

USING HERBS AS MEDICINE

Aim

Understand the general composition and chemistry of medicinal herbs and their effect on the human body.

A SHORT GLOSSARY OF TERMS DESCRIBING MEDICINAL EFFECTS

There are many plants, some commonly grown as herbs, others not recognised for their medicinal properties, which can be classed as medicinal herbs. These can be listed in certain groups, depending on what they can be used for and can be used in a variety of ways. Following are some of the terms that describe medicinal effects.

Alteratives

These are chemicals found in some herbs which tend to gradually alter a condition. Alteratives are sometimes combined with other herbs in a remedy. Herbs which in a broad sense work as alteratives include: bittersweet twigs, bull nettle root, burdock root, red clover flowers, sarsaparilla root, sassafras root and yellow dock root.

Anthelmintic

Also called vermifuges, these are medicines which will get rid of worms. Vermifuges (or anthelmintics) are herbal medicines capable of destroying worms which infest the intestinal canal (they should only be administered by a doctor). Pumpkin seeds are used as a vermifuge. Other examples include: *Melia azaderach* bark or skin from a pomegranate fruit.

Astringents

These medicines cause the skin to tighten, or increase the firmness of the skin's mucous membrane. They can often be useful in controlling excessive secretions. They can be used as washes, lotions, mouthwashes etc. Strong astringents include: bearberry leaves, black willow bark, chocolate root, agrimony leaf and stems, maiden hair fern leaves, water lily roots etc. Mild astringents include: blackberry roots, black birch leaves, *Rosa gallica* petals, rue leaves and stems and St. John's wort leaf and stems. Water can be added to dilute the strength.

Bitter Tonics

These are used to stimulate appetite by promoting the flow of saliva and other digestive juices. As such the process of digestion is improved, hence appetite should be improved. Medicines in this group include: chamomile flowers, dandelion root, gentian root, and both leaf and stems from mugwort and wormwood. Chamomile and dandelion are popular as a tea.

Calmatives

Calmatives are herbs used for their calming effect and are generally taken as a warm tea at bed time. Chamomile flowers are a commonly used calmative. Another group are the aromatics, which are substances with a pleasant smell. The aromatics are useful in expelling gas, though they are mainly used to make other herbal medicines more palatable. Leaves of *Eucalyptus spp.* and *Mentha spp.* are common calmatives.

Carminatives and Aromatics

These are strong smelling plants which are used in two ways:

- a) Mixed with other herbs to make them easier to eat.
- b) They can be used to expel gases from the digestive system.

Commonly used aromatics include: anise seed, capsicum fruit, caraway seed, celery seed, coriander seed, Eucalyptus leaves, ginger root, fennel seed, peppermint leaves, spearmint leaves and valerian roots.

Cathartics

These are medicines which encourage better bowel movement by acting on the digestive tract. They fall into two distinct groups:

1. Laxatives, which have a mild effect on the intestines e.g. *Aloe vera*, Castor oil, Agar agar, rhubarb root, a tea from coriander seed etc.

2. Purgatives, which cause heavy discharges from the bowels. These are generally only used in adults with severe problems e.g. Egyptian senna.

Diaphoretics

Diaphoretics are used to increase perspiration; lobelia and chamomile leaves are examples. Diuretics should not be self administered, but will still be included here. They are medicines or beverages which increase the secretion of urine. They are often prescribed during pregnancy. Parsley root is an example of a diuretic.

Dietetics

Dietetic medicinal herbs are generally not stimulating or irritating digestive herbs, and are thus especially useful for the young and aged during convalescence. For example, Irish moss is an excellent substitute for animal gelatine, containing all the natural elements characteristic of sea plants. It is easily digested and therefore may be given to invalids and children. Sweet or slippery elm was an important medicine and food of the American Indians and pioneers. A valuable food, it has a soothing influence on the intestines and stomach.

Demulcents

These are substances taken internally which have a soothing or protective coating property to them. They help alleviate irritation of membranes and are frequently used with coughing or sore throats. Mild and soothing demulcents include: arrow root, comfrey root, couch grass root, Gum of Arabic, liquorice root, marshmallow root or leaves, oatmeal, sesame leaves and quince seed.

Emollients

Emollients are generally oily, and are used externally for their softening or soothing qualities. They are applied as an ointment or poultice, for example *Symphytum officinale* (comfrey). Expectorants are another group. These are used to expel or loosen phlegm and are often combined with demulcents for use against colds. Liquorice root is often used as an expectorant (liquorice was found in King Tutankhamen's 3000 year old tomb).

Expectorants

These substances loosen or expel phlegm from the mucous membranes, bronchial tubes and nasal passages. They are frequently combined with demulcents to create treatments for the flu or a cough. Common expectorants include Balm of Gilead buds, benzoin gum, comfrey root, elecampane root, liquorice root, leaves from a maidenhair fern, mullein leaves and marshmallow roots.

Nervines

These are medicines which can temporarily relax nervous conditions caused by strain, fatigue, stress or over excitement. Common nervines include catnip leaves, chamomile flowers, valerian roots and yarrow foliage.

Relaxants

Relaxants are used to temporarily relax nervous irritation. Sedatives, another grouping, can be used by women to alleviate minor discomforts with menstruation. Caffeine (from coffee beans) is a well known nerve stimulant.

Vulnerary

Vulnerary is an application for minor external wounds. Practically any green plant (which does not have irritant properties), because of its chlorophyll content, can be used for minor wounds.

NERVINE HERBS AS HEALING AGENTS

The class of herbs known as nervines (which are nerve foods) are mineral foods providing potash, magnesium and phosphorus. The nerves themselves are made up of potassium, magnesium, phosphorus and sodium in a major degree, although there are other elements. Lecithin is also a major organic element and therefore the presence of lecithin in the food is essential for the nerves to be regulated and relaxed.

Grains have an embryo in their centre and it is in the embryo that lecithin, Vitamin E and phosphorus are found. This is why whole grain cereals are so much better for us.

Even better yet is the sprout, for when the seed starts to open and come to life, then the activity of life is increased and the values are more easily assimilated into the body.

Lecithin is in the oil of the grain and is more or less destroyed by heating, due to the oxidation of the phosphorus. Therefore, the raw sprouts are excellent foods.

Nervines

There are two classes of nerve foods. There are the excitors and the relaxers or depressors. The excitors are the highly acid factors and low in mineral content. The depressors are the elements that conserve or restrict the flow of energy and are more alkaline. Bromine is one of the depressors. Other depressors are any inorganic substances high in carbon and low in hydrogen. Alcohol slowly starves the tissues and more especially the nerves. Alcohol relaxes the nerves, for the minerals are taken from the nerves by the alcoholic action, and may also cause the tissues to become subject to malnutrition and slow starvation.

Organic Foods and Nerves

Organic foods such as celery, cucumbers, garlic, honey, molasses, red pepper, ginger, and cloves have a direct effect on the nerves and tend to assist in maintaining a reserve of energy. Therefore they are sources of nerve regeneration as well as providing minerals. Iodine compounds in foods, especially in ocean foods, have a direct action through the thyroid gland, to stimulate the cells and tissues and excite the nerves to contraction. This contraction is brought about by the action of iodine itself. Ocean plants furnish iodine in the best form. Health food stores have dulse and kelp, and these are best in all respects for slow assimilation, along with other minerals that are common to the ocean plants that furnish potassium with iodine. Ocean plants or herbs are a fine source of minerals for health.

NATURAL CHEMICALS IN HERBS AND THEIR EFFECTS ON HEALTH

Many of the plants and herbs which we use to prepare comforting and healing teas, baths, dressings, wines and other remedies can readily be found in the average kitchen. Sage, bay leaves, thyme, cinnamon, anise and cardamon are just a few examples of herbs that can be used in the kitchen and which also possess medicinal properties. Onions for example, can dissolve away dangerous blood clots in the blood vessels. Similarly, lemons have long been consumed by sailors on long voyages for their Vitamin C content which prevents scurvy. Other plants or herbs (which may not be eaten regularly as a food) can be taken as tonics to protect against disease and poor body function, or as alleviants for pain and illness. In many cases, properly extracted and combined plant substances can still be the safest, most effective and economical way of providing medicinal relief.

Plant Chemical Groups which; cure, protect and alleviate

Group 1: Saponins

Saponin-containing plants are characterised by soap-like foam when they are shaken in water. For this reason, many native peoples throughout the world have long used saponin-containing plants for cleansing. Basically they act to speed up the passage of other substances through the walls of the gastrointestinal tract and to stimulate secretion from the mammary glands and glands along the respiratory tract.

Saponin containing plants can be used as:

- a. Expectorants (ie. phlegm removing substances) eg. primrose roots, mullein flowers and leaves, lungwort leaves.
- b. Diuretics (ie. substances which increase the flow of urine) eg. golden-rod leaves, Java tea leaves.
- c. Lactation stimulants. Nursing mothers have used goat's rue for this purpose.

They have also been used to help re-establish the smooth functioning of body fluids eg. pansy and horsetail leaves.

Group 2: Phenolglycosides

There are two particularly significant types of phenoglycosides:

1. Arbutin has a disinfecting action on the urinary tract when the urine is alkaline eg. blueberry and bearberry leaves.
2. Salicin is chemically related to the salicylic acid in aspirin, therefore is useful in reducing fever and relieving pain eg. pansy leaves, willow bark, poplar leaves and bark.

Group 3: Anthraglycosides

In this group, Anthraquinone (also called emodin), is used to relieve constipation eg. senna leaves, aloes, buckthorn, rhubarb.

Group 4: Flavonoids

Some flavonoids can act to stimulate the cardio-vascular system; others have diuretic properties, whilst others inhibit infections. Rutin, one of the flavonoids, has an anti-haemorrhagic effect. It also helps the blood vessels to expand, thereby lowering blood pressure. Examples of flavonoid containing plants are camomile flowers, juniper berries, broom leaves, linden blossoms, hawthorn flowers and birch leaves.

Group 5: Mustard Oils

Plants that contain mustard oil glycosides can be used as rubefacients i.e. can improve the blood circulation near the surface of the skin. They can be particularly useful for relieving breathing problems during colds and bronchitis. Mustard oil glycosides also have antibiotic properties eg. water-cress.

Group 6: Polysaccharides

The polysaccharide group includes pectin which acts to control diarrhoea and bleeding; mucilage which soothes inflamed mucous membranes, and inulin. Fructose results from the digestion of inulin which is readily metabolised in the body and is converted into glycogen ("animal starch") even when insulin is lacking. Mucilage containing plants are linseed, marshmallow root, coltsfoot leaves and mullein. Pectin is found in fruits such as apples.

Group 7: Prussic acid

Prussic acid has a local anaesthetic effect. It is found in almonds and may be one of the reasons for the relief given to dry, chapped skin when almond oil is used.

Group 8: Glycosides

Digitalis glycoside (from the leaves of the foxglove), convallatoxin glycoside (from lily of the valley), and oleandrin (from oleander), are natural chemical compounds which have an effect on the heart muscles. These should only be used with extreme caution as they contain toxins which can be fatal.

Group 9: Coumarin

Coumarin-containing plants such as woodruff are used to prevent or dissolve blood clots or thrombotic clots.

Group 10: Tannins

Tannins have a mild astringent effect on the skin. They also have disinfectant properties, and can help to combat diarrhoea. Examples of plants that contain tannins are walnut leaves, sage leaves, blueberries, and oak bark.

Group 11: Bitters

Bitters promote bile secretion, improve the uptake of nutrients from the gastrointestinal tract, and stimulate digestive juices. They also combat gastrointestinal fermentation. Plants which contain bitters are angelica root, milfoil leaves, gentian root and wormwood foliage. These four plants are called aromatic bitters because they also contain essential oils (see next paragraph).

Group 12: Essential oils

When heated, essential oils (also called aromatic, volatile or ethereal oils) will variously act to reduce inflammation, relieve cramping, promote milk flow, aid digestion, expel gas, disinfect, and sooth the nerves.

Group 13: Alkaloids

Alkaloids are nitrogen-containing compounds with certain chemical characteristics such as reacting chemically like alkaline substances. They have many different effects on the human body, for example morphine and codeine in opium are well-known pain-relieving alkaloids. Nicotine in tobacco is also an alkaloid.

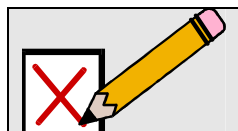
Group 14: Purines

Caffeine is a purine which increases the flow of urine and supports healthy heart function. Too much caffeine though will cause harmful over stimulation.

Group 15: Essential minerals

Plants of all kinds contain minerals which are essential for good health.

For example, spinach contains large amounts of iron and Vitamin A; horsetail is rich in silicon which acts to clear up the symptoms of arteriosclerosis; bladder wrack seaweed is rich in iodine which is used to treat people with goitre and obesity.



SELF ASSESSMENT

Perform the self assessment test titled 'Self Assessment Test 5.1'
If you answer incorrectly, review the notes and try the test again.

THE CHEMISTRY OF HERBS

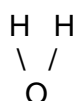
The chemistry of herbs can be quite complex. It can take several hundred chemicals to contribute to just one characteristic of a herb such as its taste or smell. To understand the chemistry of herbs you will need to do a great deal of study; far more than what can be dealt with here. If you already have a good grasp of chemistry, it will help you to understand the following information.

If you have a weak background in chemistry however, you may find the following information difficult to understand. If this is the case; do not become too concerned. The important thing is to begin to appreciate the complexity of the chemical make-up of medicinal herbs; and to realise that these herbs, and the chemicals within them, can be strong and can possibly contribute to "side effects", within a person. Different people may react in different ways to the same herb; one person may be sensitive to an obscure component which another person has no sensitivity to.

Parts of a Compound

Atoms group together in small OR very large numbers to make chemical compounds.
There are however sub-groups within compounds. Take water for example:

Water is H₂O i.e. this is two hydrogen atoms and one oxygen atom (the hydrogen atoms are bonded or stuck to the oxygen atom, but not to each other). We represent the water molecule by drawing it showing the bonds, where they exist in the molecule, as follows:



In actual fact, one of these two bonds tends to be stronger than the other, and it is possible for the molecule to break up producing a hydrogen ion with a positive charge (ie. H⁺), and a hydroxide ion (ie. OH⁻).

Summary: water is made up of a hydroxide ion where the bond between the hydrogen and oxygen is very strong, *and* a hydrogen ion joined to the hydroxide by a weaker and more easily disrupted bond.

Similarly, other chemicals, even very complex chemicals are made up of various groups (within which the chemical bonds are very strong), joined together by bonds which are weaker.

Other Bio-Chemical Groups

Group Name	Simplified Representation of Structure
Methyl	CH ₃ ---
Ethyl	CH ₃ CH ₂ ---
Propyl	CH ₃ CH ₂ CH ₂ ---
Butyl	CH ₃ CH ₂ CH ₂ CH ₂ ---
Isopropyl	CH ₃ CH ₃ CH---
Isobutyl	CH ₃ CH ₃ CH ₂ CH---
Amino	---NH ₂
Hydroxyl	---OH
Carbonyl	CO---
Aldehyde	---COH
Carboxyl	---COOH

Chemical Names

Chemical names give you an indication of the different chemical groups which make up a compound.

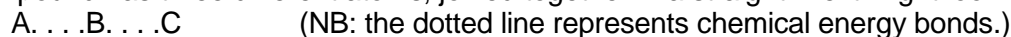
- Ethylene is: CH₂=CH₂ (Note: this is very similar to the ethyl group; and the name is similar to ethyl).
- Ethane is: CH₃=CH₃ (Note: the preface "Eth" stays the same; and it also has similarities to ethyl group).
- Methane is CH₄ (Note: this is very similar to the methyl group; just one extra Hydrogen atom).
- Alkyl Groups: these are groups of continuous chain parent hydrocarbons where the normal ending "ane" is replaced with "yl" (eg. Butyl is an alkyl group from the parent hydrocarbon butane; and methyl is an alkyl group from the parent hydrocarbon methane).

Arrangement of Atoms in a Compound

Two different compounds can have exactly the same number of atoms of each of their constituents, but be different compounds with different characteristics. They are different because the arrangement of the atoms is different

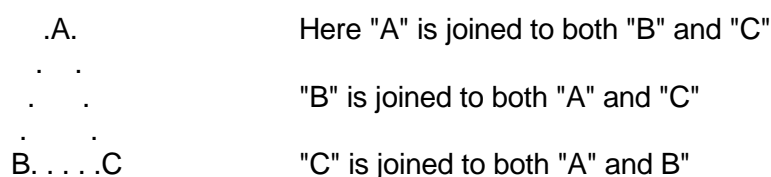
A Hypothetical Example:

If a compound has three different atoms, joined together in a straight line it might look like this:



A therefore is joined to "B"; and "B" is joined to "C" *but* "A" and "C" are not joined together in any way.

Another compound also has one each of A, B and C atoms but in this case the arrangement is:



Carbohydrates

Carbohydrates are one of the most significant groups of organic compounds that are made (ie. synthesised) by living systems (ie. within the tissues of plants or animals). Carbohydrates are significant both in terms of both quantity made and the importance of their use in living organisms. Carbohydrates are compounds which when analysed give empirical formulae which are multiples of the simple formula CH₂O. Examples of carbohydrates include: sugars, starch, glycogen, cellulose and chitin.

Other particularly significant groups of chemicals are lipids and proteins.

Amino Acids

These are organic compounds which contain both the amino group (ie. NH₂) and the carboxyl group (ie. COOH).

Note: the carboxyl group is acidic.

Different species of organisms have the need for "specific" essential amino acids.

Man requires the following 8 specific types of amino acids: valine, leucine, phenylalanine, tryptophane, lysine, isoleucine, methionine and threonine.

Proteins

These are complex compounds made up of a number of amino acids. A single protein molecule can contain hundreds of thousands of amino acids joined by peptide links into one or more very long chains. There are 20 different types of amino acids which can be found in these chains. All types are found in animals; but the variety of types found in plants is generally less.

Lipids

Lipids are fats and oils. Fats and oils are esters. They should not be confused with petroleum or mineral oils though. They are insoluble in water; but are very soluble in organic substances such as ether or hot alcohol. The term lipid doesn't refer to a structural characteristic of these compounds, it refers to behavioural characteristics. The structural characteristics of lipids are extremely variable. Fats are solid or semi solid at room temperature, while oils are liquid. Lipids occur in both plants and animals, and are among other things, used to store chemical energy.

Lipids are divided into the following types:

a/ Neutral Lipids

b/ Phosphatides and Sphingolipids

c/ Glycolipids

d/ Terpenoids eg. Carotenoids and steroids.

Nucleic Acids

Nucleic acids are the chemicals which make up genetic material in a living cell.

DNA refers to "Deoxyribonucleic acid".

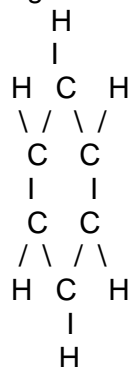
RNA refers to "Ribonucleic acid".

DNA molecules (like proteins) are very long (ie. polymers). The molecular weight of a DNA molecule can be about 100 million. Different DNA molecules are similar, but still different to each other. A DNA molecule can self duplicate itself: this characteristic being the basis for reproduction of an offspring which shares characteristics with its parent.

Aromatic Compounds

Aromatic compounds are ones which have atoms bound together in a part of the molecule to form a ring.

eg. Benzene



Notice how the six carbon atoms are bonded in an arrangement that forms a ring.

Aryl Groups - when something attaches to an aromatic hydrocarbon an aryl group is formed (eg. an aryl halide would be created when bromine or chlorine for example, attaches to a benzene ring).

What is an Acid or a Base?

An acid is commonly defined as a chemical that can lose a hydrogen ion (eg. H_3O^+ is an acid. When it loses a hydrogen ion it becomes H_2O).

A base is commonly defined as a chemical that can gain a hydrogen ion (eg. OH^- is a base. When it gains a hydrogen ion, it becomes H_2O).

Acidity in simple terms is a measure of the balance between acids and bases/ or the balance between positive and negative charged particles. Plant acids are responsible for a bitter taste when ingested.

Buffers

A buffer is a chemical that resists the tendency for pH to change.

Buffers are important because a change in pH can cause a change in the rate of chemical reactions. Metabolism in a plant or animal can be controlled by the presence of a buffer: keeping the pH under control, hence keeping the metabolic rate under control.

Alkaloids

Alkaloids are nitrogen containing compounds which are extracted from plants by use of an acid solution. The word alkaloid simply means, like an alkali.

- Alkaloids are made in plants from amino acids, and are found mainly in leaves, seeds and roots.
- Alkaloids are important because they tend to have significant effects on animals. Most herbal medicines are rich in alkaloids. The active constituents (ie. the poisonous parts) of poisonous plants are also alkaloids.
- Alkaloids normally have complicated, cyclic structures, and nitrogen is almost always located in a heterocyclic ring.

Alkaloids are classified into four main groups according to the type of heterocyclic ring system they contain.

- a. Pyrrolidine Alkaloids eg. Atropine (found in deadly nightshade) and cocaine.
- b. Quinoline and Isoquinoline Alkaloids eg. Quinine, Opium, Methadone, Codeine, Morphine, Mescaline
- c. Pyridine and Piperidine Alkaloids eg. Nicotine, Coniine (found in poison hemlock), Pyridine and Piperidine
- d. Indole Alkaloids eg. Indole Acetic acid, Tryptophan, Skatole and Indole.

Tannins

Tannins have been a confusing group of chemicals. They occur in the bark of various plants used for "tanning" leather; including oak, hemlock and certain *Acacia*. They also occur in plant parts other than bark; and in a wide variety of plants.

They are aromatic chemicals divided by chemists into two groups:

- a. Hydrolyzable Tannins
- b. Condensed Tannins

If ingested, tannins in plants will cause an astringent taste. (NB: unlike plant acids which taste bitter).

HERB SOURCES FOR HUMAN NUTRIENTS

Vitamins

Vitamins which are manufactured within plants are much easier to digest than vitamins and minerals of animal origin. The presence of plant vitamins is dependant to some extent on the overall health and vigour of the plant, the plant variety and the conditions under which the plant is grown.

Vitamin A: needed for night vision and functioning of cells and mucous membranes. It is stored in the body, but under conditions of stress and strain, a surplus is rapidly dissipated. Plant sources: alfalfa, dandelion, okra pods, paprika, parsley, watercress.

Vitamin B1 (Thiamine): needed for growth and maintaining normal appetite. Plant sources: bladder wrack seaweed, dulse, fenugreek, kelp, okra, wheat germ.

Vitamin B2 (Riboflavin): needed for normal growth of children and good nutrition of adults. Plant sources: bladder wrack seaweed, dulse, fenugreek, kelp, saffron.

Vitamin B12: needed for normal development of red blood cells and acts as a growth factor for children. Plant sources: alfalfa, bladder wrack, dulse, kelp.

Vitamin C: needed for healthy teeth and gums, and prevents scurvy. It is destroyed by heat, cooking, low temperatures and oxidation, and is not stored in the body (i.e. a fresh supply should be provided daily). Plant sources: burdock seed, capsicum, coltsfoot, elder berries, marigold, oregano, paprika, parsley, rose hips, watercress.

Vitamin D: needed for building and maintaining healthy bones and teeth; prevents rickets. A limited amount is stored in the body. Plant sources: watercress, wheat germ, annatto seed.

Vitamin E: abundant in many plant seeds. As a nutritive source, its use has not been established. Plant sources: alfalfa, dandelion leaves, kelp, linseed, sesame, watercress, wheat germ.

Vitamin K: needed for the physiological process of blood clotting. Plant sources: alfalfa, chestnut leaves, shepherd's purse.

Niacin: prevents pellagra. Plant sources: alfalfa, blueberry leaves, burdock seed, fenugreek, parsley, watercress, wheat germ.

Vitamin P (Rutin): believed to be of benefit in strengthening tiny blood vessels. Plant sources: buckwheat, German rue, paprika.

Minerals

The term "mineral elements" refers to elements other than carbon, hydrogen, oxygen and nitrogen. About 15 mineral elements are known to be essential to humans, and must be obtained from food. Compared with carbohydrates, proteins and fats, mineral elements are only required in very small amounts, and compose only about 6.9% of the body by weight. Carbohydrates, protein and fats comprise 31.5%. Water comprises 61.6 %. All are equally essential to the body structure and function.

It is possible for mineral elements to be present in foods in a form which the body cannot absorb. They are then said to be unavailable (e.g. Calcium is present in spinach as calcium oxalate which is not absorbed). Theoretical calculations may show adequate intakes of minerals, but in fact the body is not able to make use of them all. It is therefore wise to have a variety of foods in the diet, so there will be several sources of any one mineral element, and if one is not available, another will be, at the risk that a shortage of the mineral element is lessened. Fortunately most mineral elements are widely distributed in foods, and there is little risk of anything being in short supply; but calcium, iron and iodine perhaps require more consideration than some others.

Calcium

Bones and teeth consist mainly of calcium phosphate. The diet must therefore contain sufficient calcium and phosphorus to meet the body's needs, not only during periods of growth, but at all times. This is because the bones are not static: they continue to grow with old bone cells dying and being replaced. Bones also provide a reserve of calcium if it is needed for something else; so it is constantly being withdrawn from and replaced in blood. The level of calcium in the blood is controlled by the parathyroid gland.

Calcium is needed for:

- a. Proper development and maintenance of bones and teeth.
- b. Normal clotting of blood.
- c. Normal functioning of nerves and muscles.
- d. Activity of several enzymes.

During pregnancy the foetus is assured of its supply of calcium because the mother's body always provides the calcium provided. If the mother's diet is deficient in calcium it is she who suffers as the calcium required for the foetus is drawn from her bones and teeth. Pregnant or lactating women require more than double the normal calcium intake required by adults.

Calcium Content of some foods (mg per 100 gm):

Milk, liquid	120
Milk, dried	1020
Cheese, cheddar	800
Yoghurt, natural	180
Eggs	52
Cod, baked	22
Pilchards	300
Chicken, boiled	11
Beef, roast	10
Bread, white	100
Bread, wholemeal	23
Cabbage	57

Other plant sources of calcium include: arrowroot, chamomile, chives, coltsfoot, dandelion root, meadowsweet, stinging nettle, okra, plantain and sorrel. Hard water is also a source of calcium.

In the past, rickets was the deficiency disease associated with calcium. Rickets is due to a deficiency of calcium, brought about by poor absorption due to a lack of vitamin D, fortunately the incidence of rickets is now very low. It is characterised by curvature of bones and limbs or other improper bone formation.

Osteomalacia (decalcified bones) is sometimes seen both in women who have had repeated pregnancies, and in the elderly. Again, a more likely cause is lack of vitamin D. In some elderly people however, because of a restricted and unvarying diet, calcium intake may be inadequate. Osteoporosis (the loss of bone) in old people is sometimes thought to be due to a calcium deficiency, but in actual fact, the basic cause is unknown.

Normally only 20-30% of calcium intake is absorbed, and factors concerning the absorption of calcium are not fully understood. It is however known that certain substances assist the absorption of calcium, and others interfere with it.

Absorption of Calcium is *assisted* by:

- a. Vitamin D, which is derived from foods or sunlight, and is essential.
- b. Proteins, including amino acids resulting from protein digestion form soluble calcium salts.
- c. Lactose

Absorption of Calcium is *interfered* with by:

a. Oxalic Acid, which is present in some fruits and vegetables (eg. rhubarb, spinach, strawberries, and when present in the diet, renders calcium unavailable. Fortunately the amount of these foods eaten is low.

b. Phytic Acid, which is present in cereals, nuts. Forms insoluble compounds with calcium, and when in the diet renders the calcium unavailable. It was partly because of this loss that calcium carbonate was first added to flour (except wholemeal) during the Second World War. It is still added although it is now known that enzymes that are present in the flour break down phytic acid during bread making. Vegetarian diets have a higher phytic acid content than many others, and an adequate calcium supply should be assured.

c. Fats, where large amounts of fat in the intestine interfere with calcium absorption because unabsorbed fatty acids form insoluble salts with calcium.

The 70-80% of calcium which is unabsorbed is excreted in the faeces. Excretion of the absorbed calcium is via the kidneys. Adults on a mixed diet are normally in a state of equilibrium (ie. calcium absorbed = calcium lost) Pregnant and lactating women, and growing children must of course obtain more calcium.

Phosphorus

The bones and teeth contain 80-85% of the body's phosphorus as calcium phosphate. Phosphorus is a constituent of all body cells and body fluids, and plays an important part in the release of energy. It is present in all natural foods, but the phosphorus content in refined or processed foods is often reduced greatly. However, phosphates are often added to processed foods.

The best sources of phosphorus are those which contain calcium and protein, so if the levels of calcium and protein are adequate, the diet should contain enough phosphorus. Cheese, liver, eggs and milk are valuable sources. Botanical Sources for Phosphorus include caraway seed, garlic, liquorice root, marigold flowers, meadow sweet flowers, okra pods, sesame seed, sorrel and watercress.

Iron

About two thirds of the small amount of iron in the body (only about 4 gm) is in the haemoglobin in the blood. Haemoglobin carries oxygen to the tissues and carbon dioxide away, and if the body is deficient in iron, the circulating haemoglobin is reduced, resulting in anaemia. (NB: there are other types and causes of anaemia).

Iron is stored to some extent in the liver, and this is of great importance to infants because milk is deficient in iron. It is present in muscle protein as myoglobin, which stores oxygen for use when muscles contract. Iron is required for certain enzymes concerned in the release of energy.

The loss of iron from the body is small, and an adult man only loses about 1 mg of iron a day. Red blood corpuscles have a life of about 4 months, but the iron involved in the formation of haemoglobin is reused.

Bleeding accounts for the most loss of iron, and there will be extra demands during periods of growth, menstruation and pregnancy.

The amount of iron absorbed is regulated to a large extent by the needs of the body, but is only likely to be 10-20% of the iron in the diet.

The total iron content of different foods gives no true value of the iron absorbed, as some is unavailable, and absorption also depends on the nature of foods eaten.

Absorption of iron is *assisted* in the presence of:

- a. Vitamin C, where the value of green vegetables as a source of iron may be partly due to their vitamin C content.
- b. Proteins

Absorption of iron is *interfered* with by the presence of:

- a. Phytic Acid and Phosphates
- b. Oxalic Acid.

Iron content of some foods (mg per 100 gm):

Milk	0.1	Potatoes	0.5
Eggs	2.0	Cabbage	0.6
Beef	1.8	Watercress	1.6
Chicken	0.7	Bread, white	1.7
Liver	11.4	Bread, wholemeal	2.5
Kidney	6.0	Flour, white	2.4
Fish, white	0.3	Chocolate, plain	2.4
Dates, dried	1.6	Cocoa powder	10.5

Traditional sources for iron include meat, bread, flour and other cereal products, potatoes and green vegetables are the main sources of iron in the diet. Other sources include meadowsweet, parsley, strawberry leaves and watercress.

Iodine

Iodine is needed in minute amounts, but is essential to the proper functioning of the thyroid gland which controls the basal metabolic rate. Deficiency of iodine leads to an enlargement of the thyroid gland. At one time this was endemic in countries away from the sea, (eg. Switzerland). In the U.K. it was sometimes known as Derby shire neck.

The iodine content of plant and animal foods depend on the amount of iodine in the soil. Sea foods and vegetables grown near the sea have a higher content than other iodine foods. Milk and cereals are other foods which contain iodine, but the amount is very variable. Because the iodine content of food can vary so much, iodised salt (25 ppm) is available in some countries.

Sources include Irish moss and kelp (eg. Japanese sushi).

Sodium

Sodium in the form of common salt is a major factor in maintaining the proper water balance in the body, and is found in extra-cellular fluids.

It is also required for normal muscular activity, and a deficiency may lead to cramps. A shortage of sodium however, is unlikely unless there is excessive sweating with the constant loss of salt. About 4 gm per day is required, and many foods contain small quantities of sodium. Because larger quantities are often added to cooked or processed foods, it is not uncommon for people to take in several times their daily requirement.

Minor sources may include chives, cleavers, fennel seed, okra pods, sorrel, stinging nettle and watercress.

Potassium

Potassium behaves similarly to sodium, except that it is in the intracellular fluids. There is not likely to be any deficiency as it is found in a wide variety of foods. It is supplied in virtually all vegetables, and legumes, as well as many herbs.

Magnesium

Magnesium is present in bones and teeth, and is necessary for some of the enzymes involved in the production of energy. It is widely distributed in foods, and a deficiency is unlikely.

The above, with the exception of iodine, might be considered as "major minerals". The remaining minerals are also essential, but are required in much smaller quantities. They are also known as "Trace Elements" The exact role which these trace elements play in the body is not always fully known, but most of them are associated with enzymes, hormones or vitamins.

Fluorine

Fluorine is found in bones and teeth, and is beneficial in protecting teeth against decay (especially in children). Drinking water is the main source, but the amount in water varies considerably. Soft waters may contain no fluorine at all, and others may fall below the minimum 1 ppm. Other fluorine sources include sea fish where bones are eaten (eg. sardines) and tea. Botanical sources include garlic and watercress.

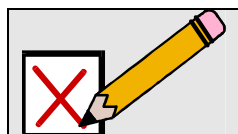
Copper is a component of many enzymes, and is required when iron is used in the synthesis of haemoglobin. Good sources include fish, nuts, liver and other meats.

Cobalt is a constituent of vitamin B¹².

References:

'The Herbalist' by J.E.Meyer (Meyer Books)

'Normal and Therapeutic Nutrition' by Robinson et al (Macmillan)



SELF ASSESSMENT

Perform the self assessment test titled 'Self Assessment Test 5.2'
If you answer incorrectly, review the notes and try the test again.

MORE HERBS AND THEIR TRADITIONAL USES

The information below is extracted from herbal literature which has a good reputation, in a general sense, including: *The Herbalist*. Published by Meyer Books 1st edition 1918, final edition 1979, final printing 1993

Caution: This information should be seen as a reflection of how medicinal herbs have been used in the past; but NOT necessarily as a guide to what has conclusively and scientifically been proven to be safe and effective. It is strongly recommended that before using any herb that you are not totally familiar with; you should investigate more recent and up to date research and knowledge that relates to that herb.

Be careful, misuse of some medicinal herbs can be very dangerous.

Do not assume a remedy is safe just because a medicinal herb is listed here or anywhere else as having been used for a particular remedy.

Acacia spp. (Gum Arabic)

Family: Mimosaceae

A number of different Acacia species are harvested commercially to obtain a product called "Gum Arabic". The characteristics and value of Gum Arabic can vary from one Acacia species to another, and dependant upon the place in which the plants are growing.

The gum is obtained by wounding the plant and allowing sap to ooze out of the wound.

Gum Arabic is used in a number of ways, including:

- Pharmaceuticals and herbal medicines
- As an edible food or food additive
- In glue

The following are some of the species that are harvested for gum Arabic. There are also other species harvested that are not listed here.

A. *Abyssinica*

- Common name is Flat Top Acacia
- Considered a good quality commercial gum, but only limited quantities are thought to reach the market
- Tolerates extreme heat and cold (to minus 8 degrees Celsius; losing foliage just below zero)
- Indigenous from Ethiopia to Zimbabwe
- Slow growing tree to 8 metres or higher
- No thorns
- Open normally flat topped canopy
- Bipinnate leaves
- Cream yellow ball flowers in spring or early summer

A. *glaucophylla*

- Considered a good quality commercial gum, but only limited quantities are thought to reach the market
- Shrub plant occurring in semi arid areas around lower parts of the Red Sea (north eastern Africa)

A. *gummifera*

- Common name is Mogadore Gum
- from a tall tree in Morocco and on the Island of Bourbon
- Closely related to *Acacia nilotica* (These species are distinguished by differences in the number of pinnae pairs and the number of pairs of leaflets per pinnae and tardily dehiscent pods)
- Two forms exist; one a shrub to 2metres tall; the other a tree to 6 metres.

***Acacia nilotica* (syn. *A. arabica*)**

- Common name is “Prickly Acacia” or “Egyptian Mimosa”
- There are many different sub species
- Spiny plants; shrubs or small trees
- Gum is harvested from wounded plants and can be used commercially
- Occurs in Africa and parts of the Middle East (Israel and Syria) through to Asia (Bangladesh and India). Naturalised in much of north half of Australia where it is considered a weed.
- A useful fuel (firewood or charcoal)
- Used for tanning, dye, construction timber
- Cultivated as a landscape plant, for revegetation, hedge rows, etc.
- Can be toxic to mammals
- Specimens growing in India are often known by the synonymous name *A. arabica* and common name is Indian Gum
- Gum can be harvested for commercial purposes (the product from this species is considered inferior, but acceptable substitute for other types of Acacia Gum)
- Generally sweeter than other types of Acacia Gum

Acacia senegal

- Common name is Sudan Gum Arabic
- Commonly grows 2 to 4 metres tall but occasionally as a tree to 9 metres tall
- Spiny plant with black thorns occurring in threes, the middle one curved
- Indigenous in West Africa through to Egypt, in parts of Kenya; and in the south –Namibia and South Africa
- Produces a valuable edible gum, known as “gum Arabic” in the food and pharmaceutical industries. It is also used in commercial production of glue. The gum production is promoted by wounding or stripping the bark.
- The quality of gum produced does vary between locations and is commercially more viable in some parts of Africa than others.

Almond (*Prunus dulcis*)

Family: Rosaceae

- Medicinal Part: Kernels
- Use:
 - Emollient, demulcent, pectoral and sweet
 - Almonds are said to be useful to treat kidney stones, gallstones and constipation
 - Ayurvedic medicine uses almonds as a laxative
 - Traditional Chinese medicine uses almond oil as an anaesthetic and muscle relaxant
 - Almond kernels are used in various ways including: eaten as nuts, as oil taken internally or externally.

Asparagus (*Asparagus officinalis*)

Family: Asparagaceae (Once classified in Liliaceae)

- Medicinal Part: Young shoots
- Use:
 - Edible vegetable; Diaphoretic, aperient and deobstruent
 - Said to help with kidney health and the chlorophyll in asparagus helps build the blood
 - Native Americans used to dry asparagus and use it to treat ailments of the kidney, bladder and heart.
 - Water from steamed asparagus can be drunk as a diuretic.

Barberry (*Berberis vulgaris*)

Family: Berberidaceae

- Medicinal Part: Bark and berries
- Use:
 - Tonic and laxative. Used for 3,000 years in traditional Chinese medicine.
 - Whilst used mainly for digestive complaints, it has a range of different affects: haemostatic, diuretic, vasodilator, hypertensive, antibacterial (kills bacteria and parasites), anti inflammatory
 - It is quite strong in it's affects and should be used very carefully and only prescribed by professionals
 - A decoction of bark or berries is used as a mouthwash, gargle or drink

Bilberry (*Vaccinium myrtillus*)

Family: Verbenaceae

- This plant is closely related to the blueberry
- Medicinal Part: Leaves and berries
- Use:
 - Circulatory tonic, blood sugar lowering treatment, anti inflammatory.
 - Leaves are a strong astringent and used to treat diarrhoea
 - Generally Bilberry is safe, but if a person is taking certain other drugs including medicines for lowering blood pressure; it can increase the affects of those drugs. Can also cause digestive upsets, dizziness and headaches.

Birch (*Betula* species)

Family: Betulaceae

- Medicinal Part: Leaves and bark
- Use:
 - Leaves of *Betula lenta* can be used to promote discharge of urine
 - Betulinic acid found in *Betula alba* can kill cancer cells, and is used as a treatment on prostate cancer
 - *Betula alba* and *lenta* also contains Methyl salicylate (ie. Wintergreen) which is an additive in oils and liniments used for massage and treating muscles, rheumatism, etc.
 - Birch has also been used for a number of things, including as a pain killer in traditional Scottish medicine.

Bitter Root (*Apocynum androsaemifolium*)

Family: Apocynaceae

- Medicinal Part: Root
- Use:

- Emetic, diaphoretic, tonic and laxative
- Stimulates digestion. Useful for constipation.

Black Currant (*Ribes nigrum*)

Saxifragaceae

- Medicinal Part: Leaves
- Use:
 - Diuretic
 - Berries are rich in vitamin C

Blue Flag (*Iris versicolor*)

Family: Iridaceae

- This has traditionally been considered to be a herbal medicine that can be used a lot.
- Medicinal Part: Rhizome which contains a volatile oil called furfural, a glycoside (Iridin), various acids (including salicylic and isophthalic) and a range of other components including gum, resin and sterols.
- Use:
 - Alterative, laxative, cathartic, anti inflammatory, diuretic, hepatic.
 - Has been used widely to treat skin conditions (eg. Acne, Eczema and Psoriasis)
 - Said to be good to treat vomiting, heartburn, gall bladder, liver and sinus problems
 - Can sometimes cause salivation
 - Can cause dermatitis in some people
 - The resin in *Iris versicolor* can affect the liver, pancreas and gastro-intestinal tract adversely in some people.

Cassia (*Senna*)

Family: Caesalpinaceae

- Several species of Cassia are used medicinally, including *C. senna*, *C. acutifolia*, *C. marilandica*, *C. augustifolia*.
- Parts Used: Leaves and pods
- Uses:
 - Contain chemical sennosides (hydroxyanthracene glycosides) which are strong laxatives. They also increase secretion of fluid in the colon increasing the bulk of the stool.
 - Cassia is also sometimes included in hair treatments and it will thicken and strengthen hair. (Note: It is sometimes confused with Henna, also used in shampoos, which is in fact a totally different plant).
 - Warning: Be cautious using senna as a laxative unless prescribed. Pregnant women and children should not use senna. Do not use senna more than daily for a week. It can also be a problem for people suffering a range of conditions including ulcerative colitis, Crohn's disease, severe haemorrhoids, blood vessel disease, congestive heart failure, heart disease, severe amenia, abdominal hernia, gastrointestinal cancer, recent colon surgery, or liver and kidney disease.
- American Senna (*Cassia marilandica*) - leaves are Cathartic, reported equally as useful as non American Senna
- Cassia fistule –seed capsules/fruits are mildly cathartic, leaves are purgitive and bark is an astringent

Cardamom (*Elettaria cardamomum*)

Family: Zingiberaceae

- Related to the gingers.
- Medicinal Part: Seeds
- Use:
 - Carminative, stimulant, aromatic.
 - Rarely used by itself; incorporated into other medicines to treat flatulence, bronchial irritation and asthma.

Carrot (*Daucus carota*)

Family: Apiaceae

- Medicinal Part: Roots and seeds
- Use:
 - Stimulant, diuretic, carminative

Elder (*Sambucus canadensis*)

Family: Caprifoliaceae

- Medicinal Part: Flowers, berries, roots
- Use:
 - Diaphoretic and mild stimulant can be created from a warm infusion of flowers
 - Juice from elder berries is an aperient and alterative. 25gm of the juice will purge the system
 - A tea made from the root, taken daily is a hydragogue cathartic and stimulating diuretic.

Fenugreek

Family: Fabaceae

- Medicinal Part: Seed
- Use:
 - A tea is used as a gargle for an irritated throat
 - A poultice is used to treat wounds or minor skin irritations.

Feverfew

Family: Asteraceae

- Medicinal Part: All parts of the plant
- Use:
 - Tonic, carminative, emmenagogue, vermifuge and stimulant
 - Drink 1 or 2 cups of tea a day for an ordinary cold or for flatulence.

Fig Tree (*Ficus carica*)

Family: Moraceae

- Medicinal Part: Fruit
- Use:
 - Laxative and demulcent

Flaxseed (*Linum usitatissimum*)

Family: Linaceae

- Also called linseed.
- Medicinal Part: Ripe seeds
- Use:
 - Demulcent and emollient.
 - Taken internally as an oil extract or a tea made from seeds
 - Combined with elm bark and used externally as a poultice

Ginseng (*Panax quinquefolium*)

Family: Araliaceae

- Medicinal Part: Dried Root
- Use:
 - Used extensively in Chinese medicine.
 - Widely used as a preventative medicine, not only in China but also western countries.

Henna (*Lawsonia alba*)

Family: Lythraceae

- Medicinal Part: Leaves
- Use:
 - Astringent properties.
 - Contains high levels of tannin. Used as a dye. A weak rinse is used to treat hair.
 - Used as a gargle in India
 - Henna flowers are used in perfumery.

Hops (*Humulus lupulinus*)

Family: Cannabaceae

- Medicinal Part: Strobiles (ie. cones)
- Use:
 - Tonic, hypnotic, febrifuge, antilithic and anthelmintic.

Kava Kava (*Piper methysticum*)

Family: Piperaceae

- Medicinal Part: Root (which has a lilac scent but bitter taste)
- Use:
 - Tonic, stimulant, diuretic and diaphoretic
 - Make up as a tea. Drink one mouthful at a time, and no more than a cup a day –colds.

Knot Weed (*Polygonum persicaria*)

Family: Polygonaceae

- Medicinal Part: Whole plant
- Use:
 - Tea can be drunk as a diuretic
 - Juice is used to treat damaged skin (wounds, cuts, bruising etc)

Kola Nuts (*Cola acuminata*)

Family: Sterculiaceae

- Medicinal Part: seed
- Use:
 - Stimulant, tonic, nervine, diuretic astringent
 - Seeds contain caffeine, tannin, theobromine and starch
 - Used to treat fatigue, neuralgia and headaches.

Lads Love (*Artemisia abrotanum*)

Family: Asteraceae

- Medicinal Part: all parts of the plant
- Use:
 - Astringent, bitter and tonic
 - French use this to protect clothing from insects. Italians use it as a culinary herb.

Lady's Mantle (*Alchemilla vulgaris*)

Family: Rosaceae

- Medicinal Part: Whole plant
- Use: Astringent

Lavender Cotton (*Santolina chamaecyparissus*)

Family: Asteraceae

- Medicinal Part: Whole plant
- Use:
 - Was once used as vermifuge for children.
 - Oil has been used in perfumes, but has been banned in many places today; being considered dangerous

Lemon

Family: Rutaceae

- Medicinal Part: Fruit, oil extracted from fresh peel by cold pressing.
- Use:
 - acidulous, refrigerant, anti-scorbutic
 - Oil is considered anti-anaemic, antimicrobial, anti-rheumatic, anti-sclerotic, antiseptic, bactericidal, carminative, cicatrisant, depurative, diaphoretic, diuretic, febrifuge, haemostatic, hypotensive, insecticidal, rubefacient, tonic and vermifuge
 - Used in mouthwashes, lotions, cremes, massage oils or oil burners.

Liquorice Root (*Glycyrrhiza glabra*)

Family: Fabaceae

- Medicinal Part: Dried root
- Use:
 - Demulcent, expectorant and laxative
 - Create a tea from 1 teaspoon of dried root in a cup of boiling water. Drink one or two cup fulls daily, cold.

Mulberry (*Morus rubra*)

Family: Moraceae

- Medicinal Part: Bark (in Chinese medicine almost all parts of the plant are used)
- Use:
 - Bark - vermifuge and cathartic
 - Leaves - antibacterial, astringent, diaphoretic, hypoglycaemic, odontalgic and ophthalmic

Nutmeg (*Myristica fragrans*)

Family: Myristicaceae

- Also known as Mace.
- Medicinal Part: Kernels from the fruit
- Use:
 - Stimulant and aromatic
 - Low doses are considered safe
 - Has been used to treat infections in the digestive tract.
 - Ointments containing nutmeg oil are rubbed on the skin for eczema and for rheumatic conditions.

Pomegranate (*Punica granatum*)

Family: Punicaceae

- Medicinal Part: Rind of the fruit, and sometimes bark from the root
- Use:
 - Bark and rind are astrigent, and are an ancient treatment for tape worm
 - Also has been used as a gargle for throat irritations.

Raspberry

Family: Rosaceae

- Medicinal Part: Bark, root and leaves
- Use: Considered a very useful astrigent
 - Infusion of leaves has been used for diarrhoea
 - Decocotion of leaves combined with cream to treat nausea or vomiting.

Rhubarb (*Rheum palmatum*)

Family: Polygonaceae

- Medicinal Part: Root
- Use:
 - Cathartic, astrigent and tonic.
 - Mild laxative, considered by many to be appropriate for use on children
 - Prepared as a teaspoon of cut or shredded root in one cup of boiling water to create a tea. An adult can drink one cup at a time

Sweet Cicely

(*Osmorrhiza longistylis*)

Family: Apiaceae

- Medicinal Part: Root (all parts can be consumed, but root is the strongest part)
- Use:
 - Aromatic carmative expectorant, stomachic
 - Native Americans used this for digestive disorders, and as an antiseptic wash.
 - A strong infusion is said to induce delivery in pregnant women

Sweet Gum

(Liquidambar styraciflua)

Family: Hamamelidaceae

- Medicinal Part: Bark and sap (resin)
- Use:
 - Has been used in the past as a household remedy for colds
 - 1 teaspoon of cut or granulated bark per cup of boiling water; drink one mouthful at a time, cold.
 - The resin is extracted for a range of commercial uses, including some medicinal.

SET TASK

Visit a chemist to determine which, if any, herbs are commonly used in medicines today. This may involve talking to a number of chemists (or reading a number of medicine packages)



ASSIGNMENT

Download and do the assignment called 'Lesson 5 Assignment'.