltrate deeply. Spread in the deeper aspect forwards and laterally leads to invasion of the thyroid cartilage and also the thyroid gland; and in case of spread forward and medially, the arypepiglottic fold and ventricular band become infiltrated and then the affected side of the larynx will be fixed. If the growth is infiltrated behind the cricothyroid joint the recurrent laryngeal nerve may be paralysed. Post cricoid growth may be spread circumferentially, as well as vertically, thus producing stenosis.

In lymphatic spread, the lymphatic vessels from the laryngopharynx converge on the thyrohyoid membrane and pierce it and drained into the jugulodigastric node and some drain in the deep cervical lymph node. Lymphatic vessels from the lower part of laryngopharynx may pass directly to the lower nodes of deep cervical chain or even upto paratracheal nodes. As the lymphatic network freely crosses the midline, lymph node may involve bilaterally, which is mostly seen when growth itself crosses the midline. In
case of cancer laryngopharynx, lymph node involvement is early, sometime large lymph nodes may be seen in the neck with a tiny growth in the laryngopharynx. Many of the cases of cancer laryngopharynx may present with cervical lymph node only when first present for diagnosis.

Distant metastasis may also occur rarely to the distant organ like bones and viscera etc. in case of cancer laryngopharynx.

Cigarette smoking: - Tobacco was first introduced in Europe for its medicinal value at the end of sixteenth century, but soon after it became controversial. Earlier it was used either in the form of cigar, snuff, pipe etc., but it became popular in the form of cigarette just prior to the world war I. However, after 1910 the production of cigarettes climbed up with increase in public health problems including cancer.

It is very difficult to know who smoke cigarette and why they do so. After going through different literatures, it is found that smoking of cigarette is seen amongst people of different social status irrespective of age, sex and socio-economical condition whether rural or urban.
The smoking motive may under certain circumstances be a conscious effort to solve a problem and to reduce social insecurity by offering or smoking a cigarette. We may learn to smoke a cigarette to make us feel less afraid, less angry, less ashamed, less disgusted. People use to learn smoking cigarette during their school days; in case of lower age group they prefer hidden place and in case of slightly older age group they prefer crowded place. In both the case they think that they were not seen by anybody known to them or in case of crowded they thought that nobody of the crowded known to them.

Investigation on relationship between cigarette smoking and cancer laryngopharynx invariably include measurement of cigarette smoking. In some investigation the cases are classified into broad categories e.g, filter tip cigarette, non filter tip cigarette, other from smoking tobacco, smokeless tobacco etc. In other studies the individuals have been classified according to the quality of various cigarette smoked. There are relatively approximate method applied for measuring cigarette smoking and generally found satisfactory.
In principle, quantitative data on cigarette consumption may be obtained either on the basis of supply or on consumption. As far as the state is concerned, accurate information on total annual supply of various cigarette may usually be obtained from data on cigarette taxation. But this data merely has got limited value for the purpose of this study. This is due to the fact that, this can give no information on distribution of consumption, age group of the consumer, type of cigarette use etc. The distribution of consumption in various age group is very important in this study, and so also per capita consumption of cigarette, as to see relation of it with cancer laryngopharynx. Not only that one must remember that supply data can give accurate information as supplies but only limited information on consumption. If data on the distribution of consumption on consumer groups are needed must apply interview investigation, which is adopted in this study.

Data from interview surveys suggest that the age at which regular smoking of cigarette starts varies significantly amongst the populations, but seems to have an average age. In this study we have also recorded the distribution
and consumption of cigarette amongst the smoker. We also used both personnel interview method and mail method to collect the data.

To be more accurate, data from interview investigation can be compared with supply data as an extra control but this needs study on all categories of consumers. So, in this series of study this has got limitation. The main weakness of interview studies for cigarette smoking is found in measuring the quantity. Interview always adds "perhaps" in all answers regarding exact age of starting cigarette smoking and daily consumption, which really varies in different cases. Then also we can consider this method as most satisfactory one as we easily make cross interview and can find out the average very easily.

The class interval applied in the quantitative grading plays an important part in this study to find out individual consumption. In various study either in India or in foreign countries the class intervals taken are not similar. For example, in some study it is taken as 1-5, 6-10, 11-15 etc and in some other case it might be of Again "now stopped" and "now reduced" smokers are
of difficult to put in any category as many of them except a few turn to previous state after some intervals.

Again cigarette are of 2 (two) types:

1. With filter.
2. Without filter.

One more thing to be added here is passive smoking. Passive smoking is involuntary exposure of tobacco combustion product to non-smoker from the smoking of the others. Though previously it was said to be controversial topic regarding its ill effect on health, but now it is said to be equal importance.

During tobacco smoking smoke is produce incomplete combustion of the tobacco leaf. During burning of tobacco three types of chemical reaction occur simultaneously i.e., pyrolysis, pyrosynthesis and distillation. The process of tobacco burning leads to thermic decomposition in which organic matters fractioned into smaller molecules i.e., pyrolysis. The newly formed fragments are partially unstable and recombine to form components that were not
originally present in the tobacco i.e., pyrosynthesis. Nicotine and some other organic compounds take part in the process of distillation and decomposed to some extent.

The heat produced during tobacco combustion may be divided into mainstream and side stream smoke. Mainstream smoke emerges from the tobacco product through the mouth piece during puffing along the air is drawn through cigarette at which the temperature of the burning zone may reach 880 oC. Where as side stream smoke comes from burning core and from the mouth piece during puff intermission i.e., during rest at which the temperature may reach 835 oC (Towey, 1957). The mainstream smoke contains $1 \times 10^9$ to $5 \times 10^9$ particles per ml with the mean particle size ranging from 0.2 to 1.1 u (Steadman, 1968). There are approximately 500 mg mainstream smoke in a cigarette, of which more than 85% is composed of nitrogen, oxygen, carbon dioxide. After smoke is drawn into the mouth, nose and throat, some constituents are absorbed directly through the oral mucosa, other constituents are inhaled into bronchopulmonary tree where they are either absorbed or retained (Dalhamm T et al, 1968)
Nicotine: The primary purpose of laboratory investigation in the field of tobacco carcinogenesis, is to determine whether various tobacco and tobacco products are carcinogenic or not. Approximately 3800 different compounds have been identified in tobacco smoke (Dube et al, 1982); some of these are:

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Nitrogen</td>
<td>54.0%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>12.0%</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>13.0%</td>
</tr>
<tr>
<td>Carbon mono oxide</td>
<td>3.5%</td>
</tr>
<tr>
<td>Strong acid</td>
<td>3.0%</td>
</tr>
<tr>
<td>Weak acid</td>
<td>1.2%</td>
</tr>
<tr>
<td>Alkaline products</td>
<td>0.5%</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>2.0%</td>
</tr>
<tr>
<td>Aldehydes</td>
<td>0.7%</td>
</tr>
<tr>
<td>Ketones</td>
<td>0.5%</td>
</tr>
<tr>
<td>Nitrides</td>
<td>0.3%</td>
</tr>
<tr>
<td>Water</td>
<td>3.0%</td>
</tr>
<tr>
<td>Others</td>
<td>3.3%</td>
</tr>
</tbody>
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Nicotine \((\text{C}_{10}\text{H}_{14}\text{N}_{2})\) is the alkaloid of tobacco \((\text{Nicotinina tabacum})\) and occurs in the dry leaves of the. Refractive index is 1.5280 and weight per ml is about 1.01 gm. Nicotine is colourless, oily liquid, boiling point is 247 °C.
turning brown owing to oxidation. It has a tobacco like smell and a burning alkaline taste. It is soluble in water and also in organic solvents. The natural alkaloid is levorotatory. It is highly toxic to animal but in very small amount it stimulates the nervous system for a while, which is followed by depression. The structural formula of nicotine has been shown in the figure.

Lipid profile: - The lipids are heterogenous group of compounds related either actually or potentially to the fatty acids. They have the common property of the (1) relatively insoluble in water, and (2) soluble in monopolar solvent such as ether, chloroform and benzene. Lipid includes fats, oils, waxes and related compounds. Lipids are important dietary constituents not only because of their high energy value but also because of the fat soluble vitamins and the essential fatty acids contains in the fats of natural food. In the body fat serves as an efficient source of energy who directly and potentially, when stored in adipose tissue, it serves as a thermal insulator in the subcutaneous tissue and around certain organs and nonpolar lipids act as an electrical insulator (Mayes PA, 1985). A wide variety of lipids occur in animal and plant
tissues and may obtained synthetically; these are:

a) Cholesterol: It is the parent compound of all steroids synthesized in the body. It occurs in animal fats, but not in plant fat. Cholesterol is widely distributed in all cells of the body, particularly in the nerve tissues. Cholesterol has several asymmetric carbon atoms, and about 512 stereoisomers and possibly only a few of these isomers are found in nature. It melts at 149-150°C. It has no taste and no odour. It is insoluble in water, alkali or acid, but readily soluble in organic solvents such as ether, benzene, chloroform and petroleum ether (Talwar, 1980). The metabolism of cholesterol is of particular interest to both biochemical and medical scientist; because of its possible relationship between high plasma levels of cholesterol and incidence of some disease mostly atherosclerosis, but the most accurate estimation method should be use with caution (Jukka M et al., 1995).

b) Triglycerides: The triglycerides or so called neutral fats are esters of alcohol, glycerol and fatty acids in naturally occurring fat. They are merely all mix acetylglycerols. Partial
acylglycerols consisting of mono and di-
acylglycerols where in a single fatty acid or two 
fatty acids are esterified with glycerol are also 
found in the tissues. These are of particular 
significant in the synthesis and hydrolysis of 
triglycerides.

Important enzymes:—The recognition and description of the enzymes that mediate the various steps in the intermediary metabolic sequences in tissues have constituted one of the great advances in biochemistry during the past 30 years. Many of the studies involved in this development were performed on unicellular organism and animal tissues. If metabolic processes and the associated enzyme activities in tissue could be reflected in the blood of man, the ready and repeated availability of this fluid would add much to the dynamic study of disease.

The investigation of blood enzymes has followed a variable course. A few enzymes such as the alkaline and acid phosphatase, received much attention because of their diagnostic applicability. But, as it was pointed out more fully later, these serum enzyme activities were also found to be alerted in other disease, failed to achieve
the specificity of the alkaline and acid phosphatase, and hence have had only limited applicability (Bodansky O, 1961; Potter VR, 1950).

Considerable interest continues to be shown in the clinical, biological and the pathological implications of those products that are synthesized and released by human tumours.

a) Serum alkaline phosphatase: This enzyme was first demonstrated histochemically in leucocytes by Wachstein in 1946, and its activity in normal and leukemic cells has subsequently received considerable study. Franseen and Mclean (1935) were the first to report on the basis of the observations of high levels of this enzyme in the tissue and blood plasma.

Serum alkaline phosphatase activity is elevated in two main groups of disease: those affecting the bone and bone forming tissues and those affecting the structural and functional integrity of the liver.

Study of the alterations of these serum enzymes have had some but, as a whole, limited applicability in major disease, including cancer. In a study on experimental animal rat in the
year 1979 (Ingleton DM et al, 1979) it was found that increased level of the enzyme were not detectable till the tumour had reached a radially palpable size. In another tissue culture study from 12 different patients with osteosarcoma and normal fibroblast, in all cases of osteosarcoma line contains significantly more alkaline phosphatase than does the paired normal line of fibroblast of the same patient (William T et al; 1979).

b) Serum Glutamic Oxaloacetate transaminase: This enzyme (SGOT) transfers an amino group from glutamic acid to oxaloacetic acid and also catalyzes the reverse reaction. SGOT activity amounts to 8-40 units per ml of normal serum. The unit is a measure of the decrease in optical density of the test solution per minute due to the enzyme catalized reaction. Heart, liver and skeletal muscles are rich in the enzymes in a decreasing order. SGOT rises even by 5-30 times for a short period during and following myocardial infarctions even when ECG gives no clear indication. The cytoplasmic isozymes of SGOT predominates in the serum in less severe myocardial lesions, but the mitochondrial isozyme also rises in severe myocardial necrosis and exceeds SGPT in myocardial infraction. SGOT also rises in
Congestive cardiac failure, acute pericarditis and infective hepatitis, but usually lags behind SGPT in hepatic disorders. Small rises in SGPT occurs in neuromuscular disorders (Das D, 1988; Graner DK et al, 1985).

c) Serum glutamic pyruvate transaminase: This enzyme (SGPT) transfers the amino group from glutamic acid to pyruvic acid and also catalyzes the reverse reactions. SGPT activity amounts to 9-30 units per ml of normal serum. The unit measures a specific decrease in the optical density of the test solution due to the enzyme catalyzed reaction. Liver has the highest amount of this enzyme, cardiac muscles are poorer. In infective and toxic hepatitis, homologus serum jaundice and some forms of obstructive jaundice, serum SGPT rises rapidly, exceeding the SGOT activity. But in myocardial infarctions, SGPT lags far behind SGOT (Das D, 1988; Hasper HA et al, 1979).