10

A DECADE of Link Digests

LINK NATURAL DIGEST

Volume 10, Issue 1, 2014 ISSN : 1391-8869

IN THE PAGES THAT FOLLOW.....

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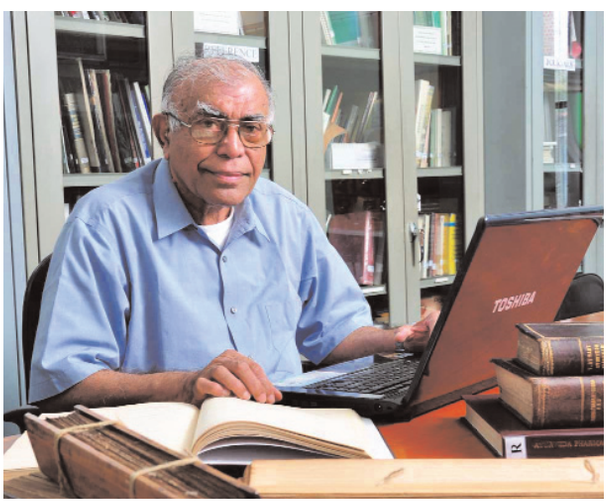
EDITORIAL



We have now to commemorate a landmark stage when the LINK NATURAL DIGEST which commenced publication as the LINK NATURAL PRODUCTS DIGEST in 2004 reaches the ten year mark with the present issue. We commenced with the objectives that we defined then as follows: *"To combine the twin goals of introducing the company and its products and philosophy to its customers as well as underpinning the scientific and technological foundation based on which these products are manufactured. The idea is to be transparent in regard to its activities and to share with its customers the methodology and rigour with which the company's products are made. We wish to underscore the issue that when the company sells its products, with them the company also sells its underlying research and scientific knowledge."*

Although at the time they seemed lofty and ambitious for a modest company albeit with a science engine governing its activities ranging from the procurement of raw materials through their processing, quality control, and the development of products, we are proud to state that they have largely been accomplished. We have developed an appreciative clientele of readers, worldwide and will be looking to expand their range. The subject of Natural Products, also referred to as Phytochemistry in Europe, emerged as a definite discipline first as a specific branch of chemistry when research chemists had accumulated a plethora of organic compounds which had interesting characteristics, like bioactivity or interesting odour characteristics. Prior to this and for centuries preceding modern times, traditional societies all over the world had been using plant-derived products as cosmetics, fragrances, and medicaments. In the warfare of yore, arrow poisons were derived from plants.

In modern terms these are recognised as herbal products and the sale of these products measured in billions of dollars include the cosmetics, fragrance industries, as well as the pharmaceutical and personal care industries. Today there is major interest in these herbal industries as they are deemed to be more empathetic with the human system than synthetic products, which had burgeoned into use just after the Second World War. The scientific nature of these herbal products can now be studied in great detail due to the development of the spectacularly wide range of techniques in analytical methodology. Mankind has then a new box of powerful tools for such studies.

Over the ten years of its existence the articles of the LINK NATURAL DIGEST portrayed these developments as well as some of the men and women who made these possible and the scientific intricacies of the natural plant products themselves. The stories would never have been complete without the historical theories that went to illustrate the thinking of mankind as they progressed from the traditional to the scientific age, and this aspect too has received attention.

The LINK NATURAL DIGEST now seeks to continue on its ambitious and interesting trail seeking new methods of enhancing the numbers it will be able to influence in the next decade to come.

R. O. B. Wijesekera

MESSAGE FROM THE CHAIRMAN

The Link Natural Digest, completes a decade since it was first published. The original objective was to tell the stories relating to the development of natural products, or herbals as they are sometimes termed, in a form that is true to their scientific features, and yet of interest to readers who belong, in addition to the scientific community, to the informed general public as well.

Over the past decade the Digest has been able to successfully increase awareness of themes related to herbal products, the science behind the features relating to therapeutic properties and organoleptic characteristics that turn these plant-derived products into medicines and fragrances. Of equal interest has been the historical aspects of the development of medicines in the several regions of the world and the origins of the well established product commodities of this day. So the Digest has brought to its readers a wealth of information. Without being pretentious, it may be claimed that the Link Natural Digest has brought to those readers who would not normally indulge in reading scientific journals, a type of literary magazine which fulfils a void in their pursuit for scientific knowledge. This would be true particularly of a community interested in herbal products like herbal medicines, natural fragrances, essential oils, spices, and such products derived from nature's sources.

The Digest has also explored the fascinating history of medicine and cosmetics which seem to have sprung from similar beginnings as mankind emerged fighting dreaded diseases and adorning the environment, from prehistoric times. The legends of the eminent medical giants of ancient Arabia of Greece and India and the original creators of what is today known as traditional Chinese medicine feature in the well researched articles of the Digest. These articles are such features of history that will not dim with time. These are such stories that will resonate for long.

One of the features of herbal medicine for instance that continues to fascinate the modern lay mind is how modern research brings up to the modern market place products that have enjoyed a history of traditional use as medicaments and how new research seeks to use traditional fragrances that were deemed to alter or enhance moods. The search for more indulgence in things that are natural and even connected to natural life styles is an understandable trend in the search for new agents for the marketplace. In the pages of the digest is revealed some of these trends as well as the rationale that drives them along.

It is our endeavour to keep the digest at its high creative level while maintaining its mission to provide interesting fare in the print medium to illustrate the wonder within nature's repertoire of constituent agents that can benefit and enhance the well being of human beings.

Devapriya Nugawela

FEATURES

A COMPARISON OF GUIDANCE TO FOOD AND NUTRITION IN AYURVEDA AND WESTERN MEDICINE

By Lakshman Andrady[1], PhD and Buddhi L. Jayawardana[2]

Medicinal Systems

Good nutrition is central to maintaining good health and longevity. We in Sri Lanka benefit from two very different schools of thought on the topic; the Western medical sciences and the Traditional Herbal practices. The latter system in Sri Lanka is a synthesis of the Indian *Siddha* ayurveda medical system introduced into the country and ancient medical skills (*'Hela medicine'*) that predate the introduction of Ayurveda and goes back several thousands of years. For convenience these practices taken together will be referred to as the 'Ayurveda' (the term means 'science of longevity') system here. According to Ayurveda three factors that control health, are *Aushada* (medication), *Ahara* (Food) and *Vihara* (lifestyle) and the dictum "food is medicine" illustrates how important good nutrition is to health. Western allopathic medicine similarly emphasizes the importance of good nutrition. Each school has its own strengths. It is therefore interesting and worthwhile to compare and contrast the knowledge on topics developed within each of these, especially on any practical guidance on selection and consumption of food.

At the outset we appreciate the difficulty of making this comparison because of the very different ways the human body or body-mind is modelled in the two systems of medicine. Western allopathic models are based on microstructure and physiological function ranging from cell membrane receptors to the major organ systems of the human body. Allopathic medical specialties are based on organ systems such as heart, brain, kidney or skin. Ayurveda models the human body holistically tracing poor health to overall imbalances of the three *doshas* in the body. The traditional medical specialties therefore tend to be by class of disease. Despite this fundamental difficulty and the ensuing differences in terminology it is still enlightening to make such a comparison.

Eating Enough Food for Good Health

Modern nutritionists take an accounting approach to the question of how much food is needed daily to maintain good health in a healthy person. Ideally, a balance between the caloric (we mean the food calorie ~ 4.184 J) of the food consumed and that expended for function (and growth) is suggested.

A young person will then need 2000-3000 calories (male) or 1600-2400 calories (female) depending on age and activity.

Sedentary individuals, especially those over 51, are recommended to use the lower numbers in the range. An athlete or a soldier expends more energy and will need a much higher intake. If more calories than needed are consumed obesity will result unless vigorous physical exercise is deliberately undertaken to 'burn off' the resulting stored adipose. The body mass index (BMI), a common measure of body fat relative to a subject's height and weight is commonly used to assess obesity in individuals. Sadly, especially in North

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America and Western Europe, obesity is prevalent. The 2010 numbers for Sri Lanka 25.2% overweight and 9.2% obese (BMI >30) is relatively high for a middle-income country[1] .

Ayurvedic guidance has no such metric to estimate the 'required' intake of calories or food though obesity is still recognized as a disease condition and treated[2,3]. Ideally, the intake of food is based on physiological cues; the quantity one should consume is based solely on the appetite. One must never eat unless hungry and not consume to full satiation; it is recommended that at the end of a meal one should have residual appetite for 20-30% more food. The number of daily meals also depends on body cues. Digestive capability of the body is believed to be strongest between 10:00 am and 2:00 pm and the heaviest meal is best taken during this period.

Ayurvedic understating of nutrition parallels the views of modern nutritionists in that both agree that only digested or absorbed fraction of the food is assimilated and used by the body. This part (called *prasada in* Ayurveda) is used to grow or maintain the seven *dhatus* in the human body (corresponding to different classes of body tissue in modern Biology).The seven *'dhatu's* of Ayurveda can be approximately compared to the following tissue types in Table 1.

Table 1: A comparison of the Dhatu's in Ayurveda with Body Tissue Types

***Dhatus* in Ayurveda**	**Corresponding Tissue**	**Class of Tissue**
Rasa	Lymph and Plasma	Connective
Rakta	Blood	Connective
Mamsa	Muscle	Muscular
Meda	Adipose	Connective
Asthi	Cartilage and Bone	Connective
Majja	Bone Marrow & Nerves	Connective/ Nervous
Shukra	Germ cells	Cells – Not a tissue

There are two interesting points in the Table. Some classes of tissue such as the epithelial tissue that include stomach lining, surface lining of organs and skin, is either missing or included in other categories of *dhatus*, in the Ayurveda classification. Also, the *dhatus* are said to develop in sequence from one another, starting with *Rasa* making the *Rakta* and the *Rakta* making *Mamsa* and so on, ending up with *Shukra*. Relatively more energy and nutrients are needed to synthesize the *'dhatus'* lower in the Table such as *shukra*. Obesity for instance, according to the Ayurvedic model, is a result of nutrients flowing down the cascade in the first column of the Table and accumulating in the *'Meda'* step, unable to move down further.

Modern science sees enzymatic digestion in the alimentary canal as a means of reducing the molecular sizes of complex food molecules to a range that allows their transport across the wall of the gut. These can then be metabolized and the energy from their oxidation is used for maintenance and growth of the body tissue. Tissues do arise from embryonic stem cell tissues differentiating into different tissue types, though not in any sequence.

Basic Food Categories

In addition to the total intake nutritionist also need the requisite calories to be derived from the main food groups of Carbohydrates, Fats and Proteins in different proportions. For an adult, the majority of the calories (45-65%) should be from carbohydrates (rice, bread, pasta) and the rest from fats (20-35%) and proteins (10-35%). Selection of food from the five 'food groups' ensures that these as well as micronutrients such as vitamins and minerals are included in a healthy diet. For example, according to US Department of Agriculture, an 18 yr. old who intakes 2400 calories, must select 8 oz. grain (4 oz. unrefined), 3 cups of vegetables, 2 cups of fruit, 3 cups low-fat milk, 6.5 oz. of meat, fish or protein-rich seeds such as lentils. One is encouraged to vary choices but within each food group (leafy veggies versus brightly colored) and cheese or yoghurt may be substituted for milk. Western medical guidance on the above food types is for all healthy individuals. The need for a more 'personalized' nutrition regime is now drawing research interest[4].

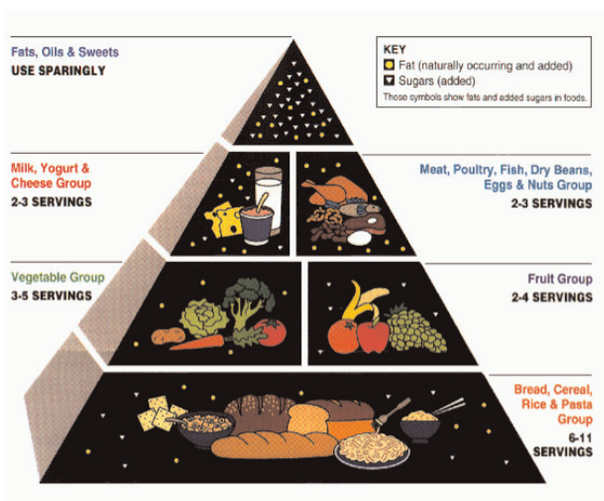

Figure 1: Food Pyramid according to western formula for good nutrition. (Source: Food and Drug Administration, USA)

Ayurveda has a different classification of foods that is not based on their carbs, proteins or fat content. The six-fold classification of food groups in Ayurveda is based on taste. The two classifications are compared in Table 2. The basic difference between the classifications is that Western medical grouping is chemical/structural while the other (the Ayurveda) is purely sensorial.

Table 2: Food Classification
Ayurveda and Modern Nutrition

	Food Types (Western)	Food Types (Ayurveda)
1.	Vegetables	Sweet
2.	Grains - rice or bread	Salty
3.	Fruits	Sour
4.	Dairy	Pungent
5.	Protein	Bitter
6.	-	Astringent

Each of the six food categories of Ayurveda must ideally be included at each meal. The ratio of these in a meal varies with the body type of the person. Looking at the different tastes, however, it is likely that 'salty' category is intended to provide mineral micro-nutrients while some of the 'acidic' food ensures a supply of Vitamin C. Leafy greens such as broccoli in the 'bitter' category provide other vitamins and phytonutrients. An Ayurvedic equivalent of a food pyramid will have all six tastes, but the emphasis of each taste differs with the body type of the individual. So no single Ayurvedic food pyramid that is generally applicable can be drawn.

An interesting aspect of Ayurvedic nutrition not met with in the Western system is the preferred sequence in which the food should be eaten. It is counter-intuitive and in some respects is the exact opposite of what we commonly practice at the dinner table in Sri Lanka.

The Ayurvedic recommendation is to consume "sweet" category of food at the beginning, "salty" and "acidic" in the middle and "bitter" and "astringent" at the end of the meal. This is the exact opposite of our dining practice where we tend to start off with an appetizer, then have a heavy meal and finally end up with a sweet (or fruit) dessert! Also, drinking iced beverages is discouraged in Ayurveda. The digestive capacity of the body (due to on active *pachakpitta)* is believed to be compromised by iced beverages. On the other hand a weak *pachakpitta* is revived with some spices such as black pepper *(Piper nigrum),* long pepper *(Piper longum)*, and ginger *(Zingiber officinale)*.

A somewhat surprising related teaching is that water that is too hot to drink must never be cooled by adding iced water or cold water to it; it should be left aside to cool or poured from cup to cup to accelerate cooling. The strict warning against mixing hot and cold drinking water (as well as eating ice cold and hot beverages at the same time) is even described as '*visha'* or poison. Perhaps one can speculate that in ancient times, adding un-boiled cold water to boiled or hot water was risky because of potential microbial contamination with potential activation of dormant spores in the cold water by elevated temperature. The cold water is typically from a well or a river and water as collected can easily be contaminated. Eating hot and cold food together can be bad for teeth (because of thermal stress on the enamel due to alternate hot and cold contact). But, triggering the hot and cold receptors in the epithelium together is not expected to have an ill effect according to Western medicine (medication such as Vick's Vapor Rub for instance has Menthol and camphor intended to do exactly this!).

Individual Food Prescriptions

The recommendation on what food to consume is generic in Western medicine but the need for a more 'personalized' nutrition regime is now drawing research interest[5]. Caloric count and food groups all apply across the board to all individuals of same weight/height, age and physical activity. Ayurvedic system gives general guidelines; eat locally grown food (rather than imported food), eat raw or partially cooked vegetables and eat whatever is available in season. It has a volume of instructions in this regard and goes into great details on the classification of individual body types and the food appropriate for each.

Samkhya, the Indian philosophical foundation of Ayurveda, specifies three governing principles or humors in the human body, called *doshas: vata, pitta* and *kapha.* These three *doshas* or qualities exist in individuals to varying degrees, although one and sometimes two tend to be predominant and the other(s) secondary. Ideally, the three *doshas* should be in balance to promote the normal functioning of the body. When out of balance, they create mental, emotional and physical ailments. The body-types (or *prakirti*) classification in Ayurveda is based on the body type which can be determined by the nature of the pulse, physical constitution, skin type and other characteristics (usually by a qualified practitioner). Individuals generally fall into one of these categories.

The three main types *vata, pitta* and *kapha* along with *vata-pitta, vata-kapha* and *pitta-kapha* make the 6 types. All three in balance can be a 7th type.

Different foods have the property of increasing or decreasing one or more of the *doshas*. Appropriate foods are those that help the individual's own *doshas* to be kept in balance. For instance, an individual with a high *kapha* must avoid 'salty' and 'pungent' foods but consume more 'sweet' and 'sour' food to keep the humor in control.

Table: Types of Foods and their Effect on Doshas

Taste	Taste		Decrease	Increase
Sweet	Heavy	*Madhura*	V, P	K
Salty	Light	*Lavana*	K	P, V
Sour	Oily	*Amla*	V,P	K
Pungent	Dry	*Katuka*	K	V,P
Bitter	Hot	*Tiththa*	V,K	P
Astringent	Cold	*Kasaya*	P	V,K

However, even within this classification all the classes of food in the Western classification as well as vitamins and minerals are likely included.

This allows personalized Ayurvedic 'food pyramids' to be qualitatively developed.

Both systems of medicine, however agree that food is best eaten raw or lightly cooked to preserve the nutrients in them. Also both agree that the evening meal should be light and taken fairly early in the evening. Ayurvedic knowledge in addition encourages one to eat 'locally' – fruits and vegetables grown in the location where one lives and seasonal produce.

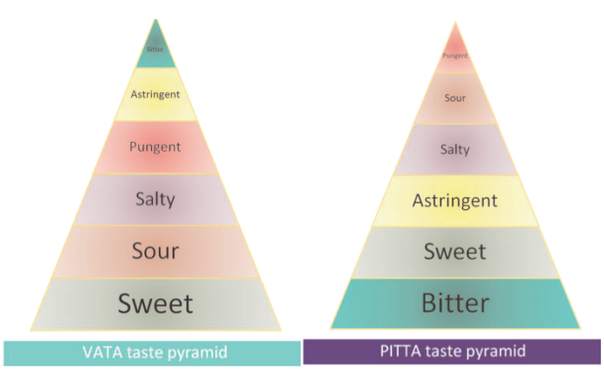

Figure 2: Ayurvedic Food Pyramids for *Vata* and *Pitta* body type. Courtesy: Ayurveda and Yoga. http://ayuryoga.com.sg

Incompatible (*apathya* or *viruddha*) Food Combinations.

The notion of 'incompatible' combinations of food is found only in the Ayurveda system and is a generic prescription that does not depend on individual body type or other personal characteristics. Individuals may have specific allergies to foods that can be discovered using appropriate tests that suggest specific foods be avoided. The restriction incompatible food is not made on an individual basis in Ayurveda[6]. Scientific basis behind these food combinations are not always easy to discern.

Ayurveda recognizes 18 different criteria for *viruddhaahara*. The space does not allow a full description of all of these. Some examples are incompatibilities that are location-specific (*deshaviruddha*), season-specific (*kalaviruddha*), digestive-capability specific (*agniviruddha*). Some examples of contradictory combinations that should apply to all individuals are as follows.

a) Milk: With bananas, melons, sour fruits, fruit salad or any sour food including yoghurt. Or with mung beans, chickpeas or gram varieties. Meat, fish and baked goods with yeast. Also, consuming milk after eating radish, garlic or basil leads to skin problems.
b) Yoghurt or buttermilk: With milk, eggs, fruit, cheese, fish, meat and hot tea or coffee.
c) Fish: All meats, milk, sugar or jaggery.
d) Meats: With fish, sugar, honey, sprouts, radish or lotus stalk.
r) Beans: Fruit, dairy items, eggs, fish and yoghurt.
f) Eggs: Milk, fish, meat yoghurt, cheese and beans.
g) Tapioca: Banana, mango (and most other fruit) raisin and jaggery.
h) Hot Beverage: with or after alcohol, curd (yoghurt) or honey, mango, fish, meat, yoghurt.
i) Fruits, especially melons, are best eaten without combining with any other type of food as a single meal or snack.

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The Dry Eyes Syndrome; DES..

This syndrome is fast becoming a new concern. There are numerous reasons for this and the main risk factors are the wearing of contact lenses, and the staring onto computer screens for long periods of time, a common feature of the modern lifestyle. The ability to maintain a stable tear film, which acts as a protective covering that spreads over the eyes each time we blink is an important necessity to keep the eyes comfortable, and healthy. The tear film lipid layer (TELL), is located at the interface between the outer air and the tear layer. It is mainly composed of melbomian lipids, complex mixtures of wax, steroid esters and polar molecules. It is believed that the role of the TELL is to minimise the evaporation of the tear fluid. But recent studies reveal that the TELL layer is ineffective in that role. Recent ly, work carried out by Georgi Georgiev of the University of Sofia, Bulgaria, and Norithiko Yokoi, of the Kyoto Prefectural University of Medicine, Japan, have another view. These workers think that the visco-elastic properties of the TELL, which determine how the film stores energy within its structure may be the key to its importance. They extracted the melbomian lipids from healthy volunteers, and and sufferers of melbomian gland disfunction – a condition strongly associated with DES. They spread the lipid films over a replica tear-air interface and measured how the films responded to controlled blink like deformations. Healthy TELL s were leastic: they were able to store the energy transferred upon deformation, and recover rapidly when the deformation was eased. Diseased TELLs on the other hand were viscous and less able to recover after stress and more liable to breaking up. Emergent treatments that the group may develop would be based not on the motive of suppression of evaporation but on the improvement of TELLs mechanical properties such as viscoelasticity.

Kate Bayliss in Chem. World. 2014. July p23.

Sex after a field trip brings a scientific first.

An American vector-biologist is reported to have accidentally written virological history just by having sex with his wife following his return from a field mission to Senegal. The story reveals that Brian Foy of Colorado State University in For Collins and a graduate student Kevin Kobylinsky got bitten mercilessly while collecting mosquitoes in Sengal for their research studies on Malaria. On returning home both researchers developed severe symptoms such as rash, fatigue, swollen joints and pains and similar unpleasant symptoms. Days later Foy's wife also fell ill with similar symptoms. The scientists suspected mosquito borne virus but laboratory studies failed to reveal any confirmatory clues. On hi next visit to Senegal Kobylinsky told the tale to Andrew Haddow a medical entomologist at the University of Texas Medical Branch at Galveston, whose grandfather had isolated a virus called ZIKA in Uganda way back in 1947. Haddow suggested that the obscure mosquito borne agent might be the cause. Sure enough laboratory tests turned up zika antibodies in samples from all three persons.

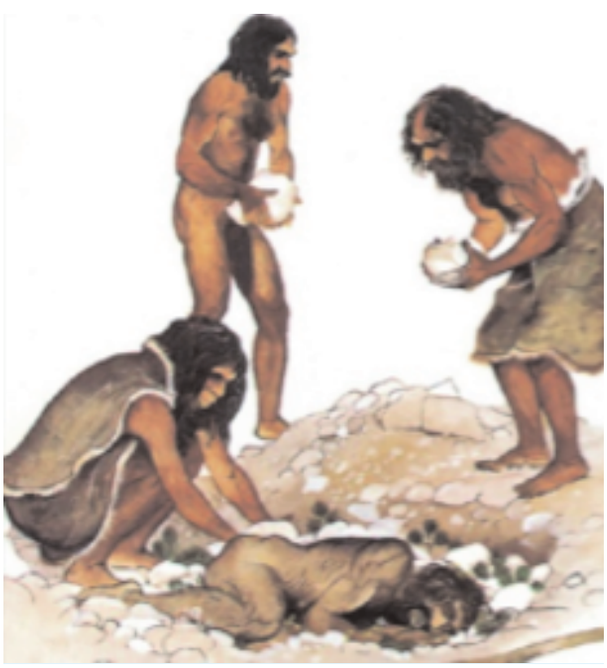
Now, Zika transmitting mosquitoes do not live in northern Colorado. A paper published online in 2011 in Emerging Infectious Diseases, points instead to "vagina sexual intercourse in the days after patient (Foy) returned home – which would be the first case of a sexual transmission of a mosquito borne virus." Foy was to comment: "My wife wasn't happy but she is a co-author of the paper".

Gleaned from Science (2011), 332, 290.

ROLE OF THE MATERIA MEDICA – RETROSPECT AND PROSPECT

By R.O.B. Wijesekera

Neanderthal hunting scene



One had always imagined that the association between medicines and plants began with our own civilization. However, recent paleontological research reveals that even Neanderthal man employed plants for his health care. So it would seem that 60,000 years or more ago Neanderthal man was aware of the medicinal value of plants. However, our own story commences a very long time later. Over the ensuing multi millennia, humankind has made ample use of the enormous array of plants on earth in order to overcome diseases and ailments.

First, during the zenith of Arabian culture, then on to the Greco-Roman age, spanning the Indo-Aryan periods and the Chinese dynasties, medicinal plants that is: the *Materia medica,* formed the basis of therapy for all human diseases and conditions, and this was spread throughout so many varied geographic regions.

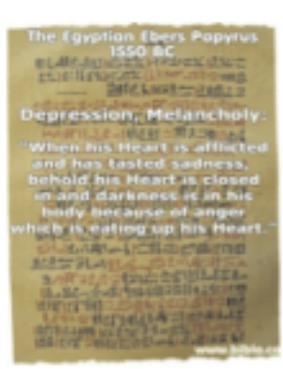
Traditional medicine, therefore, as we identify it now, follows three major patterns:

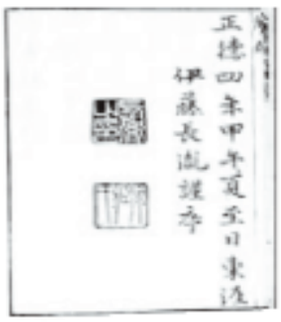
- that which emerged from the Arab-Greek- Roman origins and became the Euro-centric model.
- that which developed in the Indo- sub continental region and identifies itself as the Indo-centric model.
- Traditional Chinese and Tibetan systems identified as the Sino-centric model.

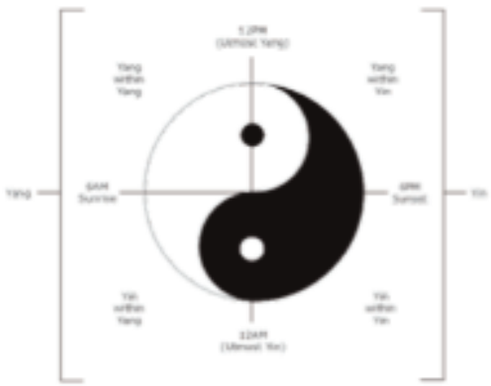
All of these had accumulated an invaluable *corpus* of knowledge and wisdom regarding human illnesses, the power of plants to heal, and the methodologies of diagnosis and practice of healing.

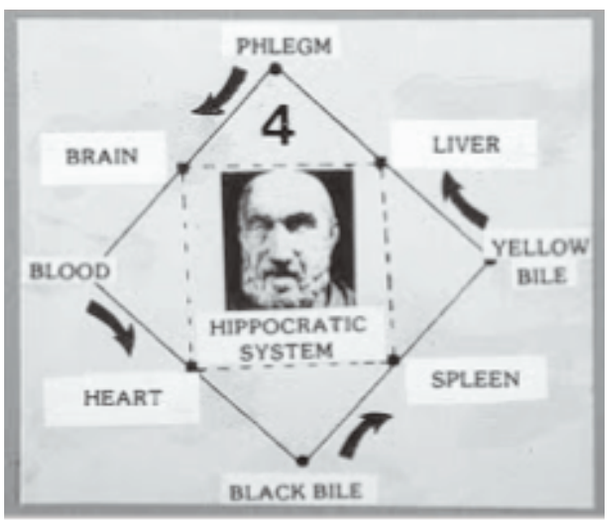
Despite the destruction of records due to the ravages of time, and human conflicts through the ages, there still remains for us some documentary evidence of these great medical systems, in theses such as:

- the Ebers Papyrus of Egypt, (ca 1550 BC),
- the *Corpus Hippocratiens* of Greece.ca 460 BC,
- the *Charaka Samhita* (ca 600 BC)
- the *Susruta Samhita* (ca 600 BC),
- the Chinese text: Wu Shi Bing Fang (ca 350 BC), Shen Nang Ben Cao Jing(Han Dynasty 25-220 AD), and later Li Shi-Zhen's celebrated Compendium of Medicinal Materials.(1587 AD).
- Dioscorides: Die Materia medica 50 AD.
- Galen: Materia medica, 130 AD.









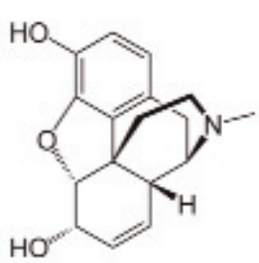
These major systems developed largely independently of each other, although there had been some interaction between the Arabian-Greek-Roman systems and the Indo systems. There had been some interaction too, between the Indo-centric model and the Sino-centric model caused, perhaps mainly by the spread of Buddhism throughout the South and South Asian region. Accordingly, striking similarities, between them were evident. The use of plants and plant derived therapies was the dominant common factor. The other major feature was the concept that illnesses were caused by a disturbance of an otherwise existing inherent balance of factors within the body, and therapies were aimed to redress the imbalance. This was manifest in the System of four humors of the Greco-Roman system, formalized as the Hippocrates system, the *"Tri dosha"* system - *Vata, Pitta,* and *Kapha* - of Ayurveda, and the "Ying-Yang" concept of the Traditional Chinese system. So, to strengthen the body's ability to counter the imbalance was indeed, the basic underlying theoretical objective of medical therapy in all of the three systems.

If interpreted in terms of recent concepts,- concepts that have entered modern systems undoubtedly derived from the older systems,- this would translate in modern terminology, into: the "strengthening of the body's immune system". The similarities in terms of diagnostic methodology and therapy too were indeed most significant. For example, it is recorded that Hippocrates used the plant *Veratrum album*, as an anti-tussive, while at the same time the Chinese were using the plant *Veratrum nigrum,* for the same purpose. There were many such similarities in the use of plants of related genera for similar purposes.

Permit a digression here to illustrate such instances with some personal experience. During the author's tenure as the Manager of the WHO Task force for Research on Plants for Fertility Regulation, Geneve, 1978-80, the Task Force noted that the plant genus Aristolochia, was used by several different cultures in different geographical locations and different regions of the world as an agent of fertility regulation. As a result it was rated a priority candidate for the Task Force investigation and endeavour to find a plant-derived fertility regulating agent. It was further found that although the member plants of this genus contained Aristolochic acid, a strongly toxic secondary metabolite, the extracts were innocuous in the dosages administered. This feature was researched and published by the members of the task force, but this is a feature that is now well established, namely, that although a plant may yield toxic constituents, the total extract may be harmless or even as the case may be, more effective than an isolated pure chemical the presumed "pure active constituent". The existence in the plant itself of the secondary metabolites in a form linked with sugar residues and not as the toxic aglycones may be a ready explanation. In the sugar linked form the substances being soluble can be easily eliminated from the body before the toxicity can manifest itself.

The global trend remains today, as humans worldwide, sophisticated or otherwise, depend on the use of medicinal plants as the main source of therapeutic agents to combat disease, as it has remained for many millennia since those ancient times; and continued till the time when modern organic chemistry, focused now as "Phytochemistry" or the Chemistry of Natural Products, became a dominant force. One could say, that the modern phase of therapy, based on single chemical substances as the active agent, commenced with the rise of organic chemistry itself, - which later came to be identified as the specialty, Natural Product Chemistry or in Europe as Phytochemistry.

About the beginning of the nineteenth century the German organic chemist F.W.Serturner isolated Morphine, from the opium poppy exudate, and thence began the use of pure chemicals. Morphine was commercialized in 1826 by Merck, to begin what came to be identified as the Pharmaceutical Industry.



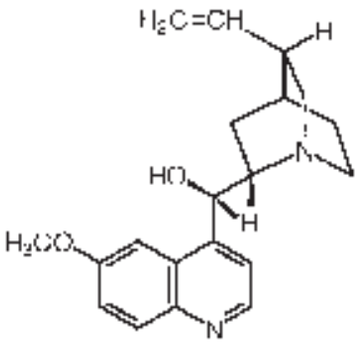
Morphine

Frederich Serturner

The industry depended on a sequence of research which investigated plants with established bioactivity, with a view to isolating and identifying the chemical entity which was supposed to be the agent responsible for the activity. From then onwards there was the White Willow plant or *Salix alba*, from which came the drug Aspirin, commercialized by Bayer, *Cephalis ipecacuanha,* from which came emetine, and followed by others such as quinine and reserpine which were epoch making stories in themselves. May one recall some of these stories, as they are a significant part of medicine's history? Malaria was a scourge then too as it has been since. Jesuit priests working in the jungles of Peru in the mid nineteenth century came across the natives using the extract of a bark of a rain forest tree, *(Cinchona ledgeriana)*, and successfully curing a fever that was killing many of the colonists ; they brought it to the notice of the Spanish viceroy, whose wife, at the time, was also seriously ill with the disease. When administering the extract of the bark successfully cured her, the viceroy sent it to Europe and chemists Joseph Caventou and Pelletier in Europe isolated from it the historical substance Quinine. From then onwards it was the endeavor of all chemists, for the ensuing half a century, to try to imitate nature by isolating from medicinal plants the perceived active principle; and following it up by attempting to synthesize the desired individual chemical.

Caventou & Pelletier

Sir Robert Robinson

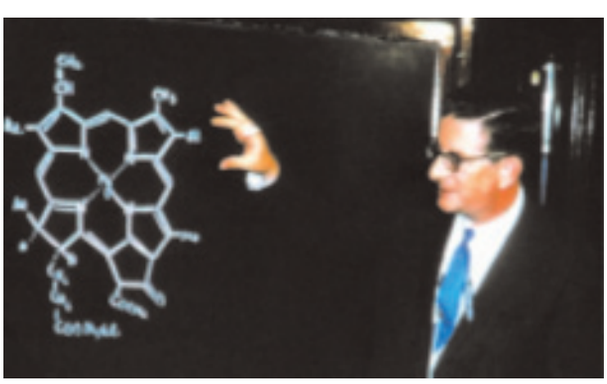


Quinine

The great Nobel Prize winning organic chemist of Oxford University, Sir Robert Robinson OM, FRS,, spent decades in unravelling the complex structure of Quinine but, earlier, his mentor, William Perkin, in attempting a quick- strike synthesis ended up with not quinine, but the dye Mauve, thus beginning the commercial synthetic dye industry.

The synthetic trail of drug discovery was set in rapid motion during the period of the World War II when natural quinine became unavailable due to the Japanese occupation of the south Asian region where cinchona had been cultivated by colonial powers notably the French, the Dutch and the British. With this as the desperate driver, the synthetic chemical industry speeded ahead, and the vast array of synthetically produced pharmaceuticals was to follow. Great Nobel Prize winning Chemists like: Leopold Ruzicka, Robert B.Woodward, Carl Djerassi, and Gilbert Stork, among a generation of others, were engaged in these synthetic efforts.

Rauwolfia serpentine

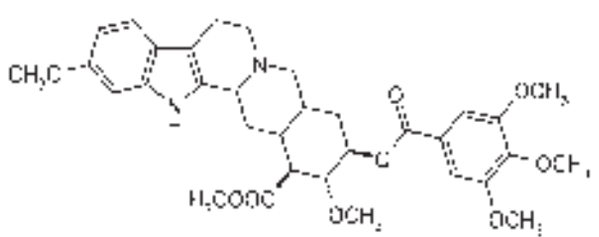


Prof. Robert Woodward

Prof. Gilbert Stork

The story of Reserpine, now the subject of a book, was a similar epic. Up until the period of the mid twentieth century there was no cure for hypertension and the condition was confused with insanity, and treated as such.

Prof S. Siddqui



Reserpine

The Pakistani chemist Salimuzzaman Siddiqui, working in pre-divided India, noted that the plant *Rauwolfia serpentina* was used by Ayurvedic physicians to cure symptoms of insanity. He isolated the alkaloid Reserpine from it, and sent the total plant extract to Ciba in Switzerland whose chemists led by Emil Schlittler were able to isolate several alkaloids from it. Ciba marketed reserpine, which for several decades after the 1950's, remained the standard treatment for hypertension. Synthetic variants have now taken its place, although it is contended that the total extract, referred to in Ayurveda as: *Sarpaganda gnanavati,* still has merits as well, in terms of efficacy and safety, and lack of untoward side effects.

A few recent landmark examples of natural products, which similarly led the way towards new drug developments are:

- Artimisinine from *Artimesia annua* the Chinese plant known as quinghasu, the present gold standard for treatment of malignant Falcifarum malaria, and the ethers derived from artimisinine.

- L Dopa from *Mucuna pruriens*, in the treatment of Parkinson syndrome,
- Taxol from *Taxus brevifolia,* as an anti cancer agent.
- Vincristine, and Vinblastine from *Catharanthus roseus,* in the treatment of cancers.
- Bacosides A & B from *Bacopa moniera* for memory enhancement and Alzheimer syndrome

There are a host of others, which have now entered the modern armory of medicine, and still more in the final stages of doing so.

The need for new and inexpensive therapies for chronic illnesses cannot be over emphasized. In addressing this need some facts of relevance may be stated:

- According to the National Institute of Health of the US 50% of the bestselling pharmaceuticals of today are derived from natural products.
- 70-80% of the Global population is dependent for their therapeutic requirements on natural products mainly used as aqueous extracts, according to the WHO..
- 60% of the anti-cancer drugs and 75% of the anti-infective drugs approved by the FDA during the period 1981-2002 are traceable to natural product origins.
- 50% of all drugs approved since 1994 by the FDA are derived from natural products.
- 80% of the molecules used in all pharmaceutical drugs sold worldwide, are derived from natural products.
- At the present time over 100 new natural product-derived drugs are in clinical research and development.
- Despite the chemical synthetic industry, 25% of prescribed drugs are still those of vegetable origin (WHO).

Thus natural products remain a matchless source of novel drug agents, Nature gives the leads and chemists imitate them. This brings us to another monumental issue which is the wanton destruction in the name of development of the natural rain forests of the world the treasure trove of potential drugs of the future. This according to the International Union for the Conservation of Nature is one of the major global issues. Besides, the volume of wisdom and knowledge accumulated in the traditional systems of medicine, mostly lodged with the rural societies, it is now realized, should not be missed in the new approaches to health care and therapy. This also emphasizes the crucial role that modern Phytotherapy can play in health care. Sadly it is a less appreciated factor in the Anglophone countries of the world, although a mandatory requirement in the Eurozone.

A paradigm change now being recommended by the new generation of pharmacologists and clinicians, in the development of new drugs is:

- To jettison the present dogma of a single chemical approach to the treatment of disease..
- To recognize multi-drug therapy,& a multi-target approach
- And to take cognizance of the synergistic factor in respect of interaction between the chemical entities.

Traditional therapy as well as modern Phytotherapy, has long followed similar strategies using mono-extracts or poly-extracts, in the belief, that a complex patho-physiological process can be influenced more effectively and with lesser if any side effects, by a combination of several low dosage compounds (eg.in extracts), than by a single chemical compound at high dosage level. To facilitate this new paradigm a deep study of the therapeutic methods of the traditional systems would be a distinct guide. In the formulation of drugs, modern high-tech analytical

methodology such as three dimensional HPLC enables even complex extracts to be standardized accurately, and hence the extracts of yore may be a facile means for the future therapy enabling cost-effective therapies in the developing regions of the globe.

Professor Hildeberte Wagner

It would be pertinent to end by quoting Professor Hildeberte Wagner, of the Centre of Pharma Research in Munich, Germany, who puts it thus: "The main aim is to find a scientific rationale for the therapeutic superiority of many herbal drug extracts derived from Traditional Medicine, as compared with single constituents. The efficacy of these extracts used for centuries was verified in many cases by clinical studies."

It is anticipated that there will be a smooth transition to a new kind of multidrug therapy, incorporating the benefits arising from deep studies of the traditional systems, for the enhancement of the health of all mankind.

N.B. Adapted, updated, & extended from a lecture delivered to the Ceylon Medical Association 126th Anniversary Scientific Congress: Symposium on Herbal Medicine, by the Author, on 12th July 2013

Passion in Success

What is the secret to success in science or anything else? Hard work alone is not enough. It is being passionate about something, enough to make a wholehearted commitment of creativity, rigour and determination.

Alice S. Huang, California Institute of Technology, President AAS 2011.

Peripatetic Nobel Prize Winner - Baruch Blumberg.

Baruch Blumberg, popularly known as Barry, won the Nobel Prize for Physiology in 1976, for his discovery of the Hepatitis B virus, and his inventing a vaccine against it. Characteristically when eventually he died at the age of 85, he was many miles away from his home base of Philadelphia, attending a NASA Conference in California. He spent many years working with and leading NASA's astro-biological research program, and in research on Cancer at Philadelphia. Blooberg was constantly on the move and he was reputed to be one of the researchers who had one of the most massive collections of samples of blood. He guessed that he had amassed over 450,000 blood samples during his career. To acquire this collection he had travelled to West Africa, the Arctic, Rumania, Italy, Taiwan, the Pacific islands and more. His geographical reach was so great that his face appeared on stamps in the Maldives and Angola. "I carried a Lab around the world," he was to say.

NASA has now announced the creation of a Blumberg Chair in Astro-biology to honour the pioneer in the subject.

Science 332, (2011), 289: *Science:* (2010), 135 .7 *Science* (2011), 334.p 1328.

The formidable issue – Vaccine for TB?

When the celebrated tuberculosis researcher and Harward University immunologist Barry Bloom wishes to illustrate how difficult is the scientific research to reach this objective, he displays a slide of a man holding a small saw alongside a massive redwood tree. The slide draws a laugh from the audience but it indicates the magnitude of a public health challenge that is far from funny.

Barry Bloom

THE STORY OF JIVAKA – PHYSICIAN TO THE LORD BUDDHA

By Vikrama

Preamble

Jivaka

The story of medicine within the Indian sub-continent goes back several millennia prior to the modern era. Like in all regions of the world the early attempts of mankind to combat disease were inextricably linked with mystery and the supernatural. Commencing with the Aryan invasion of the continent around 1500 BCE, the so-called *vedic* period of medicine may have commenced. Religious teachings, concepts of life, of well-being, and disease, are contained in the sacred teachings of dubious antiquity known now as the *vedas*. These are four in number namely: The *Rig veda,* the *Samaveda*, the *Yajurveda,* and the *Atharveda*. Through the ages the knowledge and wisdom of these *vedas* had been handed down from teacher to pupil orally and memorised for handing over to the next generation. They for the most part consisted of charms and spells designed to ward off diseases. The *Atharveda,* which was one that was mostly concerned with curative methods, was through the centuries improved by observation and intuition, and eventually became a corpus of literature, that came to be identified as *"Ayur Veda"*. This literally meant the science or knowledge of life. It is believed that the earliest literature appeared during the second millennium BCE, following this Vedic period. The progressive increase in the literature on medicine and healthy living may have developed over centuries and the landmark events were the emergence of the two compendia by Charaka and by Sushruta. These now constitute the basis of all Ayurvedic medicine, but the period during which they emerged is unclear, being differently placed by historians as between 600 BCE and 100 CE.

Dr.M.S.Valiathan, the internationally distinguished modern surgeon and authority on Ayurveda puts it thus: "The core of Ayurvedic doctrines, profiles of diseases and procedures remained unchanged over centuries whereas changes which did occur were more or less confined to medicinal formulations…"

It is probably during this grey period of history that the Lord Buddha lived, 563-483 BCE, and so the vague period of the life of his physician Jivaka is placed as the 6th century BCE. This is prior to the period of the famed Ayurvedic experts, Charaka and Susruta and organised Ayurvedic practice. However the story of Jivaka, told in a fashion that may be apocryphal, makes one of the charming tales of the early medical history of the subcontinent. It is also indicative of the nature of the roots of Ayurveda and the spread of knowledge over the regions at the time

Early life of Jivaka

The story of Jivaka, the great physician of the Lord Buddha, was recorded to have been unearthed in the library of Dr. Bharat Vaidya. The story had been originally published in the Pali journal called Health, - a publication of the: *Prabhuram Anant Pharmacy for the Upheaval of Ayurveda.*

It is recorded as having been re- written by a Raj Vaidya Harjivan Ratnaji Bhatt, in 1929, and based on an original script of Jivaka's life, along with a list of Jivaka's prescriptions preserved and presented by, Rev. Ch. Damodar Swami, a professor of Sanskrit from Sri Lanka. It had been translated into English, by Dr. Bharat Vaidya (2011), and re-published in English, (Heather, 2012, MuleyGunakar, 2000).

Location of the ancient empire of King Bimbisara and birthplace of Jivaka in Magadha

King Bimbisara, at the time was the reigning monarch of the Magadha empire, a predominantly Buddhist region during the time of the Buddha; and the boundaries of this region were quite different to those of present day India. King Bimbisara reigned in Rajgriha, near, Nalanda and Gaya, in the province of Bihar. He had expressed the desire to have a dancer in his court, like the famed dancer who was Ambapali. Accordingly, a dancer Salavati, with the enchanting voice and mesmerising dance technique, was presented to him, and she was accepted; and in time ascended to the position as the favourite courtesan of the King's court. As would invariably happen, she soon became pregnant and gave birth to a baby boy. Salavati, thinking less of the child, and more of her position and professional prospects, decided to abandon the baby, and instructed her servants to place the baby in a basket and leave him in the garbage heap beyond the walls of the city. The crown prince, Prince Abhaya, while riding past noticed some crows surrounding the garbage dump and on inquiry found the abandoned baby, who in reality may have been the illegitimate son of the king himself. Prince Abhaya caused the baby to be brought to the palace to be brought up by the ladies of the court. He gave him the name Jivaka. So in this strange turn of events the baby had been rescued by his step brother. He had been given the name Jivaka, (meaning life), as he had successfully survived his harsh fate prior to the rescue. Upon learning, as he grew up, of his humble beginning, Jivaka endeavoured to study purposefully, and encouraged by Prince Abhaya, his foster father, he set his sights on becoming a physician.

As a teenager he, on his own, travelled on the established trade route and entered the great seat of learning that was in Taxila. This was an institution near present day Rawalpindi in Pakistan. In the time of the Buddha, Taxila or Takshasila as it was also known was a celebrated seat of learning. It was then not a University Town, with a normal campus and halls such as even then existed in Nalanda. Reference to student life in the Buddhist Jataka stories indicate, that at Taxila at the time, the homes of the teachers, was where the actual learning took place. Students were generally admitted when in their teens,. Those from wealthy families boarded with the teachers and paid them handsomely for the food lodging and instructions. Pupils from Royal families had their separate independent quarters. Those from poor families who were unable to pay their expenses were called upon to attend on their teacher and the family. Apart from medicine Takshasila was a world famous centre of learning for a variety of subjects including: sciences, arts, crafts, and the humanities. Jivaka who was one of the less wealthy pupils chose to study medicine under one who was then recognised as one of the world famous physicians, Atreya, styled in Chinese and Tibetan texts as "Streya". He was to spend seven years at this seat of learning.

Jivaka proved a hardworking and able student, with a penchant for investigation and observation befitting that of a physician. He worked diligently for his Guru, and also selflessly assisted fellow students with their work. Seven years had passed when Jivaka inquired of his Guru, as to when his work would be finished. It was nearing what was the equivalent of graduation time, and the story is told as follows:

As a final exercise the Guru had assigned the pupils a practical examination. He asked the students to take a shovel and travel one square yogama, (14 km square approximately,) around the region of Taxisala, and bring back samples of any plants that did not possess medicinal properties. Most of the students had returned with a variety of plants; but a disappointed Jivaka, had come back much later without any, and had said: Oh! Teacher: all the plants are remedies and there is nothing which is not one.

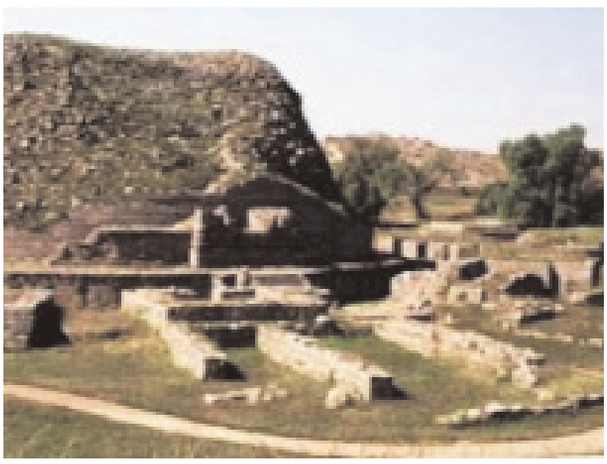
Satisfied with this, the teacher pronounced that Jivaka was ready to do his own professional work.

Yet another episode that is quoted in the stories of Jivaka's early life is this:

Jivaka together with the Guru Atreya and several other students were travelling on a jungle track and noticed some animal foot-prints. Jivaka informed the party that those were foot-prints of an elephant, a female one and blind in the right eye, and about to bring forth a calf that day. He had also observed, that a woman who was riding on the elephant was also blind in the right eye, and she would be delivering a baby boy that same day. Asked by Atreya and his astonished fellow students to explain his observations, Jivaka had responded thus: Having been brought up within a Royal family, he knew that the footprints of male elephants were circular, whereas those of female elephants were oblong. Explaining further, he had said that the elephant had eaten grass only from the left side of the road and that she was pressing hardest towards the right side, suggesting that the foal was to be a male. Lastly, he had explained that the woman riding the elephant was blind in the right eye because she had, upon descending, picked flowers that grew on the left side, and the heels of her feet had made deeper than usual impressions, and that the backward lean suggested that she was pregnant. The students as well as their Guru Atreya, had been astounded to find that when they verified them, all of the statements had been correct.

There were many such tales about Jivaka.

Finally, Jivaka had graduated, and was now a fully-fledged Physician, and the Guru, Atreya congratulated him on his successful completion of his training, and gave him basic funds and the means to get back to his native Magadha.



Taxila University in the ancient times was a celebrated centre of learning

Jivaka's Professional exploits

Jivaka is stated to have set out on foot and reached the city of Saketa, now known as Ayothya. In Saketa, Jiwaka ran out of the modest funds he had been given and realised that the path ahead to Magadha would be difficult without adequate means. He bravely decided to try out the value of his acquired expertise. The story is told of how he began his professional practice by offering his services as a Vaidya of Ayurveda throughout the city.

On inquiring after those who may be potential patients he had come across a wealthy merchant whose wife had been unwell for seven years. He had gone to the merchant's house and announced that he was a Vaidya who had come to treat the patient. The merchant's wife had inquired from her security guard about the nature of the Vaidya who had come, and was informed that he was quite young. She had been treated by the most reputed scholars of the city and was hesitant to trust the youthful stranger. However Jivaka had endeavoured to win her trust and had informed her that he would not request any payment to begin with, but with confidence had told her that she may pay him whatever fee she thought fit, once she was completely cured. With this the merchant's wife had agreed to be treated by him. As had been taught him during his training he was said to have firstly applied the technique of "Ashtavida Pariksha" – the eightfold method of examination of a patient. (This constituted examination of the nadi, that is the pulse, the mala, which is the bowel movements and excreta, the mutra, which is the urine, jinva, the tongue, and rupa the patient's body,etc.) Eventually Jivaka had diagnosed, that the lady primarily needed treatment for the recurrent headaches she was suffering from. He treated her for a sinus condition with a nasya – an extract of herbs with ghee, and after a while her condition improved. He continued with treatment that completely rid her of her seven yearlong ailments. She was reported to have paid him in 16,000. Kahapanas, silver coins, and so did her grandson and his wife; and her husband gave her in addition, even more coins, servants, a horse and carriage. Now enriched as he was, Jivaka returned to Magadha to the palace of Prince Abhaya. He was then said to have handed over all he had earned to Price Abhaya his foster father, for educating him. Abhaya refused this, and instructed him to build his own home in proximity to the Palace.

The Mahavagga, a Buddhist text, attributes many such miraculous cures to Jivaka. It is due to these Buddhist texts that some facts of the life of one of India's great physicians is recorded. Another such anecdote that is reported of Jivaka, the Physician is this:

The old king Bimbisara of Magadha, had been suffering from bleeding haemorrhoids, and the blood on his garments had been an embarrassment. He confided in his son Prince Abhaya who advised him to consult Jivaka. Soon Jivaka the physician had cured the old king of his ailment and he was again offered payment which was declined. The king thereupon gifted Jivaka a Palace with a garden full of mango trees and other fruit trees, and a small village within the district. Jivaka was to later build a monastery in this garden for Buddhist monks. (Jivakambhavana)

Jivaka had by now become the most sought after physician in King Bimbisara's kingdom. Rich and prestigious merchants had sought his services to cure them of various ailments and apocryphal stories of a number of such cases are in the records. He had received wealth and property but he valued most of all a silk shawl he was given by the King to be presented to the Buddha. The King wished him to be the official physician to the Buddha whose health was at the time beginning to cause concern.

Physician to the Buddha

Jivaka image as Buddha's doctor

Following the successful treatment of the Old King Bimbisara, himself, the King made him Physician to his Royal court. The king who had now become an ardent follower of the Buddha also recommended Jivaka to the Buddha too. So Jivaka saw the Buddha and soon became physician to the Buddha as well as to his monks.

And as had been stated:

Jivaka had treated the Buddha for his ailments and received accolades from the great sage, but he had only requested that the Buddha accept the shawl that King Bimbisara had given him to be presented to the Lord himself.

In his time as a celebrated physician there are many anecdotes that were related in regard to Jivaka's skill as a physician. Unfortunately, there are no indications in any of the stories about the species of medicinal plants that were used by the physician Jivaka to accomplish the cures he made. However in his treatment of the ailing Buddha there is indication that in a purgation program of treatment, he may have used the plants *Terminalia chebula,* (Sinhala: *Aralu,* and Sanskrit: *Amalaki)* and *Embilica officinalis.* (Sinhala: *Nelli*). This story goes as follows:

At this time Lord Buddha had revealed to his disciple, Ayushaman Ananda, that he had toxins within his body for which he wished to take the treatment known as purgation. Ayushaman Ananda called in Jivaka who having examined the Buddha proceeded to prepare the medicines for the treatment. This would bring on nine rounds of purgation and then a second medicine was to be administered which again would bring another nine rounds of purgation. This would be followed by another round of medicine and as Jivaka estimated the Buddhas's condition needed nineteen rounds of purgation. It had been noted that the myrobolans, Amalaki, was one of the ingredients used as in the previous instances where Jivaka had treated the King. When the Lord Buddha had completed the final round of purgation he was cured and Jivaka had ordered Ananda to prepare a warm bath for him. When the Lord Buddha had asked Jivaka what he wished to have as a token of his appreciation for the cure, Jivaka declined any presents but requested the Lord Buddha to accept a Shawl the king Bimbisara had presented to him to be given to the Buddha. He also requested the Buddha to discontinue the traditional practice of his monks using clothes stitched from discarded pieces of cloth, cut and stitched together and dyed. Jivaka's request was promptly granted by the Buddha and thenceforth monks and disciples were permitted to accept cloth offered to them by laymen and townsfolk.

During this period that followed it is said that Jivaka had been consulted by several of the rulers of neighbouring states as his reputation had spread far and wide. One such monarch to seek his services had been the King of Ujjeni, King Prodyod, one of his most formidable patients.

As the story is told the King was reputedly averse to the consumption of Ghee, which was at the time a popular medium for the introduction of herbal extracts for internal use. Jivaka is recorded to have circumvented this in his treatment by preparing an astringent decoction with the necessary ghee incorporated within, and administering it to the king, while making arrangements for his swift getaway in case the hot tempered monarch found out. The medicine had eventually cured the King who was most grateful.

Once again, these stories are mainly at best apocryphal, and their veracity can never be ascertained. However, more importantly, they are strongly indicative of the existence at the time of an exceptional human being with medical knowledge and skills that were extraordinary, who lived during the Buddha's lifetime which means, prior to the time of Charaka or Sushruta.

According to the Mahavagga, Jivaka also performed surgical interventions. The following story is about a Sethi or merchant prince of Rajagrha who was ailing for a considerable time with a head ailment. He had been treated by several physicians of the day but he appeared doomed to die. Then another merchant went to the Magathan King Bimbisara and told him that the sick Sethi had rendered good service to His majesty and to the merchant's guild. He implored the king to request the Royal Physician, Jivaka to treat him. The king accordingly invited Jivaka to go to the Sethi; and the story goes on as:

After examining the Sethi, Jivaka told him that he had to be operated and that after the operation he would have to lie on his left side, his right side and on his back for seven months in each position. The patient agreed. Then Jivaka in performing the

operation got the Sethi to lie on his bed tied him fast to the bed and cut through the scalp, and drew apart the skin on the two sides to enable him to draw out two worms from the wound.Then he stitched up the skin and anointed it with salve.... Following the operation the Sethi could only lie seven days each in the positions prescribed. He expressed his inability to lie any further. Jivaka then told the Sethi that he had rested enough and added: "If I had not spoken to you as I did you may not have rested even as long as you did. Now you are cured" It is stated that the Sethi gave a 100,000 Kahapanas to the King and another 100,000. toJivaka.

Yet another Mahavagga story about Jivaka's surgical skills concerns the son of the Sethi of Varanasi. The youngster while performing Gymnastics had suffered a strangulation of the intestines. Again the father had come to the king and requested the attention of the Royal physician for his son's acute condition. The king consented and Jivaka had to go to Varanasi to attend to his patient. Then as the story goes:

He ordered all the people to leave the patient's room, drew the curtains and tied him fast to a pillar and cut through and drew out the strangulated intestines corrected them and placed them inside before stitching up. He then daubed the wound with herbs and salve. The Sethi's son was cured in time and Jivaka was given a large fee.

In more serious vein, one of the main contributions of Jivaka to medicine at the time appears to have been to elaborate the virtues of purgation as a methodology for the elimination of toxins from the body., a methodology that is now well entrenched in modern day Ayurvedic practice.

Jivaka, it is said, was able to treat chronic constipation as well as to perform surgical interventions when there seemed to be intestinal obstructions. He was also reputed to have developed herbal remedies for the healing of wounds. It is understandable that the medicines used by Jivaka were those currently in use by the established schools of medicine such as in Taxila, where Jivaka studied under Atreya, and they would undoubtedly have subsequently entered the subsequent compendiums such as those of Charaka and Sushruta. Jivaka's work is also mentioned in several Buddhist Chronicles such as the *Mahawansa*.

Jivaka as a healer outside India

Jivaka's reputation as a benign healer of disease had spread far and wide beyond the borders of modern India. In Thailand for instance he has been recognised as the Father of Thai Medicine and the founder of the presently globally known Thai Massage system. Tradition holds that:

The founder of what was termed Buddhist Medicine was a Jivaka Komarabhacca, the personal doctor of the Buddha. One of the earliest Buddhist texts the Pali Canon mentions Jivaka in several places as a wealthy lay physician and the donor of a mango grove called Jivakarama, which he donated to the Buddha as a retreat for the Sanga.

Along with the spread of Buddhism, the medicine of India also spread to other lands. The personal physician of the Buddha Jivaka was also known as Jivaka Kaumara Bhitya which means "expert in Paediatrics" In the early part there existed a large volume of literature on the subject but it has been noted by subsequent scholars that the Jivaka compendium was regarded as the authoritative work on paediatrics. But today no text of Jivaka is available. All that remains are references to Jivaka saying...Thus spoke Jivaka..and cohesive texts that existed are no more.

There is however a detailed biography of Jivaka in the Mahavagga section of the Vinaya Pitaka. This section describes his beginnings and the miraculous cures he was known to have affected. The Buddha's period of Indian history was an era when Indian medicine was in transition from the vedic system, which included also supernatural phenomena, to the more rational system that evolved into what we know as Ayurveda. The transition had taken many centuries and was perhaps finalised into a rational basis with the twin compendia of Charaka and Sushruta. Jivaka's reputation travelled with the Buddhist scriptures in many directions. Jivaka appears in Tibetan Medical scrolls and his life is depicted in the art form in Thanka paintings.

Thanka Painting depicting Jivaka's skills

In most of the Buddhist world of today he is not a well identified figure, but in Thailand he is revered as the "Father Doctor" who developed herbal medicine, therapeutic massage and other healing practices which he taught to successive generations. Though the transmission of ancient medical practices may have had several pathways, it is clear that the work of Jivaka is an important landmark in the tradition of eastern medicine.

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Innovation

The failure to keep up with innovation is really the failure to develop and focus core competences in the direction of change of progress.

Jas. M. Utterback Mastering the Dynamics of innovation. Haarvard Business School Press 1994.

Allergic to Peanuts?
For some kids eating them helps.

A new study is adding to a small but growing pile of evidence that kids with food allergies can benefit when exposed, under a doctor's supervision, to the very food they react poorly to. Last week, a team of British researchers reported that 22 children with peanut allergies generally did well when given higher and higher doses of peanut flour mixed into chocolate bars over several months. After 30 weeks the children got about 32 roasted peanuts to eat. Fourteen tolerated that dose; on average, the peanut serving size the children could handle grew 1000 fold. The work was done in Cambridge. Its not the last word and doctors warn that parents should not try this on their own; the study was small and had no control group. But it builds on similar evidence for eggs and milk allergies. There's also hope that eating peanuts can help to prevent allergies to them in the first place. A different UK study expected to end in 2014 is trying to thwart peanut allergies in hundreds of kids who are at high risk.

Science Vol.331 25March 2011

Ballet of Plant Movement.

In the Northern Hemisphere winter is ending and the world of plants seems dead and lifeless. However spring is on the way and the ever present plants will again resurface. Their return will herald a re-greening of the Earth, a ballet of germination and sprouting. But for most people, plants are seen as if inanimate objects. Trees stand majestically, grass carpets a lawn, and flowers provide a backdrop of colour, yet all appear to stand lifeless, except for swaying in the wind. Intellectually you know they are alive, you learnt that in school. You also learnt they are sessile – they do not move, at least not in the animal-centric sense of the word.

Sarah E. Wyatt in Science (2011), 331, 1520.

A TALE OF THE "EARTH'S ESSENCES", AND NATURAL FRAGRANCES REVISITED

By R.O.B.Wijesekera

Preamble

In the world of today we are dependent on a variety of technological innovations that augment our senses. In contrast, in the earliest age of hunting and gathering mankind depended very heavily on the sense of smell. So millions of years ago, the only fragrances that mankind knew were the fragrances that came from the earth itself. These were the "Earth's Essences," that is, the essences which came through the flora and the fauna that was evolving within the biosphere.

From then on during the millennia that followed, people gathered parts of plants and extracted their fragrances to bring delight and sensuality, feelings of wellbeing, and even sacred elements into their lives. Recently, archeologists have unearthed what is reckoned as one of the earliest perfumeries in the world; this was in the Mediterranean island of Cyprus. Similar sites have been excavated in other parts of the world, indicating that the perfumery technologies were practiced even during the Bronze Age.

A Bronze age perfumery factory

Ancient Greece, Egypt, China, and India, and the countries on the ancient trade routes, all had well developed perfumery industries. In ancient Egypt perfumes were made up of aromatic plant ingredients which provide a pleasing fragrance and healed a person of certain illnesses too. In India the Ayurvedic system of medicine recognized the value of psychotherapy for illnesses connected with the mind and the fragrant plant ingredients were used as one form of therapy. Health benefits were known along with personal and environmental benefits and these properties were extensively employed throughout the region. It was in the seventeenth century and after that chemistry entered the equation. Extensive scientific studies on organic natural products generated chemicals with distinctive aromatic characteristics that enabled the perfumer to extend the repertoire of constituents with which to compound individual perfumes; and this became a deluge when synthetic aroma chemicals came in to further widen the perfumer's palette. This phenomenon eventually developed into the vast modern perfumery and fragrance industry, amounting today to multiple billions of dollars. Perfume formulations tend to include natural derived substances, synthetic imitations, as well as purely synthetic aroma chemicals. Grasse, in France came to be regarded as the modern perfumery capital of the world.

Now another movement has emerged, which in consonance with the move towards naturals so evident in the revival of herbal medicine, strives to make perfumery to be totally natural as well. So the old art of perfumery comes a full cycle as the art of natural perfumery, comes to be revisited in a modern day image.

Ancient use of Natural Fragrances

Taputti Belatekelim, a woman perfumery chemist mentioned in a cuneiform tablet from the second millennium BC in Mesopotamia, is regarded as the first recorded exponent of the perfumery art.

She was reputed to have employed flowers, oil, and *calamus,* along with *cyperus,* myrrh and *balsam,* mixed with water, in her perfumery compositions, and even conducted purification and filtration methods to enable her to produce perfumes for the personnel of a palace for which she worked. Her utensils are one of the first recorded and she was believed to have worked with a researcher named *Ninu.*

The very first form of perfumery used by humans is believed to be the burning of aromatic exudates, barks and leaves. This led to the discovery of incense, which is a resin exudate; and it also was responsible for the origin of the nomenclature. Perfume is derived from the latin *per fumum* literally, "through smoke". Incense was in use from over 4000 years ago as the ancient cultures were known to burn many kinds of resins, fragrant woods at their ceremonies. The Egyptian tombs of over 3000 years ago bear the hieroglyphics that tell us of the part played by incense and perfumes in their lives. The trend was popularized by Queen Hatshepsut who was believed to have led expeditions in search of incense and other aromatic commodities. The temple created in her honour bears testimony to her interest and boasts a botanical garden with incense trees, resulting from the expeditions she sponsored. This predated the celebrated golden age of Arabian culture when perfumes were enclosed in the tombs of the ancient Pharaohs. For many centuries Egypt was the centre of perfumery and the strikingly beautiful containers which held their perfumes were made of expensively elaborate porcelain, glass, and even of gold. Perfumes were used in their embalming process, and urns containing the fragrant materials were enclosed with the dead.

Perfumes were part of Egyptian everyday rituals

The Egyptians were able to import flowers such as lilies and roses, and other fragrant materials such as anise and *orris* root from other parts of the world.

Ancient Egyptian perfumes made from flowers and other plant parts together with gums and resins and vegetable oils were called "unguents". Egyptian women often wore a cone made with fresh macerated roses on their heads. Body heat allowed the fatty oils bearing the scent of the preparation to melt and trickle down their faces and neck.

The famous Egyptian perfume **Kyphi** – meaning welcome to the Gods- was composed of sixteen materials of natural origin *viz:* frankincense, myrrh, cardamom, juniper mint, cypress, spikenard, and cinnamon, along with honey, wine and raisins. This was used for spiritual rituals, physical healing, and psychic awareness.

The methods of extraction and distillation and the ingestion into oils to form unguents were initially developed by the Egyptians. The Armenian scientist, Avicenna, is credited with the innovation of the technique of steam distillation. These early products from natural materials were extensively used as health care by both men and women at the time. The celebrated Queen of Egypt, Cleopatra, was lavish in her use of perfumes just as Nefertiti a beauty from an earlier Egyptian dynasty was reputed to have surrounded her with assortments of perfumes in vivid containers and handsomely ornamented jars of unguents.

Alexander the Great invaded Egypt in the third century BC and this brought the use of perfumes and incense to Greece. The consumption of perfumes was at a peak in the region at the time and the custom of daily bathing in the warm milieu involved the use of fragrant substances. The Greeks developed their own characteristic perfumery substances with fragrance carriers made from vegetable oils such as olive oil and flowers such as lilies and roses. Theophrastus of Athens, known also as the Father of Botany, in his thesis, *Concerning Fragrance,* discussed aspects of the technology of production of fragrances such as the suitable carriers of scents, the essentials oils and their extraction, and their effects on the moods and thinking processes of individuals. He also researched on how people perceived odour and taste.

Greek perfumes were different from what we know today. They were fragrant powders mixed with liquids which were stored in elongated bottles, made of alabaster and gold called *"alabastrums"*.

Ancient Greek Perfume containers

At around this time the Romans had begun their tryst with perfumery. They probably learnt it from the Egyptians, or the Greeks, or even from Turkey where fragrant flowers such as roses were available in plenty and used in various ways like *pot pourri*. The Roman public baths were a feature of the period the most famous being the baths of the Emperor Caracalla. A section of the bath, called the *"unctuarium"* featured shelves with pots of unguents, jars of fragrant oils, and essential oils in jars of various sizes. The Romans were reputed to apply perfume thrice daily, and even pets were perfumed. At their feasts birds with their wings perfumed, were released to disperse perfume from their wings. Draperies, candlesticks, tableware, and cushions, were all perfumed; and the servers wore preparations of musk, marjoram, spikenard, and similar aromatics.

The remains of the volcanic eruption of Vesuvius (79 AD) revealed the presence of equipment used in the making of perfumes of Pompeii, and traces of common plant material used at the time such as roses, jasmine, lily, marjoram, fennel, and laurel.

The Cedar of Lebanon was originally used as a perfume and as a moth and insect repellent. In the time of King Solomon valuable papyrus manuscripts were coated with cedar oil to protect them from insect attack. The Roman emperors also used cedar to protect their clothes in wardrobes so the insect repellent properties of cedar were well recognized even in ancient times.

Cedrus libani – the cedar of Lebanon, now an endangered species

Perfume Moved along the Ancient Trade Routes.

When the Ancient Trade Routes opened up to the outside world they caused the trade in fragrant materials to expand globally to specifically include the Indian sub-continent, the wider Arabian region, and China. All fragrant plant material, spices and essential oils were in high demand akin to gold and were the prelude to the subsequent conquests of this part of the world by the maritime powers.

The Syrian Phoenicians were some of the earliest to trade in the raw materials of perfumery. The Europeans with whom they traded were interested in the aromatic gums from which incense was made. There were a number of other aromatic substances such as myrrh and frankincense which were highly valued during Biblical times. Possession of large quantities of aromatic gums, sweet smelling herbs, unguents, was socially coveted as a symbol of wealth, in European society of the time.

In the Indian sub-continent there are traces of the old fragrance era and in the city of Kannauj there still exists the technology of a bygone age in the production of Attars, which surely is the characteristic perfume, of the Arabian region.

A perfumery in Kannauj showing the Deg-Bhapka technology

The spread of Islam accelerated the spread of perfumery too which was inextricably linked with religious ritual. Indeed there is even evidence to suspect that the method of extraction of essential oils by steam distillation was contemporaneously evolved during the *Mohendradaro* period in India too. The Indian Tantric ceremonies featured the bodily anointing of the participants, with fragrant oils; the men were anointed with sandalwood, and the women wore jasmine flowers in the arms, and were anointed with a variety of fragrant oils - patchouli on the neck and cheeks, amber on the breasts, spikenard in the hair, musk on the abdomen, sandalwood on the thighs, and saffron on the feet. In the spread of perfumery the celebrated "silk route" played its role.

In China, and the orient they used perfume widely, scenting their bodies and the things they used even to the extent of their stationery and clothing and linen.

As the perfumery arts and technologies were spreading far and wide the European regions of Italy and France were beginning to enjoy the fragrance influx which was helped along by the Crusades and the mobility of the era between the 11th to 16th centuries.

Italian archeologists have recently (AD 2003) unearthed what is believed to be the world's oldest known perfume factory. The discovery was made on the Mediterranean island of Cyprus, the reputed birthplace of Aphrodite, the Greek goddess of Love, Lust and Beauty. Dr. Maria Rosaria Belgiomo. of the National Research Council of Rome, the leader of the archeological excavation team believes that the excavated perfumes were beyond four thousand years old. The remnants of the perfumery were found within a three hundred square meter area which was probably a factory within a larger industrial complex, at Pygros, which had been destroyed by an earthquake in 1850 B.C. The remnants found included perfume bottles, mixing jugs, large oil storage jars, and distillation stills which had been preserved under the collapsed walls.

Dr. Belgiano and her team have analyzed the remnant material inside the mixing jugs and were able to identify fourteen fragrances native to the Mediterranean region, and known to be used in perfumery. Extracts of anise, pine, coriander, bergamot, almond and parsley were among the ingredients the ancient perfumers were known to have preferred. Belgiomo and her team also discovered several "recipes" of ancient fragrance formulations. An experimental archeology centre in Blera, Italy were able to recreate these compositions using techniques described by Pliny the Elder, the Roman author, who perished observing the eruption of Mt. Vesuvius in A.D. 79. Belgiomo explained how this was done. Plant parts and Herbs were ground and mixed with olive oil in clay jugs and then distilled in a clay apparatus. She noted that the smell of the perfumes was "a nice experience that recreates in our minds a sort of ancestral reminder".

Dr.Belgiomo reflected on the historical role of the island of Cyprus in regard to perfumes. Aphrodite was likely recognized as the goddess of Cyprus as the island was well renowned for its perfumes before the myth arose. The Cyprus perfumes originated before Aphrodite, and they remained afterwards linked to the island and its goddess. However Belgiamo had no clue as to why the island's people started making and wearing perfumes Pliny the Roman historian believed that Cyprus was the earliest source of some of the most popular perfumes of the ancient world.

Regardless of this she believes that the perfumes of today just did not compare with the fragrances of yore particularly the natural fragrances and scents of centuries ago. " We have lost the real world of natural fragrances" she observes.

European Developments

In the earliest Christian traditions we hear of frankincense being brought to the Christ child and Mary Magdalene anointing the feet of Christ with the oil of spikenard. In more recent times it is the French who transformed perfumery into a higher art form. The French city of Grasse located in the extreme South of the country slowly came to be regarded as the perfume capital of the world. In the modern context the South of France brings to mind the vast fields of lavender, and other strikingly fragrant flowers a feature that arose in a strange manner. Grasse had become a prosperous city as a result of a flourishing trade in animal hides and leather. It had developed a burgeoning industry in tanning. However the stench arising out of tanning operations gave the city a degree of unpopularity whereupon the innovative tanners began to impregnate their leathers with scented ointments. The scented leathers soon began to have a demand, and the scented glove trade catering to Parisian ladies of wealth prospered. A new profession emerged as a Perfume Glovers Guild and identified the City with it. Following the wake of the increase in demand for fragrance materials the city began to expend its growing of aromatic plants and even began to domesticate species from outside the country. They brought in species such as jasmine from India, roses from Bulgaria in addition to the lavender which they already possessed. The perfume producers of Grasse began to abandon the ancient methods of production and newer techniques such as *enfluerage* took their place. *Enfluerage* is the process of extracting the essential fragrance from the petals of flowers by laying them on fat-coated plates. When the fat is saturated with the essences, after several layers of petals are so treated, the fragrance is extracted from the fat with alcohol and after removal of the solvent an "absolute" is left. This process slowly gave way to the method of steam distillation by which much of the fragrant plants are now treated to extract their essential oils which latter are the eventual product that is used. By the 18th century Grasse and the surrounding region, the Provinciale, had put its emphasis on the cultivation of aromatic plants and the setting up of stations where the raw material after harvesting was subjected to steam distillation. This also gave rise to fabricators of distillation stills and the predecessors of world renowned firms such as Eisseric & Cie, and Tournaire Fres of today commenced activities.

Perfume production in Grasse using copper stills

Citrus oils were being cold pressed and distilled and these joined the repertoire of breathtaking natural raw materials that came to be available to the perfumer. An abundance of new natural raw materials came to be available to perfumers by the end of the 19th century as a result of improved methods of distillation and the application of this technique to a variety of new raw materials. Perfumers moved beyond making floral imitations and moved onto more creative perfumery. The emergence in the twentieth century and onwards of aromatic compounds synthesized by organic chemists escalated the creativity by offering a vastly enhanced number of aroma chemicals for the perfumer's palette. It was analogous to the entry of synthetic dyes to augment the comparatively modest array of natural ones that were available to painters and artists. This is what is now designated as: Mainstream Perfumery, where the burgeoning increase in the use of synthetic aroma chemicals due to either economic reasons or reasons of accessibility or even constancy of quality, or political reasons, is now the characteristic pattern, and results in the diminishing use of natural materials.

Back to the Earth's Essences

The new emerging trends in perfumery are now depicted as a harkening back to the deep past. There has been noticed a quest for intrinsic knowledge and the long lost wisdom from the dim distant past, which is believed to give new meaning to modern life. This quest represents a sort of revival, which stretches all the way back to the primitive rain forest, mountains and islands, is represented by a preference for natural foods, medicines, fragrances, and materials. It would appear that the more technologically advanced a culture is the more deeply does it search its past for, believably, a clue to the future. It is the new approach for healing, for foods, for weather control, and even for deep communication with plants, animals, the land itself. It seems to be based on a profound kinship to the Earth.

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Viruses in our Bodies.

During the past decade scientists have come to appreciate the vast bacterial world within the human body. They have learnt that they play a role in regulating the energy we take in from the foods we consume, and that they prime our immune systems and perform many other functions, that helps in the maintenance of health. In similar vein researchers are now beginning to appreciate the role of the viruses we carry around in our bodies. Curtiss Suttle, a virologist of the University of British Columbia, (UBC), in Vancouver, Canada, reveals that the variety and sheer numbers of viruses that inhabit us put our bacterial companions to shame. Ultimately these viruses are incredibly important in determining what's going on in the human microbiota. To understand bacteria associated with humans you have to look at the viruses as well. A comprehensive survey of the viruses in the body – the so-called virome– would be the beginning.

Elizabeth Pennisi in Science (2011), 331, 1513.

JAK FRUIT THE UNDER EXPLOITED MIRACLE

By Nirmala M. Pieris

Jak fruit (*Artocarpus heterophyllus*) also known as jack tree or simply jack or jak (Sinhalese - kos or herali, Tamil – Pelaka) is a species of tree in the Artocarpus genus of the mulberry family (Moraceae) and is closely related to figs, mulberry and breadfruit. The jak fruit tree is believed to be indigenous to the Southwestern rain forests of India There are several varieties in Sri Lanka with exotic names such as kuru kos, del kos, rosa kos, batu kos and rajasinghe pani waraka. The tree is evergreen, 10 to 15m tall with dark green oval shaped leaves. Almost all the parts of the tree secrete white sticky latex like milk (juice) when injured. The latex makes excellent cement for cracked pots especially those used for carrying water. The jak fruit tree is a very long-lived tree and generally has a life span of 60 to 70 years.

The tree grows best under tropical humid and rainy climates but rarely survives cold and frosty conditions. The jak fruit tree grows throughout the wet zone from sea level to 2,000 feet or even 3,000 feet, although it thrives best at the lower elevations. The tree prefers a rich, deep and moist soil, but will also grow well in poor soil. Once established, all it needs is ample moisture. In Sri Lanka the tree is naturally grown in scattered cultivations and in home gardens. The tree is also widely cultivated in tropical regions of India, Bangladesh, Nepal, Cambodia, Vietnam, Thailand, Malaysia, Indonesia, the Philippines and Australia. Jak fruit is also found across Africa (e.g. in Cameroon, Kenya, Uganda, Tanzania, Madagascar and Mauritius), as well as throughout Brazil, Jamaica, the Bahamas, South Florida and Hawaii. Jak fruit is the national fruit of Bangladesh.

The jak fruit tree is a multipurpose species. It provides food, fuel, timber and medicinal extracts, and also plays a significant role in the preservation of the environment. The starchy fruit is a good substitute for rice, for which reason the tree is referred to as 'rice tree - buth gasa' in Sri Lanka and is a potential source of income for both the rural and urban people of the tropics and subtropics.

The tree comes into bearing in 3 to 4 years. Arthur V. Dias a pioneer in promoting jak fruit cultivation in Sri Lanka brought across an 18 month variety from Johore Malaysia in the 1940's. During the season, each tree bears as many as 250 large fruits. The fruits are reported to be the largest tree-borne fruits in the world. Even a small jak fruit weighs 5 to 7kg, and farmers have recorded specimens of more than 45kg. While the jak fruit crop is seasonal in many countries, with the fruiting season varying from country to country it is available

year round in Malaysia, Indonesia, Thailand and Australia. A jak fruit tree in one's garden is a mini granary. With food shortages and food prices escalating worldwide, every jak fruit tree strengthens the sense of food security. Even in the worst of times, a mature tree will yield 300 to 700 kg per year. If the produce of a tree can be sold prudently, it can bring a tidy income. This needs careful harvesting, collection, transport, processing and marketing.

The outer surface of the jak fruit is covered with blunt thorn like projections, which becomes soft as the fruit ripens. The unripe fruits are green with the interior consisting of cream colored edible bulbs. There may be as many as 100 to 500 edible bulbs embedded in a single fruit interspersed between thin bands of fibers. Mature jak fruits will ripen within 3 to 4 days and will turn to a light brown color and spread a strong sweet, fruity smell. The ripe fruits known in Sinhalese as 'waraka' (hard variety) or 'wela' (softer variety) comprising of orange-yellow bulbs are highly perishable and can only be stored for 3 to 4 days. The bulbs enclose a smooth, oval, light-brown color seed.

The fruit is eaten in various forms. Before the arils ripen, they are boiled with the seeds and eaten with scraped coconut as a meal or cooked with coconut milk and made into a delicious curry commonly eaten with rice. It can be dried or fried to produce something similar to potato chips and also pickled. It is also used as a filling for cutlets.

When ripe, the rich yellow flesh (aril) surrounding the seed is sweet and aromatic. It can be eaten fresh, preserved in sugar syrup, made into a juice, smoothie and ice cream or made into

jams, jellies, cookies and muffins. For making the traditional Southern Indian breakfast dish, idli, the fruit is used along with rice as an ingredient and jak fruit leaves are used as a wrapping for steaming.

The young (immature) fruit is called 'polos' in Sri Lanka and is curried or prepared into 'mallun' (a preparation with grated coconut) or made into a pickle. It is remarkably similar in texture to chicken, making jak fruit an excellent vegetarian substitute for meat. In fact, canned jak fruit (in brine) is sometimes referred to as "vegetable meat".

Jak fruit seed is 2 to 4 cm long and 1 to 3 cm thick and is white and crisp within. The seeds are edible with a milky sweet taste and can be eaten, boiled, roasted, fried or curried. When roasted, they have a taste and texture similar to chestnuts Roasted seeds are made into sweetmeats and desserts and also used in confectionery. The seeds can be preserved by brining, soaking in syrup or freezing.

The heartwood is an excellent timber and a dye extracted from it is used for dyeing robes of Buddhist forest monastic's in Southeast Asia, giving the robes of the monks in those traditions their distinctive light-brown color. Jak fruit wood is widely used in the manufacture of furniture, doors and windows, and in roof construction. The wood is also used for

the production of musical instruments and in the manufacture of beads for jewelry due to its warm yellow brown or golden brown color with its loose wood grain.

Aroma Constituents

Jak fruit is well known for its distinct aroma. In a study using five jak fruit cultivars, the main volatile compounds that were detected are: ethyl isovalerate, 3-methylbutyl acetate, 1-butanol, propylisovalerate, isobutyl isovalerate, 2-methylbutanol, and butyl isovalerate. These compounds were consistently present in all the five cultivars studied, suggesting that these esters and alcohols contributed to the sweet and fruity aroma of the fruit. An artificial jak fruit flavoring essence is presently marketed in Thailand.

Nutritional Facts

Jak fruit is a miracle providing so many nutrients and calories. 100g of edible jak fruit bulbs provide about 95 calories. It contains a high amount of carbohydrate and a good amount of simple sugars such as fructose and sucrose, thus providing a quick boost of energy and revitalizes the body instantly. The fruit is low in sodium, cholesterol, and saturated fats and is a rich source of vitamins A, C, riboflavin, niacin, thiamine, and folate. It contains important minerals like magnesium,

calcium, iron, potassium, phosphorous, copper, zinc, manganese, and selenium. The fruit is also a rich source of dietary fiber and provides almost 11% of the daily fiber requirement. The seeds are a good source of starch and dietary fiber and contain lignans, isoflavones, saponins and all phytonutrients.

Health benefits

The high dietary fiber content of the fruit makes it a good bulk laxative. The fiber content helps to protect the colon mucous membrane by decreasing exposure time and as well as binding to cancer-causing chemicals in the colon. The vitamin-A and flavonoid pigments such as carotene-ß, xanthin, lutein and cryptoxanthin-ß that are present play vital roles in antioxidant and vision functions. Vitamin A is also required for maintaining integrity of mucus membranes and skin. Consumption of natural fruits rich in vitamin-A, and carotenes has been found to protect from lung and oral cavity cancers.

Jak fruit is also a good source of antioxidant vitamin-C and provides about 14 mg or 23% of RDA. Consumption of foods rich in vitamin C helps the body develop resistance against infectious agents and scavenge harmful free radicals. Jak fruit is one of the rare fruits that is rich in B-complex group of vitamins. It contains good amounts of vitamin B-6

(pyridoxine), niacin, riboflavin, and folic acid. The fresh fruit is a good source of potassium, magnesium, manganese, and iron. Potassium is an important component of cell and body fluids that helps in controlling heart rate and blood pressure.

Experts believe that the root and extracts of jak fruit are effective in controlling asthma and alleviating the symptoms associated with this condition. Jak fruit contains strong anti-ulcerative properties that not only help cure ulcers but also prevents a number of other digestive system disorders. Chinese medicine uses jak fruit as a treatment for fighting the effects of alcohol in the body.

The starch from the seeds is given in bilious colic and the roasted seeds have an aphrodisiacal action.

The finely minced tender leaves roasted with scraped coconut are a specific antidote for insomnia, while the juice of the tender fruit with coconut milk and jaggery is a miraculous antidote for narcotic poisoning. The leaves are also used in skin diseases. An infusion of the mature leaves and bark is given for stones in the bladder and for diabetes. The roots are used for skin diseases for diarrhoea and fever and as an anti-asthmatic.

Jak fruit for Pregnant Women

As jak fruit, is loaded with nutrients it is actually beneficial during pregnancy and breastfeeding. Being a rich source of vitamin A that is crucial for proper cell production, eyesight, and fetal development is one of the advantages. As a rich source of niacin (vitamin B3) the fruit helps regulate hormones, boost immunity, and controls stress levels in pregnant and breastfeeding women. However over consumption must be avoided as it can lead to stomach upsets due to its high fiber content.

Jak fruit in Cosmetics

A skin whitening cream with jak fruit seed extract has been developed with a combination of botanical essential oils and extracts, as a natural alternative to lighten dark spots and increase skin luminosity without aggressive treatments. This highly anti-oxidant jak fruit cream enriched with sun filters and vitamin E has an innovative combination of lightening ingredients that do not irritate the skin.

In Brazil, jak fruit has also been used for the manufacture of body lotions, body balms, body scrubs, body butter and various other cosmetic products.

Side Effects of Jak fruit

Although jak fruit has a number of health benefits, it is also important to consider some of its side effects on health. Jak fruits may cause an allergic reaction in people suffering from birch pollen allergies. It may increase coagulation in people suffering from blood disorders and may alter the tolerance levels of glucose in diabetes patients. The seeds of jak fruit may have an immunostimulative effect in patients undergoing immunosuppression therapy or patients with tissue transplants. Jak fruit should not be taken by those taking steroid medicines. It is believed that the consumption of jak fruit should be avoided by those trying to get pregnant as it may inhibit sexual arousal, libido, performance, and vigour in men.

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TANNINS, POLYPHENOLS - USES & BENEFITS

By R.O.B.Wijesekera

What are Tannins and Polyphenols?

The use of vegetable material to process animal hides into leather, termed "Tanning", was indeed one of the world's oldest crafts. It had been used by mankind since the dawn of recorded history. However the mechanism of tanning of hides with vegetable extracts and their conversion to leather was only elucidated in modern times after the advent of sophisticated instrumentation. Tanning is now believed to be the crosslinking of the collagen chains of the animal skins, by the large molecules which are part of the vegetable tanning material. Tanning of leather is now conducted with mineral materials as well, as represented by alum tanning and chromium tanning. The natural plant material used for the tanning of animal hides is found globally within many different families of higher plants such as on the woods of the chestnut and oak, in *Divi-divi, Sumach, Myrobolans,* and plant galls.

It is recorded that the term "Tannin" was used for the first time in 1796 to indicate substances present in the vegetable extracts capable of forming insoluble complexes with the proteins of animal skins by preventing the action of the proteolytic enzymes that could affect the physical nature of the hides. This is the process that has been practiced over the millennia and has developed into a major industry namely, the leather industry.

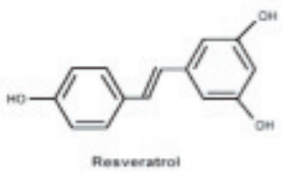
The chemistry of these vegetable tanning materials varies widely. They are polyphenolic compounds mainly, that is compounds containing multiple phenolic groups, generally containing a high molar mass. High contents of these tanning material now referred to collectively as "Tannins" are found in nearly every part of the plant such as: barks, woods, leaves, fruits, roots, and even seeds. In biological terms it is presumed that an increased tannin formation can be associated with some sickness in the plant and the biological role of the tannins is believed to be as protection against infection, insect attack or animal herbivore. When extracted from the plant material and dried the tannins appear as brown solids, with an astringent taste.

In medieval times tannin containing plant material had been used for medicinal purposes, and as foods and beverages. In traditional medicine in China and Japan, and in Ayurvedic and Sidda medicine in the Asian region, tannin containing plant extracts were used to combat diarrhoeas, as diuretics, against stomach and duodenal tumours, as anti-inflammatory and antiseptic agents, and as haemostatic agents. These are plants that contain what are now generally referred to as polyphenols.

The tanning of leather

Whereas all tannins are necessarily polyphenols, all polyphenols are not tannins, in respect of the fact that all polyphenols cannot be used to tan hides in the approved manner. These are the polyphenols derived from fruits and such sources that are used as foods and medicines which though polyphenolic are generally composed of smaller molecular weight compounds. Reserveratrol which is a component of red wines and has acquired a reputation as a polyphenol with much health giving potential is one such.

Recent research also points to the role of tannins and polyphenols as the active agents in many efficacious traditional remedies; and the role of anti-oxidants are stressed in recent researches. Many types of tannins and polyphenols have displayed extensive biological activity such as anti-viral, anti-bacterial, and anti-tumour activity. It has also been shown that certain polyphenols can selectively inhibit HIV replication.



Resveratrol

Chemistry & Structural Classification of Tannins

The chemistry of Tannins is quite complex and experimentally forbidding. This was so when the great chemist and Nobel Laureate Emil Fisher did his classical work in Germany. The tradition was followed in Heidelberg by Freudenberg followed by Otto Theodore Schmidt who with the new tools of instrumental analyses was able to unravel the complexities.

Modern research has enabled the chemical structural diversity of the tannins to be explored. Early classifications identified two categories, but currently four main categories are recognised as:

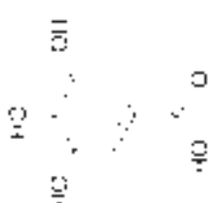
1. Gallotannins
2. Ellagitannins
3. Complex tannins
4. Condensed Tannins.

Gallotannins (1), are those tannins in which galloyl units (units of gallic acid groups), are bound to diverse polyol- , catechin, or triterpenoid units. When hydrolysed they give rise to Gallic acid.

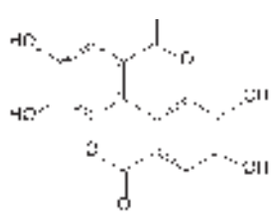
Ellagitannins, (2), are those in which at least two galloyl units are C-C coupled to each other and do not contain a catechin unit, linked with a sugar unit. When hydrolysed they yield mainly ellagic acid and gallic acid.

Complex tannins,(3), are tannins in which a catechin unit is bound to a gallotannin or ellagitannin unit with a sugar unit.

Condensed Tannins, (4), are all oligomeric and polymeric pro-anthocyanidins, formed by linkage of a C4 of one catechin with a C-8 or C-6 of the next monomeric catechin.



Gallic acid



Ellagic acid

Condensed Tannins are those that are not hydrolysable with such ease and are in chemical nomenclature, oligomeric and polymeric pro-anthocyanidins, based on the anthocyanidin scaffolding. They are also termed pro-anthocyanidins, which means they are a group of polyhydroxyflavan-3-ol oligomers and polymers linked by C-C bonds between flavonol sub-units.

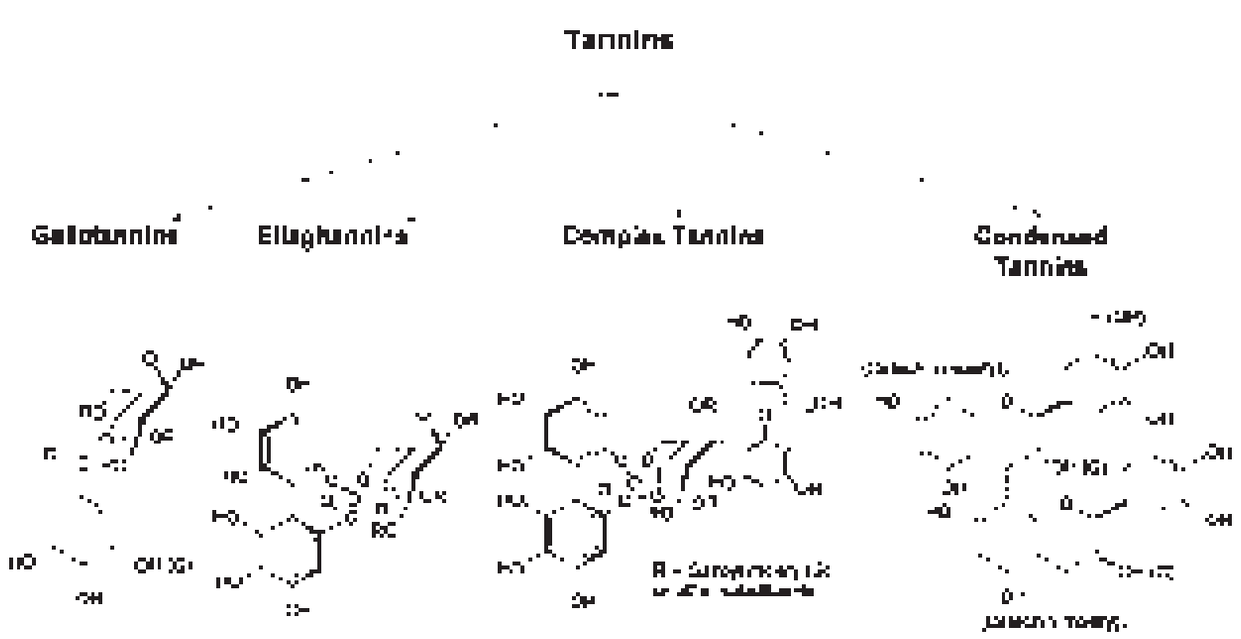
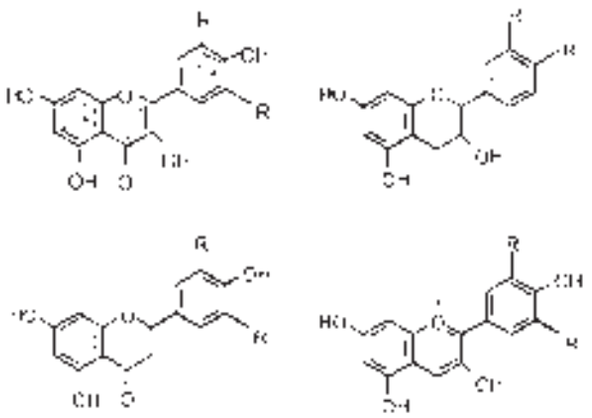


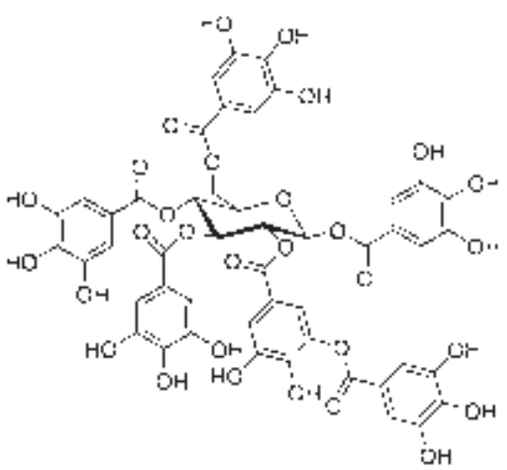
Fig. 1: Classification of the tannins.

Accordingly they are referred to as Flavonoids, and flavonoid derivatives.



Typical flavonoid structures

The Gallotannins and Ellagitannins are sometimes referred to as Hydrolysable Tannins, since they are readily hydrolysed by acids or enzymes to yield ellagic and gallic acids. A central sugar unit with galloyl groups or ellagic acid groups attached to the carbon atoms of a sugar molecule are their characteristic structural feature.

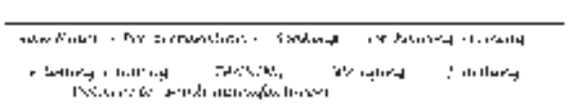


Hydrolysable Tannin

The Leather Tanning Process

It is interesting and pertinent in the context to understand the essentials of the process for the tanning of hides to produce commercial leather.

The process flow for tanning of hides for the production of leather is represented as follows:



Raw Hides--------Soaking--------Liming + De-hairing-------- de-liming + Bating-

The main goal of the process of tanning is to convert the raw animal hides, which are perishable, to the desired stable product which is leather. In modern times the majority of the leathers produced, with the exception of speciality leathers, are tanned with chromium salts. However in ancient times the major tanning material was indeed of vegetable origin. Here we shall discuss the tanning process, with vegetable tannins. Vegetable tanning is believed to be the most classic, traditional and in cases of certain types of leather the most preferable method although it is agreed that environmental pollution is at a maximum with this methodology. It was even during ancient times considered a trade that generated considerable malodours. Accordingly tanneries were even in the earliest times located in areas far from the cities and dwelling places. Cities such as Lyon and Grasse in France now famous in their own right were originally regarded as evil smelling places on account of a tanning industry located there. Attention to the unpleasant odoriferous exudates of the industry form one of the major factors in modern times as eco-friendly methods have necessarily to be employed to avoid atmospheric pollution. Trades that in modern times employ vegetable tannin to produce leather, argue that the texture and characteristic odour of the leather produced by this technique is "natural". They also state that such leathers are produced by skilled craftsmen blending the best natural vegetable extracts with selected natural oils, and fat liquors. The smell of leather it is claimed then becomes a perfume for leather lovers. Handbags, briefcases, portmanteaus, wallets, rugs, belts, chairs, seats, boots and saddles, are some items where the preference for tanning the leather has been vegetable tannins; and add to this the smell of new leather in luxury models of cars.

Vegetable extracts in a Tannery

Preparation of the hide

In the modern tanning process skilled craftsman use vegetable tannins which are commercially available both in liquid and powder form. The most popular extract is that obtained from the chestnut wood, and it is the classical and most valued tanning material. Equally popular is the tannin obtained from the Argentinian tree, known as *Quebracho* Tannin. This extract is known as one that gives the leather a special reddish tint and a characteristically warm feel and a bright appearance. Another extract, namely *Tara* Tannins are the ones used to produce leathers for the automobile industry for use as upholstery material. They are deemed to maintain appearance under hardwearing conditions. Mimosa extracts, also called *tanwat* give a rose colour to the hides, and are used to obtain leathers for shoe uppers and soles. Gambier extracts are mainly used for full grain and fine articles, and *myrobalan* tannins produce leathers with a uniform colour and softness of feel. So there is variety in the tanning process employing vegetable tannins, and the craftsmen are able to use the diverse extracts to produce leathers for a multiplicity of different uses.

The following are the various stages in the complex process of the tanning of leather (with special reference to the tanning with the use of natural vegetable extracts).

Stages in tanning.

Pre-preparation:

Raw hides from the slaughter houses are preserved for transportation to the tanneries by a process of "Pickling and drying". This is to arrest deterioration by enzyme action, which would cause rotting and generation of malodours.

Operations at the Tannery.

- **Soaking.**

The dry preserved raw hides are enabled to regain their normal content of moisture by soaking in water. Soaking is preceded by removal of dirt and contaminants, salt and residual matter.

- **Removal of Hairs, - Liming.**

Removal of hairs and extraneous flesh is carried out in a medium of lime and sulphide.

- **Deliming, - Bating**

The hides are then neutralised (deliming), with ammonium salts and weak acid pressed, to flush out any impurities together with the excess water. The hides then becomes flaccid. It is then treated with proteolytic enzymes,- enzymes similar to those in the digestive system to clean the grain and make the pelt smooth and silky.

This removes hair roots or roots of the wool, and pigments.

- **Vegetable Tanning Process**

The hides are transferred to vats in which they are hung in series. A rocker arrangement enables the liquor in the vats to be agitated.

The hides are next transferred to a second series of lay-away vats without agitation. In these vats progressively increasing concentrations of tannin liquor are used. Vegetable tannins are polyphenolic compounds of two broad types. Hydrolysable Tannins are those like Chestnut and Myrobalans, and condensed tannins as exemplified by wattle and hemlock. The mechanism behind the process of vegetable tanning is the formation of hydrogen bonds between the phenolic groups of the tanning material, with the peptides of the protein chains in the hide. It has been recorded that even as much as 50% of the tannin material can be incorporated into the hide in the tanning process.

- **Wringing**

The excess moisture after tanning is removed by wringing between rollers.

Finishing Operations

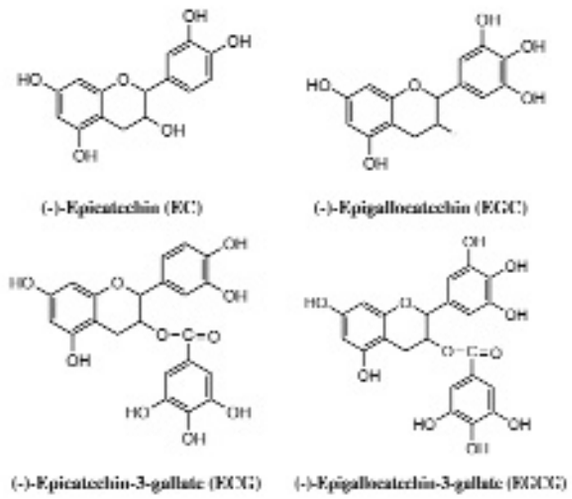
The finishing operations are chemical and mechanical and are

designed according to the nature of usage of the crude leather. Various oils, pigments, mechanical toning, pressing methods are used to get the final finish of the leather before it can be sent to the product manufacturers.

In the modern tanning process, vegetable tannins processed and available in both liquid and powdered forms are used. From the wood of the chestnut tree the most famous and ancient tannin extract is obtained. Almost equally popular in vegetable tanning is the *Quebracho* extract obtained from the wood of a tree that grows primarily in Argentina. This extract gives the leather a special reddish tint with an unmistakable warm touch and bright appearance. Mimosa extracts which are reputed to give the hides a special rose pink hue are deemed suitable for leather in shoe uppers, and soles. Gambier extracts are used for full grain and fine valuable articles, while the extracts from *Myrobalans* are said to produce leathers with a uniform colour and soft touch. *Tara* tannins are mainly used to produce leathers for automotive upholstery, where durability resilience and strength are important.

Some Health Benefits of Tannins & Polyphenols

Tannins and polyphenols from plant sources represent a wide variety of chemical structures. All of them bear the characteristic of possessing many phenolic groups attached to large molecular scaffoldings. That is why the collective term "Polyphenols" is used to refer to them. Many of the tannins used in the tanning process are those that have very large molecular weights, though a few of them have lesser molecular weights. Tea polyphenols and their health benefits have been known to mankind for many years. Modern research has definitely demonstrated the specific benefits of tea tannins, although there are the sceptics who are unable to explain these and so wallow in disbelief. The characteristic polyphenols of tea, *Camelia sinensis,* are the "Catechins" represented as four main types. The displayed benefits are known to fall into the categories in the figure.



Health Benefits of TEA
The Polyphenols of Green Tea

The chemical nature of the main tea polyphenols are as depicted above. They are different to the polyphenols in the extracts that are generally used for the tanning of leathers. The health benefits of tea are such that Ayurvedic specialists tend to classify it as a *Rasayana,* mostly because of the effect on degenerative diseases. Research on the effects of dietary polyphenols on human health conducted during the past decade strongly supports a role for them in the prevention of degenerative diseases, particularly cardiovascular diseases and cancers. The anti-oxidant properties of the polyphenols have been intensely studied, and it is clear that their action extends beyond the modulation of oxidative stress. The main dietary sources are: fruits, plant derived beverages, such as tea, red wines, vegetables cereals and legumes. Recent studies on animal models indicate effective results of polyphenols as anti-amoebic agents, antibacterial agents, antifungal agents and even anti-viral agents. For example extracts of *Terminalia chebula, - a plant widely used in the Ayurvedic pharmacopoeia and a main constituent of the Ayurvedic preparation known as Triphala-,* showed significant protective effects when applied to the epithelial cells infected with the influenza A virus in vitro. Extracts have shown anti-herpes simplex virus type 1 activity and significant inhibitory activity on the effects of human immunodeficiency virus 1 reverse transcriptase.

A methanol extract of *T. chebula* was studied for the effects on the growth of malignant cell lines including a human (MCF7) and a human osteosarcoma cell line (HOS 1), a human prostate cancer cell line (PNT 1A). The extract was found to decrease cell viability, inhibit cell proliferation, and induce cell death in a dose dependent manner. A tannin fraction from *T.chebula* was also reported to have anti-mutagenic activity in vitro, and in another study a high potential for inhibiting the growth of leukaemia cells was observed.

A variety of other potential clinical benefits have indeed been observed which underscores the value of the tannin containing plants as more than promising multi-drug candidates yet to be fully developed. The results underscore the benefit of following leads from the uses in traditional pharmacopoeias which trail is being followed avidly by modern researchers.

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De-mining operations

De-mining operations are essentially a post conflict requirement and is hazardous, costly, and time consuming. Despite sophisticated new technology that is currently available, many explosive devices are still cleared manually with the help of trained animals. For example, a rat can check the ground faster than a man with a metal detector. Dozens of giant pouched rats tethered by deminers are used to sniff out landmines.

Economist Technology Quarterly 7th June 2014.

Primitive menus - Could eating like our ancestors make us healthier?

The Tsimane a primitive tribe in the Amazon of lowland Bolivia enjoy porridge of plantains and sweet manioc. They get most of their food from the river, the forest, or fields and gardens carved out of the forest.

However, a diet that revolves around meat and the dairy will take a greater toll on the world's resources than one based on unrefined grains, nuts, fruits, and vegetables.

The popularity of so-called Stone Age diets is based on the idea that modern humans evolved to eat the way hunter-gatherers did during the Palaeolithic period.

The Bajau of Malaysia indulges in fishing and diving for everything they eat. Some live in houses on the beach or on stilts; others have no homes besides their boats.

The Kyrgyz of the Pamir Mountains in northern Afghanistan live at a high altitude where no crops grow. Survival depends on the animals that they milk butcher and barter.

The real hallmark of being human therefore is not our taste for meat but our ability to adapt to many habitats and to crat many healthy diets,

Adapted from: Ann Gibbons: in The Evolution of Diet, *National Geographic,* Sept. (2014)

Food problems

When we think of threats to the environment, we tend to picture cars and smokestacks, not dinner. But the truth is, our need for food poses one of the biggest dangers to the planet. Agriculture is among the greatest contributors to global warming, emitting more greenhouse gases than all our cars, trucks, trains, and aeroplanes combined, - largely from methane released by cattle, and rice farms, nitrous oxide from fertilised fields, and carbon di oxide from the cutting of rain forests to grow crops or raise livestock.

National Geographic .vol, 225, No,5,(2014)

RESEARCH/
REVIEWS

STANDARDIZATION OF HERBAL PREPARATIONS: SCIENTIFIC APPROACH FOR CONVENTIONAL HERBAL MEDICINE

By Chanika D Jayasinghe[1] and Preethi V Udagama[2]

Introduction

Herbal medicine is still the mainstay of about 80% of the world population for their primary healthcare. Plant based medicines are accepted as therapeutic agents for many diseases such as diabetes, arthritis, liver diseases, cardiovascular diseases, infections etc. Currently, herbal medicine is increasingly becoming popular among the developed countries with the more apparent manifestations of side effects of modern drugs. Herbal drugs have intrinsic worth over modern drugs for their perceived efficacy, low cost and low incidence of side effects. The desired benefits of herbal drugs rely on the correct plant material, quality of preparation, correct dosage, time period of administration etc. Phytochemicals or the active ingredients responsible for the bioactivities greatly vary with genetic variation, climatic and environmental factors, method of preparation, storage etc. (Thus, maintaining the quality and consistency of herbal formulations has become a challenge. Evaluation of a herbal product does not necessarily require purifying the active constituent unlike in allopathic medicine. Instead the best approach would be the analysis of the active ingredients in the herbal mixture and maintaining the quality and purity of such preparations by standardization.

In most countries, herbal products are formulated and launched to the market without proper scientific evaluation. Though it is believed that herbal products are less toxic, untested preparations could lead to severe side effects, especially where substitution or adulterations are encountered. Thus, it is evident that the herbal medicine industry requires strict guidelines and regulations to maintain the quality standards of herbal preparations. In 1992, WHO recognized this issue and formulated a set of guidelines for quality control and standardization of medicinal plants (WHO,1993).

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Standardization of herbal formulations

Standardization of herbal products referred to as "confirmation of its identity and determination of its quality and purity" is with a clear objective to provide general test methods for correct botanical evaluation and identification of medicinal plants, widely used in traditional and home remedies (WHO,1998). Today, standardization has become a fundamental requirement of industries and other organizations dealing with herbal products. It is also a timely requirement to make the general public aware about the quality standards of raw herbal products they use in their day to day life, with an emphasis to minimize the side effects of contaminated or adulterated plant material. Although, some of the herbal formulations are well documented in pharmacopeias, chemical standards have not been mentioned. Thought, the standardization of herbal preparations is not an easy task. The following guidelines will help to ensure the purity, quality, safety and reproducibility of herbal preparations.

General testing parameters for characterization and Standardization of Herbal medicine

Standardization of herbal raw drugs include passport data of raw plant material, botanical authentification, macroscopic & microscopic examination, identification of chemical composition by various chromatographic techniques and biological activity of the whole plant.

1. Botanical

a) General information- Geographical location, harvesting time, harvesting procedure- To minimize the variations of active constituents in plants
b) Gross morphology -Macro and microscopic examination of plant material. For identification of correct variety and search of adulterants
c) Organoleptic evaluation – colour, odour, taste, texture etc to confirm the identity of the preparation

Figure: Schematic diagram of standardization of herbal plant material (WHO,1998)

2. Physical

a) Foreign matter evaluation- this involves removal of matter other than source plant to get the drug in pure form.
b) Ash values – Will help to judge the identity and purity of the crude drug
c) Water/moisture content – reduce the error when estimating the weight of the preparation
d) Extractive value – these are indicative weights of the extractable chemical constituents
e) Crude fibre content – helps to determine the woody material component.

3. Chemical

a) Chemical analysis - Qualitative and Quantitative chemical evaluation. This encompasses the identification and characterization of the crude drug with respect to active constituent for known and unknown constituents
b) Chromatographic examination - Identification of crude drugs based on the major chemical constituent as markers
c) Photometric analysis

4. Biological

a) Pesticides – herbal drugs are liable to contain pesticide residues that accumulate from agricultural practice
b) Heavy metals – contamination by heavy metals such as mercury, lead, copper, cadmium and arsenic in herbal remedies can cause adverse effects. Atomic adsorption spectrophotometry (AAS) can be used to measure the heavy metal contamination.
c) Aflatoxins- Aflatoxins in herbal drugs can be dangerous to health even if these are absorbed in minute amounts. Aflatoxin producing fungi can build up during storage. Proper cleanup methods are required and TLC can be used to test the toxic contamination.
d) Microbial purity –medicinal plants may be contaminated with a broad variety of microbes such as virus, bacteria and fungi. Also, medicinal plants can be contaminated by poor methods of harvesting, drying, handling, storage. Therefore, it is important to test for microbial contaminations.
e) Radioactivity – radioactive contamination is a concern only in areas where nuclear accidents were reported. Naturally occurring radionuclides are not of much concern.

5. Bioactivities

a) Toxicological studies-help to determine the potentially harmful substances
b) Pharmacological activities- evaluate specific activities of the preparation
c) Other specific activities

In general, all the above mentioned parameters confirm the quality and purity of a herbal preparation.

Recent approaches in herbal drug standardization

The traditional approach towards standardization is insufficient for the current global market.
Hence, there is need for more advanced techniques for standardization. The new era of herbal drug standardization includes molecular approaches in addition to the conventional methods.

1. DNA fingerprinting

Correct identification and quality assurance of raw plant material is a prerequisite for quality herbal preparation. DNA analysis has proved to be an important tool in herbal drug standardization. This technique is useful for the identification of phytochemically indistinguishable genuine drugs from substituted or adulterated drugs. There are hybridization-based methods, polymerase chain reaction (PCR) –based methods and sequencing methods for DNA fingerprinting.

2. Chromatographic fingerprinting

This technique has been widely used in pharmaceutical industry for isolating and purification of herbal compounds. Recently, it has become one of the most powerful methods to quality control herbal drugs. In addition to the conventional HPLC, Liquid Chromatography- Mass Spectroscopy (LC-MS), Gas chromatography (GC-MS) Gas chromatography flame ionization detector (GC-FID), Supercritical fluid chromatography (SFC) and capillary electrophoresis have emerged as novel chemical techniques of standardization of herbal drugs (Schaneberg et al, 2004).

Future aspects

Maintaining quality of a herbal formulation requires careful monitoring of the process from the collection of plants to the finished packaged product. It is recommended that the relevant stakeholders should follow a more universal approach for standardization of herbal formulation placing emphasis on the WHO guidelines. Development of herbal monographs using various quality standards is also encouraged to minimize the quality breach. The applications of high-technology oriented advanced hyphenated techniques will serve as rapid and unambiguous tools in herbal research, thereby, upgrade the entire pharmaceutical industry as well as benefit people around the world.

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`Acknowledgement: Mr S Muraleetharan, RA of the Department of Zoology, UOC for computer assistance

The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honours the servant and has forgotten the gift.

Albert Einstein (1879-1955)

PROMINENT RESEARCHERS NO.11

PROFESSOR MARTHANDA VARMA SANKARAN VALIATHAN

By Dilmani Warnasuriya

Prof Valiathan is an eminent cardiac surgeon, having being trained in cardiac surgery in the UK and US, and is a Fellow of the Royal College of Surgeons in UK, and Fellow of Canadian Royal College of Cardiac Surgeons. In the US, he was trained in cardiac surgery in the John Hopkins, George Washington and Georgetown University Hospitals . Not withstanding his fame as a surgeon, he is most renowned for his original research work on cardiology and the development of Medical technology, laying the foundation for the medical devices industry in India, and most significantly for his pioneering contribution in synthesising Ayurveda with modern biology. The new discipline of Ayurvedic Biology has thus emerged, with Prof Valiathan. This work has earned him the post of National Research Professor in India for two consecutive terms. He is currently the Chairman of the Task Force in Ayurvedic Biology of the Department of Science and Technology and Hon Advisor, Manipal University. He was previously the Professor of Cardiac Surgery and Director of the Sree Chitra Tirunal Institute of Medical Science and Technology for two decades. It was here that he developed unique medical devices for cardiovascular diseases. He is the recipient of many awards, medals ,fellowships and honarary doctorates in India and abroad for his contribution to the field. In 2005 he was awarded the Padma Vibhushan.

Prof Valiathan has an intense passion for Ayurveda, which he attributes to his upbringing in an Ayurveda friendly environment.. His intial studies in Medicine however did not include the field of Ayurveda, and his interest was rekindled only around the 90s, when he was lamenting over the fact that after the advent of modern medicine in India over 200 years ago, there was no significant original contribution from an Indian towards the development of medicine. Searching for a time where Indian medicine showed some innovation, he came across the Charaka, Susrutha and Vagbhata. He commenced his studies on Charaka Samhita with an eminent scholar and Ayurvedinc physician , and these studies continued for over two and a half years.

Prof Valiathan is of the view that Ayurveda should be included in the curriculum of a medical or basic science course. He believes that Ayurveda being a holistic science would provide scintillating opportunities for research by investigating ayurveda through the perception of contemporary science. He firmly believes that when new science and new techniques are applied to old science, new sprouts of knowledge would appear, and indeed he was able to show that this was so, through his research work.

PRODUCTS FROM LINK NATURAL

HAIR OIL TREATMENT FOR HEALTHY LIVING

According to Ayurveda, the right balance between physical and mental well-being, results in a healthy life. Hence, the head is considered the most important organ of the body, and maintenance of health of the head and hair leads to the well-being of the whole body.

It is said that the regular treatment of head and hair with a high quality Ayurveda oil,

- Prevents premature greying and hair loss
- Prevents discolouration of hair
- Prevents split ends of hair
- Prevents thinning of hair
- Relieves headache
- Results in a healthy lustrous head of hair and healthy living

A time tested and proven answer for the premature greying and hair loss

The Link Natural Products team have identified an important issue faced by both male and females as they mature in age, which is the premature greying and hair loss. According to Ayurveda these are issues that can be addressed effectively by proper hair care treatment. Link Natural Akálapalitha, is the solution proposed to address these issues.

Mildly perfumed, Link Akálapalitha is manufactured according to a time tested and proven Ayurveda formula for preventing premature greying and hair loss, using modern technology. Quality herbal ingredients used in the production of Link Akálapalitha includes,

- Keekirindiya (*Eclipta alba* (L.) Hassak.)
- Kithul (*Caryota urens* Linn.)
- Puwak (*Areca catechu* Linn.)
- Madhu (*Merremia tridentata* (L.) Hall.f.)
- Beli (*Aegle marmelos* (L.) Corr.)
- Pamba (*Lygodium flexuosum* (L.) Sw.)
- Diyamittha (*Cissampelos pareira* L.)
- Olilnda (*Abrus precatorius* Linn.)
- Savendara (*Vetiverai zizanioides* (L.) Nash.)
- Suduhandun (*Santalum album* Linn.)

Daily use and massaging,

- Prevents premature greying
- Prevents premature hair loss
- Promotes growth of healthy hair
- Provides a lustrous head of hair

Directions for use

Apply directly on scalp and hair and massage gently.

GLEANINGS FROM THE LITERATURE

Effect of Cinnamon Supplements on Type 2 Diabetes

One of the forms of treatment for Type 2 Diabetes, in addition to medication, is dietary modification. Dietary supplements are not usually recommended due to the lack of standardised formulations and also because their clinical efficacy has not been sufficiently proved.

Some research studies have shown that Cinnamon (*Cinnamomum* spp) has the ability to lower serum lips and blood glucose and promote insulin release among other effects. Further studies carried out to confirm these findings did indeed show positive results. Cinnamon supplements significantly reduced fasting plasma glucose, although lower than that of the standard drug, metformin. Low density cholesterol and triglycerides were also reduced although again at a lower amount than conventional drugs. However, there was a high level of heterogeneity in the studies and this was attributed to the variation in age and health of patients , dosage and form of supplement used. The studies have led to the conclusion that cinnamon supplements did have a positive effective on type 2 diabetes.

Herbal Gram, Journal of the American Botanical Council, No.101, Feb – Apr. 2014, pp 28-29

Tea taste and Quality Affected by Climate Change

Recent research conducted in South Western China has shown that the phytochemicals in tea can be affected by climate changes occurring in the area. This research has a profound impact on tea drinkers as the beneficial health effects attributed to tea can be adversely affected. This is particularly so in the case of green tea, where the health benefits have come to be accepted as being proven. The research also has implications for other medicinal plants and their compounds as the nutritional and medicinal values are liable to change according to the weather, and thus their efficacy will be subject to changing climates.

During the study , discussions with tea farmer were also held, and these have brought to light findings which further confirmed the research . The farmers assert that changing weather patterns change the quality and taste of their crop. During the dry season, the leaves are said to be more potent and have a strong flavour, while during the monsoons, the leaves have a gentler aroma and taste. Through studies conducted with samples of tea extracts obtained from Chinese farms, it was shown that tea catechins which are the key health giving compounds from tea, can decrease by almost 50% when the leaves are harvested after the monsoons when compared to leaves harvested after the drought. These findings are consistent with the observations of the farmers as far as taste and flavour is concerned. This research could have far reaching implications in the future in many areas.

Herbal Gram, Journal of the American Botanical Council, No.103, 2014, pp 44-51

"LINKING" WITH PEOPLE & SOCIETY

One of the many goals of the company is to develop and update the knowledge base of its staff , particularly the R & D personnel. One such avenue is to avail of the experience and knowledge of experts in the field. The lecture given by Dr De-an GUO at the company Auditorium to the researchers of Link Natural and other interested persons, was organized in pursuance of this goal. A brief review of his lecture is given below

QUALITY- ORIENTED RESEARCH OF TRADITIONAL CHINESE MEDICINE

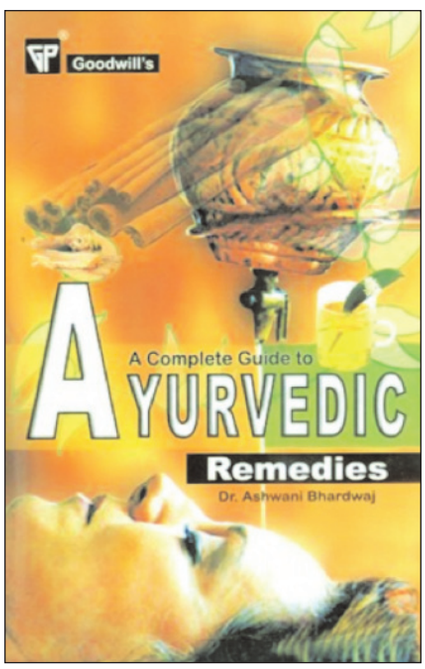
By De-an GUO, Ph.D.
Reviewed by Achala Liyanage

Traditional Chinese Medicine (TCM) is an extremely complex system with hundreds of or even thousands of chemical components. Hence, it is a great challenge to establish the quality control standards for such a complex TCM herbal system. The first challenge would be to clarify the chemical composition of the herbs or herbal formulas. Secondly, the active or effective components should be clear in order to establish the chemical markers for assay. Thirdly, translation from the basic research results to the feasible quality standards should be performed by setting up a research model. As to the above-mentioned challenges, we have made a great endeavor, in the last decade, to perform chemical, metabolic and biological analyses for TCM complex system to aim at elaborating scientific and feasible quality standards of TCM herbal medicines and their preparations. A series of chemical analytical methods including fingerprinting have been developed for the holistic analysis of multiple component TCM system including multiple marker quantification of single herbs or herbal combinations. Metabolic analysis for TCM herbal medicines also plays an important role for clarifying the active components of TCM complex systems. Metabolic fingerprint profiling method was developed for a number of typical Chinese herbs including Licorice and Chinese Salvia. Advances in high-throughput 'omics' technologies to measure changes of genes, proteins, and other biomolecular components in complex biological systems have dramatically revolutionized research of traditional Chinese medicine. Proteomics techniques such as 2-DE and nano-LC-MS/MS were used in our lab to study the mechanism of TCM including *Salvia miltiorrhiza, Ganoderma lucidum*, etc. On the basis of the above mentioned methods and techniques developed, comprehensive quality standards model has been established for TCM by taking some TCM herbs or preparations as exemplified cases. Finally, the comprehensive quality monographs of several above-mentioned herbs were elaborated and adopted by Chinese Pharmacopoeia and United States Pharmacopoeia.

Dr De-an GUO is the Director & Professor, National Engineering Laboratory for TCM Standardization Technology, Shanghai Research Center for TCM Modernization, Shanghai Institute of Materia Medica, Chinese Academy of Sciences, Shanghai

BOOK REVIEWS

A COMPLETE GUIDE TO AYURVEDIC REMEDIES



Author : *Dr. Ashwani Bhardwaj*

ISBN : *978-81-7245-300-8*

Publisher : *Goodwill Publishing House (India)*

Ayurveda means the "Science of Life". It represents a system of healing that has been used over more than five thousands years. This traditional medicines system is native to the Indian subcontinent.

Ayurvedic medicines are generally harmless and very useful to root out a disease. It takes into consideration the relationship between energy and matter. Even though the modern medicine treats for the afflicted part of body, Ayurveda believes in treating for the individual as a whole.

The book 'A Completed Guide to Ayurvedic Remedies' by Dr. Ashwani Bhardwaj describes many diseases, disease causes and the corresponding Ayurvedic treatment in this book. The content of the book is supported by diagrams at critical points, making it easier for the user to identify the plant species, etc.

The book is very useful for everyone lay persons, who are interested in expanding their knowledge in Ayurvedic medicine, as well as for the medical students, ayurvedic practitioners, etc.

FIGHTING MULTIDRUG RESISTANCE WITH HERBAL EXTRACTS , ESSENTIAL OILS, AND THEIR COMPONENTS

Author : *Mahendra Rai and Kateryna Kon*

ISBN : *978-01-2398-539-2*

Publisher : *Academic Press*

Price : *$129*

Resistance to antibiotic is one of the on going problems relating to infective bacteria. Several thousands die each year due to resistant infections. Multi drug resistant microbial strains is a severe threat to the health globally, and little seems to be done about developing novel antimicrobials. Most anti microbial compounds are derived from natural products, and Botanicals , one such category is thought to offer a number of chemical compounds which combat emerging multi drug resistant microbial strains. This book provides several reviews from eminent researchers on the use of phytochemicals for treating microbial infections resistant to multiple drugs. Essential oils seem to offer the best remedy but for dermatological infections. For researchers interested in the subject , this books will provide much food for thought.

DIGEST MAIL BOX

Letter 1

Dear Dr Wijesekera,

I had the privilege of visiting the Link Natural Products factory with IESL members and receiving Vol 9 Issue 1 & 2 as complimentary presents from Chairman Nugawela.

I must give you and your team credit for this excellent scientific Journal. I had the opportunity of reading about Gotukola and Papaya. I believe in these two healthy foods for my daily diet and grows these in my Garden at Kohuwela. I would appreciate if future copies of this digest could be sent to me.

My brother Dr Mahasen DE Silva from Colombo Medical college in 60's has been in USA for over 50 years and visits Sri Lanka regularly' They too might appreciate a copy of your digest. If available electronically it will be much more convenient.

Tissa

Tissa De Silva
BSc Eng (Cey);MEngSc(NSW);PGDipEnvLaw(ANU)
Galle

NOTES TO POTENTIAL CONTRIBUTORS

Link Natural Digest

The DIGEST is a popular publication, albeit a scientific one, dedicated to medicinal plants, herbal healthcare and personal care products, essential oils, aromatherapy, herbal therapy and Ayurveda, and related healthcare systems. It is published bi-annually.

The DIGEST welcomes contributions in English in the category of reviews, brief communications, ethno reports in brief, phytomedical and phytochemical communications, book reviews, and reports on safety and efficacy of phytomedicines.

Potential authors may consult the Editor-in-Chief prior to dispatch of communications, reports and reviews.

Authors may submit manuscripts by By email to :

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Please forward to the editor one original hard copy and a soft copy in the form of a PC compatible diskette (Microsoft Word).

All manuscripts must include the following :

Title (in brief), author(s), address(es) of affiliated institutions. The authors' names must include initials and/or forenames as required in publication. All papers and submissions are subject to peer review, but the editors reserve the right to regulate the content. No proofs can be sent prior to publication. The decision of the Editor-in-Chief will be final in all matters.

The Digest Mail Bag Welcomes Reader's Views & Ideas.