# Evolution

**Evolution** is a natural raw wholefood, combining a selection of some of nature's most perfect foods. Nutrition is the key to good health and this wholefood blend of Rare West Australian native bee pollen, certified organic Barley grass, certified organic Maca and Aloe Vera, is abounding with vitamins, minerals, enzymes and amino acids in their naturally occurring state. **Evolution** does not contain any fillers, all the ingredients bring their own special benefit to the product. **Evolution** helps provide the daily nutrition you need to develop a strong foundation for your good health.

The concentration of nutrients in food depends on the soil content. Alcohol, smoking, the cooking of vegetables, meats, and processed food can rob the body of nutrients which can be obtained from a whole food supplement. Studies have shown that regular consumption of natural fruits and vegetables is strongly associated with a reduced risk of developing chronic diseases such as cancer and cardiovascular disease. Clinical trials with individual antioxidants do not appear to provide the consistent protective effects anticipated. Rather the additive and synergistic effects of the complex mixture of phytochemicals present in these whole foods are responsible for the potent antioxidant and anticancer activities. This explains why no single nutrient can replace the combination of natural phytochemicals to achieve health benefits. The evidence suggests that bioactive compounds are best acquired through whole-food consumption and not from isolate dietary supplements.

### West Australian Native Bee Pollen:

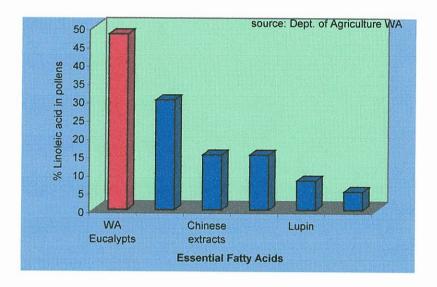
Western Australia has a high density of unique plant species that produce high quality pollens. This pollen is harvested free of chemicals from pristine forests and conservation reserves in natural indigenous bush, away from any farming activity to ensure it is in its purest form possible. Bee pollen has been described as nature's most complete food and has been widely used for centuries.

There are 2 types of pollen. Anemophile pollen is wind carried and is responsible for plant fertilisation. The other is entomophile pollen, which attaches to insects, such as bees when they forage for nectar. Bee pollen is essentially entomophile pollen, which is more solid and substantial than the wind driven kind.

New health properties have been identified and should excite health conscious consumers

Western Australian Pollen is a nutrient-dense natural source of high protein and low fat that contains essential fatty acids and a complete range of minerals and vitamins. Gathered from the stamen of flowers, the pollen is rich in vitamins A, D, E and all the B-complex, enzymes and co enzymes, carbohydrates and fatty acids.

Eucalyptus pollens are dominated by an "essential" fatty acid for human health known as linoleic acid. This needs to be consumed as it cannot be manufactured in the body. As a polyunsaturated fatty acid, linoleic acid helps lower the ratio of low-density lipoproteins (LDL's) to high-density lipoproteins (HDL's). The LDL's known as the bad lipoproteins, carry fats such as cholesterol from our liver to our cells whilst HDL's carry cholesterol to our liver to be excreted as bile into the intestine. Eucalypt pollens have one of the highest percentages of linoleic acid in the world, making it unique and beneficial.



Pollen is a good source of iron, zinc, manganese and copper and is rich in rutin, which strengthens capillaries. Vitamin B<sub>12</sub> and E are found in relative abundance.

The Amino Acids present in this pollen are superior to those of animal origin, with pollen containing five to seven times more amino acids than beef and cheese of equal weight. Bee pollen is a low calorie food, high in lethicin, about 15% by volume, Lethicin helps to normalise fat metabolism.

In spite of all the sophisticated high technology available bee pollen cannot be duplicated in the laboratory. This native bush pollen in its pure state is a powerful natural food source.

### Barley Grass, Certified Organic by BFA IFOAM Accredited

The Organic Barley Grass powder is a wholesome green food made from the powdered dehydrated leaves of organically grown young barley plants (*Hordeum vulgare*). Our Barley grass powder is an excellent provider of green vegetable nutrition. It is a rich source of dietary fibre for good colon health and regularity and a natural source of minerals, vitamins and antioxidants.

The bright green colour reflects the abundance of chlorophyll, a source of magnesium.

Contrary to popular opinion, our Barley Grass does not contain gluten. This means it is safe for those who have gluten allergies.

Timing is critical for nutritional value. Not all barley is harvested at its nutritional peak. Since 1935 scientists have known that the highest concentrations of nutrients are present for just a few critical days. By the time the young sprout reaches its nutritional peak it is between 6 and 8 inches tall. It then forms a joint that goes on to form the stalk of the grain.

At harvest, only the top 10 centimetres of the grass are harvested because this section has the richest content of nutrients. Harvest occurs just prior to jointing. Once jointing occurs, the nutritional level in the leaves begins to drop as the shoot's nutrients are used in the growth and development of the head of the grain. After low temperature warm air-drying, the grass is powdered in a special air mill at room temperature.

**Main features -** Significant source of Chlorophylls, mixed Carotenoids, Antioxidants, Folic Acid, Protein and Omega-3.

**Alkaline Foods** - It is important to keep the fluids in our bodies on the alkaline side to reduce the risk of bone loss. Barley grass is an alkaline food.

Antioxidants - Barley grass contains significant levels of antioxidants. We have known of the presence of the antioxidant superoxide dismutase, but the presence of Vitamin E Succinate an analogue of alpha-tocopherol, and an even more powerful antioxidant," 2"-O-glycosyl isovitexin, which is an isoflavonoid have been reported. Although isoflavonoids are potential therapeutic "anti-estrogens", they have significant antioxidant value as well.

**Benefits -** Barley grass powder is a concentrated source of vegetable greens, essential to life. Chlorophyll, for natural cleansing of the blood and support to the immune system, and Beta Carotene, the precursor of Vitamin A, are present in highly significant quantities.

### Maca, Lepidium Meyenii, Certified Organic

Maca is a root vegetable cultivated high in the Andean Mountains. Its use as a superfood dates back 10,000 years.

Maca is a whole food. It is adaptogenic meaning that it will work on the body according to needs, age and gender of the person taking it - allowing males and females of all ages to benefit from taking it regularly.

Maca was originally identified in the 1800's by a German botanist who named it "Lepidium meyenii, Walpers" (after himself) - still the ONLY name officially recognized by the Peruvian government. From the 1960's, a research worker investigating Maca's constituents attempted to rename Maca after herself, hence "Lepidium peruvianum, Chacon".

There is only one species that is grown commercially for harvest, which is "Lepidium meyenii, Walpers" and should not be confused with other species.

The best Maca is grown in the Junin Plateau where it has been grown for thousands of years using traditional farming methods. The key factors resulting in good quality Maca are altitude (4,100m above sea level), soil type & microclimate.

Maca Root contains significant amounts of amino acids, complex carbohydrates, Vitamins B1, B2, C, E and minerals including calcium, phosphorous, zinc, magnesium and iron.

How Do I Know Which Maca Brand Is The Best Quality?

A superior quality Maca brand as used in **Evolution** is certified organic and not genetically modified and this is your only guarantee. A high protein count is a great indicator of optimal growing conditions and careful processing. Maca is a carbohydrate root vegetable, so a light colour and sweet taste means that the amino acids, vitamins, minerals, essential fatty acids and other nutrients have been better preserved.

### Aloe Vera (Aloe barbadensis) Certified Organic

Aloe Vera is another ingredient that adds remarkable healing properties to **Evolution**. Historical documents reveal that the Roman, Greek, Arab, Indian and Chinese cultures used Aloe Vera extensively as a medicinal plant. Aloe Vera is a great source of more than 200 active ingredients, including vitamins, minerals and amino acids.

Aloe Vera is not a cactus plant as many think or consider, but rather a member of the Lilly family. The official name *Aloe barbadensis* is from the botanist Dr Miller who characterised the plant in Barbados, although the plant is native to Northern Africa. Components are obtained from the leaf, the sap and a mucilaginous gel derived from the inner cells of the leaf. The inner Aloe

gel is made up of polysaccharides and a vast array of bioactive chemical substances, which play a major role in the healing process.

The Aloe Vera in Evolution is bifurcated Aloe Vera gel and combines all the ingredients of the leaf including the outer Aloe rind, as recent research indicates this contains numerous bioactive ingredients including the glycoproteins, polysaccharides and important enzymes such as superoxide dismutase, glutathione peroxidase and catalase. The powerful protective antioxidant activity of superoxide dismutase and catalase works in conjunction with vitamins C, E and glutathione.

The substances identified in Aloe Vera are divided into 2 groups based on their molecular weight.

The high molecular weight substances include the mucilaginous polysaccharides such as the neutral B (1-4) mannans, acidic galacturonic mannans and galacto-mannans. The other substances are glycoproteins and a variety of enzymes

The main feature of this Aloe Vera, is that the long molecular polysaccharide mannan, is not hydrolysed during manufacturing into smaller components, losing its original chemical structure and biological activity. The manufacturing process allows the original Aloe Vera polysaccharide mannan to be present in the final product unaltered and unmodified. One unique characteristic of this Aloe Vera polysaccharide is that human gastric enzymes cannot hydrolyse its linkages.

The low molecular weight substances include; Saponins, Flavonoids, Fatty acids and their esters, Tannins, Sulphur derivatives, Glucosamine, glutamine, terpenoids and biological growth factors.

Although each one of the above contents has an individual biological ability, an aspect that makes Aloe Vera unique is that all these substances act synergistically as a group. Chemically, two major classes of substances form Aloe Vera; hydrophilic substances that are water soluble and hydrophobic or non water soluble. Since human metabolism and cell composition are compose both types of systems, Aloe Vera can act as a natural biological vehicle, capable of stimulating and normalising the main physiological biological functions of the human body.

Therefore, in bifurcated Aloe Vera gel the benefits include the inner Aloe gel and the other active substances present in the outer Aloe rind resulting in a superior product.

### Main Features

Vitamins

A, C, E, B, B12, Choline, Folic Acid

Amino Acids

Aloe contains 7 of the 8 essential amino acids.

Provides 20 of 22 amino acids required by humans.

Minerals

Aloe provides 9 essential minerals such as Calcium, Copper,

Chromium, Magnesium, Iron, Potassium, Zinc, Sodium, and

Manganese.

Phytonutrients Natural plant growth hormones, sterols and salicylates.

Enzymes Provides 8 important enzymes

Sugars Monosaccharides and Polysaccharides (long chain sugar

molecules that are essential to the quality and efficacy of

Aloe Vera.

### Benefits

Several detailed scientific studies have revealed that the diverse biochemical components present in Aloe Vera participate in the following biological processes.

A number of the substances present in Aloe Vera decrease the effects of inflammatory mediators reducing pain and inflammation.

Aloe Vera through the action of its B (1-4) mannan can stimulate the immune function. This substance is a long chain polydispersed beta (1-4) polymannose with interspersed O acetyl groups with a mannose monomer ratio of approximately 1:1. The acetyl groups make this polysaccharide distinct from other similar mannans in the animal and plant kingdom. How this functions in the immune system is unclear and the Aloe polysaccharide may activate macrophages, the initiating cell in inflammation.

One of the most well known properties of Aloe Vera is the ability to promote wound healing

The antioxidant activity and radical scavenging effect of Aloe Vera is related to a large number of substances and not to a particular group.

Two low molecular components may prevent ultraviolet B immune suppression in the skin, acting as a defence mechanism and assisting with repair.

Aloe Vera juice has a favourable effect on gastrointestinal physiology in humans. The frequent ingestion of Aloe Vera may benefit many diverse human metabolic functions and strengthen the immune system.

# Typical analysis of *Evolution*

Proximates		Mono-unsaturated	
Energy	1480	C14:1 Myristoleic	0.2%
<del>-</del> -	kJ/100g		
Moisture	13.8 g/100g	C16:1 Palmitoleic	0.2%
Fat	3.8 g/100g	C17:1 Heptadecenoic	<0.1%
Saturated fat	1.4 g/100g	C18:1 Oleic	
Protein (N x 6.25)	0.8 g/100g	C20:1 Eicosenic	<0.1%
Ash	3.8 g/100g	C22:1 Docosenoic	<0.1%
Carbohydrates	78 g/100g	C24:1 Nervinic	0.3%
Total			
Fructose	39 g/100g	Total mono-unsaturated	5.6%
Glucose	8.4 g/100g		
Sucrose	0.8 /100g	Poly-unsaturated	
Maltose	<0.2 g/100g	C18:2w6 Linoleic	38.3%
Lactose	<0.2 g/100g	C18:3w6 gamma-Linolenic	<0.1%
		C18:3w3 alpha-Linolenic	16.5%
Saturated		C20:2w6 Eicosadienoic	0.3%
C4:0 Butyric	<0.1%	C20:2w5 Eicosatrienoic	<0.1%
C6:0 Caproic	0.2%	C20:4w6 Arachidonic	<0.1%
C8:0 Caprylic	<0.1%	C20:5w3 Eicosapentaenoic	0.9%
C10:0 Capric	<0.1%	C22:2w6 Docosadienoic	
C12:0 Lauric	0.4%	Omega 3 Fatty Acids	17.8%
C14:0 Myristic	0.7%	Omega 6 Fatty Acids	
C15:0	0.1%	C22:4w6 Docosatetraenoic	0.3%
Pentadecanoic			
C16:0 Palmitic	30.0%	C22:5w3Docosapentaenoic	0.1%
C17:0 Margaric	0.4%	C22:6w3Docosahexaenoic 0.3	
C18:0 Stearic	2.3%	Total Poly-unsaturated 56.9	
C20:0Arachidic	0.9%		
C22:0 Behenic	1.4%	Total Mono Trans Fatty Acid <0.1	
C24:0 Lignocaric	0.7%		
Total saturated	37.1%	Total Poly Trans Fatty Acid	0.5%
	1	P:M:S ratio	1.5:0.2
			:1

# Typical analysis of Evolution

Vitamins	Minerals	Amino Acid Anaysis mg/g
Provitamin A	Boron	after hydrolysis
B1 Thiamine	Calcium	Alanine 8.4
B2 Riboflavine	Chlorine	Arginine 9.8
B3 Niacin	Chromium	Asparagine +
B6 Group	Cobalt	Aspartic acid 14.3
Pantothenic acid	Copper	Glutamic acid +
Biotin	Iodine	Glutamine 18.4
B12	Iron	Glycine 6.1
Folic acid	Lithium	Histidine 3.3
Choline	Magnesium	Isoleucine 6.3
Inositol	Manganese	Leucine 11.0
Vitamin C	Molybdenum	Lysine 9.5
Vitamin D	Phosphorous	Methionine 1.9
Vitamin E	Potassium	Phenylalanine 6.5
Vitamin K	Rutin	Proline 18.4
Chlorophylls	Selenium	Sarcosine 0.07
Carotenes	Silicon	Sarina 4.6
	Sodium	Threonine 6.0
<u>ORMEs</u>	Sulphur	Tryptophan 0.49
monatomic gold 663ppm	Titanium	Tyrosine 3.4
monatomic rhodium 3210ppm	Zinc	Valine 6.2
monatomic iridium 2290ppm		
Others	Nucleic acids	Fats
Alpha-amino-butyric-acid	Nuclein	Linoleic
Auxins	Pentosans	Oleic
Brassins	Phenolic acids	Omega 3
Crocetin	Terpenes	Omega 6
Flavonoids	Vernine	Palmitic
Hexodecanal	Xanthophylls	Saponins
Kinins	Zeaxanthin	Sterols
Lecithin	Zouranumi	
Mannans		
aramatikkii.		

The nutritional make-up of Barley Grass / 100g powder

Energy	1550kJ	Chlorophylls	200mg	Manganese	2mg
Protein	28g	Carotenes	64mg	Iron	14mg
Fat-Total	6g	Folates	1300mcg	Copper	1mg
Omega-3 ALA	4g	Moisture	3.6g	Chromium	92mcg
Saturates	0.7g	Ash	10.5g	Zinc	2.7mg
Carbohydrate total	53g	Vitamin C	191mg	Potassium	3800mg
Sugars 3.3gm					
Crude Fiber	18g	Phosphorous	290mg	Sodium	400mg
Magnesium	150mg	Calcium	400mg		

Barley Grass Amino Acid profile per 100g after hydrolysis

Alkamine	7.4g	Hisridine	2.5g	Proline	5.8g
Arginine	6.9g	Isoleucine	4.1g	Serine	5.6g
Aspartic Acid	12.8g	Leucine	9.4g	Threonine	0.6g
Glutamic Acid	13.8g	Lysine	7.7g	Tyrosine	4.5g
Glycine	5.7g	Phenylalanine	5.9g	Valine	7.7g

Nutritional make up of Maca

Nutritional make t	***			
Energy	1542kj	Minerals		
Fats	1.9g	Calcium		
Total sugars	31.3g	Copper		
Potassium	1700mg	Iron		
Protein	14.6g	Iodine		
Carbohydrates	72.1g	Manganese		
Sodium	39mg	Potassium		
Calcium	351mg	Sodium		
Amino Acids		Zinc		
Alanine				
Arginine		Fats/Lipids		
Aspartic acid		Linoleic		
Glutamic acid	- 11 Territoria - 12 - 12 - 12 - 12 - 12 - 12 - 12 - 1	Palmitic		
Glycine		Oleic		
Histidine				
HO-Proline				
Isoleucine				
Leucine				
Lysine				
Methionine				
Phenylalanine				
Proline				
Sarcosine				
Serine				
Threonine				
Tryptophan, Tyrosir	ne, Valine			

### Major substances present in Aloe Vera barbadensis

1) Low molecular weight

Barbaloin(Aloin, isomers A and B)

Homonataloin Aloesin

Alomoin Saponins Asparagine

Flavonoids and Glycosides

Galacturonic and hexauronic acids

Fatty acids and esters

Myrcene

Tannins Tryptolidine

Sulfur derivates

D Citatoral and stards

B-Sitosterol, and sterols

Isoprenoids

2) High molecular weight

a) Mucilagenous polysaccharides, neutral B (1-4) mannans, acidic galacturonic mannans and galacto-mannans.

b) Glycoproteins

- c) Enzymes
  - Isoenzymes
  - Catalases
  - Cellulases
  - Bradykinase
  - Carboxypeptidases

Phenta-hydroxyflavones Minerals and their salt Calcium Oxalate D-X ylotocopherol Pentahydroxyflavones

Limonene Lupeol

Glucosamine and glutamine

Vitamins Terpenoids

Carditionic glycosides

Phenols

Biological growth factors

Alkaloids Salicyclic acid

### **GLYCONUTRIENTS**

Scientists have recently discovered that in the modern diet many vital nutrients are missing including the glyconutrients, which are a group of biologically active sugars. These specific natural substances are immune enhancers that prepare and optimize our defense system and can provide us with added protection by immoblising the immune system when required. Some researchers have called these glyconutrients "miracle sugars". These sugars are considered critical and essential for human health.

These glyconutrients are required for every cell in the body to function and these sugars sustain complex processes that occur in the cell to transfer coded messages. These sugars should not be confused with common table sugar, which is refined sugar, also known as sucrose

The term 'Glyco " is derived from the Greek word meaning " sweet'. Therefore a glyconutrient is any substance that contains sugar and the sugar can be attached to any molecule and is also termed a glycoform.

Glyconutrients are the recently discovered class of necessary carbohydrate nutrients and although there are over 200 specific carbohydrate monosaccharides only a few are considered 'necessary biologically active sugars'. There are 8 specific and 3 intermediate biological sugars and it is important to have a balance of these sugars, as refined white sugar is over consumed and provides little benefit to our health.

Plants that have a high glyconutrient content are known as 'healing plants. Glyconutrients are found in Aloe Vera, garlic, yeasts, coconut, maize, some algae, Echinacea, saps, gums and certain mushrooms.

The leaves of **Aloe Vera** are extremely rich in the long chain sugars (polysaccharides) that give Aloe Vera its healing and anti - infective properties when used both internally and externally. Aloe contains mannose, galactose and arabinose and it is the mannose content that makes it a superior immune booster.

Studies show that aloe vera has numerous properties, namely, Anti-fungal, anti-viral, anti bacterial, and anti-inflammatory properties.

The following sugars are required in the diet and breast milk contains all the essential sugars.

Mannose, Xylose and Fucose are not readily available in the diet. Mannose and Fucose have well documented benefits for the immune system, has a natural anti-inflammatory effect and may lower blood sugar levels. Xylose is used in sweets, does not cause tooth decay and has anti-bacterial and anti-fungal properties.

Glucose and galactose are readily available in the diet. Glucose occurs in sugar, rice, potatoes, corn and wheat and other starchy foods. Galactose is "milk sugar" and is derived from lactose.

The sugars with an acetyl group, namely, N-acetyl-neuraminic acid, N-acetyl-glucosamine and N-acetyl-galactosamine are not readily available in the diet.

N-acetyl-neuraminic acid is abundant in breast milk; effects brain function and boosts the immune system.

N-acetyl- glucosamine is beneficial for cartilage regeneration and joint inflammation. Glucosamine is derived from this sugar compound.

The least information is known about the essential sugar N-acetyl-galactosamine.

Glyconutrients are essential in virtually every interaction between cells and are an immune system modulator. They are involved in cell-cell communication and are a vital part of how a cell functions, similar to an 'operating system'. In particular studies on the function of the brain, they indicate glyconutrients increase reaction time and concentration.

An inadequate intake of the essential sugars requires the body to synthesize the necessary glyconutrients from other sources. If there is a deficiency of the needed glyconutrients from other sources, the cells ability to carry out the intercellular communications is limited and most probably defective making the organism susceptible to disease. A supply of glyconutrients to the body promotes and maintains health.

There have been numerous studies performed worldwide at universities and major pharmaceutical companies and this research is ongoing.

Research has shown the effects of the biologically active sugars are: -

- Boosts the immune system by increasing natural killer cell and macrophage count. These cells are the first line of defense.
- Mannose stimulates macrophages and also initiates other the secretion of cytokines involved in the immune cascade. T Cells are also activated under certain conditions.
- Assists immune cells recognize invaders or foreign antigens and enables cells to communicate initiating the right intercellular reactions.
- Has antioxidant properties protecting the body against free radical damage.
- Due to their saccharide components glyconutrients have antiinflammatory properties and are beneficial for cartilage regeneration and joint inflammation.

### **VITAMINS**

A vitamin is a chemically organic substance, containing carbon, essential for regulating both the metabolic functions in the body cells and the biochemical processes that release energy from food. In addition, evidence is accumulating that certain vitamins are antioxidants – substances that protect tissues from cell damage and may possibly help to prevent a number of degenerative diseases.

With a few exceptions, namely, vitamin D and vitamin K the body cannot manufacture vitamins so they must be ingested.

There are 13 known vitamins, which are classified as water-soluble or fat-soluble. This distinction is important because the body stores fat-soluble vitamins for a long time (months or even years), whereas water-soluble vitamins (except for vitamin  $B_{12}$  remain in the body for a short time and must be replaced regularly.

The Water-soluble vitamins are vitamin C (ascorbic acid) and eight members of the vitamin B complex- thiamine (B1), riboflavin (B2), niacin, pyridoxine (B6), folic acid, cobalomin, (B12), biotin and pantothenic acid.

The Fat-soluble vitamins are retinal (vitamin A), cholecalciferol and ergocalciferol (vitamin D), a- tocopherol (vitamin E), and phylloquinone and menaquinone (vitamin K). Only vitamins A, E and B12 are stored to a significant extent in the body.

### VITAMIN A AND CAROTENES.

Vitamin A (retinol) was the first recognized fat-soluble vitamin and rapidly gained recognition as a factor in the maintenance of the immune system.

Carotenes are the most widespread group of naturally occurring pigments in nature. These occur in green leafy vegetables and are converted to retinol in the mucosal cells of the small intestine. Retinol is then reduced to retinal and then esterified. Most of the body's vitamin A is stored in the liver as retinyl palmitate.

The conversion of provitamin A carotenes to vitamin A depends on several factors, including protein status, zinc and vitamin C.

Vitamin A is vital for the visual system, particularly the components of the eye, skin, mucous membranes of the respiratory, genitourinary and gastrointestinal tracts. The immune system abnormalities associated with Vitamin A deficiency include an impaired ability to mount an effective antibody response.

The role of vitamin A and the carotenes in the maintenance of epithelial tissues cannot be over emphasized. Inadequate intake can cause: -

- Impaired dark adaptation and night blindness related to the retina.
- Damage to the cornea and conjunctiva of the eye
- Alterations to the mucous lining of the respiratory, genitourinary and gastrointestinal tracts (keratinisation) so the function is impaired
- Increased susceptibility to infections (immune system)

Changes to skin (follicular keratosis).

It is believed Vitamin A affects growth and development as it has a role in the synthesis of many glycoproteins (mucus), which may control cellular differentiation and gene expression.

Carotenes have antioxidant activity.

### THIAMINE (VITAMIN B1).

Thiamine was the first B vitamin discovered and was named vitamin B1.

The active form of thiamine is the coenzyme thiamine pyrophosphate and is essential for proper energy production and participates in carbohydrate metabolism.

Thiamine is involved with the other B vitamins in energy metabolism. Magnesium is required in the conversion of thiamine to its active form.

Inadequate intake affects the brain, spinal cord, heart, gastrointestinal tract and the peripheral nervous system and may result in fatigue, poor memory, and constipation.

The syndrome of peripheral neurological changes due to thiamine deficiency is called **dry beriberi**. The changes begin with pins and needles sensations in the toes and feet, burning sensation in the feet and muscle cramps in the calves.

When the heart is mainly affected the condition is called **wet beriberi**. This is high output cardiac failure and may result in pulmonary oedema and swelling of the feet.

Thiamine is essential for proper energy production in the brain. The combination of thiamine deficiency and alcohol can produce **Cerebral beriberi**, which is called Wernicke- Korsakoff's syndrome, a serious brain disorder.

### RIBOFLAVIN (B<sub>2</sub>)

Riboflavin was first recognized as a yellow – green pigment in milk. Riboflavin functions in two important enzymes FMN (flavin mononucleotide) and FAD (flavin adenine dinucleotide). These act as essential coenzymes in many reactions involved in carbohydrate metabolism.

Green leafy vegetables are a source of riboflavin.

Inadequate intake results in oral, ocular, cutaneous and genital lesions.

The most common signs are pallor and maceration of the mucosa in the angles of the mouth (angular stomatitis) and a red colour to the lips (cheilosis) followed by fissures that may leave scars when healed. There are other signs of disorders of the mucous membranes. Rarely there may be changes to the eye.

Riboflavin is crucial in the production of energy and is involved in regenerating glutathione, one of the main cellular protectors of free radical damage. Riboflavin interacts with thiamine.

### NIACIN (B<sub>3</sub>)

As the body converts tryptophan to niacin, niacin is not considered an essential nutrient as long as tryptophan intake is adequate.

Niacin is a component of the coenzymes NAD and NADP, which play an important role in energy production, fat, cholesterol and carbohydrate metabolism and in the manufacture of many body compounds including sex and adrenal hormones. It is also involved in the regulation of blood sugar, antioxidant mechanisms and detoxification reactions.

Inadequate intake causes pellagra, which is characterized by the 3 D'sdiarrhea, dermatitis and dementia. The skin develops scaly dermatitis, the brain does not function properly leading to confusion and dementia and the diarrhea results from impaired manufacture of the mucous lining of the gastrointestinal tract.

Niacin is involved with the other B vitamins in energy metabolism.

### VITAMIN (B<sub>6</sub>)

Vitamin  $B_6$  comprises a closely related group of compounds: pyridoxine, pyridoxamine and pyridoxal.

Vitamin  $B_6$  is required for the proper functioning of more than 60 different enzymes and plays a vital role in the multiplication of all cells. Pyridoxine is an extremely important B vitamin involved in the formation of body proteins and structural compounds, chemical transmitters in the nervous system, red blood cells, prostaglandins and mucous membranes. Vitamin  $B_6$  is critical in maintaining hormonal balance and proper immune function and is involved in the manufacture of all amino acid neurotransmitters.

Inadequate intake is rare but secondary deficiency may occur and result in changes in the skin, mucous membranes, the peripheral nerves and in blood.

Riboflavin and magnesium are necessary to convert pyridoxine to pyridoxal-5-phosphate and vitamin B<sub>6</sub> interacts with magnesium and zinc.

### PANTOTHENIC ACID (B<sub>5</sub>)

Pantothenic acid (vitamin B<sub>5</sub>) is required in the manufacture of coenzyme A and acyl carrier protein, two compounds that play a critical role in the utilization of carbohydrates and fats in energy production and in the manufacture of adrenal hormones and red blood cells.

A large number of foods contain pantothenic acid and its name is derived from the Greek word "pantos " which means everywhere.

Inadequate intake is characterized by "burning foot syndrome" which consists of numbness and shooting pains in the feet.

Panthothenic acid works in conjunction with carnitine and coenzyme  $Q_{10}$  in fatty acid transport and utilization.

### **BIOTIN**

Biotin is a B vitamin that functions in the manufacture and utilization of fats and amino acids (proteins). Without biotin, body metabolism is severely impaired. Biotin is manufactured in the intestines by gut flora.

Biotin functions in the body as an essential co-factor for four enzymes. The enzymes are carboxylases that add a carbon dioxide molecule to another molecule to form a carboxyl group. Biotin-dependent carboxylases are involved in the metabolism of sugar, fat and amino acids.

Inadequate intake is characterized by dry, scaly skin, nausea, anorexia and seborrheic dermatitis.

### FOLIC ACID (FOLATE)

The name is derived from the Greek word *folium*, which means foliage because it is found in high concentrations in green leafy vegetables. Folic acid functions together with vitamin B12 in many body processes. It is critical to cellular division because it is necessary in DNA synthesis and without folic acid cells do not divide properly. Folic acid is essential for the development of the central nervous system of the foetus and a deficiency of folic acid during pregnancy has been linked to several birth defects including neural tube defects like spina bifida.

Despite the wide occurrence of folic acid in food, folic acid deficiency is a common vitamin deficiency in the world. The reason reflects food choice as plants are a rich source but are not frequently consumed.

Inadequate intake affects all cells of the body but the rapidly diving cells such as red blood cells and the cells of the gastrointestinal and genitourinary that are affected the most. This may result in poor growth, diarrhoea, anaemia, gum disease and an abnormal pap smear in women.

The anaemia of folic acid (or B12) deficiency is characterized by enlarged red blood cells (macrocytic anaemia). Folic acid is a methyl donor. It carries and donates methyl molecules to facilitate reactions, including the manufacture of DNA and neurotransmitters.

Homocysteine is an intermediate in the conversion of the amino acid methionine to cysteine. An inadequate intake of folic acid results in raised levels of homocysteine. This compound promotes atherosclerosis by damaging the vessel walls and in osteoporosis elevated homocysteine levels lead to a defective bone matrix.

Folic acid works together with vitamin B12, vitamin B6, Choline and SAM (Sadenosyl-methionine).

### CHOLINE

Choline is essential in the manufacture of the important neurotransmitter acetylcholine and some of the main components of our cell membranes.

Choline is also required for the proper metabolism of fat. Although choline can be manufactured from amino acid precursors, it has recently been considered an essential nutrient.

When animals have an inadequate intake of choline they develop liver and kidney problems. An inadequate intake in humans results in liver dysfunction.

Choline like folic acid acts as a "methyl" donor. Choline supplementation increases the accumulation if acetylcholine in the brain an important chemical in many brain processes and may improve memory.

Choline works with other methyl donors and helps the body conserve folic acid and carnitine.

### **INOSITOL**

Inositol functions closely with choline and is a primary component if cell membranes.

Inositol is present mainly as a fibre component known as phytic acid. Intestinal bacteria liberate inositol from phytic acid.

Inositol like choline exerts a lipotropic effect. This means it promotes export of fat from the liver. Inositol is necessary for proper nerve, brain and muscle function.

Inositol works with other methyl donors.

### VITAMIN B<sub>12</sub>

Vitamin  $B_{12}$  is found mainly in animal foods.

Vitamin  $B_{12}$  works with folic acid in many body processes including DNA synthesis, red blood cells, and the insulation sheath (the myelin sheath) that surrounds nerves and conducts the impulse along the nerve. The stomach secretes intrinsic factor a substance required for the absorption of Vitamin  $B_{12}$ . Vitamin  $B_{12}$  is stored in the liver, kidney and other body tissues.

Inadequate intake affects the brain, spinal cord and the classic blood changes are pernicious anaemia. Impaired nerve function can cause numbness, pins and needles or a burning sensation. In addition to anaemia and nervous system symptoms Vitamin  $B_{12}$  deficiency can result in a beefy red tongue and diarrhoea.

Vitamin B<sub>12</sub> like folic acid is a methyl donor and is involved in homocysteine metabolism and plays a critical role in energy metabolism, immune function and nerve function.

Vitamin  $B_{12}$  and folic acid work in conjunction and as B12 works to reactivate folic acid and inadequate intake of  $B_{12}$  results in a folic acid deficiency only if folic acid levels are marginal. A high intake of folic acid may mask a  $B_{12}$  deficiency as it prevents the changes in the red blood cells but does not counteract the changes in the brain.

### VITAMIN C

The human body does not manufacture its own vitamin C. The primary function of Vitamin C is collagen formation, which is a major component of connective tissue, bones, cartilage, tendons and dentin. Specifically vitamin C aids in the joining of the amino acid proline to hydroxyproline resulting in a stable collagen structure.

In addition to its role in collagen metabolism vitamin C is also critical to immune function, wound repair, healthy gums, the manufacture of certain hormones and the prevention of easy bruising.

Vitamin C is a nutritional antioxidant.

In adequate intake result in lassitude, muscle pains, joint pains, poor wound healing, bleeding gums, extensive bruising and multiple small haemorrhages into the skin.

Vitamin C is intricately involved with other nutritional antioxidants especially vitamin E, selenium and □- carotene. Vitamin C increases the absorption of iron.

### VITAMIN D

Vitamin D is a fat-soluble vitamin and also considered a hormone, as our bodies can make it from sunlight. There are 2 major forms of vitamin D are  $D_2$  (ergocalciferol) found in irradiated yeast and vitamin  $D_3$  (cholecalciferol) formed in human skin by exposure to sunlight (ultraviolet light). Natural sources of vitamin D are cod liver oil, cold water fish, butter and egg yolks. The best vegetable sources of vitamin D are dark green leafy vegetables. Milk is fortified with both forms.

Vitamin D is a prohormone with several active metabolites that act as hormones. In the skin previtamin  $D_3$  is synthesized and slowly converted to vitamin  $D_3$  which is removed by vitamin binding protein and transported to the liver where is converted to  $25(OH)D_3$  the major circulating form. It is reabsorbed from the gut and in the kidneys it is further converted to the active form  $1,25(OH)_2D_3$  also called calcitrol or vitamin D hormone. The action of the active form is controlled by parathyroid hormone.

The main function of vitamin D is to:-

- Increase calcium and phosphate absorption from the small intestine.
- Promote normal bone formation and mineralisation.
- Maintain extracellular calcium homeostasis through its interaction with parathyroid hormone.

Groups at risk for low vitamin D levels are

- · People in residential care.
- Older people admitted to hospital
- Dark skinned women (particularly if veiled)

### Causes of vitamin D deficiency are

- Reduced intake
- Reduced synthesis
- Abnormal gut function and malabsorption e.g. small bowel disorders as celiac disease and inflammatory bowel disorders.
- Pancreatic and liver disorders.

Inadequate intake resulting in metabolic bone disease is called rickets in children and osteomalacia in adults. Rickets is abnormal formation of the developing bones and osteomalacia is demineralisation and softening of adults' bones.

### **VITAMIN E**

Vitamin E, a fat soluble vitamin, discovered in 1922, is a generic term for a group of related compounds called tocopherols which occur in four major forms, alpha ( $\square$ beta ( $\square$ ), delta ( $\square$ ) and gamma ( $\square$ ) tocopherols. Most animal species including human require vitamin E.  $\square$  - tocopherol is the most common and most potent form.

One of vitamin E 's basic functions is to protect cell membranes. In general, the tocopherols act as antioxidants to prevent lipid peroxidation of polyunsaturated fatty acids in cells membranes, meaning that is assists in destroying or neutralizing free radicals, the unstable oxygen molecules that cause damage to cells. Vitamin E is important to immune function protecting the thymus gland and circulating white blood cells from damage.

The principal use of vitamin E is an antioxidant in the protection against heart disease and strokes.

Good sources of vitamin E are seeds, nuts, whole grains, green leafy vegetables, berries and tomatoes.

Low levels of vitamin E occur in:-

- · Fat malabsorption syndromes such as celiac disease
- Premature infants
- · Disorders of red blood cells
- Haemodialysis patients.

The diseases caused by vitamin E deficiency are varied and may result in disorders of reproduction, abnormalities of liver, bone marrow and brain function, breaking (haemolysis) of red blood cells, muscle weakness and nerve damage.

Vitamin E interacts with other antioxidants especially vitamin C and selenium, improves the use of vitamin A, may be required to convert  $B_{12}$  to it's active form and protects essential fatty acids from being damaged.

### **VITAMIN K**

Vitamin K is essential for the manufacture of clotting factors. Recent studies show that vitamin K is also necessary for healthy bones and may play a role in preventing osteoporosis. There are 3 forms of vitamin K – vitamin  $K_1$  (phylloquinone) the natural vitamin K from plants; vitamin  $K_2$  (menaquinone) derived from bacteria in the gut; and vitamin  $K_3$  (menadione) a synthetic derivative.

One of the best sources of vitamin K is fat-soluble chlorophyll and the natural chlorophyll found in green plants is fat-soluble. Green leafy vegetables and green tea are a rich source of vitamin K.

Vitamin K plays an important role in bone health because it is responsible for converting a bone protein osteocalcin to its active form. Osteocalcin is the major non-collagen protein found in our bones and vitamin K is necessary for allowing osteocalcin to join with calcium and hold the calcium in the bone, assisting in the prevention of osteoporosis.

Vitamin K deficiency is rare in healthy adults because the bacteria in the gut can produce vitamin K<sub>2</sub>. Since newborns do not have gut bacteria they are susceptible to vitamin K deficiency. However, vitamin K deficiency can occur in adults with a marginal dietary intake if they undergo extensive surgery or long term treatment with antibiotics.

Vitamin K deficiency is caused by a reduction in clotting factors. Bleeding is the major manifestation whether the cause is dietary deficiency or antagonism of vitamin K by medications. Bruising, mucosal bleeding, excessive menstrual bleeding and haemorrhagic disease of the newborn occur.

Reduced vitamin K leads to impaired mineralisation of the bone and an increased susceptibility to fractures.

### **CHLOROPHYLL**

Chlorophyll, a phytochemical, is found in the chloroplasts of plants and is the substance that gives plants their green colour. This molecule, called a photoreceptor, absorbs sunlight and uses the energy to manufacture carbohydrates from CO<sub>2</sub> and water. This process, known as photosynthesis is essential for maintaining life in plants.

The basic structure of chlorophyll is a porphyrin ring with a central atom, attached to a protein so it can function effectively. This is very similar in structure to haemoglobin; the structure in red blood cells that transports oxygen, except in haemoglobin the central atom is iron, whereas in chlorophyll it is magnesium. There are actually 2 types of chlorophyll, named a and b. Both of these two chlorophylls are very effective photoreceptors allowing the plant to absorb the energy from sunlight. This discovery resulted in chlorophyll becoming a useful nutritional aid. Chlorophyll can be altered when heated as the central Magnesium atom is replaced by hydrogen.

Chlorophyll has a similar effect as iron and is a nutrient for red blood cells. This can assist cells to function at an optimal level in an oxygenated environment.

It has been reported that chlorophyll cleanses the body, and strengthens the action of the vascular and intestinal systems. Chlorophyll is a body cleanser, rebuilder, and neutralizer of toxins. Chlorophyll deodorizes the bowel, is a natural antiseptic to the intestinal tract. It is useful in external skin applications and as gargle. Chlorophyll boosts the immune system and is an antioxidant, meaning it has the ability to scavenge free radicals, protecting cells from damage. As chlorophyll is digested it is transformed into pheophytins which are much more stable than naturally occurring chlorophyll and are absorbed in the small intestine.

Chlorophyll is a potential anticarcinogenic substance and although the mechanism of action is varied, phytochemicals can inhibit carcinogenesis by inhibiting enzymes, scavenge DNA reactive agents and inhibit certain properties of a neoplastic cells.

The chlorophyll in Evolution is in the barley grass, which is also rich in vitamins and minerals and amino acids.

### **MINERALS**

Minerals are vital to human life. Without them, the body cannot function effectively. Minerals are inorganic substances that the body cannot manufacture. Minerals often work in partnership with vitamins. Even though minerals make up a small part of the body's actual weight, they are essential to life.

Six macrominerals are required daily by humans in varying amounts. Four of them, cations (sodium, potassium, calcium and magnesium) and two (phosphate and chloride) are anions.

Nine trace minerals (microminerals) are also required daily, namely, iron, iodine, fluorine, zinc, chromium, selenium, manganese, molybdenum, and copper.

### **BORON**

Since 1980, evidence suggests that boron plays a major role in calcium, magnesium and phosphorus metabolism, which is the major components of bone and recent research, indicates Boron has a protective effect against osteoporosis. Boron is necessary for the conversion of vitamin D to its active form.

Interestingly a diet rich in fruit and vegetables offers significant protection against osteoporosis and osteoarthritis, 2 conditions in which boron appears to offer benefit.

Inadequate intake may be associated with an increased risk for postmenopausal bone loss and increased urinary excretion of calcium.

### **CALCIUM**

Calcium in the most abundant mineral in the body and is vital to our health as 99% of all calcium in our bodies is found in our bones and it makes up 1.5-2% of the total body weight. Calcium builds healthy bones and teeth. Bone is dynamic living tissue constantly being replaced even in adults. Normal bone metabolism depends on many nutrients and hormones but for optimum bone health calcium and vitamin D are the most important factors.

The primary source of calcium is dairy products but green leafy vegetables also contain calcium. Inadequate intake in children may lead to rickets (bone deformities) and growth retardation. In adults it may result in osteomalacia (softening of bones) and contributes to high blood pressure and osteoporosis.

Low blood levels may result in muscle spasms and leg cramps.

Calcium interacts with many nutrients especially vitamins D, K and magnesium.

High doses of magnesium, zinc, fibre and oxalates reduce calcium absorption. Caffeine, alcohol, phosphates, protein, sodium and sugar increase calcium excretion.

### CHROMIUM

In 1959 chromium was identified as a substance called the "glucose tolerance factor" primarily because of its effects on blood sugar control mechanisms. Although it is thought to work closely with insulin in facilitating the uptake of glucose into cells, the apparent biological activity of chromium in promoting glucose tolerance remains unexplained. Without chromium, the action of insulin is impaired and blood sugar levels are elevated. Chromium is a factor in helping insulin work properly.

### COPPER

Copper is an essential trace mineral involved in several key enzymatic reactions and is the third most abundant essential trace mineral after iron and zinc. The highest concentration of copper is in the brain and liver and copper is also distributed in skeletal muscle, bone, bone marrow and skin.

Copper is a heavy metal present in the body bound to proteins. Excess copper absorbed in excreted via the bile.

It is required to convert the body's iron into haemoglobin and is essential for the utilization of Vitamin C. Our brain nerves and connective tissues depend on copper.

Inadequate intake results in iron deficiency and anaemia, as copper is required for iron absorption and utilization. Other symptoms are impaired immune function.

Copper also assists in the cross linking of collagen and a deficiency results in poor collagen integrity. This poorly formed collagen results in damage to blood vessels, osteoporosis and bone and joint disturbances.

Copper is a component of ceruloplasmin and superoxide dismutase and performs antioxidant functions and various copper complexes exert an anti-inflammatory effect.

A high intake of vitamin C, zinc, iron and other minerals may decrease the absorption of copper.

### IODINE

lodine is a trace element required in the manufacture of thyroid hormone (thyroxine and triiodothyronine) and 80% of the body's iodine is in the thyroid gland.

Inadequate intake of iodine results in a wide spectrum of illnesses and can affect any age but is particularly harmful in pregnant women and the newborn. The iodine deficiency disorders result in low thyroid hormone, which leads to an enlarged thyroid gland called a goitre.

Since iodine influences the thyroid and the thyroid controls metabolism, iodine plays an important role in brain function, energy and weight gain.

### **IRON**

Iron is an essential mineral and is critical for human life. It is necessary for the production of:- haemoglobin (red blood corpuscles) where it transports oxygen from the lungs to the body's tissues and returns carbon dioxide from the tissues to the lungs, myoglobin (red pigment in muscles) and certain enzymes including DNA synthesis.

Iron deficiency is the commonest nutritional deficiency in the world and is the most common cause of anaemia and symptoms of anaemia such as extreme fatigue reflect a lack of oxygen being delivered to the tissues and a build up of carbon dioxides.

Inadequate intake can also lead to excessive menstrual loss, learning difficulties, impaired immune function and decreased energy levels and physical performance.

High intake of other minerals mainly calcium, magnesium and zinc can interfere with iron absorption.

Vitamin C enhances iron absorption.

Anti-inflammatory medications may contribute to iron loss via gastrointestinal bleeding.

### **MAGNESIUM**

Magnesium is a mineral that has the ability to relax nerves and muscles. Its primary function is enzyme activation and approximately 60% of magnesium is in bone, 26% in muscle and the remainder in body tissues. The tissues with the highest magnesium are the most metabolically active, namely, brain, heart, liver and kidney. Most of the bodies' magnesium is within the cells and not in the serum (non cellular portion of blood).

Green leafy vegetables are a good source of magnesium.

Known as the "anti-stress" mineral, it also plays a role in helping to calm nerves. Magnesium is important in converting blood sugar into energy. This vital mineral is also necessary so our bodies can utilize Vitamin C, calcium, phosphorus, sodium and potassium in a more effective manner. Magnesium helps to keep teeth healthy and is a helper in bringing temporary relief from indigestion.

### **MANGANESE:**

Manganese is a component of several enzyme systems and is essential for normal bone structure. Intake varies greatly as rich sources of manganese are unrefined cereals, green leafy vegetables and tea.

Manganese functions in many enzyme systems including enzymes involved in blood sugar control, energy metabolism and thyroid hormone function. It also functions in the antioxidant enzyme superoxide dismutase (SOD), which prevents the damaging effects of free radicals.

Manganese helps to nourish the body's nervous system, brain and regulate muscles in the body. It is found in virtually all body tissues. This mineral works as an activator in helping to stimulate enzymes that can convert protein, fats and carbohydrates into energy.

It is important to both the male and female reproductive systems.

Human manganese deficiency is not as well defined as in animals. Studies indicate that deficiency could lead to a disruption of normal growth and metabolism.

### **MOLYBDENUM**

Molybdenum is a transition metal that forms oxides and functions as a component of several coenzymes including those involved in alcohol detoxification, uric acid formation and sulphur metabolism.

Molybdenum is derived mainly from meats, whole grain cereals and legumes. The concentration of molybdenum in foods depends on the soil content.

An inadequate intake of molybdenum manifests as an inability to detoxify sulphites because the enzyme sulphite oxidase is sulphite dependent. The features of sulphite toxicity are an increased heart rate, headache, nausea and vomiting. Molybdenum deficiency may be the cause of sulphite sensitivities.

Molybdenum is almost completely absorbed from the intestinal tract. Apart from the interaction between copper and fluoride, there are no known interactions with other nutrients.

### **PHOSPHOROUS**

Phosphorous, in the form of phosphate is critical for the formation and mineralisation of bone, the structure of teeth and works in conjunction with other minerals.

Phosphorous is present in lecithin in the form of phospholipids, which are a unique mixture of nitrogen, fatty acids and glycerol and assists in the metabolism of fats and carbohydrates.

Hormones produced by the pancreas, thyroid, and adrenal glands require small amounts of phosphorous to function effectively.

### POTASSIUM AND SODIUM

Potassium and sodium, positively charged molecules, are electrolytes, which are mineral salts that conduct electricity when dissolved in water. A negatively charged molecule like chloride always accompanies potassium or sodium. Chloride is the ionic form of chlorine.

Good sources of potassium are green leafy vegetables.

Potassium is the most abundant cation inside cells and is mainly in muscle. Only about 2% of potassium occurs out side the cell and sodium is the major cation outside the cells, namely, the extracellular compartment. The total body sodium content is regulated by dietary intake and renal excretion. Potassium and sodium interact via a sodium-potassium pump, which is on the cell membrane and controls the amount of sodium and potassium inside and outside the cell. This pump also maintains the electrical charge of the cell for muscle contraction and nerve impulse transmission.

Potassium is an important dietary electrolyte. It is essential for the conversion of blood sugar to glycogen, which is stored in the liver and used for energy.

Insulin is vital for potassium to enter the cells and insulin disorders such as diabetes result in high blood potassium.

A potassium deficiency is characterized by muscle weakness, fatigue, confusion, irritability, heart disturbances and problems in nerve conduction and muscle contraction. A depletion of potassium occurs through excessive sweating, diahorrea and vomiting.

A diet low in potassium and high in sodium is associated with high blood pressure. Numerous studies show that a diet high in sodium and low in potassium plays a major role in the development of cancer and cardiovascular disease, namely, heart disease, high blood pressure and strokes.

Patients with kidney disease do not handle potassium in the normal way. Potassium interacts with magnesium in many body systems.

### **RUTIN**

Rutin is a member of the bioflavinoids, a group of metabolites occurring in plants. Rutin is important because it strengthens capillaries and controls the permeability of vessels walls. This may assist with bruising, haemorrhoids, and varicose veins. It is also a powerful antioxidant scavenging free radicals. It may be of value in high blood pressure and atherosclerosis.

### **SELENIUM**

Selenium is a part of the enzyme system glutathione peroxidase, which metabolises hydroperoxides from polyunsaturated fatty acids. Selenium functions as an antioxidant in conjunction with vitamin E to prevent free radical damage to cell membranes and other antioxidants work synergistically to raise glutathione peroxidase levels. Selenium is required for the production of thyroid hormone and it is antagonistic to heavy metals like lead, mercury, aluminium and cadmium.

The concentration of selenium in foods is directly related to the soil content.

It has been reported that low levels of selenium are linked to a higher risk for cancer, cardiovascular disease and inflammatory diseases

### SILICON

Silicon is the second most abundant element on earth and was recognized as an essential nutrient in 1972. The exact biological role of silicon is undetermined, however it is required for integrity of hair, skin, ligaments, tendons and bone.

Rich sources of silicon are unrefined grains.

Silicon is required for the enzyme prolyhydroxylase, that functions in the formation of collagen in bone, cartilage and other connective tissues.

Silicon deficiency has not been documented in humans

### SULPHUR:

Sulphur is vital for healthy hair, skin and nails. It also plays an important role in maintaining oxygen balance assisting the brain to function. Sulphur interacts with B-Vitamins.

### **ZINC**

Zinc is in every cell in the body and is found mainly in bones, hair, teeth, skin, liver, white blood cells and testes. Other tissues with high zinc concentrations are kidney, pancreas, retina and prostate. Zinc is a component of at least 200 enzymes and functions in more enzymatic reactions than any other mineral. It is required for protein synthesis and cell growth and therefore for wound healing.

Rich sources of zinc are shellfish, fish and meats. Good concentrations are found in several plant foods.

Adequate zinc levels are essential to good health, as zinc is involved in virtually every aspect of immunity.

Marginal zinc deficiency may result in an increased susceptibility to infection; poor wound healing, decreased sense of taste of smell and a number of minor skin disorders including acne, eczema and psoriasis.

### **AMINO ACIDS**

Amino acids, the building blocks of proteins, are individual chemical substances found in foods that the body digests and then recombines to form specific proteins. Without amino acids there would be no proteins. There are two types of amino acids, essential and non-essential. The body can manufacture non-essential amino acids but essential amino acids are the components obtained from various food sources in the diet. Of the 20 amino acids in proteins, 9 are essential, all humans require 8 and infants require two more, histidine and arginine.

The essential amino acids are:- Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine.

Dietary proteins provide amino acids to build and maintain tissues. This need continues throughout life. Every cell in the body requires amino acids, which have the following functions:-

- Maintain and repair muscles, tendons, skin, ligaments, organs, glands, nail and hair.
- Production of certain hormones including insulin, thyroxine, adrenaline, parathyroid hormone, calcitonin and some of the pituitary hormones.
   Hormones are regulatory substances secreted by endocrine glands and are transported in the blood to specific sites.
- Formation of neurotransmitters, which are message-carrying chemicals in the brain.
- Involved in the synthesis of all enzymes including digestive enzymes and those required for oxidation, reduction and all chemical processes in the cell.
- All antibodies in the blood belong to a class of proteins called immunoglobulins, which react to foreign antigens in the blood. This reaction is called the immune response.

The amino acid composition of proteins varies widely. The extent to which a protein matches the amino acid composition of animal tissues determines its biological value (BV). An egg provides all of the essential amino acids in adequate amounts for protein synthesis and the BV is a 100. Animal proteins in milk and meat have a high BV (~90) whereas proteins in cereal and vegetables have a lower BV (~40). A correct balance in the diet is BV~70. The major cause of amino acid deficiency is a poor diet low in protein, amino acids and may be affected by infection, stress, trauma and medications.

### Important

This information is intended for educational purposes only and is not recommended as a means of diagnosing, prescribing for, or treating any disease, illness, or injury. The author, publisher, and printer do not accept responsibility for such use. All matters concerning physical and mental health should be supervised by a health practitioner knowledgeable in treating that particular illness. It is hoped that this information will empower you to make more informed decisions regarding your health and wellbeing.

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Aconcentrate of Special elements abundant in sea water has exerting polential in inproving the soil increasing crop yields assisting human and animal health and even in combatting climate change.

by Roger Taylor, PhD, BVSc © 2006 Email: rogerbt@onetel.com Also published in *Caduceus*, issue 71, Spring 2007 Website: http://www.caduceus.info

# A POSSIBLE NEW STATE OF MATTER WITH PROMISE FOR AGRICULTURE AND HEALTH

his article introduces a recent and so far little-known discovery which could be of great importance for the future of the world. But the scientific stakes are high: if these claims are fully borne out, we should have to take cognisance of a group of substances—probably chemical elements—whose very existence up till now has not been suspected. It is for these that the name ORMUS has been coined. Some of the highly controversial ideas about what they are, and about their extraordinary chemistry and physics, are outlined below.

But first, the practical import of the discovery consists in the beneficial effect of these elements on plant and animal life. As detailed below, the effect of supplementing these elements on the growth of plant crops is no less than phenomenal. Remarkable benefits to human and animal health have also been obtained.

### David Hudson's discovery of ORMEs

The story of the discovery begins in the late 1970s with a rich cotton farmer in Arizona named David Hudson. Because the volcanic soil in that region had unusual properties, and the underlying rock was known to contain precious metals, he decided to have a complete elemental quantitative analysis done on it. His analysts were then puzzled to find a fraction which defied analysis: it had no metallic characteristics, no chemical reactions and no spectroscopic signature. Eventually one spectroscopist suggested giving it a "longer burn". It was only then that spectral characteristics began to appear and, most surprisingly, they were suggestive of certain precious metals. Clearly this demanded further investigation so, having considerable private finances; Hudson hired some chemists and determined to solve the problem. The results of what he found are written up in considerable detail in his patent. He also gave a number of public lectures. It was from watching nine hours of videotape of these that I first learned about the phenomenon.

However, no single article on this subject has appeared in any scientific journal. It is because Hudson's claims are so challenging that I have delayed writing about it, in the hope of finding academic confirmation. While no official academic research appears to be underway, a loose group of scientists and lay people has been working on this subject for a number of years. Without the benefit of funding or official laboratory premises, and having no connection with Hudson, they have managed to reproduce at least some of his claimed findings. Their work, together with that of Hudson, is summarised in a number of articles by Barry Carter on his very extensive and informative website. There are also several lively Internet email forums, one of which, a science working group, discusses various aspects of the chemistry and physics as well as the methodology for extracting and analysing these materials.

So what conclusions can be drawn so far? It is becoming clear that, with this discovery, we are entering into a new and very complex area and are still very low on the learning curve. Indeed, it might be said that a new chapter in physics, chemistry and biology is being opened. The basic fact seems now beyond doubt, both from Hudson's work and that of the independent group, that a number of precious (and some not so precious) metals, including rhodium, iridium, gold, platinum, palladium, copper and several others, can exist in a completely different state, in which they are not metallic—being grey or white powders when isolated in the solid state.

Hudson made three other main claims, which could be more arguable. He said that, in

the ORMUS form of these elements, the electrons are re-arranged in such a way that they no longer participate in chemical reactions. Likewise, the bonds which normally hold metal atoms together in the solid form are lacking, so that they would be effectively monatomic. Because of this, he originally named them Orbitally Re-arranged Monatomic Elements, or ORMEs. More recent work now suggests that at least some of these may be diatomic, and also that very loose bonds can exist with certain other elements, particularly alkaline metals. Hence the generic name has been changed to ORMUS. They are also frequently referred to as the M-state of these elements.

Another, and still more radical, claim is that the electron rearrangement involved the formation of Cooper pairs, so that they can be (or can become with certain treatments) superconductive at normal temperatures. In support of this, Barry Carter has posted a short video file showing a grey powder jumping away from a magnet. It can be argued, however, that this "grain-hopping" phenomenon does not, of itself, prove superconductivity. Without going further into this controversy, it is worth mentioning that there are a few mainstream publications which Hudson claimed could provide indirect support.3 These identify a "high-spin" state into which certain heavy metal atoms can be made to enter and in which the nucleus becomes elongated and takes on a higher value of spin. But no one has obtained this kind of matter in bulk.

Hudson performed analyses on a wide variety of materials and reported finding ORMUS elements in most of the samples of soil he tested, but especially soils from volcanic regions. Other researchers later found them to be present in most samples of natural waters tested, with particularly high concentrations being present in the sea and especially the Dead Sea. One researcher has even found it in the air. (Here it is perhaps not too surprising that even a heavy element in the monatomic form could behave like a rare gas.)

Hudson's chemists made analyses of a number of plant tissues

and found ORMUS to be highest in plants, especially aloe vera, which are grown in volcanic soils. They also analysed calf and pig brain tissue and obtained a remarkable five per cent of the dry-matter content. These analyses are not easy, since they require conversion of the ORMUS content back into the metal form. For analytical purposes, this occurs during the "long-burn" spectroscopic procedure used by Hudson. But to prepare the metals in bulk is a very lengthy procedure, and one far from being sufficiently worked out or described. Very few of the independent researchers have access to the facilities necessary for spectroscopy, and I know of none who is in a position to do this kind of work officially. Unfortunately, for a variety of reasons (financial and legal have been suggested), Hudson himself does not appear to be doing any more of this work.

A great deal more needs to be done on the physics and chemistry, not least to elucidate some of the extraordinary phenomena which have been observed. For example, on drying an aqueous preparation of ORMUS rhodium on filter paper in sunlight, Hudson observed it to disappear with an intense flash of light, but with no sound or shock wave. Still more strange, when working with ORMUS iridium and subjecting it to repeated heating to red heat and cooling, he found its weight to oscillate violently with each cycle of annealing-even, at one point, to lose and then regain all of its weight. This result has been incorporated into the hyperdimensional theory of Finnish theoretical physicist Matti Pitkänen.4

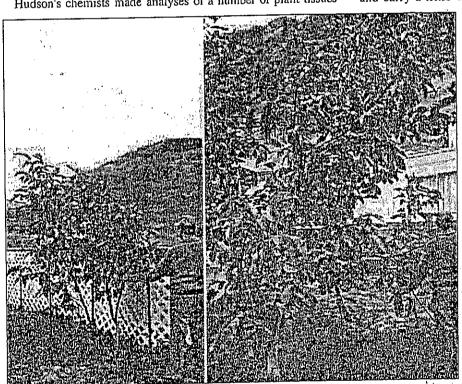
Independent researchers have confirmed the soundless flash of light, and there is one claim to have confirmed the weight changes. Several of them have observed another strange phenomenon: drops of liquid, containing concentrated ORMUS, forming on the outside of closed containers—especially under the influence of magnetic fields. This has led them to suppose that ORMUS atoms can pass through the walls by quantum tunnelling, and carry a little water with them. Also unexplained is the

observation that certain ORMUS preparations in aqueous solution acquire a static electric charge. This can be discharged with an audible spark, after which the charge will re-form and can again be discharged an indefinite number of times.

### **Biological effects of ORMUS**

The biology of these materials is also wide open to investigation. It could be said, however, that the new chapter in biology has already been opened; in the quantum understanding of life. According to this view, the holistic properties of life are only accountable on the basis of quantum coherence; that is, the apparently random activity of biological molecules (according to classical thermodynamics) is actually coordinated by the same quantum principles which govern the action of a laser. This radical re-visioning of biology has been persuasively introduced by Dr Mae-Wan

Further vistas in quantum biology have been opened in some exciting recent work which suggests that, while a small fraction of the DNA functions by coding for proteins, the bulk of it (the so-called "junk"



The walnut tree on the right, treated for several years with ORMUS, is now producing six times the weight of nuts compared to untreated trees on the left. (Source: http://www.subtleenergies.com/ORMUS/tw/walnuts.htm)

DNA) operates in a way that's independent of chemistry to inform the quantum "field" of the body. This, together with a number of publications which suggest the presence of superconductivity in living organisms, might support Hudson's speculations on the close involvement of ORMUS with DNA—even that it can actually correct DNA damage.

Hudson foresaw that there could be great potential for these materials in industry—especially as his analyses led him to conclude that far more of these precious elements exist in the world in this form than in the metallic form. At some point, however, his uncle, who had an interest in alchemy, suggested that if he looked into this subject he might see a connection with the "white gold" that some of the alchemists had described and which had properties of healing and extending life-span." He therefore gave an ORMUS preparation to a very sick dog, which was likely to die from both cancer and tick fever. When the dog recovered, human volunteers began to offer to take it themselves, apparently with good results. Hudson then gave samples to a

number of doctors, with the suggestion that they try ORMUS on a few of their terminal patients. In his talks, he gives graphic reports of some of the remarkable recoveries which occurred. He also mentions that he gave a sample of ORMUS rhodium to a number of laboratories, including Merck & Co. and the US National Cancer Institute, which tested it on cultures of cancer cells and found it not to be toxic to these cells.

Since then, numbers of independent producers have sprung up, making and selling ORMUS

concentrates prepared from various sources, including sea water, water from deep springs, salt mined from mineral deposits and certain medicinal plants such as aloe vera. There are now probably some thousands of people taking these products. While most of them seem to have had no history of serious illness, many have obtained improvements in general health and energy, often including changes in attitude which they take to be spiritual. Nevertheless, a few reports can be found from within the forums of ORMUS-attributed recoveries from serious illnesses including cancer. All of the data on human health, however, has to be classed as anecdotal. There have been no clinical trials, not even any collated tables of results. And here, of course, it has to be understood how much care needs to be taken not to make medical claims for materials such as these, for which no precise analyses exist.

While eschewing medical criteria, however, one can show a more immediate effect of ORMUS by certain techniques widely used to monitor the effectiveness of energy medicine therapies. One is dark-field microscopy of the blood. In a few hours after taking ORMUS (as with many other beneficial treatments, such as acupuncture, massage, etc.), a person's red cells are shown to become more rounded and well-separated and the amount of debris in the serum decreases. There are also reports from EEG studies of increasing balance between left and right hemispheres of the brain.

Another promising technique is bioelectrography. This is a more general term to cover Kirlian photography and later developments from it. It has been elaborated into a quantitative science by Dr Konstantin Korotkov. 10,11

Here I report my own experience. I had been taking a proprietary preparation of ORMUS for about one year, and had been aware of increased energy and a feeling of "well-being". For the test, I used the GDV (gas discharge visualisation) equipment designed by Dr Korotkov. First, I ceased to take the ORMUS for a period of two weeks, then took an initial (control) reading with the GDV, and immediately after this I took a large dose of ORMUS (six times the recommended daily dose), and then took further readings at intervals subsequently. Figure I [not shown here; Ed.] shows the time course of the response, in which the area of the image rose to a maximum of 1.5 times the control at about four hours, then declined slowly over the next 12 hours. From Dr Korotkov's extensive work with the GDV, it is clear that, of the many parameters of the image which can be analysed, the area is the one most indicative of general health.

For readers who want to make some of these products themselves, see descriptions of methods on Barry Carter's website.<sup>12</sup> The simplest procedure involves merely raising the pH

of a solution of sea salt to between 10.6 and 10.78. The resulting precipitate, mainly magnesium and calcium hydroxides, carries down the ORMUS elements with it. It only remains to wash out the bulk of the salt.

### ORMUS results in agriculture

In view of the difficulties in obtaining scientific data on human health, most of the emphasis must go to the effects on plants. These are unarguable, and are indeed phenomenal. They can be seen on several websites.<sup>13</sup>

The preparation most used is the simplest and cheapest: a crude concentrate made from sea water. There is in fact a history, prior to the discovery of ORMUS, of the use of products from the sea, particularly seaweed, in agriculture. Some people have even reported good results from putting unaltered seawater on the land.

Dr Maynard Murray<sup>14</sup> recorded a great deal of data on the health of animals fed on grain from sea water-treated land. One experiment was done with a strain of mice, of which 90 per cent normally develop spontaneous breast cancer. Of those fed the grain from treated land, however, only 55 per cent developed the cancer, and in the second generation this figure was reduced to two per cent. Of course, land so treated would eventually become oversalinated and the yields would decrease. The procedure to concentrate ORMUS, however, probably increases its ratio to salt about 80 times. We note Dr Murray's comment that human populations where malignancy is rare tend to be found in areas where there is "very little egress of water to the sea", so that the vital elements washed down from the mountains remain to be reutilised.

Very little of the concentrate is required: from four to 20 litres per acre [~0.405 hectare], depending on the crop. The results of using ORMUS concentrate, however, far outstrip those with sea water. Indeed, without the photographic evidence, they would be hard to believe. For example, a walnut tree treated over several years has grown to over twice the height of control trees and now produces six times the weight of nuts—and the nuts themselves are the size of tangerine oranges! A plum tree produced, in the first year of treatment, individual fruit nearly twice the weight of those from the control tree, and in the second year they were over

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five times the weight. One photograph shows maize plants so high that the owner has to stand on a stepladder to reach the top. They appear to be some 12 feet [~3.6 metres] high. Oranges were produced the size of canteloupe melons! There are many other examples. In addition, there are consistent reports by those using ORMUS that ORMUS-treated crops are not only much more productive, but they also mature earlier, need less fertiliser and have greater resistance to pests. They even taste better!

My own experience is with potatoes. Of four rows (comprised of two varieties), two were treated and two received an equivalent watering. At harvest, the aggregate weight of the controls was 31 pounds [-1.41 kilograms] and the treated was 58 pounds [~2.63 kilograms]. In addition, although I have no strict controls, some of my carrots have weighed over one pound [~454 grams].

There has been a consistent finding that yields further increase

during the second and subsequent years after treatment. This is very probably due to the effect of ORMUS in building up the soil's content of mycorrhizaethe fungal symbionts which are necessary for plant growth. We have yet to give sufficient recognition to the importance of these fungi.15 They become seriously depleted by overuse of chemical fertilisers and herbicides.

Of course, there is no proof that these results, impressive as they are, are due to ORMUS. Some might still argue that the effects are due to supplementation

with conventional minerals. This, as with so much of the foregoing, must await more precise scientific work.

Potential applications for ORMUS elements

However, there is no call to wait for such work before making use of these discoveries. The growth of world population is inexorable; at the same time, the area of arable land is limited and already is nearly all cultivated. If it is possible to increase production even two times with this very cheap sea water preparation, then abundance would replace the starvation which otherwise looms over us. And, even without the use of ORMUS as a direct supplement, human health would be greatly enhanced. Furthermore, since sea water cannot be patented, there is little danger that multinational companies would be able to corner the market and sell the product at inflated prices, beyond the means of Third World farmers.

How has it come about that plants, land animals and humans seem to be chronically deficient in these elements? Since they are so concentrated in sea water, one might suppose that, during the life of the Earth, they have been largely washed into the sea. This could provide a partial explanation for the increasing desertification of so much of the land. And the general decline in plant growth would contribute to the rise we are seeing in atmospheric carbon dioxide, and thus to global warming. Treating large areas of land could thus have immense benefits in offsetting global warming. One could imagine spraying large areas, especially forests, from aeroplanes. In addition, to replace fossil fuels, it would be possible to produce much greater quantities of biofuel crops on smaller areas of land.

Time is short. If we are to avert the worst environmental catastrophe, many kinds of actions need to be taken. Among

these, a very important role could be played by treating land with these sea water products. We need to start doing this now. That is why I ask anyone reading this article to make every effort to spread information about ORMUS.

About the Author:

Roger Taylor, PhD, BVSc, has a PhD in immunology and set up the UK Medical Research Council's Immunobiology Research Group at the University of Bristol, where he

University of Bristol, where he directed work mainly on immunological tolerance. He has spent the last 18 years independently studying the scientific basis for subtle energy.

Dr Taylor is science editor/writer for Caduceus, and his ORMUS article is also published in Caduceus, issue 71, Spring 2007 (Caduceus Journal Ltd, 9 Nine Acres, Midhurst, West Sussex GU29 9EP, UK, telephone +44 01730 816799, website http://www.caduceus.info). He can be contacted by email at rogerbt@onetel.com.

### Editor's Note:

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ORMUS-treated crops are

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For background information on ORMEs, see David Hudson's twopart article "White Powder Gold: A Miracle of Modern Alchemy" in NEXUS vol. 3, nos 5 and 6; and Laurence Gardner's three-part article "Star Fire: The Gold of the Gods" in NEXUS vol. 5, no. 6 and vol. 6, nos 1 and 2, as well as "Lost Secrets of the Sacred Ark" in NEXUS vol. 10, no. 2.

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