CHAPTER 1

INTRODUCTION
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Herbs are staging a comeback and herbal ‘renaissance’ is happening all over the globe. The herbal products today symbolize safety in contrast to the synthetics that are regarded as unsafe to human and environment. Although herbs had been priced for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security.

Over three-quarters of the world population relies mainly on plants and plant extracts for health care. More than 30% of the entire plant species, at one time or the other, were used for medicinal purposes. It is estimated that world market for plant derived drugs may account for about Rs.2,00,000 crores. Presently, Indian contribution is less than Rs.2000 crores. Indian export of raw drugs has steadily grown at 26% to Rs.165 crores in 1994-'95 from Rs.130 crores in 1991-'92. The annual production of medicinal and aromatic plant’s raw material is worth about Rs.200 crores. This is likely to touch US $1150 by the year 2000 and US $5 trillion by 2050.

It has been estimated that in developed countries such as United States, plant drugs constitute as much as 25% of the total drugs, while in fast developing countries such as
China and India, the contribution is as much as 80%. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world. These countries provide two third of the plants used in modern system of medicine and the health care system of rural population depend on indigenous systems of medicine.

Of the 2, 50,000 higher plant species on earth, more than 80,000 are medicinal. India is one of the world’s 12 biodiversity centers with the presence of over 45000 different plant species. India’s diversity is unmatched due to the presence of 16 different agro-climatic zones, 10 vegetation zones, 25 biotic provinces and 426 biomes (habitats of specific species). Of these, about 15000-20000 plants have good medicinal value. However, only 7000-7500 species are used for their medicinal values by traditional communities. In India, drugs of herbal origin have been used in traditional systems of medicines such as Unani and Ayurveda since ancient times.

The Ayurveda system of medicine uses about 700 species, Unani 700, Siddha 600, Amchi 600 and modern medicine around 30 species. The drugs are derived either from the whole plant or from different organs, like leaves, stem, bark, root, flower, seed, etc. Some drugs are prepared from excretory plant product such as gum, resins and latex. Even the Allopathic system of medicine has adopted a number of plant-derived drugs which form an
important segment of the modern pharmacopoeia. Some important chemical intermediates needed for manufacturing the modern drugs are also obtained from plants (Eg. diosgenin, solasodine, bionone). Not only, that plant-derived drug offers a stable market worldwide, but also plants continue to be an important source for new drugs.

Over the centuries, people in India have had a fascination and respect for the natural heritage, traditional plant ethics and herbal medicine has become a part of its culture. This wealth of traditional herbal knowledge is diminishing with the advancement of modern medicine. However, these valuable traditional practices are still followed in deep woods and interior tribal areas of India. One such area is the Western Ghats, which runs majestically parallel to the west coast of India covering an area approximately equal to 160,000 sq. km. It is amongst the 32 biodiversity hot-spots identified in the world, due to its rich and unique assemblage of flora and fauna. Among approximately 4000 flowering plant species of Western Ghats, more than 2000 plants are reported to be of medicinal value. This wealth of medicinal plants as well as their information resources is diminishing day by day due to over exploitation and lack of interest in herbal medicine.

Traditional system of medicine has been practiced since historical times and traces its roots to ancient civilizations. The World Health Organization (WHO) has recently
defined traditional medicine (including herbal drugs) as comprising therapeutic practices that have been in existence, often for hundreds of years, before the development and spread of modern medicine and are still in use today. This traditional medicine is still the mainstay of about 75–80% of the world population, mainly in the developing countries, for primary health care because of better cultural acceptability, better compatibility with the human body and lesser side effects.

India has a long history of healing tradition, in fact from pre-historic era. It is estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine, representing about 75% of the medicinal needs of the Third World countries. More than 80% of the population, especially the rural folk are still dependent on traditional herbal remedies for their primary healthcare. However the rich tradition of herbal healing, which has the potential to tackle primary healthcare problems of millions and enable them health security, is eroding fast due to lack of social and policy support. Therefore there is an urgent need of revitalization of these traditional medical systems for their conservation through which the whole mankind can be benefited.

Traditional systems of medicine continue to be widely practiced on many accounts. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of
several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. Global estimates indicate that 80% of about 4 billion population cannot afford the products of the Western Pharmaceutical Industry and have to rely upon the use of traditional medicines which are mainly derived from plant material. This fact is well documented in the inventory of medicinal plants, listing over 20,000 species. In spite of the overwhelming influences and our dependence on modern medicine and tremendous advances in synthetic drugs, a large segment of the world population still likes drugs from plants. In many of the developing countries the use of plant drugs is increasing because modern life saving drugs are beyond the reach of three quarters of the third world’s population although many such countries spend 40-50% of their total wealth on drugs and health care. As a part of the strategy to reduce the financial burden on developing countries, it is obvious that an increased use of plant drugs will be followed in the future. Among ancient civilizations, India has been known to be rich repository of medicinal plants. The forest in India is the principal repository of large number of medicinal and aromatic plants, which are largely collected as raw materials for manufacture of drugs and perfumery products. About 8,000 herbal remedies have been
codified in Ayurveda. The Rigveda (5000 BC) has recorded 67 medicinal plants, Yajurveda 81 species, Atharvaveda (4500-2500 BC) 290 species, Charak Samhita (700 BC) and Sushrut Samhita (200 BC) had described properties and uses of 1100 and 1270 species respectively, in compounding of drugs and these are still used in the classical formulations, in the Ayurvedic system medicine. Unfortunately, much of the ancient knowledge and many valuable plants are being lost at an alarming rate. With the rapid depletion of forests, impairing the availability of raw drugs, Ayurveda, like other systems of herbal medicines has reached a very critical phase. About 50% of the tropical forests, the treasure house of plant and animal diversity have already been destroyed. In India, forest cover is disappearing at an annual rate of 1.5mha/yr. What is left at present is only 8% as against a mandatory 33% of the geographical area. Many valuable medicinal plants are under the verge of extinction. The Red Data Book of India has 427 entries of endangered species of which 28 are considered extinct, 124 endangered, 81 vulnerable, 100 rare and 34 insufficiently known species (Thomas, 1997).

Ayurveda, Siddha, Unani and Folk (tribal) medicines are the major systems of indigenous medicines. Among these systems, Ayurveda is most developed and widely practiced in
India. Ayurveda dating back to 1500-800 BC has been an integral part of Indian culture. The term comes from the Sanskrit root Ayu (life) and Veda (knowledge). As the name implies it is not only the science of treatment of the ill but covers the whole gamut of happy human life involving the physical, metaphysical and the spiritual aspects. Ayurveda recognizes that besides a balance of body elements one has to have an enlightened state of consciousness, sense organs and mind if one has to be perfectly healthy. Ayurveda by and large is an experience with nature and unlike in Western medicine, many of the concepts elude scientific explanation. Ayurveda is gaining prominence as the natural system of health care all over the world. Today this system of medicine is being practiced in countries like Nepal, Bhutan, Sri Lanka, Bangladesh and Pakistan, while the traditional system of medicine in the other countries like Tibet, Mongolia and Thailand appear to be derived from Ayurveda. Phytomedicines are also being used increasingly in Western Europe. Recently the US Government has established the “Office of Alternative Medicine” at the National Institute of Health at Bethesda and its support to alternative medicine includes basic and applied research in traditional systems of medicines such as Chinese, Ayurvedic, etc. with a view to assess the possible integration of effective treatments with modern medicines.
The development of systematic pharmacopoeias dates back to 3000 BC, when the Chinese were already using over 350 herbal remedies. Ayurveda, a system of herbal medicine in India, Sri Lanka and South-East Asia has more than 8000 plant remedies and using around 35,000-70,000 plant species. China has demonstrated the best use of traditional medicine in providing the health care. China has pharmacologically validated and improved many traditional herbal medicines and eventually integrated them in formal health care system.

Green plants synthesize and preserve a variety of biochemical products, many of which are extractable and used as chemical feed stocks or as raw material for various scientific investigations. Many secondary metabolites of plant are commercially important and find use in a number of pharmaceutical compounds. However, a sustained supply of the source material often becomes difficult due to the factors like environmental changes, cultural practices, diverse geographical distribution, labor cost, and selection of the superior plant stock and over exploitation by pharmaceutical industry.

Plants, especially used in Ayurveda can provide biologically active molecules and lead structures for the development of modified derivatives with enhanced activity and /or reduced toxicity. The small fraction of flowering plants that have so far been investigated
have yielded about 120 therapeutic agents of known structure from about 90 species of plants. Some of the useful plant drugs include vinblastine, vincristine, taxol, podophyllotoxin, camptothecin, digoxigenin, gitoxigenin, digoxigenin, tubocurarine, morphine, codeine, aspirin, atropine, pilocarpine, capscicine, allicin, curcumin, artemesinin and ephedrine among others. In some cases, the crude extract of medicinal plants may be used as medicaments. On the other hand, the isolation and identification of the active principles and elucidation of the mechanism of action of a drug is of paramount importance. Hence, works in both mixture of traditional medicine and single active compounds are very important. Where the active molecule cannot be synthesized economically, the product must be obtained from the cultivation of plant material. About 121 (45 tropical and 76 subtropical) major plant drugs have been identified for which no synthetic one is currently available. The scientific study of traditional medicines, derivation of drugs through bioprospecting and systematic conservation of the concerned medicinal plants are thus of great importance.

A major lacuna in Ayurveda is the lack of drug standardization, information and quality control. Most of the Ayurvedic medicines are in the form of crude extracts which are a mixture of several ingredients and the active principles when isolated individually fail
to give desired activity. This implies that the activity of the extract is the synergistic effect of its various components. In the absence of pharmacopoeia data on the various plant extracts, it is not possible to isolate or standardize the active contents having the desired effects. Ayurvedic pharmacopoeia compiled on modern lines and updated periodically is an urgent requirement. A combination therapy integrating Ayurveda and allopathy whereby the side effects and undesirable reactions could be controlled can be thought of. Studies can show that the toxic effects of radiations and chemotherapy in cancer treatment could be reduced by Ayurvedic medications and similarly surgical wound healing could be accelerated by Ayurvedic medicines. An integrated approach for the cultivation, conservation and preservation of important plant species through plant molecular biology, plant tissue culture; research on the rationale and methodology of Ayurvedic medical practice; isolation of active constituents and their development into new therapeutics; standardization and validation of known herbal medicines and other related aspects need to be focused upon.

Chinese, Indian, Arabian and other traditional systems of medicines make extensive use of about 5000 plants. Nearly three fourth of the drugs and perfumery products used in the world are available in natural state in the country. India possesses almost 8% of the
estimated biodiversity of the world with around 1,26,000 species. It is one of the 12 mega biodiversity centers with 2 hot spots of biodiversity in Western Ghats and north-eastern region. The sacred groves are a miniature ecosystem conserving biodiversity in its pristine form. There are about 400 families in the world of flowering plants; at least 315 are represented in India. According to WHO, around 21,000 plant species have the potential for being used as medicinal plants.

About 5000 species have been studied. There are at least 121 major plant drugs of known structure, but none of them is currently produced through synthetic means. For developing phytomedicines as a major area of concern, it would be essential to adopt a holistic interdisciplinary approach, have a scientific basis of the understanding of the plant systems, new innovations and their conservation for utilization in future on a sustainable basis (Sharma, 1997).

Despite the diverse nature of crops grown in the country and the existence of a fast growing pharmaceutical sector, the share of India in world trade is quite insignificant considering the large geographical area. However, this is bound to rise rapidly with better research inputs and efficient management of the farm sector. So far, India has been involved in the export of only large volume raw material. To achieve competitive
advantage we need to resort to low volume high cost (value) trade through value addition to the raw and unfinished products. It is therefore, necessary to develop genetically superior planting material for assured uniformity and desired quality and resort to organized cultivation to ensure the supply of raw material at grower’s end. Post harvest storage and process technologies need to be developed to produce the value added finished products that may be directly utilized by the industry. Inventorisation of herbal drugs used in traditional and modern medicines for a country like India, appears to be a stupendous task, where a number of well established indigenous or traditional systems, including Ayurveda, Unani, Siddha, Homoeopathy, Tibetan, Amchi, Yoga and Naturopathy are practiced along with modern medicine for the management of total health care system. In all these systems a large number of plant drugs are used, although there may be some common plants. Another problem in correct identification of plants is that the plant drugs in those systems of medicine are known by their classical, Shastriya or vernacular names. It is not easy to correlate these names with acceptable scientific names. One plant species can have many vernacular classical names and one name may refer to different plant species.

The Western Ghats of India covers an area of 1,60,000 Sq. Km., which is among the ecologically richest regions and considered as one of the eight 'hottest' biodiversity hotspots...
of the 34 identified biodiversity hotspots worldwide. Of the 15,000 plant species recorded so far, 4,000 are endemic to the region. As the region boasts of a tremendous diversity of plant and animal life, the forests are source of herbal medicine for many of the local ethnic communities. This indigenous system of medicine thrives on naturally occurring floral diversity, collectively referred to as medicinal plants. However, interest in Ayurveda and traditional medicine, which has a known history of treating and curing mankind across five millennia, has increased globally; it is becoming homeless in its own birthplace. Many of the herbal remedies, which are evolved over generations of experience and practice, are not well documented and are unknown or least known to the modern world.

Meantime, it is evident that the forests in the Western Ghats region are under increasing stress due to over exploitation, degradation and habitat destruction affecting the very existence of medicinal plant flora. Already 586 species of the plants from the region are endangered and feature in the 'Red Data' book. Thus, there is an urgent need of conservation priorities, primarily for the medicinal plants which are facing the maximum stress and are in the verge of extinction. Thus, there is a need to create awareness among the public about the importance of our traditional heritage of herbal healing and importance of medicinal plants and their conservation.
Plants contain a wide range of potent chemical compounds, many of which have evolved to protect plants against pests and predators. Some plants and plant compounds have been demonstrated to be effective against illness. Examples include the Madagascar rosy periwinkle (*Catharanthus roseus*) against childhood leukaemia, arnica (*Arnica montana*) for bruises, and *Aloe vera* for wound-healing.

However, it is important to note that some plant compounds are poisonous and that some are ineffective. Although herbal medicines are ‘natural’, this does not necessarily mean they are safe. Consumers should be aware that the vast majority of herbal medicines have not undergone intensive laboratory testing for safety and efficacy compared with Western medicines; neither are they subject to the same monitoring or government regulation.

All the great Asian medical traditions embrace herbal medicine, using a wide variety of plant species. Medicines might originate from any part of a plant, be it the flowers, stems, leaves, fruits, roots or bark.

Harvesters pay particular attention to the places where plants grow, the time they are harvested and their method of processing. In addition, some traditions include animal products, metals, minerals and precious gems in their remedies.
Plants and other ingredients are classified primarily by the five tastes (sweet, sour, bitter, pungent and salty) of the Chinese medical tradition and by the six tastes (sweet, sour, salty, bitter, pungent/hot and astringent) of Ayurveda and the Tibetan medical tradition. These further correspond with the five elements - earth, metal, water, wood and fire (Chinese system) and earth, fire, water, air and space in the Indian and Tibetan traditions.

Also taken into consideration are the properties (hot/cold, heavy/light, smooth/rough and dull/sharp). The appropriate remedy is then prescribed to restore the balance of the patient.

In India, many forms of alternative medicines are available for those who do not want conventional medicine or who cannot be helped by conventional medicine. Ayurveda and Kabiraji (herbal medicine) are two important forms of alternative medicine that is widely available in India.

Many herbs and spices used in Indian cooking, such as onion, garlic, ginger, turmeric, clove, cardamom, cinnamon, cumin, coriander, fenugreek, fennel, ajowan (ajwain), anise, amchur, bay leaf, hing (asafoetida) etc., are known to have medicinal properties. Ayurvedic medicine uses all of these either in diet or as medicine. Besides, the many medicinal plants that are found in India (and elsewhere) are routinely used by the
practitioners of Ayurveda. In India over 7,000 medicinal plant species are known to exist.

Some of these medicinal plants have been featured on Indian postage stamps. The first set of stamps showing medicinal plants came out in 1997. The set had four stamps showing four different medicinal plants - Tulsi (*Ocimum sanctum*), Haridra (*Curcuma longa*), Sarpagandha (*Rauwolfia serpentina*), and Ghritkumari (*Aloe barbadensis*).

**Phytochemicals** can be defined, as chemicals produced by plants. There is abundant evidence from epidemiological studies that the phytochemicals in fruits and vegetables can significantly reduce the risk of cancer, probably due to polyphenol antioxidant and anti-inflammatory effects. The number one drug for cancer worldwide Taxol (paclitaxel), is a phytochemical initially extracted and purified from the Pacific Yew Tree. Clinical investigations are ongoing worldwide on thousands of phytochemicals with medicinal properties.

A paradox in metabolism is that while the vast majority of complex life on Earth requires oxygen for its existence, oxygen is a highly reactive molecule that damages living organisms by producing **reactive oxygen species**. Consequently, organisms contain a complex network of antioxidant metabolites and enzymes that work together to prevent
oxidative damage to cellular components such as DNA, proteins and lipids. **Antioxidants** are naturally occurring substances that combat oxidative damage in biological entities. An antioxidant achieves this by slowing or preventing the oxidation process that can damage cells in the body. This it does by getting oxidized itself in place of the cells. Thus an antioxidant can also be termed as a reducing agent. Antioxidants are considered as important in the fight against the damage that can be done by free radicals produced due to oxidative stress.

**Fig 1: The Role of Antioxidants**
Although the human body has its own defenses against oxidative stress, these become weak with age or in the case of an illness. Antioxidants are being widely used and studied for their role in treatment and prevention of disease. There has been an increasing interest in the contribution of free radical reactions participating in reactive oxygen species to the overall metabolic perturbations that result in tissue injury and disease. Reactive oxygen species are generated in specific organelles of cells under normal physiological conditions. Phagocytic cells ingest and kill invading pathogens with free radicals including superoxide anion, hydrogen peroxides, nitric oxide and hypochlorite. Peroxisomes generate hydrogen peroxide as a by-product in the process of β-oxidation of fatty acids; however, this molecule is locally decomposed by high concentration of catalase.

**Fig 2: The Destruction caused by Free Radicals**
The reduction of molecular oxygen (O2) to water (H2O) proceeds by a series of single electron transfers, therefore, highly reactive intermediates such as superoxide anion (O2\textsuperscript{-}), hydrogen peroxides (H2O2) and hydroxyradical (HO\textsuperscript{·}) are generated in mitochondria (Cadenas, 1989). Some microsomal cytochrome P-450 enzymes also reduce O2 to O2\textsuperscript{-} directly (Goeptar et al., 1995). The defence mechanisms against these reactive oxygen species include radical scavenging enzymes and cellular antioxidants. Superoxide dismutase (SOD) catalyzes the dismutation of O2 to O2 and H2O2. Catalase and peroxidase scavenge H2O2 to metabolize O2 and H2O. Vitamin E serves to minimize HO\textsuperscript{·} concentration in cell membranes. A critical balance exists between the generation and detoxification of reactive oxygen species in cells.

However, diseases, aging and chemical environments such as drugs, pesticides, herbicides and various pollutants can disrupt this balance by inhibition of the cellular antioxidant defences and/or by stimulation of the formation of reactive oxygen species. These reactive oxygen species can damage DNA, so as to cause mutation and chromosomal damage, oxidize cellular thiols (resulting in inhibition of key enzymes), and abstract hydrogen atoms from unsaturated fatty acids to initiate the peroxidation of membrane lipids. It is suggested that lipid peroxidation may be a common pathogenic
mechanism because it is considered a basic mechanism involved in reversible and irreversible cell and tissue damage (Dargel, 1992). Lipid peroxidation of biological membranes damages the membrane structures and functions, not only by degrading the highly unsaturated fatty acids, but also by forming breakdown products that can result in other types of membrane damage and disturbances elsewhere. Lipid hydro peroxides, hydroxy fatty acids and epoxy fatty acids are the major products of lipid peroxidation, and they have powerful biological effects. For example, 4- hydroxy alkenals (hydroxy fatty acids) inhibit DNA synthesis, glucose-6-phosphatase and adenyl cyclase, and react with polyamines and thiols such as glutathione (Slater and Cheesemann, 1988). Cellular damage, due to lipid peroxidation, causes serious derangements such as ischemia-reperfusion injury (Omar et al., 1991), coronary arteriosclerosis (Jackson et al., 1993), diabetes mellitus (Sugawara et al., 1992) and neurodegenerative diseases (Simonian and Coyle, 1996). It is also associated with aging (de Quiroga et al., 1992) and carcinogenesis (Smith, 1985).

Antioxidants are used for treating brain injuries such as reperfusion injury and traumatic brain injury as they help arrest lipid per oxidation in the brain. Antioxidants are
also being investigated as possible treatment agents for Alzheimer’s and Parkinson’s. Fruits and vegetables that have been identified as sources of powerful antioxidants help people counter the risk of heart ailments and different types of cancers.

**Cancer** is a term used for diseases in which abnormal cells divide without control and are able to invade other tissues. Cancer cells can spread to other parts of the body through the blood and lymph systems.

All cancers begin in cells, the body's basic unit of life. To understand cancer, it's helpful to know what happens when normal cells become cancer cells. The body is made up of many types of cells. These cells grow and divide in a controlled way to produce more cells as they are needed to keep the body healthy. When cells become old or damaged, they die and are replaced with new cells. However, sometimes this orderly process goes wrong. The genetic material (DNA) of a cell can become damaged or changed, producing mutations that affect normal cell growth and division. When this happens, cells do not die when they should and new cells form when the body does not need them. The extra cells may form a mass of tissue called a tumor. T cells are a type of white blood cell that plays a central role in orchestrating and providing specificity of action to the immune system. They do this by each expressing a different variant form of the T cell antigen
receptor that recognizes a small repertoire of specific foreign antigens. Amazingly T cells have the capacity to recognize and respond to any protein antigen that might be found anywhere in the world.

**Fig 3: The Role of T-cells in Immune system.**

Not all tumours are cancerous; tumours can be benign or malignant.

- **Benign tumours** aren't cancerous. They can often be removed, and, in most cases, they do not come back. Cells in benign tumours do not spread to other parts of the body.
Malignant tumours are cancerous. Cells in these tumours can invade nearby tissues and spread to other parts of the body. The spread of cancer from one part of the body to another is called metastasis.

Some cancers do not form tumours. For example, leukaemia is a cancer of the bone marrow and blood.

The malignant cells originate in the lining if the milk glands or ducts of the breast (ductal epithelium), defining the malignancy as a cancer. Cancer cells are characterized by uncontrolled division leading to abnormal growth and the ability of these cells to invade normal tissue locally or to spread throughout the body, in a process called metastasis. Breast cancer arises in the milk-producing glands of the breast tissue. Groups of glands in the normal breast tissue are called lobules. The products of these glands are secreted into a ductal system that leads to the nipple. Depending on where in the glandular or ductal unit of the breast the cancer arises, it will develop certain characteristics that are used to sub classify breast cancer into types. The pathologist will denote the subtype at the time of evaluation with the microscope. Ductal carcinoma begins in the ducts; lobular carcinoma has a pattern involving the lobules or the true cancer. The stage before invasive cancer is called in situ is considered a minimal breast cancer.
Cancer is not just one disease but many diseases. There are more than 100 different types of cancer. Most cancers are named for the organ or type of cell in which they start - for example, cancer that begins in the colon is called colon cancer; cancer that begins in basal cells of the skin is called basal cell carcinoma.

Cancer types can be grouped into broader categories. The main categories of cancer include:

- **Carcinoma** - cancer that begins in the skin or in tissues that line or cover internal organs.

- **Sarcoma** - cancer that begins in bone, cartilage, fat, muscle, blood vessels, or other connective or supportive tissue.

- **Leukemia** - cancer that starts in blood-forming tissue such as the bone marrow and causes large numbers of abnormal blood cells to be produced and enter the blood.

- **Lymphoma and myeloma** - cancers that begin in the cells of the immune system.

- **Central nervous system cancers** - cancers that begin in the tissues of the brain and spinal cord.

    **Cervical carcinoma** is a common malignancy worldwide and its incidence has been increasing gradually. It poses a significant health problem, especially in regions such
as Asia and North America. Despite advances in diagnostic and treatment modalities, the proportion of failed treatments is still significant, with reported rates of 15.6% to 58% (Zhao, 2005). To date, chemotherapy is the mainstay of treatment modalities for cervical carcinoma and cisplatin has proven to be the most effective single cytotoxic agent for the treatment of advanced or recurrent cervical cancer (Benedet, 2009). However, the response rate is about 23%, due to chemo-resistance. Therefore, it is necessary to develop a novel strategy to overcome the chemo-resistance of cervical carcinoma and improve clinical efficiency and prognosis. Although the molecular events responsible for the pathogenesis of cervical carcinoma remain to be elucidated, the final common pathway of carcinogenesis appears to be a disruption of the mechanisms involved in the regulation of cell cycle progression, leading to uncontrolled cell proliferation (Chen, 2009). Critical cellular signalling underlying the regulation of cell cycle progression has been implicated in a number of cancers.

A HeLa cell (also Hela or hela cell) is a cell type in an immortal cell line used in scientific research. It is one of the oldest and most commonly used human cell lines. The line was derived from cervical cancer cells taken from Henrietta Lacks, a patient who eventually died of her cancer on October 4, 1951. The cell line was found to be remarkably
durable and prolific as illustrated by its contamination of many other cell lines used in research.

**Breast cancer** (malignant breast neoplasm) is cancer originating from breast tissue, most commonly from the inner lining of milk ducts or the lobules that supply the ducts with milk. Cancers originating from ducts are known as ductal carcinomas; those originating from lobules are known as lobular carcinomas.

Prognosis and survival rate varies greatly depending on cancer type and staging. Computerized models are available to predict survival. With best treatment and dependent on staging, 10-year disease-free survival varies from 98% to 10%. Treatment includes surgery, drugs (hormonal therapy and chemotherapy), and radiation.

Worldwide, breast cancer comprises 10.4% of all cancer incidences among women, making it the most common type of non-skin cancer in women and the fifth most common cause of cancer death. In 2004, breast cancer caused 519,000 deaths worldwide (7% of cancer deaths; almost 1% of all deaths). Breast cancer is about 100 times more common in women than in men, although males tend to have poorer outcomes due to delays in diagnosis. Some breast cancers are sensitive to hormones such
as estrogen and/or progesterone which make it possible to treat them by blocking the effects of these hormones in the target tissues. These have better prognosis and require less aggressive treatment than hormone negative cancers.

**MCF-7** is a breast cancer cell line isolated in 1970 from a 69-year-old Caucasian woman. MCF-7 is the acronym of Michigan Cancer Foundation - 7, referring to the institute in Detroit where the cell line was established in 1973 by Herbert Soule and co-workers. The Michigan Cancer Foundation is now known as the Barbara Ann Karmanos Cancer Institute.

Prior to MCF-7, it was not possible for cancer researchers to obtain a mammary cell line that was capable of living longer than a few months. The patient, whose name is unknown to the vast majority of cancer researchers, died in 1970. Her cells were the source of much of current knowledge about breast cancer. Her name was Frances Mallon and, at the time of sampling, she was a nun in the convent of the Immaculate Heart of Mary (Monroe, Michigan) under the name of Sister Catherine Frances.

A **phaeochromocytoma (PCC)** is a neuroendocrine tumor of the medulla of the adrenal glands (originating in the chromaffin cells), or extra-
adrenal chromaffin tissue that failed to involute after birth and secretes excessive amounts of catecholamine, usually adrenaline (epinephrine) if in the adrenal gland and not extra-adrenal, and nor adrenaline (norepinephrine). Extra-adrenal paragangliomas (often described as extra-adrenal pheochromocytomas) are closely related, though less common, tumours that originate in the ganglia of the sympathetic nervous system and are named based upon the primary anatomical site of origin.

**PC12** is a cell line derived from a pheochromocytoma of the rat adrenal medulla. PC12 cells stop dividing and terminally differentiate when treated with nerve growth factor. This makes PC12 cells useful as a model system for neuronal differentiation.