commitment towards science which made them contribute at a relatively high level with minimal inputs. Had scientific jobs been at par with those of administrative, more brains would have entered in the mainstream of science and contributed significantly. A large number of highly skilled scientific professionals have to migrate each year as they are denied even the minimum in this country.

For all developmental needs, science will remain most important and it would be dangerous to keep on ignoring the tremendous powerful contribution it can and could make.

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SCIENTIFIC CORRESPONDENCE

On coconut and coconut oil – where modern science meets traditional wisdom

Medical opinion is divided on the nexus between coconut oil, hypercholesterolemia and coronary heart disease. Vegetable oils, including coconut oil, have been shown to contain insignificant amounts of cholesterol compared to animal fat[1]. Since the human body has the inbuilt mechanism to synthesize cholesterol from certain saturated fatty acids that are consumed, coconut oil with its medium chain fatty acid content was presumed to contribute to cholesterol synthesis[2]. Contrary to this assumption which has been in vogue for a long time, a direct relationship between consumption of coconut kernel and coconut oil and incidence of coronary artery disease has not been well established. Moreover, population studies on coconut-consuming Polynesians in Hawaiian islands[3] and Sri Lankans from Sri Lanka[4] indicate low levels of serum cholesterol and incidence of heart disease compared to their western counterparts.

The reasons are perhaps not hard to find. Compared to all edible oils, palm and coconut oils contain appreciable amounts of tocotrienols[5], the levels in palm oil being relatively higher. Their concentration in oil is dependent on the extraction procedure. Though coconut oil has a relatively lower tocotrienol content compared to palm oil, the quantity of coconut kernel consumed would compensate for it. Tocotrienols represent a subclass of vitamin E and have similar isomers (alpha, beta, gamma and delta) as in tocopherols, the other subclass of vitamin E (ref. 6). Tocotrienol fractions from palm oil have been found to inhibit biosynthesis of cholesterol[7–9] and tocotrienols decrease hepatic cholesterol production and reduce plasma cholesterol levels in animals[10]. Similarly, administration of tocotrienols to humans reduced serum cholesterol[11]. When genetically hypercholesterolemic pigs were fed a standard diet supplemented with 50 µg/g tocotrienol rich fraction isolated from palm oil, there was a 44% decrease in total serum cholesterol, 60% decrease in low-density-lipoprotein (LDL)-cholesterol[9]. Tocotrienols differ from other known inhibitors of cholesterol biosynthesis in that their mechanism of hypolipidemic action involves post-transcriptional suppression of HMG-CoA reductase[7]. Although alpha and gamma tocotrienol isomers inhibit cholesterol biosynthesis, gamma-tocotrienols exert a 30-fold greater inhibitory activity[7]. Importantly, of the total tocotrienols present in coconut oils about 53% is of the gamma type[5].

Tocotrienols not only inhibit biosynthesis of cholesterol but also prevent lipid peroxidation by virtue of their anti-oxidant properties. For instance, alpha-tocotrienol has 40–60 times greater anti-oxidant activity than alpha-tocopherol, though its vitamin E activity is only 30% of the latter[12]. Being an anti-oxidant, it scavenges the free radicals produced in our body by various mechanisms[1]. There is some evidence that free radical damage contributes to and may actually cause some of the problems associated with many chronic health disorders including inflammation, cancer, atherosclerosis, heart attacks, stroke, emphysema and ageing[1, 5, 13]. Free radicals initiate chain reactions especially in membranes which have a large proportion of unsaturated fatty acids. Despite the presence of anti-oxidant enzymes namely superoxide dismutase, catalase and glutathione peroxidase in the cells, deficiency of vitamin E (tocopherols and tocotrienols) leads to inadequate protection against hydroxy radical-induced damage[1]. Therefore, it is recommended that as the consumption of polyunsaturated fatty acids (PUFA) increases, the intake of vitamin E should be increased[1, 6]. In many oils, with the exception of fish oils, the proportion of vitamin E increases with increase in unsaturated fatty acid content[1].

The people of Kerala consume a large quantity of fish which are rich in polyunsaturated fatty acids but contain low vitamin E. The requirement of vitamin E as an anti-oxidant has therefore to be met from other sources including the tocotrienols present in coconut kernel and coconut oil which are consumed along with fish. Traditionally, women in Kerala applied coconut milk and oil derived from coconut milk (*Urukkuvelichanna*) to their skin. The same was applied for some types of physical injury as it was believed to facilitate healing. Further, in Ayurveda, one of the remedies for the loose facial skin, due to ageing, is to astringe grated coconut on the facial skin[14].

Given the hypocholesterolemic (and anti-oxidant) action of tocotrienols and

their comparatively higher concentration in coconut, do we have to look too far for an explanation for the low levels of cholesterol in the Polynesians and Sri Lankans? Does it not appear yet again that traditional wisdom and age-old practices have the fullest sanction of modern science?

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Value addition: A threat to *Calophyllum* species

At the 'Round Table Conference Assessment, Conservation and the Sustainable Use of Genetic Resources: Achieving National Objectives through Regional Collaboration', in Indonesia, from 11 to 13 October 1994, several scientists, government agents and traditional medicine-men met and discussed a number of issues relating to biodiversity prospecting. One of the important topics discussed at length was the screening of medicinal plants for pharmaceutical purposes, thereby 'adding value' to such species. Prof. Vichai Reutrakul from the Mahidol University, Thailand, a biochemist presently involved in screening medicinal plants for dealing with AIDS, reported that three species of *Calophyllum* have already shown promise in this regard. An active principle called *calonoli* has proved very effective against viruses under experimental conditions. Interestingly, one of the species screened and found promising is *C. inophyllum*, the Indian laurel.

Calophyllum is one of the many genera of trees in the family Clusiacea. The genus is widely distributed in tropical Asia and Africa. *C. inophyllum*, which is a fairly common tree in south India, especially in the coastal areas, is also found in some African islands and Southeast Asia This species has been traditionally used by the local people in India as timber for boat-making and the oil extracted from the seeds as lamp oil. The oil is also used as a cure against

Figure 1. *Calophyllum inophyllum* typical leaf and fruit morphology.