

*The secrets of the Tahitian Noni plant revealed  
through a systematic review of scientific studies of  
its component substances and of the Noni plant as  
a whole.*

# **WHY NONI WORKS!**

**A Reference Book for  
The Biological Activity of the  
Constituents of  
Morinda citrifolia  
(NONI)**

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# **Morinda citrifolia ("Noni")**

*The reference book for research  
studies on the components  
of Morinda citrifolia  
and on Noni Juice*

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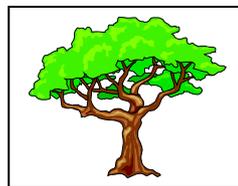
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## Preface



### WHEN I FIRST CAME IN CONTACT

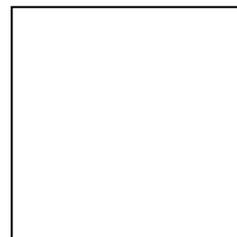
With Noni Juice I was curious as to how one fruit juice could positively affect so many people with so many different health conditions. There was a large body of anecdotal evidence that Noni Juice, a fruit juice extracted from the fruit of the *Morinda citrifolia* tree, was a nutrient miracle. Many people with a variety of medical conditions claimed an improvement in wellbeing and a reduction in the number and/or severity of their symptoms after drinking Noni Juice for varying lengths of time and in varying quantities.

*Noni Juice should be a part of everyone's daily diet because of its exceptional nutritional value.*

This booklet briefly describes research studies into the *Morinda citrifolia*, (Noni) plant and its components. Implications may be drawn from the results of these studies as to the possible effect on the human body. Studies on the components, for instance, scopoletin, may have been conducted on the compound being extracted from other plants. The results demonstrating the biological efficacy of the particular substances are valid nonetheless.

The material presented in this publication is by no means exhaustive as research is continuing on this remarkable plant and its components. There are more articles written about the components of Noni than are referred to here.

It is my hope that the reader will find enough information gathered in this booklet to stir their curiosity so that they may investigate Noni Juice further. This may be done either by literature search, clinical trials or drinking the juice. May it be an enjoyable journey of discovery for the inquiring mind.



## Introduction

Noni juice is derived from the fruit of The tree, *Morinda citrifolia*. This beautiful tree grows in abundance in the warm high-rainfall tropical areas of the world such as French Polynesia, Australia, Malaysia, Samoa and Tonga.



It is also found in areas of mainland Asia, Central America and India. Noni juice has been widely used as a traditional medicine for some millennia but has only recently been introduced to the general world market. It is receiving world-wide acceptance because modern man is discovering what traditional cultures have known for centuries – Noni juice provides wonderful health-promoting benefits.

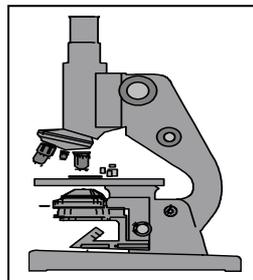
While stories of health-giving benefits of Noni juice abound, these reports are more particularly attached to the Noni that is grown in French Polynesia. This is probably due to fruit being picked in the wild (wildcrafted) from trees growing in the mineral-rich volcanic soil of the islands. The soil has not been depleted by continuous and intense cultivation as have many other areas of the world where Noni now grows.

Part I of this booklet outlines the content of some research papers discussing various components of *Morinda citrifolia* as well as the Noni plant as a whole.

Part 2 reports anecdotal evidence on the efficacy of Noni juice in animal health. Following the text is an index. References for the various research articles then follow.

# PART 1

Some of the constituents of *Morinda citrifolia* are as follows:



## Anthraquinones:

Alizarin	Anthragallool
Anthragallool 1,2-dimethyl ether	Damnacanthal
Lucidin	Morindone
Nordamnacanthal	Rubiadin
5,6-dihydroxylucidin	3-hydroxymorindone
7-hydroxy-8-methoxy-2-methylantraquinone	
2-methyl-3,5,6-trihydroxy-antraquinones	

## Terpenes

Limonene  
Sorandjidiol  
Eugenol  
Beta carotene  
Ursolic Acid

## Sterols

Beta-sitosterols  
Stigmasterol  
Campesterol

## Glycosides

Asperuloside  
3-hydroxymorindone-6- $\beta$ -primeveroside  
5,6-dihydroxylucidin-3- $\beta$ -primeveroside  
6,8-dimethoxy-3-methylantraquinone-1,0- $\beta$ -rhamnosylglucopyranoside  
lucidin-3- $\beta$ -primeveroside

## Amino Acids

Alanine	Arginine	Aspartate	Cystine
Histidine	Isoleucine	Leucine	Lysine
Methionine	Phenylalanine	Proline	Serine
Threonine	Tryptophan	Tyrosine	Valine
Glycine			

### Acids

acetic acid	benzoic acid	butanoic acid
decanoic acid	elaidic acid	heptanoic acid
hexanedioic acid	hexanoic acid	isobutyric acid
isocaproic acid	isolavenic acid	lauric acid
linoleic acid	mystiric acid	n-butyric acid
valeric acid	nonanoic acid	octaduenoic acid
octanoic (caprylic)	oleic acid	palmitic acid
ricinoleic acid	stearic acid	undecanoic acid
unolic acid		

### Others

Scopoletin	Pectin	Morindine
Morindadiol	Iridoids	

### Vitamins and Minerals

A,C,E,B<sub>1</sub>,B<sub>2</sub>,B<sub>6</sub>, B<sub>12</sub>, Niacin, Biotin, Pantothenic Acid (B<sub>5</sub>), Folic Acid, Calcium, Iron, Phosphorus, Magnesium, Zinc, Copper, Chromium, Manganese, Molybdenum, Sodium, Potassium.

### Sugars

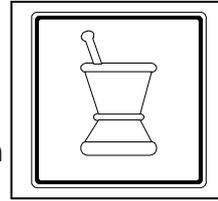
Fructose	Glucose	Hexose	Rhamnose
Pentose			

#### **SYNERGY**

*Nature keeps us healthy in a wonderful dynamic way by producing all the nutrients our bodies require in synergistic packages – we call these packages “fruits”, “vegetables” and “herbs”. The nutrients in these bounties of nature work together to optimize their effect in the tissues of our body systems.*

*The collective benefits of the nutrients contained in these products are much greater than the addition of single individual benefits. A case of 1 + 1 = 3.*

## A discussion of research studies for components of Noni



In the following pages some of the research studies on Noni juice and the biologically active components of *Morinda citrifolia* will be discussed.

### ***Anthraquinones***

These substances consist of a large group of naturally occurring chemicals found in higher plants such as the Noni plant, as well as in lower plants such as the mosses, lichens and fungi. It is interesting to note that they may also be found in some sea animals and algae.

Some anthraquinones have been used more commonly as dyes and pigments and analytical reagents in research studies. <sup>(1)</sup> However, anthraquinones have a wide variety of biological activities attributed to them. They also have very low toxicity.

Some of this biological activity includes fighting inflammation, bacteria, parasites and tumours. Some of these compounds are also considered analgesics (pain relievers). Studies with *Morinda citrifolia* have confirmed the juice of this plant to be strongly analgesic (ie. pain-relieving). In fact such studies indicate it is 75% as effective as morphine sulphate without the toxic side effects of morphine. <sup>(2)</sup>

**Studies have found Noni Juice to be 75% as effective as morphine for pain relief**

Anthraquinones are also used to fight fungal infections as well as possessing the ability to improve the immunity of the body. Anthraquinones participate in the processes of

metabolism, cellular respiration and growth. As a result of research carried out in Japan in 1993 it is now believed that **damnacanthal**, one of this group of compounds, is able to inhibit the formation of tumours by interfering with the growth of RAS cells. (3) These cells are the precursors of many malignant growths. It is also believed that damnacanthal and some of the other anthraquinones may cut off the blood supply to tumours, thereby depriving them of their nutrients. This could account for the many stories from medical practitioners and cancer patients alike about the reduction of tumour size after having drunk large quantities of Noni juice for some time.

In another summary of research carried out in Poland, the researchers wrote: "Anthraquinone compounds belong to the most important class of clinical anti-tumour agents".(4) These researchers also note that the anthraquinones may be responsible for some damaging peroxidating activity which is damage done to cells by oxidation. However, when anthraquinones are found in a synergistic formula such as Noni juice, then the strong anti-oxidant effects of other components, such as beta-carotene will overcome many negative effects. Beta-carotene mops up free radicals of oxygen very efficiently. (5)

***Evidence suggests that anti-oxidants in Noni include beta carotene, vitamins E & C, and cystine which combat the potentially destructive oxidative effects of the environment in our cells. A basic requirement of good health is our body's ability to supply adequate anti-oxidants to meet our requirements.***

Turning our attention once more to Japan, we find that in 1998 a study was conducted investigating the biological

activities of the anthraquinones **damnacanthal, rubiadin, nor-damnacanthal, morindone and lucidin 3-O-primeverodise**. The results of this work demonstrate that these particular substances show a powerful slowing effect on the growth of tumours by inhibiting important enzymes needed to form tumours. (6)

Extracts of damnacanthal have been shown to kill the parasite *Plasmodium falciparum*, the organism that causes malaria. (7) Malaria is considered one of the biggest health problems in the world today, especially in developing nations. During World War II this disease was a major challenge to troops. It was recorded that five times as many soldiers in the South Pacific area were incapacitated by malaria than by combat. *Plasmodium falciparum* and *P. vivax* (another form of the parasite) account for over 95% of malarial infections in the world today. (8) This makes any substance containing damnacanthal extremely important in the tropical areas where the malarial parasite abounds. It is probably no coincidence that Noni is plentiful in such areas.

Damnacanthal is also potent against leishmaniasis, a parasitic condition common in Central and South America, North East and Central Africa, the Mediterranean and Asia. This unpleasant and debilitating parasitic disease is transmitted by a species of fly which transmits the parasite in its saliva when it bites the victim. Skin and mucous membrane (such as the mouth and nasal passages) lesions result and if left untreated develop into a severe ulcerative condition. (9)

**Alizarin**, another anthraquinone, is the parent form of many dyes and pigments used in industry and medical research. It also has some medical applications and has

proven itself to be another useful combatant in the fight against leishmaniasis when taken together with other drugs used for the same purpose.

*It is of interest that in nature where we find a disorder or a threat to our health, there is often an antidote close by, usually as part of the plant kingdom. All we need to do is to find it.*

Alizarin also slows tumour growth (10) as well as fighting leukemia. (11) It is of interest to note that alizarin also inhibits the human immunodeficiency virus (HIV). (12)

Some anthraquinones isolated from other plants were found to significantly “tie up” the mineral calcium and reduce the growth rate of urinary crystals.(13,14) This is good news for those afflicted with gout and kidney stones. (15)

### **Terpenes**

Terpenes are a family of compounds that are widely distributed in the plant world. Some have biological activity while others are used only for various commercial purposes. These are the substances that occur in most of the essential oils and resins in plants. For instance terpenes are the major components in the oils of citrus fruits and they include the bioflavonoids and the carotenoids. These substances combat fungal and bacterial infections and there are many stories claiming that terpenes are helpful in the treatment of glaucoma, spastic symptoms of multiple sclerosis, spinal lesions and in reducing the severity of side effects of chemotherapy.

**Eugenol** is a terpene, which is an active germicide and

flavouring. It is the chief constituent of the oil of cloves and is widely used in dental treatment as an analgesic. (16) Eugenol induces anesthesia of the trigeminal nerve found in the head which is associated with trigeminal neuralgia or tic douloureux. This condition expresses itself with sudden and intense pain along the side of the face. Eugenol has been shown to be anti-tumour and while little is known about *how* eugenol works some research studies have turned up interesting information concerning its biological activities.

One study has discovered that eugenol relaxes smooth muscle by interfering with the muscle's contraction. (17) Eugenol is also found in a variety of aromatherapy oils including Melissa (Lemon Balm), Myrrh, Nutmeg and Ylang Ylang, all of which are used for their soothing, calming and comforting effect. The traditional use of these oils may be attributed to the relaxing effect eugenol has on the smooth muscles of the body.

***Fats within our bodies (especially in our cell membranes) become rancid or oxidised as do our minerals also. Free radicals are destructive molecules found in our bodies that cause oxidative damage to the fats and may be created by our body's exposure to chemicals, drugs, radiation, gases and heavy metals such as mercury and lead. This can lead to chemical sensitivity, inflammation in body tissues and over stimulation of the immune system, creating allergies etc.***

**Beta-carotene**, another terpene, is a carotenoid, a member of the most widespread group of naturally occurring

pigments in nature. Carotenes are the most potent quenchers of the singlet oxygen free radical and are many times more potent than vitamin E in this regard.

Research studies in human subjects have demonstrated that a high intake of beta-carotene is associated with a reduced rate of cancers of the cells of the lung, skin, cervix, respiratory tract and the gastrointestinal tract. (18,19,20) The reason for this protection may be that beta-carotene reduces the oxidative damage caused by free radicals by “mopping them up”.

Supplementing the diet with beta-carotene will also offer benefit to the immune system. The thymus gland gradually deteriorates with age and stress, primarily from oxidative damage. Beta-carotene should offer significant protection to the thymus gland from this damage thus maintaining optimum immune function. A study conducted in 1985 discovered that after one week of supplementation with beta-carotene (180 mg/day) the number of all T cells significantly increased in normal volunteers. (21)

***The thymus gland (which is found between the lungs) is important to our immunity as it helps produce and distribute T cells that destroy invading microbes. It is large in infants and youth but gradually is replaced by fat and connective tissue as our bodies age.***

Because of its antioxidant properties the presence of beta-carotene in our bodies offers protection to the large bacteria-“eating” immune cells called phagocytes as well as increasing the production of other immune cells. The cytotoxic or natural killer cells (see pge 14) which kill tumours are also more active.

Beta-carotene was one among a number of natural products selected for testing to determine if daily dietary supplementation would reduce blood cholesterol levels.

Beta-carotene was found to significantly reduce cholesterol levels, making it an important nutrient to be included in the human diet. (22) Supplementation with beta-carotene has also been found to reduce the risk of heart attack in women. (23)

Beta-carotene, of the three carotenes, alpha, beta and gamma, is the most significant to human nutrition as it is the carotene that most commonly gives rise to vitamin A within the human body. In fact it supplies about two thirds of the necessary vitamin A for our bodies.

***The beta-carotene molecule consists of two vitamin A units joined together. The bond between these units can be broken down by the body to release vitamin A for use in the tissues. This structure allows beta-carotene to be a good plant source of vitamin A eliminating the toxic side effects that may arise from ingesting too much vitamin A from animal sources.***

Vitamin A is important for our night sight and the formation and maintenance of the healthy functioning of skin and mucous membranes which are the body's first barrier against infection and injury. This important vitamin also cares for our gastro-intestinal tract, respiratory system and the genito-urinary tract.(24)

It is apparent then, that consumption of fruits and vegetables rich in beta-carotene should be included in the

daily diet. The daily intake of Noni juice is a good source of this vitamin.

**Limonene**, another terpene has been involved in some early studies concerning alzheimers disease. (25) The results show some promise for future investigations with limonene and its efficacy in improving the symptoms of this distressing disorder. Limonene has also demonstrated some antagonism to tumour formation (26) and antimicrobial activity. (27)

**Ursolic Acid** is one of the unsung heroes among the components of Noni juice. This terpenoid, also known as urson, and prunol, occurs naturally in a large number of foods, medicinal herbs and plants. For some time it was considered biologically inactive and was primarily used in pharmaceuticals, cosmetics and food preparations as an emulsifier. (28) However, after numerous research studies it was discovered to be medicinally active when used both topically (on the skin) and internally. (29) The action of ursolic acid is probably one of the reasons Noni juice has reportedly worked so well in relieving the symptoms of inflammatory and fungal infections of the skin when applied topically.

When ursolic acid is applied to the skin it has been shown to inhibit the formation and growth of tumours of the skin. (30) as well as being strongly anti-inflammatory. It also has alopecia- and dandruff-preventing properties. (31) Because ursolic acid is not dangerous to the human body and because it greatly reduces irritation to the skin it is deemed by the experts as “dermatologically innocuous”.(32)

***Alopecia is a condition where an individual loses their hair. It may be isolated to a bald patch on the head or it may include most body hair including eyebrows and eyelashes. In Japan ursolic acid is used in formulae to enhance hair growth and reduce scalp inflammation.***

This remarkable substance is also anti-microbial for several strains of staphylococci (33) as well as fighting the fungal infections of *Candida albicans* and *Microsporium lenosum*. (34) Considering the number of individuals in the population who have been diagnosed with candidiasis and yeast overgrowth then Noni juice, with its supply of ursolic acid and caprylic acid (another well know anti-candida agent) becomes valuable in the diet of afflicted persons.

Research has also revealed that ursolic acid is useful in fighting leukemia (35) and AIDS (36) and. is anti-histaminic (37) thereby reducing allergic reactions.

### ***Sterols***

Sterols are natural alcohols found in animals and plants; *cholesterol* is the most important sterol in animals and *ergosterol* the most important in plants. The plant sterols, called **phytosterols** have been the subject of extensive research in latter years as the problems associated with high levels of “bad” cholesterol (LDL) in the human body have increased. These problems include the cardiovascular diseases that are a primary cause of death in developed nations. In Vancouver, Canada, researchers discovered that phytosterols which are found in many vegetables, grains, nuts, seeds and fruit (including Noni) slow down the intestinal absorption of cholesterol and thereby lower

total plasma and LDL cholesterol levels.(38) The three most nutritionally important phytosterols are **(beta)-sitosterol, stigmasterol and campesterol**. All three are found in Noni juice adding still further to Noni's nutritional capabilities.

Studies have revealed that men consuming a low-fat, high-fibre diet containing high amounts of plant products have a lower risk of prostate cancer than those who do not. One of the main differences between the two diets is the presence of plant sterols in the high plant diet and the different types of fat found in both.

In a comparison of sitosterol (found in plants) with cholesterol one study revealed that sitosterol was more effective than cholesterol by 24% in causing the disintegration and decreased growth of cancer cells in the prostate. (39)

***Benign Prostatic Hyperplasia is a condition whereby the prostate gland enlarges in size with no malignant tumour involved. This enlargement results in an obstruction of the flow of urine which increases in urgency and frequency and results in many nightly excursions to the bathroom for affected individuals.***

Reports from individuals with Prostatic Hyperplasia suggests that after consumption of Noni juice the urine obstruction is alleviated considerably. One of the reasons for this improvement may be the beta-sitosterol content of Noni juice. A study was conducted in the USA comparing beta-sitosterol with other substances in regard

to their action on enlarged prostates. Those conducting the study concluded that the prostate was not reduced in size but that this sterol definitely reduced the annoying symptom of frequent urination. (40)

In animal studies beta sitosterol has been shown to be anti-inflammatory, anti-neoplastic ( ie.anti-cancer), anti-pyretic (lowers fever) and able to balance the immune system. (41) A trial conducted on animals and humans demonstrated that beta-sitosterol mixed with its glycoside helped regulate the functions of specific T-helper lymphocytes and improve natural killer cell function (insert). In addition, a dampening of antibody responses (hence a balanced immune system ) as well as the normalisation of biochemical processes was observed.

The conclusions drawn from these tests indicate that with the immune system being properly regulated, numerous disease conditions will be improved including rheumatoid arthritis, allergies, cancer, auto-immune diseases (such as psoriasis, Hashimoto's disease etc.) and chronic viral infections. (42)

Many individuals have related successful reduction of symptoms in all of these conditions after drinking Noni juice for some time.

***T-cells are lymphocytes (white blood cells) processed in the thymus gland. They change into many types of immune cells such as T- helper cells, which help antibody production. Natural Killer (NK) cells is the first line of defense against cancer cells & other cells infected with viruses. It has been noted that there are decreased numbers of NK cells in cancer patients.***

Extracts of **stigmasterol and sitosterol** have been found to have a powerful anti-inflammatory effect when applied topically. Any quantities of these substances, which were trialed, reduced swelling and inflammation and worked very well in cases of acute conditions. (43)

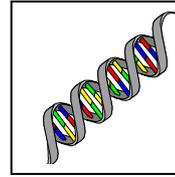
In addition campesterol, stigmasterol and sitosterol have been found to have significant anti-platelet aggregation activity (ie. it reduces the tendency of platelets to clump together), which is especially important if one is prone to thrombotic (blood clotting) conditions. Platelets (also called thrombocytes) are produced in the bone marrow. Their function is to repair slightly damaged blood vessels and begin a series of reactions that results in blood clotting.(44) There are conditions within the body that may result in the platelets becoming overly “sticky” and creating dangerous blood clots which obstruct the blood vessels. The phytosterols reduce this stickiness to appropriate levels.

### ***Glycosides***

These substances once called “glucosides”, are a group of organic compounds found in abundance in the plant kingdom. They are made from a combination of simple sugars (monosaccharides) and a non-carbon/hydrogen component. The sugars involved may be glucose, rhamnose, xylose, fructose or any other sugar while the residue may be a sterol, terpene, anthraquinone or other substances.

***Some glycosides are valuable heart treatments and are called cardiac glycosides. These include derivatives of digitalis, a natural substance commonly used in medicine for the treatment of heart ailments.***

One of the important glycosides in Noni Juice is **Asperuloside**. Traditionally this glycoside has been used for diuresis (reducing water retention), treating inflammation and varicose veins and phlebitis. (45) Research has indicated that it is anticlastogenic (that is, prevents the breakage of chromosomes), as a result it is anti-mutagenic or resists mutation within the cell's DNA. (46)



**DNA HELIX**

### ***Iridoids***

Iridoids are powerful phytochemicals produced by plants as a self-defense mechanism. While Iridoids are found in a large percentage of plants, they are not very common in fruits. These dynamic compounds provide a wide range of bioactivity. They are also adaptive, which means they can adapt to an environment to safely benefit the health and function of biological systems.

A biology scientist will explain that an adaptogen is a plant that enhances the overall ability of the body to adapt to stress – physical and mental (which produces physical effects).

Iridoids have been scientifically proven to eliminate harmful free radicals, maintain cholesterol at already existing normal levels, increase energy, promote heart health, boost the immune system, support DNA, and support healthy brain activity.

What makes the Iridoids stable in the properly prepared noni juice is the simple chemical structure from which they are built.

Therefore, Iridoids have the following properties when consumed as part of a healthy lifestyle nutritional supplement.

- Support the immune system
- Protect the liver
- Protect DNA
- Contain strong antioxidants
- Promote joint health
- Increase energy & endurance
- Help maintain blood pressure at an already existing healthy level
- Help maintain healthy HDL cholesterol within already existing normal levels

In the last few years a series of scientific studies have discovered what people who in the tropics and who cultivate Noni in their gardens have known for centuries. Here is a list of 5 Cardiovascular Studies performed with noni juice:

1. Palu, 'AK, Santiago, RA, West, BJ, et al. The Effects of *Morinda citrifolia* L. Noni on High Blood Pressure: A Mechanistic Investigation and Case Study. American Chemical Society Symposia Series (In press)..

2. Wang, M-Y, Nowicki, D, Anderson, G. The Heart Protection Study: Improvement of Lipoprotein Profiles in Current Smokers Receiving Morinda M.citrifolia (Noni) Fruit Juice. 2004. *Circulation, J Am Heart Assoc*, 109: 71—144 (Abs #P93). Available online at <http://circ.ahajournals.org/cgi/reprint/109/7/e71>
3. West BJ, Jensen CJ, Westendorf J, and White LD. A Safety Review of Noni Fruit Juice. *Journal of Food Science* 2006 October; 71(8): R100-R106. Available online at <http://www.blackwell-synergy.com/doi/pdf/10.1111/j.1750-3841.2006.00164.x>.
4. Kamiya K, Tanaka Y, Endang H, Umar M, Satake T. Chemical constituents of Morinda citrifolia fruits inhibit copper-induced low-density lipoprotein oxidation. *J Agric Food Chem*. 2004 Sep 22; 52(19): 5843-8.
5. Ayanbule F, Wang MY, Peng L, Nowicki J, Anderson G, Nowicki D. Antithrombotic Effect of Morinda citrifolia (Noni) Fruit Juice on the Jugular Vein Thrombosis Induced by Ferric Chloride in Male Adult SD Rats. *Arterioscler. Thromb. Vasc. Biol*. 2006; 26; e104.

Iridoids are bioactive compounds linked to over two dozen real health benefits. Iridoids have been studied by scientists for over 50 years, and now 12 unique iridoids have been identified in the noni fruit.

Among these real health benefits of Iridoids has been their anti-inflammatory, anti-tumour and anti-viral effects. Their activity is consistent with immune modulators and adaptogens.

### **Scopoletin**

Scopoletin belongs to a group of compounds called coumarins. In a variety of scientific studies scopoletin has been described variously as having hepatoprotective activity (cares for the liver) (48), inhibiting the growth of *Escherichia coli* in the gut (49) and antibacterial against *Staphylococcus aureus*, *Strep. pneumoniae*, *Streptococcus sp.*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Haemophilus influenzae*.(50)

***These various species of bacteria are responsible for such disorders as food poisoning, septicemia, pneumonia, nephritis, urogenital infections, endocarditis, respiratory infections, gastroenteritis and many more.***

In addition scopoletin has shown a strong anti-inflammatory effect that has been particularly useful in the treatment of bronchial illnesses and asthma (51), in fact, it has been shown to be **five times more effective than aspirin**.

Other studies have shown scopoletin to be useful as a topical application (52), antipyretic (fever reducing), analgesic, bacteriostatic,(53), antifungal and hypotensive (lowers blood pressure)(54). It is of interest that studies have shown when scopoletin is ingested in large amounts in foods in which it naturally

occurs (other than Noni) , that blood pressure can be driven down to hypotensive (ie. lower than desirable) levels.(55) However, reports of the lowering of blood pressure in individuals drinking Noni juice have not found this same effect. Blood pressure, when it does lower from abnormally high levels in individuals drinking Noni juice, comes to rest at normal levels. There appears to be some control factor within the Noni juice that prevents the abnormally low blood pressure effects of scopoletin. Synergy at work again.

### **Pectin**

This fibre is a non cellulose complex sugar (polysaccharide). As part of the fibre content of Noni juice it performs important functions within the gastrointestinal tract which have ramifications on the entire health of the body.

Pectin absorbs water and slows the emptying of the stomach contents into the small intestine. Because of this action and because it provides bulk in the gut it provides a feeling of fullness. Pectin also binds bile acids and cholesterol and regulates glucose absorption through the gut wall which is important for those with blood sugar conditions of any sort.

It has been shown that high fat diets, low in fibre, cause a build up of fecal bile acids. This situation may promote tumours within the bowel caused by colonic bacteria converting these acids to secondary bile acids. These particular acids then act as tumour promoters within the bowel. Pectin in the diet will increase the volume of material moving through the bowel, thereby reducing the

concentration of faeces through the bowel, thereby reducing the concentration of potentially carcinogenic substances in the bowel. Pectin will also speed the transit of the material through the bowel thus allowing a reduced time for fecal carcinogens and colonic bacteria to be in contact with the bowel wall. Pectin also alters colonic bacterial metabolism which aids in the reducing the production of carcinogens within the bowel.(56)

### ***Amino Acids***

There are 20 amino acids and 9 of these are essential (ie they cannot be made by the body but must be taken in through the diet). Seventeen of the amino acids including the nine essential amino acids are found in Noni juice The essential amino acids are Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine.

Amino acids are the components of protein and those substances that contain all the essential amino acids in adequate amounts are termed complete proteins. In the plant kingdom it is unusual to find a plant that provides all the essential amino acids; *Morinda citrifolia* does provide all of these amino acids and all but three of the non essentials.

If an individual does not eat foods containing a complete protein balance then protein synthesis in the body ceases. This means that the production and maintenance of muscles, connective tissue, blood-clotting factors, blood transport systems, visual pigments and the protein matrix inside bones would be at risk. Even cell membranes (the protective "coat" or "skin" of the cell) contain protein and as most vital body proteins are in a constant state of breakdown, rebuilding and repair, (mostly carried

out in the intestine and bone marrow) then the body is in need of a constant supply of amino acids.

Only some of the functions of the following amino acids are mentioned:

**Alanine** Ammonia (a poisonous byproduct of amino acid breakdown in the muscles) is carried by alanine in a non toxic form to the liver. Ammonia is formed in very active skeletal muscles and is removed from the body as urea.

Alanine is also termed a glucogenic amino acid. This means that it is the forerunner in the formation of blood glucose or liver glycogen. This is an essential function of the body without which our bodies would starve. The other amino acids found in Noni juice perform the same function.(57)



Alanine also contributes to thymus growth and increases lymphocyte division. Both of these activities are important for optimum defence against disease. This amino acid is also a vital component of the nucleic acids (which make up our DNA) found in the nucleus of each of our cells.(58)

### **Arginine**

#### ***Arginine and children***

Adults require nine essential amino acids but infants and growing children require a tenth amino acid, arginine. Arginine is made by the liver as a step in producing urea in order to rid the body of the toxic build up of ammonia in the muscles. Children, however, cannot manufacture arginine fast enough to keep their bodies detoxified in

addition to caring for the manufacture of necessary proteins required for their growth, therefore they must obtain it through their diet.

### ***Arginine and high energy requirements***

There is a high energy compound called creatine phosphate which is important in keeping energy stores high in muscle and other excitable tissues such as brain and nerve. Body builders and other athletes often supplement themselves with this important nutrient so that their energy levels will remain high. Arginine and methionine are both important amino acids required by the body for the synthesis of this compound within the body and must be present in adequate amounts for this process to take place. Both of these amino acids are found in Noni juice.

Arginine also stimulates the release of growth hormone and insulin. Like alanine it is involved in immune system processes as well as the synthesis of collagen, insulin, elastin, glucagon and haemoglobin.

***Body injuries sustained through the day may only consist of microfibre injuries within the muscles. These are repaired during stage 4 of sleep (the deepest stage of sleep) when growth hormone is released. For those with fibromyalgia, sleep is disturbed and these repairs do not take place, giving rise to continually aching muscles. The disturbed sleep also gives rise to chronic fatigue in these individuals.***

### ***Arginine and Reproduction***

Men consuming arginine as a food supplement have been

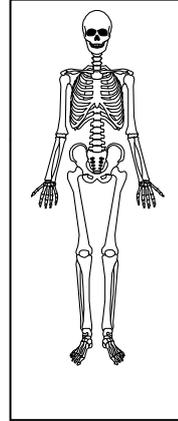
able to have sperm count and motility improved where there was previously poor sperm count and activity.

**Aspartate** This amino acid, also known as aspartic acid is a neurotransmitter involved in brain metabolism. Its other functions include those in common with arginine and alanine and other amino acids such as urea production and glucose synthesis.

It is also involved in bone calcification and glycoprotein synthesis. The glycoproteins are important group of substances composed of combined proteins and carbohydrates.

They include the gamma globulins and mucins which make up the mucous substances of the body.

Aspartate is often added to potassium and magnesium to produce a nutritional supplement of those minerals which is more easily absorbed by the body.



**Cysteine** When this compound is found as a single molecule it is called **cysteine** but when two cysteine molecules are joined together, it is called **cystine**.

As cystine, it plays a special role in the structure of some proteins such as insulin and immunoglobulins (or antibodies). Generally the proteins so composed are found outside the cell. Cystine is also an important antioxidant within the body's protective cell defences. As a therapeutic agent it is used as an agent to help bring up phlegm in such conditions as cystic fibrosis, chronic bronchitis and bronchiecstasis.(59)

As cysteine this amino acid can perform important functions such as slowing or preventing the action of some enzymes. It is important in the detoxification of some chemicals and like its fellows it is also involved in glucose manufacture.

**Glycine:** Of all the amino acids glycine performs the most biochemical functions of any of the amino acids. It is involved in the formation of nucleic acids (RNA and DNA) which are the basis of our genetic makeup, therefore glycine's presence is of paramount importance to us. Glycine is also a constituent of collagen, bile acids and many hormones and is involved in liver detoxification.

***Glycine and Gout***

Glycine has the ability to increase growth hormone release as well as the excretion of uric acid from the body. As abnormally high levels of uric acid can cause painful bouts of gout, increased removal of this acid from the body of afflicted persons can bring a substantial reduction in the number and severity of gout attacks. Indeed stories of relief from gout have come from those who drink Noni juice on a regular basis. Glycine is also involved in glucose and creatine phosphate synthesis as discussed earlier.

**Histidine:**

***Histidine and the brain***

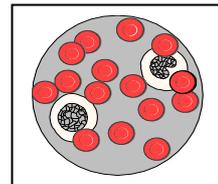
This amino acid is the major ingredient required for the manufacture of histamine, which is concentrated in the pituitary gland in the brain and in some brain nerves. Histamine promotes alpha wave activity in the brain and therefore improves resistance to stress and anxiety. A histamine imbalance may result in psychological disorders

such as anxiety and schizophrenia as well as lethargy, poor appetite and nausea.

### ***Histidine and the nerves***

Histidine is involved in the synthesis of collagen and the myelin sheath that surrounds the nerves. It is the destruction of the myelin sheath that is the major cause of the symptoms of multiple sclerosis. Any substance which is involved in the sheath's protection and/or maintenance is of paramount importance in the body as the myelin sheath integrity allows the nerve impulses to travel correctly along the nerves.

Histidine also aids in the manufacture of haemoglobin ( the red substance found in our blood cells that transports oxygen around the body). Histidine is also significant in proper gastric function and in dilating blood vessels in order to lower blood pressure.



Blood Cells

### ***Histidine and acidity***

Research has discovered that it has significant “buffering” properties at the pH (the acidity level) of the blood and body fluids. This means the presence of histidine will help prevent excessive acidity in those fluids.

### ***Histidine and rheumatoid arthritis***

The application of therapeutic levels of histidine in rheumatoid arthritis has shown positive results in the alleviation of symptoms. Patients with this disorder are low in histidine.

**Isoleucine** Like so many of the other amino acids isoleucine is also involved in glucose synthesis. It is a

*branch chained* amino acid found commonly in the interior of globular proteins and in company with valine and leucine it is used in special amino acid products for the treatment of liver disease or kidney failure.

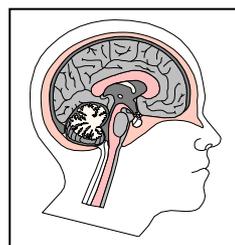
**Leucine** There are three branch chain amino acids and with valine (one of these), leucine plays a significant role in energy production, muscle metabolism and stress management. Skeletal muscle uses these amino acids directly for production of energy and protein. When there is increased stress then these amino acids are used more than any other. Studies have shown that when there is starvation, physical trauma (such as surgery or injury) or infection then branch chain amino acids are required in higher amounts.

#### ***Leucine and Olivoponto Parkinson's Disease***

In studies it was revealed that the 5% of Parkinson's patients who suffer from olivoponto cerebellar atrophy respond well to high doses of leucine, probably because that particular amino acid lowers the brain levels of dopamine.

For the 95% of Parkinson's patients who require an *increase* in dopamine levels, personal reports given by individuals taking Noni juice have demonstrated an improvement in ease of movement and speech as well as other symptoms of Parkinson's Disease.

This is an interesting example of where the adaptogenic properties of Noni juice is demonstrated: both the lowering and increase of dopamine appears to occur.



Leucine is a component of elastin (a major component of connective tissue) and is a potent stimulator of growth hormone. This latter effect is particularly important for growing children and for wound healing.

**Lysine** One of the major amino acids required for the production of elastin and collagen is lysine. Because of this it is also important for the production of connective tissue.. Lysine is a significant component of hormones and provides a connecting linkage for vitamin B<sub>6</sub> on enzymes which allows vital metabolic reactions to take place. Lysine is also an important constituent of genetic material in the cell. Lysine has been used in therapeutic doses to help reduce the recurrence of cold sores and other herpes infections.

### **Methionine**

#### ***Methionine and liver detoxification***

Methionine is involved in the support of liver detoxification reactions; because of its efficacy in this function it is often used in liver support therapeutic formula. It has been used in the treatment of paracetamol overdose and to help protect the liver against its toxic effects. Methionine will also increase the excretion out of the body of toxic overloads of lead and calcium.(60) It is required for nucleic acid, protein, collagen, phosphatidyl choline (lecithin) and antibody manufacture within the body and acts as a precursor for the amino acids cysteine and taurine.

Methionine is important for antioxidant activity within the body because it is a powerful free radical scavenger. In addition one of its more vital functions is its involvement

in the synthesis of the neurotransmitter acetylcholine and the hormone adrenalin.

Methionine is also important in the synthesis of creatine phosphate in the muscles and of glucose.

***Acetylcholine is the substance that is used by the nerves to transmit impulses from one nerve to another. Without it our nerves would not function. Adrenalin is the most potent stimulant of the body and acts to increase heart rate, respiration and a number of other body functions in response to sudden stress.***

### **Phenylalanine**

#### ***Phenylalanine and hormones***

Phenylalanine is a precursor to tyrosine which leads to the manufacture of dopamine, noradrenalin, thyroxine and melanin. As we have discussed previously, increased levels of dopamine are required by people suffering with Parkinson's Disease.

***When there are reduced levels of noradrenalin in the brain then depression accompanied by fatigue may be the result. Thyroxin is important for normal growth and mental development in children, normal nervous system activity, blood flow and pressure and proper gastrointestinal activity. Melanin is a pigment produced by the body to help screen out harmful ultra-violet rays and is the pigment that gives us our "tan".***

#### ***Phenylalanine and pain***

Phenylalanine is also known as an analgesic which is

slower acting than many analgesics, but pain relief is longer in duration: it has the added benefit of helping other analgesics such as flavanoids and aspirin work better. Gastric acid secretions are also potentiated by phenylalanine so digestion is greatly enhanced.

**Proline** This is a major amino acid for the production of connective tissue. This tissue consists of a complex of insoluble protein fibres embedded in a ground substance. Connective tissue is widely distributed throughout the body and makes up the dermis of the skin, tendons, ligaments, cartilage and bone matrix.

**Serine** This amino acid is a precursor to the neurotransmitter glycine and is also involved in the manufacture of the amino acid cysteine. Serine is a neurotransmitter in its own right, reducing the excitability of nerves of the spine as well as a major component of important brain substances.

***Serine and cell membranes***

One of serine's more vital functions is as a component vital to cell membrane structure. The cell membrane is the thin "skin" which encloses and protects the contents of the cell. It regulates the entry and exit of the various chemicals the cell needs or excretes. The cell membrane is made of fats and proteins and has complex chemical reactions occurring within it therefore the cell membrane's structure, flexibility and integrity must be maintained to keep the body healthy It is important that all the correct substances used in the cell membrane are available, including serine.

**Threonine** Many amino acids act as precursors or the basic building block for other amino acids, such is the economy

of the body. So it is that threonine is an essential precursor to the amino acids glycine and serine. It is also involved in glycoprotein synthesis and in the maintenance of connective tissue integrity. It is an immunostimulant, one of the countless substances required to keep the immune system functioning normally.

### **Tryptophan**

#### ***Tryptophan and depression***

This amino acid is one of the more famous and the most widely studied of its group. It has been commonly used for treating depression particularly where insomnia has been a feature of that condition. Some studies have indicated that tryptophan is as effective as conventional antidepressants but this has not been confirmed.

#### ***Tryptophan and Sleep***

Tryptophan is a precursor to the manufacture of vitamin B<sub>3</sub> and the hormones melatonin, and serotonin as well as stimulating liver protein synthesis.

***Serotonin is primarily responsible for the regulation of appetite and sleep. A deficiency of this neurotransmitter is associated with aggression, depression and obsessive-compulsive disorders. Melatonin is the hormone that helps regulate our sleep cycles.***

**Tyrosine** Like tryptophan and phenylalanine, tyrosine has been used for the control of depression. It is essential for the manufacture of thyroid hormones, adrenal hormones, dopamine, noradrenalin and melanin. Tyrosine is also

involved in the pigmentation of the skin, regulating blood pressure and aiding concentration.

**Valine** This amino acid helps maintain the myelin sheath around the nerves and is one of the branch chain amino acids vital to energy production and repair in the muscles.(61)

### **Acids**

Among the acids found in Noni juice are many of the important fatty acids (the structural components of fats) which are so important in the overall complex metabolic processes of the body.

**Acetic acid** is *the* fundamental acid and all fatty acids are synthesized from acetic acid units in a process called lipogenesis.

**Linoleic acid** is the only essential fatty acid (that is, the only one which cannot be manufactured within the body and must be obtained from the diet). Noni juice contains linoleic acid. This fatty acid serves several important functions within the body. These are:

- it strengthens capillary and cell membranes which in turn increases skin strength. A linoleic acid deficiency leads to a breakdown in skin integrity leading to the characteristic eczema and skin lesions,
- it combines with cholesterol to form important compounds,
- it helps lower serum cholesterol levels as do other unsaturated fatty acids. It is important for the transport and metabolism of cholesterol,
- it is a major precursor for essential compounds including prostaglandins. These and other vital compounds are needed to regulate important body functions.(62)

**Caprylic Acid** is one of the substances in unflavoured Noni juice which gives it the smell of old cheese. However, this dynamic fatty acid exhibits an inhibitory effect towards yeast and fungal overgrowth within the human body. The candida organism can become undetectable to the human body by losing its coat of identification (mycelating). Its toxins may then begin to suppress or fatigue the body's defense systems and allow the possibility of other opportunistic bacteria to take hold. Caprylic acid's anti-fungal action in this case, becomes invaluable even though its antibacterial effect is slight. Because it is in a synergistic situation in the Noni juice then the antibacterial action can be carried out by another component.

### Research Studies conducted on *Morinda citrifolia*

#### **Pain**

Research carried out at the Universite de Metz, in France in 1990, tested the analgesic (pain relieving) activity of an extract from the *Morinda citrifolia* plant on animals. The extract did supply significant pain reduction as demonstrated through a series of tests. The pain killing effect of the Noni extract was 75% as effective as morphine sulphate without the toxic side effects of that drug.(63)

#### **Sleep**

In the same study at the Universite de Metz, the administration of the extract from *Morinda citrifolia* demonstrated a sedative effect on the animals.(64)

#### **Parasites**

An alcoholic extract of *Morinda citrifolia* was tested along with extracts from other plants for its action against the

human parasitic worm, *Ascaris lumbricoides*. Noni proved to be vigorous in its anti-parasitic action.(65)

### **Cancer**

In 1994 Drs Hirazumi, Furusawa, Chou and Hokama published a research paper entitled *Anticancer Activity of Morinda citrifolia (Noni) on Intraperitoneally Implanted Lewis Lung Carcinoma in Syngeneic Mice*. In this study Noni fruits were collected and left in a lidded jar for 1-3 days after which the juice from the fruit was collected. This juice was administered to mice participating in the experiment. All the mice were implanted with Lewis Lung Carcinoma cells and half were fed Noni Juice in varying dosages while the others were not.

The former group had a significantly longer life span than the deprived group and the summary of the report includes the statement "This report demonstrates the antitumour activity of the Noni juice on ip implanted LLC in syngeneic C57BL/6 mice. LLC has been used as one of the standard syngeneic tumours for antitumour screening in the NCI since 1975."(66)

This study revealed that Noni juice passed the standard test for the inhibition of tumour growth with flying colours.

### **ANIMALS**

There are many accounts of success in reviving ailing animals by feeding them Noni juice. An increasing number of veterinary doctors are using Noni juice as an adjunct to their practice of animal medicine as they are seeing the positive results in their patients. Many animal and pet owners are using Noni juice to help their sick and injured animals. The area of veterinary application of Noni juice is yet to be researched but the anecdotal evidence of positive health results in animals is overwhelming in volume.

## The Future

Even as this booklet is published research studies are ongoing in scientific establishments around the world. We should expect to read the results of these tests within the next few years.

## Summary

Having now read the material and checked the references in this booklet it should become obvious to the reader that this remarkable plant, *Morinda citrifolia* (Noni) has much to offer by way of optimum nutrition. Further studies on its components and on the juice itself will reveal even more positive biological activity than is now obvious.

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## About the Author

Melanie Alfred is a practicing Naturopath living in Brisbane, Queensland, Australia with her husband and five children.

She earned a Bachelor of Science degree in Biological Science and Chemistry from Brigham Young University, later completing Post Graduate Diplomas in Clinical Nutrition and Naturopathy.

Melanie has worked in her own clinic for the last twenty three years advising clients about nutrition and the application of herbs, vitamins and minerals to improve well being. During the last fourteen years she has spent considerable time researching scientific literature about *Morinda citrifolia* (Noni) and its constituents. Out of that research arose this booklet.

***This is a publication that provides a scientific explanation as to the marvellous workings of Morinda citrifolia (Noni) in that it describes the what, how, and to some extent the why.***

***This book is a gathering together of the results of scientific research regarding the components of Noni from around the world. These results are assembled in one encyclopaedia of Noni properties. The effects of the various components on the functioning of the human body are outlined, including possible effects on various human ailments.***

***It is a MUST reading for all existing and potential users of Morinda citrifolia as well as a practical guide for the professional who seeks a scientific explanation for the healing qualities of this unique plant.***