PERSONAL CARE TOXICOLOGY: THE FACTS

AN ONGOING SERIES IN RESPONSE TO PUBLIC MISCONCEPTIONS ABOUT WHAT CONSTITUTES A SAFE AND EFFICACIOUS NATURAL PERSONAL CARE PRODUCT

-CONTENTS-

PERSONAL-CARE URBAN LEGENDS, TRUTHS AND REALITIES

By Stuart Thomson, Director, Gaia Research Institute

As Director and principal researcher at the Gaia Research Institute, I have a tremendous **responsibility** to ensure the integrity of our proprietary research and by extension, the safety of our products and protocols.

For those who do not know me, I have been a full-time independent natural health researcher for 30-years, about half as Director of Research at the Gaia Research Institute, which I founded in 1990. Gaia Organics, my natural personal care and health product manufacturing business is the funding arm for this research and supports a **free clinic** for **seriously and terminally ill** individuals availing themselves to my protocols.

The Gaia Organics range of personal care products had their genesis as self-formulated natural homemade products for personal use more than 20 years ago, during our self-sufficient living-off-the-land period. My standards were what one would normally classify as 'radical' and still are today, albeit tempered with the wisdom that time tends to bring to philosophical idealism adjusted to practical reality learned by experience.

I can, in good conscience, stake my reputation on all Gaia products being true to our slogan: *"Earth, People and Animal Friendly"*. If it's good enough for me and my family and friends, it ought to be good enough for you and your loved ones. We now export to the UK and Germany under independent labels, but identical formula and standard, having succeeded in the momentous task of clearing with national health authorities.

For more **background**, perhaps an evaluation of my websites and the risqué and controversial topics and depth of the research thereon, might serve to confirm the integrity of my commitment to my responsibilities. *www.gaiaresearch.co.za* is my external personal care and internal health care research and products portal. *www.gaiaresearch.co.za/pharmapact* is my old health freedom website with link-out to the original archives.

Arising from consumer exposure to confusing and worrisome **partial truths and urban legends** that seem to inevitably shadow any topic, but this one particularly so, we are often questioned about our products, the most common of which I will deal with here to facilitate hopeful re-evaluation of the reader's assumed knowledge on these topics. *What you will encounter is guaranteed to humble even the worst 'know-it-all'.*

Much of this has been necessitated by fall-out arising from a fraudulent marketing campaign by **Neways**, a multi-level marketing personal care company in the US, which cowardly decided to cast aspersions upon the safety of the most commonly used ingredients in the personal care industry, in many cases, not due to any genuine issues, but rather sadly to sway gullible consumers to purchase their supposedly safe alternatives.

Noticing the phenomenal success of Neways, which used its ever-increasing network of agents, mostly online Internet consumers availing themselves of an opportunity to cash in and in the process being provided with free web-space, tools and a vested interest in unquestioningly repeating the propaganda, many manufacturers, fearing being sidelined, converted to the new religion and so the lies are cast in stone.

I have been an independent, usually controversial and often **revolutionary thinker** and activist for some 30-years and although the main active ingredients in my personal care formulations have little in common with mainstream or alternative products, some elements, especially of my base spreading creams, are on the 'hit-lists'. I shall however, rather than convert to the Neways religion, defend my faith and superior position.

Should you have been exposed to the Neways doctrine via the Internet or locally via hypocritical commercial propaganda in **Biophile magazine**, or **Esse** Organic Skincare, **Enchantrix**, **Naturebabes** or some other disciple's pamphlets or websites, you now likely believe claims that the products are **'chemical free'**, natural, **'organic'** and 'safe' and that mineral oil, sodium lauryl ether sulphate and parabens are highly toxic.

If so, not only are your beliefs illusions, but may be dangerous delusions, exposing you instead to genuine, albeit unexpected and possibly unknown harm from **toxic natural substance breakdown products**. In the case of the three mentioned perfectly safe natural substances, formulating *'without'* these, ironically actually leads to far greater risks to consumers, in ways that further render said culprits criminally reprehensible.

I have restricted my discussion to the logical and scientific defense of three of the most commonly used, criticised and best scientifically investigated, generally regarded as safe personal care ingredients, namely **Sodium Lauryl Sulphate/Sodium Lauryl Ether Sulphate, Parabens and Mineral Oil** and in my response, have critically evaluated the claimed superior alternatives, I believe you will agree, with surprising results.

Before profiling these main three and other falsely criticised natural ingredients and exposing the genuine toxicity of claimed superior alternatives, I shall briefly address several frequently asked questions, to afford the reader an overview of other main issues facing a formulator and manufacturer of natural personal care and health products such as myself, based on science, safety and efficacy rather than **silly risky idealism**.

Why does Gaia use **plastic containers**?

From an ecological and human health perspective, plastic is an incontestable priority choice over glass or metal (actually bamboo with corks was my first choice, but was simply unfeasible). With plastic, a very small amount of oil, a perfectly natural resource brought to the surface by natural gas pressure and similarly transported, relatively fuel efficiently, largely via pipeline, is consumed as the raw material to produce thin-walled, chemically inert/stable and importantly, vastly lighter containers, thereby reducing transport pollution.

The production of glass (or metal) uses vastly more fossil fuels than the fossil products used to manufacture and transport the plastic alternative, just to quarry (mechanical) and smelt (furnaces) the raw materials (special sand or metal ores). Eventually, these materials have to be transported, not only from quarry to foundry, but thereafter the containers themselves, weighing 10 times more, accordingly using vastly more fuel wherever transported, to and fro around the world, sometimes prior to even the filling and sale thereof.

Why does Gaia not list **SPF's (Sun Protection Factors)** on its sun-care products?

SPF's are irresponsibly misleading pseudo-science, popularised far more for profit than protection. SPF's only apply to the superficially penetrating UV-B rays, which only causes sunburn, not skin cancer, nor photo-aging. The UV-B spectrum is almost 50 times less than that of the far more deeply penetrating UV-A rays, which do cause photo-aging and the serious skin cancers, including the deadly malignant melanoma. UV-B screens facilitate excessive UV-A exposures. Gaia has its own 'sun defense' product rating system, taking into account the total UV spectrum. Please see my extensive scientific writings on the subject in either the free Gaia Organics Catalogue or online on our website at: *www.gaiaresearch.co.za/sunscreensuicide.html*

Does and if so, why does Gaia use **Aqueous Cream**? Also, **how is the product preserved?**

Aqueous cream is an emulsion of oil and water and is perfectly acceptable if manufactured using the finest raw materials intended for extended human use. Commercial aqueous creams might not consider these factors sufficiently and are almost certain to use the allergenic Chloro-cresol *(Britton J, et al, Br J Dermatol, 148(2), 2003)* or Phenoxyethanol preservatives *(Marks J et al, J Am Acad Dermatol, 38(6), 1998)*. Aqueous cream itself is merely a **spreading agent** for several biologically active constituents. Gaia uses pure mineral oil, the molecular size of which ensures non-entry into the skin, so serving as an inert non-inhibiting carrier for the precious fragile active ingredients and an inert barrier against environmental pollution. If not needed, residual cream may be tissued-off after 10-15 minutes, by which time the actives, including the vulnerable plant sourced essential fatty acids, having no competition, will all have been safely assimilated into the cells.

Using a **plant oil** as a spreading agent is counter-productive, by virtue of having to protect it against harmful **oxidation and rancidity**, which itself will quickly render not only the cream undesirable, but also denature many of the otherwise active natural ingredients, including the anti-oxidants intended to protect the actives and skin itself. Gaia's aqueous cream is specially formulated and is preserved with just enough of the **nature identical Paraben preservatives** to maintain the integrity of the cream prior to production of the final products, which utilise **colloidal silver, fruit acids, gum benzoin and essential oils** etc., instead of conventional preservatives. The colloidal silver preservative uniquely survives indefinitely to ensure that the products remain entirely safe in the long term without the use of high levels of any other preservative agent.

All extractive **botanical preservatives**, by virtue of their 'organic' nature, **decompose** and become inactive, if not actually toxic and so compromise the products, not only in their containers, but also in the microbial rich milieu on the skin, some of which cross-contaminates the cream and produces even further toxic by-products in storage, which contents are poorly preserved due to risky idealistic rather than truly scientific formulating. Gaia Research pioneered **colloidal silver** and copper preservation and **green tea** antioxidation internationally and only a decade later is silver being hailed as the ultimate antimicrobial preservative and green tea as the ultimate antioxidant. We coined the slogan *"We Lead; Others Follow"* to sum up our leading edge. Contemporarily, the mainstream continues to rely heavily on truly suspect synthetic ingredients, whilst self-proclaimed 'organic/natural' evangelists sadly insist on producing their even more troubling clearly toxic Wicca's brews and conning a gullible rising consciousness consumer with clearly fraudulent marketing.

INGREDIENT SCARE-MONGERING ON THE INTERNET & IN NEW AGE MAGAZINES

It is quite remarkable that the terrible hazards fraudulently attributed by the Neways religion to **parabens, sodium lauryl sulphate, mineral oil** and other ingredients safely used daily by hundreds of millions of babies, children and adults for half a century are never exposed in published science papers, newspapers or reputable investigative television programs, with good reason, its a false religion, a false doctrine, for commercial gain. For Heaven's sake, look to science rather than sales and learn to check the references.

These **fabricated ingredient scares** are often the result of internet traders attempting to gain an unfair advantage over competitors by misusing information not directly referenced to respectable scientific studies in their proper context, often from **Material Safety Data Sheets** intended for employer's of chemical workers in all industries, for industrial hygienists and other occupational safety professionals who may need such information relating to the bulk transportation, handling and post accident clean-up of often thousand-fold concentrates, to conduct effective occupational safety programs in industrial, pharmaceutical or consumer goods manufacturing sectors. The unwitting disciples of these scaremongers are paranoid Internet surfers, who break out into a cold sweat at the mere sight of chemical nomenclature and also those to which they in turn circulate such misinformation, usually all with the best of intentions, but with no real-life **perspective**.

It is the central axiom of toxicology, that ***"the dose*** (quantity and concentration) ***makes the poison"***. Some of these target cosmetic ingredients are extreme concentrates when supplied to manufacturers, because they are purified active ingredients in the form of powdered solids, liquid concentrates or even liquefied gasses. No consideration is taken by the critics of the final, often minute concentrations used in the products they summarily condemn, nor of the final formulation of such products, which too can significantly influence the safety of the product. Invariably, the majority of these scare sites will themselves have products to sell that are ostensibly free of such substances, yet often without full disclosure of their own ingredients, other than a selective listing of token pseudo-natural ingredients (often suffixed eg by the word 'from' and then the main or one starting raw material). The reader will in the following pages find frequent reference to some of the cheat alternative ingredients used (there are doubtless many we are not yet aware of and some we will never be allowed to know of). I shall explain the toxic potential of these (often pseudo-) natural alternatives.

The usual rationale is that a substance with a scientific name is a synthetic chemical and that all synthetic chemicals are dangerous, likely cancer-causing agents, whereas natural substances are safe. However, as I shall illustrate towards the end of this series, in at least half of the cases of natural substances used by humans, eg for food, quite the opposite is true, since it is a fact that **some of the most potent poisons known to science are of botanical**, animal, mineral or metallic origin, as found in nature without chemical manipulation, eg ricin from castor beans, used by the KGB and also modern day terrorists; poison hemlock, used to poison **Socrates** to death; bee, spider and snake venoms; and the minerals arsenic, cadmium and mercury. Consumption of animal products is the major cause of cardiovascular disease and cancer, yet oddly, this toxic natural product is nevertheless avoidably readily consumed even by the Neways priesthood.

Before **we expose the disproportionate toxic potential of the critic's alternative ingredients** (interspersed throughout this report), – we really have been forced to respond to these **double-standards** - let us take a look at some of **the 'untouchable' ingredients used by Gaia Organics**, all of which are indisputably **manufactured from organic natural raw materials improved upon by science** to render these safe and highly efficacious when correctly formulated in high purity and appropriate concentration.

Glycerine

Gaia Research personal care products utilise vegetable glycerine certified by the *Organic Chemical Corporation* as sourced from raw materials of **vegetable oil origin**, rather than synthetically from potentially hazardous propylene or from **animal fats**, thereby negating any concerns of animal disease from abnormal animal proteins such as prions, which are serious transmissible infective agents that cause Bovine Spongiform Encephalopathy – BSE (mad cow disease), which is capable of being transmitted to humans from animal products such as glycerine, gelatine and tallow (animal fat removed from carcasses in abattoirs, used in virtually all, including animal and vegetable glycerine soaps), none of which substances are used in any Gaia Research personal care product. Glycerine has been maliciously criticised as drawing moisture from the skin if atmospheric humidity is low, but this applies only if it is used alone. Properly formulated, especially with a microfilm of pure mineral oil or a highly refined vegetable wax such as jojoba oil, will undisputedly help to retain skin moisture without compromise, though the latter oil will shorten the shelf life.

Cetyl Stearyl Alcohol

Cetyl-stearyl alcohol is obtained by reduction of the fatty acids in **coconut oil**. It is also a natural component of whale oil (spermaceti), which latter Gaia will not use because of its cruel animal origin. The Cetyl-stearyl alcohol used by Gaia Organics is sourced entirely from natural products manufactured by Cocochem.

The conclusion of a recent safety review of Cetyl-stearyl alcohol by The European Agency for the Evaluation of Medicinal Products *(EMEA/MRL/448/98-FINAL, June 1998)* is reproduced: *"Cetyl-stearyl alcohol is used as an **emulsifying agent** in cosmetics for topical use and is also approved for use as an indirect food additive by the US FDA and the Council of Europe as a flavouring substance without hazard to the public. CSA as a component of the human diet is of low oral toxicity, is non-irritating in humans and hence topical products are accordingly approved for human and animal use without need for a maximum regulatory limit."*

Animal Products

The only animal substances that Gaia Research uses in it's personal care products are beeswax in Lip-Ice, lactic acid in a Fruit Acid Concentrate and **lanolin (wool-fat)** in Hand Cream, neither of which harm the host animals, nor contain any potentially infectious agents. Years ago, we discovered to our horror, that Royal Jelly from bees involved sacrificing the hosts and we immediately ceased using that and instead reconstituted the essential ingredients from other natural substances not reliant on the animal kingdom.

Para-aminobenzoic Acid (PABA)

PABA is a member of the **B-vitamins group, a normal part of folic acid** and is widely distributed in nature, in the food chain in whole-grains, molasses and yeast and is commercially produced from brewers yeast. It serves primarily as an antioxidant and **membrane stabiliser**, slows cross-linking, enhances tissue flexibility, promotes membrane fluidity and provides protection against ozone, second-hand smoke and other air pollutants, besides being used as a topical sunscreen, due to its ability to **naturally absorb ultraviolet energy**. An advantage over other agents is that it penetrates the stratum corneum of the skin, where it attaches to proteins and so is not washed-off. *(Pearson and Shaw, Life Extension: A Practical Scientific Approach, Warner Books, 1980); (Tyler, Brady and Roberts, Pharmacognosy, Lea & Febiger, 1988); (The Merck Index: An Encyclopedia of Chemicals, Drugs and Biologicals, S Budavari, Ed, Merck and Co, 1989)*

Being an acid and an active **UV energy absorber** (all except zinc oxide and titanium dioxide are), PABA can cause **skin irritation and hypersensitivity in susceptible individuals**, especially when not formulated with a non pro-oxidative and anti-inflammatory antioxidant such as green tea extract. PABA may also cross-react with certain medications (sulfonylureas, sulfonamides, thiazides and paraphenyleneldiamine) and even interfere with their actions, which is why PABA esters are usually used commercially in pharmaceutical products in an effort to reduce such incidences, but with a compromised previously excellent safety profile over and above badly formulated skin reactions. *(Textbook of Therapeutics, E Herfindal and D Gourley, Eds, Williams & Wilkins, 2000); (Foye, Lemke and Williams, Medicinal Chemistry, Williams & Wilkins, 2002)*

All Gaia Research personal care products use only genuine **nutritional PABA, not its esters** and hence this natural form is approved for both human nutritional and concurrently for sunscreen-use. PABA is storage-stable and moderately photo-stable *(Stenberg C et al, Photodermatol, 4(4), 1987)* and **a proven inhibitor of the photo-carcinogenic process** *(De Rijcke S & Heenen M, Dermatalogica, 179(4), 1989)*; *(Flindt-Hansen H et al, Acta Dermatol Res, 282(1), 1990).* It is necessary to formulate proactively, such as with **green tea extracts** *(Ichihashi M et al, Toxicol, 189(1-2), 2003),* since although active UV absorbers reduce the genotoxicity of UV light and thus are antimutagens, it is important to prevent photodegradation to reactive molecules or energy transfer to DNA *(Gocke E et al, J Environ Pathol Toxicol Oncol, 20(4), 2001)*.

Chemically related to PABA, are the **very badly misrepresented Parabens** (p-benzoic acid and its esters), so wrongly condemned by circumstantial evidence seized upon by sensationalist media reporting that never correctly reported the science, let alone the sober conclusions. Even cosmetic scientists, whilst confirming its safety, are responding to the pressure of public perceptions and rather than standing their ground and defending the good safety record of **methyl and propyl parabens**, as **found naturally in eg Oca** (a tuber as widely consumed in South America as the potato until cultivation was severely constrained by a weevil) **and Mango** respectively, are synthesising and using relatively new preservatives, rather than moving consensus back to reality, and in the process, are venturing into hazardous human experimentation.

Parabens

Contrary to popular misbelief, parabens are not diabolical chemical poisons invented by mad scientists to inflict havoc on human health. Parabens do have direct correlates in nature. In fact, all plants normally produce p-hydroxybenzoic acid, albeit in small quantities *(Viitanen P et al, Plant Physiol, 136(4), 2004)*. Well-known plants known to significantly synthesise parabens as defensive chemicals against attack by micro-organisms include carrot, olive, cucumber, honeysuckle and ylang ylang *(Bach M et al, Plant Physiol, 103(2), 1993); (Aziz N et al, Microbios 93(374), 1998); Smith-Becker J et al, Plant Physiol, 116(1), 1998); (Dweck A, "Natural Preservatives", Cosmet Toilet, Aug 2003).*

Plants known to synthesise Methyl paraben include Birthwort *(Aristolochia kankauensis) (Wu T et al, Phytochem, 36(4), 1994)*; Guan pepper *(Piper guanacastensis) (Pereda-Miranda R et al, J Nat Prod, 60(3), 1997)*; Coprophilous fungus *(Guanomyces polythrix) (Macias M et al, J Nat Prod, 63(6), 2000)*; **Thale cress** *(Arabidopsis thaliana) (Walker T et al, J Agric Food Chem, 51, 2548, 2003)* and **Oca** *(Oxalis tuberosa) (Pal Bais H et al, Plant Physiol Biochem, 41(4), 2003)*. **Plants known to synthesise Propyl paraben** include **Verticillium** spp, [filamentous fungi that inhabit decaying vegetation and soil (read **"organic" produce**)] *(El Aissama A, Mycopathologia, 144(2), 1999)* and **Mango** *(Mangifera indica) (Chirawut B, Sangchote S, 15th Australasian Plant Pathology Society Conference, Deakin University, Geelong, 26-29 September, 2005)*. **Methyl & Propyl parabens are 100% nature identical and are consumed by millions in natural foods.**

According to the American Academy of Dermatology *"The best preservatives for sensitive skin are those containing parabens" (2002 Prof Zoe Draelos, Summer Scientific Meeting, New York, AAD, 2002).* **Methyl-paraben and Propyl-paraben**, as used by Gaia Organics are para-natural compounds **prepared from *p*-hydroxybenzoic acid, widely distributed in many fruits and spices and also in black and green teas**. **Benzoic acid** occurs naturally in high concentrations in gum benzoin from the Styrax tree and is naturally present in many foods, including **honey**. Both parabens are routinely **used as preservatives in beer, fruit juices, jams, and wine**. *(Timothy Paustian, Microbiology Textbook, University of Wisconsin-Madison, 2004)*

The **benzoates**, including sodium benzoate, are widely used as antimycotic and antibacterial **preservatives in foods and beverages** and exhibit little or **no toxicity in the concentrations used**. The effects of orally administered benzoates have been observed for well over a century and large doses (up to 60 grams!) are well tolerated. The parabens are allocated the same GRAS (Generally Regarded As Safe) status as natural benzoic acid and the same maximum level is permitted in food (in processed vegetables, baked goods, fats and oils and in seasonings, to name just a few), approved by the US Food and Drug Administration and other national agencies worldwide as a direct food additive in amounts ranging from 0.0001% to 0.10%. **Parabens** entering the human body are hydrolysed to the even more benign parent compound, forms natural compounds and like the completely natural benzoates, are eliminated in the urine. *(Metcalf D, et al, Food Allergy: Adverse Reactions to Foods and Food Additives, Blackwell Scientific Publications, 1991)*

The antimicrobial properties of the parabens are effective over a much broader pH range than benzoic acid. The acute and chronic toxicity, **carcinogenicity, teratogenicity and mutagenicity** of the parabens were extensively reviewed by the Life Sciences Research Office of the Federation of American Societies for Experimental Biology, which concluded that "there were no short-term toxicological consequences in man and no long-term toxicological consequences in rats greatly exceeding amounts currently '**consumed'** in the normal diet" *(Schmidt A, Methylparaben & Propylparaben: Affirmation of GRAS status of direct human food ingredients, Federal Register, 38: 20048-50, 1973)*. Methyl and propyl parabens have such **weak oestrogenic activity** that no activity was detected in vivo in classical uterotrophic assays using high dose oral or subcutaneous rodent administrations *(AFC Panel, 13 July 2004, European Food Safety Authority)*.

A safety assessment from a review of the published literature is abstracted here: *"**Methyl-paraben and Propyl-paraben** are stable, non-volatile compounds and have been **safely used as antimicrobial preservatives in foods and cosmetics for over 50 years**. There is **no evidence of accumulation via the gastrointestinal tract and dermis**. Acute toxicity studies indicate that the parabens are relatively non-toxic by the oral route and mildly irritating to the skin. Following chronic administration, no-observed-effect levels (NOEL) as high as 1200-4000 mg/kg are reported and a no-observed-adverse-effect level (NOAEL) in the rat is posited at 5500 mg/kg. **The parabens are not carcinogenic, mutagenic or clastogenic. Contact sensitisation has occurred when parabens have been applied to damaged or broken skin but high concentrations of 5-15% in patch testing are needed to elicit reaction in susceptible individuals**." (Soni M, et al, Food Chem Toxicol, 39(6), 2001); (Soni M, et al, Food Chem Toxicol, 40(10), 2002)*

The **oestrogenic activity** of parabens is **so weak that no more than a handful of scientists have even mentioned the fact** and only one team, basking in an inexplicable glow of media attention, has suggested that their ubiquity might represent any risk to consumers at all, which suggestion they admit, remained unsubstantiated. In fact, due to lack of subsequent confirmation, parabens have been off the scientific radar for several years now and it is difficult to understand why parabens are still a pariah, other than the ignorant or malicious agendas alluded to previously. The following facts should put any possible risk into perspective.

The fact that **the following have potent oestrogenic activity**, rests in scientific archives, the whereabouts of which those crying wolf over parabens, remain blissfully unaware: ***alfalfa, almonds, anise, apple, banana, barley, broccoli, cabbage, canola, cauliflower, carrot, cherry, chickpea; clover, coffee, corn, cumin, damiana, fennel, flaxseed, garlic, green bean, hop, lemon, lemon balm, licorice, lima bean seeds, mint, oats, oregano, pea, pinto bean seeds, pomegranate, plum, potato, rice, rice bran, rye, rape, sage, sesame, soybean, split pea, sunflower seed, thyme, tumeric, verbena, wheat, wheat bran, wheat germ, yam & yeast. Included are the oils of olive, corn, safflower, wheat germ, soyabean, rice bran, peanut and coconut***. *(Sob M, Naturally Occurring Estrogens, in CRC Handbook of Naturally Occurring Food Toxicants, Miloslav R (Ed), CRC Press, 1983); (Davis D & Bradlow H, Sci Amer, Oct 1995); (Davis D et al, Nature Sci Med, May/June 1997); (Zava D et al, Proc Soc Exp Biol Med, 217(3), 1998)*

A number of botanicals have been identified as putative estrogenic agents *(Piersen C, Integrative Cancer Therapies, 2(2), 2003)* **All of the abovementioned foodstuffs naturally contain phytoestrogens. All are in fact endocrine disrupters**, ie. exogenous agents that interfere with the production, release, transport, metabolism, binding, action or elimination of natural hormones in the body. These effects are unpredictable, are not well delineated and are often paradoxical, sometimes beneficial or hazardous *(Barrett J. Phytoestrogens, friends or foes? Environmental Health Perspectives 104(5), 1996); (Jacob D et al, Exp Biol Med, 226(4), 2001)*. Just like the improperly maligned parabens, risk/benefit analysis is dependent on dose and circumstances, not the mere name of a single or group of chemicals (parabens), natural or otherwise.

The human diet contains several nonsteroidal estrogenic compounds structurally similar to natural and synthetic estrogens and antiestrogens. Dietary estrogens are either produced by plants (**phytoestrogens**) or by fungi that infect plants (**mycoestrogens**). Consumers of non-organic produce might take heart from the fact that high nitrogen fertiliser applications reduce endocrine disrupter content and that plants induce production of endocrine disrupters in response to attack by insects, bacteria or fungi, which is just one of several reasons why even bad conventional agriculture can be superior to even good organics. **While the estrogenic potency of synthetic estrogenic chemicals is very limited, phytoestrogens are potent** and may trigger many of the biological responses that are evoked by the physiological estrogens *(Kuiper G et al, Endocrinology, 139(10), 1998)*. **The natural endocrine disrupters** genistein, coumestrol and zearalenone (mycotoxin) **stimulate the transcriptional activity of estrogen receptors at considerably lower concentrations (100X) than synthetics** *(Bernhoft A, Endocrine Disrupters - Synthetic Chemical Contaminants and Natural Compounds in the Diet, Lecture, Norwegian Acad Sci Letters, 1997)*.

Many of the phytoestrogens that occur in plants have not yet been examined for their genotoxic potential. Some have been studied, showing that **Coumestrol** (high concentrations **in clover and alfalfa sprouts**, lower concentrations in **sunflower seeds**, lima bean seeds, pinto bean seeds, and round split peas), **genistein** (high **in soy**, lower in other legumes, eg chickpeas) and **zearalenone** (a heat-stable fungal mycotoxin, found **on cereals grains eg corn, wheat and rice**) **are clastogenic in cultured mammalian cells and lead to genotoxic mutations**. **The genotoxicity acts in concert with their hormonal activity to give rise to carcinogenic effects**. *(Kulling S, Metzler M. Food Chem Toxicol 35:605-13, 1996); (Metzler M et al, Zeitschrift für Lebensmitteluntersuchung und Forschung, 206(6), 1998)* On the other hand, **flax** mammalian lignans (enterolactone and enterodiol) are anticarcinogens in epidemiological and biochemical studies, are devoid of clastogenic potential and not genotoxic *(Kulling S et al, Mutat Res, 416(1-2), 1998)*.

Most phytoestrogens show some beneficial effects on estrogen-dependent disease. However, these **can also promote tumor growth** *(Hilakivi-Clarke L et al, Oncol Rep, 6(5), 1999); (Newbold R et al, Cancer Res, 61(11), 2001)* **and cause developmentally adverse effects** *(Delclos K et al, Reprod Toxicol, 15(6), 2001)*; *(Jefferson W, Newbold R, Nutrition 16(7-8), 2000).* The risks and benefits of estrogenic or anti-estrogenic effects depend on the target tissue and the timing and level of exposure. A thorough analysis of the properties of these compounds is warranted. *(Mueller S et al, Toxicological Sciences, 80(1), 2004)* Let us heed the trusted modern toxicological axiom pertinently observed and recorded by **Paracelsus** in 1538: *"All things are poison and nothing is without poison. Solely the dose determines that a thing is not a poison."*

In spite of my methodically laying out the evidence of misinformation on several topics, including some of the foregoing and what follows, engaging and conveying this information to all parties early in 2005 (See ***www.gaiaresearch.co.za/biofilth.html*** for ***"The Biofilth Files: Have You Been Enchantricked?"*** & *www.gaiaresearch.co.za/naturebabes.html "The Ess*ential *Files: Are Your Toddlers Truly Naturebabes?"*), the **Esse, Enchantrix, Naturebabes** and other websites still carry miscontextualised scare-mongering propaganda, including about supposed oestrogenic risk from paraben preservatives, whilst their alternatives hypocritically comprise of far more and far more potent endocrine disruptor materials. So what does **Trevor Steyn**, chief propaganda officer and convenient **manufacturer of all three product ranges** use as alternative preservatives to prevent hazardous microbial contamination and likely toxic degradation of the ***'natural' ingredients that 'nature' dictates must 'decompose' both during storage and on the skin***? It is difficult without full ingredient disclosure to tell if such products are adequately preserved or due to a corny philosophy, are pathogenic vectors, but decompose to toxics they will, without effective preservation.

Recently, **Trevor Steyn**, having another unprovoked and unnecessary cheap commercial dig at parabens and mineral oil, announced that he utilises **silver chloride and grapefruit seed extract** to preserve his aqueous cream and abovementioned product ranges *(Pharmaceutical & Cosmetic Review, March 2006)*. Sounds good? But is it? I have in my research and development work at Gaia Research personally pioneered internationally the use of colloidal and ionic silver as personal care preservatives. It is a fact that **silver chloride is insoluble and therefore almost entirely inactive as a microbicide**, so application in such crude 'organic' products could not be effective. Interestingly, the only means by which silver chloride can be rendered soluble, is by the introduction of **ammonia**. I know this better than anyone else, having put forward the "Ammonia Hypothesis" to explain how silver chloride might be microbicidal inside the chloride-rich human body (see ***http://www.gaiaresearch.co.za/silver.html*** for my undisputed thesis on the subject).

The only means by which **silver chloride** could be effective for said application would be either via the addition of **ammonia** to the product, or **decomposition of the product** itself to produce ammonia, since ammonia is the only effective solvent for otherwise insoluble silver chloride. Ammonia can be a perfectly 'natural', but potentially toxic product arising from the decomposition nitrogen-rich organic compounds in vegetable matter (Seekins B, Biocycle, 40(11), 1999) or a product of industrial synthesis. The former is what I have predicted occurs in products bulked predominantly with superfluous plant material of inevitable decomposition potential coupled with inadequate preservation to safely handle challenges that even parabens might fail to meet. See my *'Mineral vs. Plant Oil'* report for an exposé of this breakdown process.

Grapefruit seed extract (GSE) ***The only means by which the GSE could be even weakly effective long term over the life of a natural product, would be for it to be preserved with parabens or some other preservative to prevent any 'natural?' preservative itself from decomposing and becoming ineffective.*** Of course, this would be a double-standard sham, making a total mockery of claimed 'organic' and 'natural' standards for such product ranges, but without my exposé you would not know this! The name implies that GSE is produced from a simple extraction of grapefruit seeds, but **these are actually multi-step synthesized products merely using waste grapefruit seed and pulp as main raw material**. Claims for the efficacy of GSE as an alternative to conventional preservatives are legion via books, magazines and the Internet, so much so that questions arose in the scientific community about its composition and whether commercial GSE might be adulterated with synthetic preservatives. So how does GSE stand up to scrutiny?

Using sophisticated analytical methods to compare **commercial GSE** with actual laboratory grapefruit seed extract, one research group identified the synthetic preservative agents **methyl paraben and triclosan** *(Sakamoto S et al, Bull Natl Inst Health Sci, 114, 38-42, 1996).* Another group, using different methods and **commercial GSE**, subsequently additionally identified **benzethonium chloride**. Levels of these cheat ingredients were significant, as high as 10% (22% by weight) of benzethonium chloride. **Only one sample had no adulteration, but this and the laboratory extracts also showed no antimicrobial activity**. *(von Woedtke T et al, Pharmazie, 54, 452-456, 1999)* Using even more sophisticated analytical methods, another group set out to determine whether perhaps benzethonium chloride or a similar molecular weight quaternary ammonium compound was formed during the extraction of active components of grapefruit seeds, but ruled this out, **demonstrating conclusively that synthetic benzethonium chloride, an antimicrobial agent widely used in cleaning and disinfection products, was being added to or synthesized from Grapefruit Seed Extract** *(Takeoka G et al, J Agric Food Chem, 49(7), 2001).* These practices are ongoing despite these exposé, which is troubling given the widespread use and belief in GSE as natural and safe, when there are in fact toxicity and allergenicity concerns *(Takeoka G et al, J Agric Food Chem, 53(19), 2005); (Takeoka G et al, Meeting Abstr, Afgd Paper No. 50, ACS Nat'l Meeting, Mar 2005, San Diego, CA.)*.

All peer reviewed scientific studies apparently showing efficacy for GSE have likely been as a result of tests using adulterated material, these proprietary products having been accepted at face value, so **all tests prior to and several post expose' are scientifically invalid and worthless** *(Reagor L et al, J Altern Compl Med, 8(3), 2002); (Heggers J et al, J Altern Compl Med, 8(4), 2002); (Edwards-Jones V, Burns, 30(8), 2004); (Zayachkivska O, J Physiol Pharmacol, 56(Suppl 1), 2005)*. Some researchers have found non-proprietary extracts to be ineffective *(Calori-Domingues M, Foseca H, Food Addit Contam, 12, 347-350, 1995)* and the few reporting positive results, were feeble activity *(Cvetnic Z, Vladimir-Knezevic S, Acta Pharm, 54(3), 2004)* or poorly controlled equivalency studies *(Oyelami O, J Altern Compl Med, 11(2), 2005)*

The majority, if not all the activity is attributable to the preservatives with which GSE is adulterated, including, but not limited to the abovementioned. To the degree to which adulterants are absent, so are higher concentrations of GSE needed to elicit effects due to weaker action and this too is not without some increased risk due to toxic constituents of the seed (and possibly other ingredients) itself. **Where the benzethonium chloride has not been deliberately added, it is deliberately synthesised from the natural phenolics present in the seed into synthetic quaternary ammonium compounds** during manufacture of the GSE to afford it more significant activity or retain any feeble activity that it, like most fruit seeds/skins barely sufficiently posses for self-preservation. Chemical manufacturers, typically in this type of synthesis, use chemical catalysts. **Synthetic ammonium chloride is the catalyst used to synthesise what in the final analysis is the synthetic chemical, benzethonium chloride. GSE is a synthetic chemical compound, is not 'organic' or 'natural' and should not be permitted in such products.**

There is another issue with grapefruit seed extract (GSE); its high endocrine disrupting potential, since **several of the compounds that manufacturers point out are in GSE, in particular the flavones, are known to have estrogenic activity** *(Barrett J. Phytoestrogens, friends or foes? - Environmental Health Perspectives 104(5), 1996)*. GSE has never been evaluated for its estrogenic activity. This topic has been dealt with extensively in the previous data on the high relative safety of parabens, which risk again pales into insignificance against this barrage of endocrine disruptors of uncalculated risk, revealing GSE products as a tragic excuse for what is held to be quality, safe and efficacious 'organic natural cosmetics'.

Benzethonium chloride is a quaternary ammonium cationic disinfectant, a Class 2 poison because of its teratogenicity (induction of congenital defects). Cationic detergents are more toxic than other detergents due to their **caustic and systemic toxic effects**. Contamination of the eye may lead to **corneal lesions**. Oral solutions can lead to depression of the central nervous system, seizures, coma and death. *(Budavari S (Ed), The Merck Index, Merck & Co, NJ, 1989)*; *(Swiss Toxicological Information Centre, News, STIC, Univ Zurich, 7-11-2005)* Topical contact can cause **irritation and injury to the eyes and skin** and long-term - **dermatitis** *(Grant W, Toxicology of the Eye, Charles C. Thomas Publisher, 1986); (International Chemical Safety Cards, Benzethonium chloride, ICSC: 0387, NIOSH, March 27, 1996),* and also vaginal irritation *(Goodman L & A Gilman (Eds), The Pharmacological Basis of Therapeutics, Macmillan, NY, 1975).*

Dermal exposure to short and long-term, low to high levels of **benzethonium chloride** by in several rodent studies caused **epithelial and sebaceous gland hyperplasia** at the site of application *(National Toxicology Program, Abstract for TR-438 - Benzethonium Chloride, July 1995)*. **Benzethonium chloride is an endocrine disruptor** *(Endocrine Toxicants, Scorecard, Registry of Toxic Effects of Chemical Substances, August, 1997).* Health concerns include toxicity, safety limits on use, purity and manufacturing, and also estrogenic / endocrine disruptor effects, raising concern for impaired fertility or development and increased risks for certain cancers *(Ingredient Report: Benzethonium Chloride, Environmental Working Group, 2006)*.

Triclosan (as in adulterated GSE) has been reported recently to be photochemically converted to toxic dichlorodibenzo-p-dioxin (DCDD) within mere minutes in the environment *(Lores M et al, Anal Bioanal Chem, 381(6), 2005); (Latch D et al, Environ Toxicol Chem, 24(3), 2005); (Sanchez-Prado L et al, Anal Bioanal Chem, 384(7-8), 2006); (Yu J et al, Chemosphere, Mar 27, 2006 – E-pub ahead of print),* so it may not be detectable until applied to the skin, where the hidden damage proceeds unseen, though contact **dermatitis and photoallergies** may present when the skin is exposed to sunlight *(Durbize E et al Contact Dermatitis 48(3), 2003)*; *(Hazmap, Triclosan, Natl Inst Health, USA, 20 July, 2004)* **Triclosan is genotoxic and may irreversibly alter DNA strands** *(Ciniglia C et al, J Hazard Mater, 122(3), 2005).* Triclosan also reacts with free chlorine in tap water to produce intermediate compounds that convert into dioxins upon exposure to UV-radiation (from the sun or other sources). **Dioxins are extremely toxic and are very potent endocrine disruptors**. They are chemically very stable, are eliminated very slowly and can bioaccumulate to dangerous levels and persist for a very long time. *(Wikipedia, Triclosan, 30 April 2006)*

Sodium Lauryl Sulphate (SLS) and Sodium Laureth Sulphate (SLES)

SLS and SLES are naturally derived from coconut oil and have a long history of safe use in a variety of personal care products (including most toothpastes) and in foods as emulsifying, foaming, wetting and dispersing agents, without any reliably recorded significant adverse effects other than the very occasional mild skin, mouth or eye irritation that can occur with such effective products. Safety is determined by choice of purity of materials for intended use. In the case of personal care products, responsible manufacturers use only the purest grades, suitably formulated for prolonged or intimate contact with human skin and mucous membranes. The crudest industrial grades that are used as degreasers are deliberately manufactured to lower purity and hence are not used in personal care products, except perhaps in cheap imported cosmetic products. SLES (the 'eth' in laureth is for ether) is a modern milder version of SLS and is used where higher concentrations are formulated. **Rumours that SLS/SLES are linked to toxicities are widespread on the Internet. All have been responsibly investigated and exposed as hoaxes, seized upon, even strategically initiated by unscrupulous fear-mongering commercial opportunists to gain broad unfair advantage over their established competition.**

Sodium lauryl sulphate (SLS) is also known as sodium dodecyl sulfate (SDS) and is designated thus in most scientific studies dealing with other than its foaming cleaning applications. Gaia Organics could simply have listed this ingredient as sodium dodecyl sulfate so as to disassociate the ingredient with the fraudulent safety scares, but on principle have instead chosen to defend our use of this safest natural material under the defiled names SLS and SLES. **In studies of the effects of long-term (chronic) exposure, concentrated sodium lauryl sulphate is 'not' a skin sensitiser. The irritant effect, or the absence thereof, is concentration dependent.** In human testing, application of a raw-material strength 10% SLS for 24 hours caused negligible irritation to even the clipped forearm skin of 16 male volunteers *(Phillips L et al, Toxicol Applied Pharmacol, 21(3), 1972)*. A Gaia Organics cream contains, as an emulsifier, less than one-thousandth of that concentration. A Gaia Organics cleanser, **destined to soon be rinsed off**, would at worst, leave the same miniscule trace residue or considerably less and further, would not be SLS, but the far milder SLES, developed specifically for use in higher concentration very short term applications.

Regarding eye irritation, the eyes are self-cleansing and one closes the eyes when washing the face or shampooing the hair. The eye irritancy potential of SLS and SLES is irrelevant other than when perhaps an infant is involved. We are however of the scientific and common sense opinion that **no cleanser other than warm water should be used on an infant**. All cleansers strip an infant's protective barrier, increasing already extreme vulnerability (undeveloped detoxification systems) to all extraneous agents, including toxic *hype 'natural' baby products*. **The alternative to SLES most commonly used in some so-called 'natural' products by ignoramuses slating SLS and SLES is Cocamidopropyl betaine (CAPB).**

To my amusement, **Cocamidopropyl betaine was voted "Allergen of the Year" in 2004**, **yet sadly, it is widely used in infant products because it does not sting the eyes.** My alert to the effect that ***"CAPB causes of dermatitis of the head, neck and face in humans, especially so of the eyelids and lips of infants, where its standard use can lead to intractable inflammation and scaling"*** has been met with silence. **CAPB is no more natural than the SLES that hypocritical proponents criticise. Both are manufactured from coconut using petrochemicals and are subject to processing contaminants if not properly purified** *(http://www.organicconsumers.org/bodycare/organic_soap.cfm)*. See our shocking reports in the **appendix** and more at ***www.gaiaresearch.co.za/childchemexpose.html*** . Significantly, the 1.4 Dioxane levels in Gaia Organics products are considerably lower than environmental background levels.

So called 'Organic Standards' to which some manufacturers claim to aspire **are nothing more than a farce** to those who know better, as witnessed by the above **double standard** example. Germany's BIDH organic standards consider SLES to be unacceptable, yet both SLS and CAPD to be acceptable. **Weleda**, who are BIDH registered, use SLES and are disputing the arbitrary restriction. On their US website they state: "*Weleda have chosen not to use SLS, especially for people with sensitive skin. Our goal is to create personal care products that are in harmony with nature and the human being. We use a very mild cleanser and foam enhancer derived from coconut called Sodium Laureth Sulfate (SLES), which we have been found to be safe, and effective with a very low level of irritation. The main purpose of this ingredient is to keep oils and minerals in suspension during the hair washing process. This is especially necessary in hard water areas. Our research and development team has chosen this particular ingredient as the best available at this time to meet our customer's expectations of a shampoo. Over the past 80 years Weleda has established the highest standards for gathering, processing, and preparing every ingredient used."*

A comprehensive Australian government safety review published in April 2003 concluded as follows: *"The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has received* ***a large number of enquiries regarding concern over data on the Internet claiming that Sodium Lauryl Sulfate is hazardous to human health****. In response to this concern, NICNAS* ***undertook a literature search of the available data on the human health effects****.* ***There is no data to indicate SLS to be a skin sensitiser, genotoxic, carcinogenic, or a reproductive toxicant****.* ***The toxicity of SLS appears to be restricted to acute toxicity and skin and eye irritation. However, these health effects are primarily based on the effects of SLS at high doses in studies in laboratory animals.*** *The risk to humans from SLS will depend on the amount of exposure. The amounts of SLS used in cosmetics, and hence the potential human exposure is significantly smaller than that used in animal studies. Consequently, considering the human health effects associated with SLS together with data indicating potentially extensive use in both industrial and consumer areas, it appears that for consumers and workers, the human health hazards are low."* For more scientific documentation see online: ***www.gaiaresearch.co.za/nicnasls.html*** .

The United Nations Environment Programme (UNEP) has classified SLS as "readily biodegradable" and not a risk to aquatics. After extensive toxicological analysis, UNEP concluded that SLS did not induce mutations in different test systems, presents **a low potential for risk to man and the environment and is of no concern to human health** *(UNEP, Screening Information Data Sheet for High Volume Chemicals Vol. 4, Part 2, UN, Geneva, 1997)*. SLS is listed as Generally Recognized As Safe (GRAS) by the US FDA *(U.S. FDA Food Additive Database, Centre for Food Safety & Applied Nutrition, Office of Food Additive Safety, 2002)*. Sodium lauryl sulphate is not an occupational skin sensitiser; is not a mutagen and the US National Toxicology Program has not listed SLS or SLES in its reports on carcinogens *(Canadian Centre for Occupational Health & Safety, Review, Oct 2005).* If you read the Biophile magazine or the Enchantrixs, Naturebabes or Esse websites, you will find totally **fraudulent reference to cataract, eye developmental problems and blindness** from SLS, falsely attributed to **Dr Keith Green** from the Medical College of Georgia. In spite of my considerable communications with said parties showing the information to be undeniably fabricated and false, the deliberate lucrative lies continue to be perpetuated to this very day. See ***www.gaiaresearch.co.za/biofilth.html*** for ***"The Biofilth Files: Have You Been Enchantricked?"*** & ***www.gaiaresearch.co.za/naturebabes.html*** *"The Esse*ntial *Files: Are Your Toddlers Truly Naturebabes?"*

On the other hand, what one never sees on the health scare websites, are the **highly positive attributes of the substances so maligned**. A particularly interesting advantage that the SLS scaremongers are denying themselves and their consumers is that SLS has several advantages over alternative substances used in personal care products, in particular broad-spectrum microbicidal properties capable of limiting not only the concentration of other preservatives, but also providing significant additional pro-active advantages, illustrating that in this day and age, with an open mind, nature and science can combine to make the world a far safer place, eg when you use a public convenience, shake someone's hand or get intimate with another.

Specifically, **low sub-cytotoxic concentrations of SLS completely inhibit the growth and maturation of Human Immuno Virus (HIV), Human Papilloma Virus (HPV), Herpes Simplex Virus (HSV) and several other sexually transmitted pathogens** (reovirus, rotavirus and poliovirus) **that might cause sexually** and body fluid **transmitted diseases, yet is non-toxic to human and animal cells** (including delicate genital - even intra-vaginal and foreskin - tissues and is also preventive of infectious lesions in these tissues) at effective anti-viral concentrations, rendering SLS a potent preventive tool with enormous public health advantage *(Howett M et al, Antimicrob Agents Chemother, 43(2), 1999); (Krebs F et al, Antimicrob Agents Chemother, 44(7), 2000); (Bestman-Smith J, et al, Antimicrob Agents Chemother, 45(8), 2001); (Roy S, et al, Antimicrob Agents Chemother, 45(6), 2001); (Piret J, et al,* Antimicrob Agents Chemother, *46(9), 2002); (Piret J, et al, Curr Drug Targets, 3(1), 2002); (Krebs F et al, Antimicrob Agents Chemother, 46(7), 2002); (Turpin J, Expert Opin Investig Drugs, 11(8), 2002); (Howett M, Kuhl J, Curr Pharm Des, 11(29), 2005)*

Sodium lauryl sulphate possesses good spermicidal activity, completely inhibiting human sperm motility and preventing egg fertilization and as such has potential as an adjuvant contraceptive to provide topical vaginal spermicidal fertility control in women and prevent unwanted pregnancy, **in addition to its microbicidal efficacy against HIV, HSV, and HPV, which simultaneously potentially helps prevent sexually transmitted infections** *(Haineault C et al, Biol Reprod, 69(2), 2003)*. **SLS is microbicidal at low concentration**, is biodegradable and has little or no toxicity and as such (for what its worth) may help prevent/reduce transmission of disease through breastfeeding. SLS has even been shown to inactivate all of the aforementioned pathogens from infected milk at minute concentrations within reported safe limits for ingestion by children *(Urdaneta S et al, Retrovirol, 2(1), 2005); (Hartmann S et al, J Hum Lact, 22(1), 2006)*

Mineral Oil / Liquid Paraffin and Petroleum Jelly / Petrolatum

Mineral Oil and Mineral Jelly/Wax are derived from the same natural source, ie. crude oil, the natural end product of prehistoric biomass comprising of predominantly ancient vegetation. There is no substance that is more purely natural and organic than crude oil, which has lain untainted by human activity for millions of years and is the richest repository of pure organic matter on Earth. Mineral oils and waxes, just like those processed from contemporary crude vegetable lipids, are **produced by separating and refining oils and waxes from fossilised vegetation**. Those seeking market share at the expense of mineral products use marketing campaigns to 'discredit' petroleum products, yet while both high quality mineral and vegetable oil products are biodegradable, safe, and effective when used in well-designed product systems, **only vegetable oils and waxes will spoil** and the products wherein they dominate be qualitatively compromised as their lipids decompose. **The important difference between mineral and vegetable oils is that the former had already decomposed millions of years ago *before* being purified and so can't decompose again, whereas the contemporary lipids are *first* purified**, if at all, and **then still have to decompose, creating toxic breakdown products already removed from mineral oil**.

For more than 200 years, chemists have divided materials into two categories. Those isolated from plants and animals were classified as ***organic***, while those that trace back to minerals were ***inorganic***. At one time, chemists believed that organic compounds were fundamentally different from those that were inorganic because organic compounds contained a vital force that was only found in living systems. The first step in the decline of the vital force theory occurred in 1828, when Friederich Wohler synthesized urea from inorganic starting materials, setting in motion a series of experiments that led to the synthesis of a variety of organic compounds, leading inevitably to the disappearance of 'vital force' from the contesting theories within chemistry, though it still had proponents 90 years later and apparently still has within the irrational fringe of otherwise admirable organic movements today. (See ***www.gaiaresearch.co.za/organics.html***)

If the difference between organic and inorganic is not the presence of some mysterious vital force, then what distinguishes between these? Most compounds extracted from ***living organisms contain carbon***, but this as a definition of organic would include clearly inorganic compounds such as calcium carbonate and elemental forms of carbon - diamond and graphite. **'Organic chemistry'** is therefore defined as ***the chemistry of 'compounds that contain both carbon and hydrogen'***. More than 95% of compounds isolated from natural sources or synthesized in the laboratory are organic. *(Organic Chemistry: Structure and Nomenclature of Hydrocarbons, Purdue Univ College Sci, Dept Chem, W Lafayette, IN, 2004)*

The petroleum industry and consumers play a role in the fate of crude oil, ranging from production of the most toxic products to the most benign useful products available to mankind. **Mineral oil, once fully refined and purified of any toxic polycyclic aromatic hydrocarbons (PAHs) is a totally safe and inert substance suitable for diverse human use.** The most highly refined and selective fractions of food/cosmetic grade mineral oils, known as **'white oils', are not carcinogens** *(International Agency for Research on Cancer, Monographs on the Evaluation of Carcinogenic Risks to Humans, Supplement 7, IARC, 1987).* The EU allows these to be classified as such if the full refining history is known and strict purity criteria are met *(International Programme on Chemical Safety and the European Commission, IPCS, 2002)*.

White mineral oils have a long history of safe use by humans in orally ingested and topically applied products. Repeated topical exposure to white mineral oils has not been found to produce skin cancer or any local or systemic toxicity and hence on the basis of these findings and reports on negligible epidermal penetration of topically applied white mineral oils, **there is no evidence of any hazard identified for topical exposure to white mineral oils at any dose in multiple species**. This conclusion is supported by the long human use of white mineral oils in drug and non-drug topically applied products. *(Nash J, et al, Food Chem Toxicol, 34(2), 1996)* Even base oils (let alone food and cosmetic white oils) are currently intensely refined such that they are not potentially carcinogenic *(Mackerer C, et al, Appl Occup Environ Hyg, 18(11), 2003)*. Even chronic lifetime animal feeding experiments with white oils result in reversible minimal effects of no serious consequence to clinical health *(Trimmer G et al, Toxicol Pathol, 32(4), 2004)*.

The two mineral oil components in Gaia Organics cream and creamy lotion personal care products are supplied as certified food/cosmetic grade 'white oils' / 'white jelly', are amongst the purest natural primordial substances on the planet and are accordingly classified as non-toxic and free of carcinogens and hence are the safest and most inert spreading agents in existence. See *Mineral vs. Plant Oils as Carrier/Spreading Agents in Cosmetics: a Modern Reappraisal* below for my definitive treatise on this controversial topic.

NATURAL & SYNTHETIC CARCINOGENS: A RATIONAL PERSPECTIVE OF RELATIVE TOXICITY & RISK

In concluding this essay addressing uninformed and irrational consumer fear of all chemicals, it might be helpful to consider comparatively the relative risks from natural and synthetic chemicals (all substances and compounds are chemicals). **Mother Nature produces chemicals ranging from the most benign to the most deadly**. Likewise, human endeavour is equally broad and it is irrational to assume that all the products of modern chemistry are toxic to humans. Indeed, not infrequently, humans even improve significantly on nature to meet a certain goal, which might be benign, well meaning, malicious, deadly or whatever. Common sense is that we should comprehensively evaluate each application on its merits - risk vs. benefits.

Due to the **incorrect assumption that all petroleum (crude oil) based ingredients are unnatural** and exclusively carcinogenic because they are "synthetic", I will use the example of namely mineral oil to demonstrate the fallacy, since this is the only one of the discussed substances, that might indeed be carcinogenic if cheaper industrial-grade mineral oils are used unethically in personal care products by unscrupulous manufacturers (usually cheap products, often easily identified by bright colouring, which could only be artificial pigment), and thereby introducing potentially carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs) into these products. **Mineral oils are not synthetic** if they are refined fractions of crude oil. Synthesis is a process of creating new novel substances from more than one source and occurs not only in laboratories, but constantly in nature as well, for example plant-insect/microbe defense.

A US government task force set up to examine the occurrence and potential role of natural carcinogens in the causation of human cancer, including relative risk comparisons with synthetic carcinogens, concluded that overall, **the basic biological mechanisms involved are qualitatively similar, if not identical**. Following analysis of data on over 200 established carcinogens, 65 of which are naturally occurring (relatively few natural chemicals have been tested for carcinogenicity, funded by international and government agencies), lead to the conclusion that **there is also no difference between the potency of naturally occurring and synthetic carcinogens** and that consequently naturally occurring and synthetic chemicals can be evaluated by the very same epidemiological or experimental methods and procedures. Naturally occurring chemicals known to be potent carcinogens in rodents include those derived through common food preparation. *(Committee on Comparative Toxicity of Naturally Occurring Carcinogens, National Research Council, 'Carcinogens and Anticarcinogens in the Human Diet', Natl Acad Press, 1996)*

A large number of substances that occur naturally are carcinogenic when evaluated by the criteria scientists use to assess the cancer-causing potential of synthetic substances. **Natural carcinogens are also more numerous, widespread and often more potent than synthetic carcinogens.** Cooked meat and cereals are by far the worst dietary sources. One class of such compounds, the heterocyclic amines, is formed when natural meat components: creatinine, amino acids, and sugars are heated to medium and well-done states. Another is the **polycyclic aromatic hydrocarbons (PAHs)**, many of which are not only **mutagenic and carcinogenic**, but can also 'promote' the carcinogenicity of other chemicals. *(National Research Council, "Polycyclic Aromatic Hydrocarbons: Evaluation of Sources and Effects", Natl Acad Press, Wash, D.C. 1983); (Knize M, et al, Adv Exp Med Biol, 459:179-93, 1999); (Hatch F et al, Environ Mol Mutagen, 38(4), 2001); (Felton J et al, Toxicology, 198(1-3), 2004); (Knize M, Felton J, Nutr Rev, 63(5), 2005)*

PAH levels in non-meat items are generally low, with the exception of bread/cereal/grain products, where levels are even higher than cooked meat. Some cereal drying methods can also produce PAHs. *(Kazerouni N, et al, Food Chem Toxicol, 39(5), 2001)* **Crude vegetable oils have far higher concentrations of benzo[a]pyrene, than the purified deodorized oils** (that are paradoxically shunned by natural foodists) *(Lijinsky W, Mutat Res, 259(3-4), 1991)*. Cooking is clearly a serious source of indoor air pollution by PAH and emissions from cooking sources might cause much more serious problems than traffic sources, from the perspective of carcinogenic potency. *(Koyano N, et al, J Health Sci, 47(5), 2001); (Li C, et al, Environ Health Perspect, 111(4), 2003)*. **Benzo(a)pyrene is a confirmed PAH carcinogen in rodents and a probable carcinogen in humans** (it is unethical to test carcinogens in humans and epidemiological data is relied on to determine carcinogenic probability) *(Smith C, et al, Food Chem Toxicol, 38(4), 2000); (Storelli M, et al, J Food Prot, 66(6), 2003); (Goldman R, Shields P, J Nutr, 133 Suppl 3, 2003)*.

The point being made by presenting this data is that carcinogenic PAHs has been removed from cosmetic grade mineral oils, ensuring a pure, carcinogen-free end-product, yet PAHs cannot be significantly removed from cooked foods, providing a meaningful perspective on the relative risk from the same carcinogens, making any concerns iro the former truly inconsequential in light the very large and real risks from the latter.

MINERAL VS PLANT OILS AS CARRIER/SPREADING AGENTS IN COSMETICS: A MODERN REAPPRAISAL

A concerned consumer (a well-known German health author, Barbara Simonsohn) wrote (italics are mine):

*"I would like to know why you decided to include **artificial** ingredients like **paraffin** in your cosmetics. How does it **work in our skin**? Why don't you regard it as **dangerous there**? Why didn't you use **plant oils** like other companies do?*

Why do you think your products are ***superior*** to others? Would you regard them as ***totally harmless***?

*For me, cosmetics should be **'skin food'**, you should be able to eat them, and this should not endanger your health. We **'eat'** anyway **through our skin**, we don´t only eliminate through it. I am just testing skin oil produced by a competitor that you are asked to put in your salad as well. This sounds great for me!"*

In response to the above pertinent criticism and query, I (Stuart Thomson) responded as follows:

Fair questions, I would have, indeed had asked these same questions 15 years ago. My main evolving research interest at the time was botanical pesticides, ie evolutionary defensive natural chemicals in plants to control their pests (since I was growing most of my own food at the time). I was (and remain) committed to natural alternatives and being a herb farmer, decided it was safest for me to make my own personal care products. It was out of this activity that my product range arose and grew spontaneously with no intention other than to meet my own needs and much later, also as a means of funding my research institute.

Concurrently, my toxicology interests were shifting from a decade of studying toxic synthetics to the even more fascinating study of the natural defensive toxicants intrinsic to plants foods, an important and fascinating field that even today few researchers have adequately explored, a rather odd state of affairs, considering that natural substances are at least as toxic and widely used as synthetics. As a result of this rather fortuitous research direction, I found myself, having discarded the shackles of philosophical prejudice, unusually straight unbiased toxicology. On re-evaluating my crude plant oil/herb/vitamin-based natural home-made products, I was shocked at their hidden toxic nature. You should be too.

Your overall comments appear to bear testimony to your still being locked into an artificial, yet widely held *"man-made is toxic and nature is benign"* belief dichotomy. As romantic as this widely held notion might be, it simply cannot be reconciled in accordance with the facts. If you think about it for just a moment, even restricting yourself to the plant kingdom, you have to admit that at least half is toxic to humans, whether ingested or applied topically, at concentrations that commonly occur in nature. *"But"*, you might reply, *"with 'natural' product selection, we have identified and rejected the worst toxins, so man-made chemicals are far more toxic than natural chemicals"*. Incorrect, since human discernment falls equally short on both sides.

When the Soviets chose a poison to eliminate dissidents in the West, they did not concoct a deadly man-made toxin, but used the **castor bean seed** (Ricinus communis) to extract **Ricin, a super-toxin**, which toxin is lethal in quantities measured in just a few hundred millionths of a gram (size of a grain of salt) *(New Scientist, 16 July 1987)*. Ricin has also been considered, indeed prepared as **a biological warfare agent** *(D Sifton and G Kelly, Eds, Biological Agents, in PDR Guide to Biological and Chemical Warfare Response, Physicians' Desk Reference, Thomson, NJ, 2002)*. Carefully *'processed'* by humans however, castor oil has high utility and can be safely used as a very effective cathartic, purgative, laxative, personal lubricant and skin emollient *(W Lewis and M Elvin-Lewis, Medical Botany: Plants Affecting Man's Health, John Wiley & Sons, NY, 1977)*. Industrially it is used in paints, varnishes and textiles and in the production of nylon and motor oil. *(M Windholz, Ed, Merck Index: An Encyclopedia of Chemicals, Drugs and Biologicals. NJ, 1983)*.

Jojoba seed (Simmondsia chinensis) yields **jojoba oil**, a high quality polyunsaturated liquid wax/oil (two unsaturated bonds) that is used similarly to castor oil, as a treatment for skin disorders, as an antifoam agent in antibiotics production as well as for candles, plasticisers, detergents, fire retardants, industrial lubricants and transformer oil *(NRC, Jojoba: New Crop, New Raw Material for Industry, Natl Acad Press, Wash, DC, 1985).* **Jojoba contains proteolytic and protease inhibitory anti-physiological factors (Simmondsin) and toxic cyanogenic glucosides and must be *'treated'* to eliminate these toxins** *(Wantke F et al, Contact Dermatitis, 34(1), 1996); (Perez-Gil F et al, Arch Latinoam Nutr, 39(4), 1989); (Cokelaere M et al, Food Chem Toxicol, 36(1), 1998); (Shrestha M et al, J Agric Food Chem, 50(20), 2002)*.

'Purified' cottonseed oil from the cotton plant (Gossypium species) is used similarly. The relatively crude oil is widely used for cooking in developing countries. Gossypol, a major toxin, causes pathological changes in human testes and male sterility *(L Bernardi and L Goldblatt, in "Toxic Constituents of Plant Foodstuffs", I Lerner, Ed, Acad Press, NY, 1980)* and is **a potent initiator and promoter of skin carcinogenesis** *(Haroz R, Thomasson J, Toxicol Lett, Suppl 6(72), 1980)*. Crude unrefined oil contains up to 750mg/100ml of gossypol and its toxic actions are due to its oxidative production of free radicals *(Coburn M et al, Biol Bull, Woods Hole Mass, 159(468), 1980)*. In addition to **spermatogenesis arrest** in humans, Gossypol also plays a role in protecting the cotton and other plants from pathogens by the same mechanism *(Coutinho E, Contraception, 65(4), 2002); (Puckhaber L et al, J Agric Food Chem, 50(24), 2002).* Correctly processed/ purified, cottonseed oil produces less photocarcinogenesis than sunflower seed oil and is not an irritant or sensitiser *(Final Report on the Safety Assessment of Cottonseed Oil, Int J Toxicol, 20(Suppl 2:21-9, 2001)*.

Clearly nature is not always benign. She can be as deadly as she is nurturing and useful. Against the background of these three examples, how does one reconcile acceptance of these 'natural', 'treated' oils for human usage, with such irrational concern and rejection of the use of supposedly 'artificial', but perfectly natural even purer mineral oil for similar purposes? (We use the word paraffin in South Africa to denote illuminating oil and hence I differentiate the food/cosmetic grade by the descriptive name 'white mineral oil'). At what point - after how much and what kind of processing - did castor, jojoba and cottonseed oil become legitimately acceptable even to 'organic' standards during their transitions from 'natural' to 'unnatural' and paradoxical inverse transitions from 'dangerous' to 'harmless/beneficial' according to the 'man-made vs. natural' dichotomy and what 'criteria' reliably apply across the board to enable one to reach such decisions? **I propose that pure intellect and sustained logic, rather than fickle intuition and naïve belief apply.**

Please note that the **illogically offensive word 'paraffin' is derived from the Latin words 'parum', meaning 'not much' and 'affinis', meaning 'affinity', in reference to its chemical un-reactivity, rendering it the ideal oil**, vastly 'superior' to all plant oils for our purpose as a deliberately inert spreading/carrier and protective barrier. Bearing testimony to this property is the fact that whereas distilled water is routinely used as a vehicle for water soluble substances in **allergic contact patch testing**, white mineral oil is similarly used as the vehicle for oil soluble test substances, due to its reliable non-sensitising and non-irritating properties *(Kang H et al, J Dermatol, 31(5), 2004); (Torres M et al, Allergy, 59(2), 2004)*.

The other equally illogically offensive word 'petroleum' is derived from the Latin words 'petrus', meaning 'rock' and 'oleum', meaning 'oil', which is why we correctly refer to it as "mineral oil". **Being refined from crude petroleum oil (hence the term 'oil refineries'), mineral oil is not at all synthetic.** Synthetic oils are entirely manmade from various sources, including vegetable oils. Petroleum crude oil is our planet's richest repository of pure organic material, sourced from natural ancient algal/plant deposits that pre-date modern synthetic human activity and its attendant anthropogenic toxins, in fact rendering **crude oil intrinsically purer than all contemporary plant oils**. White mineral oil is a highly refined fraction thereof.

Crude oil as a raw material resource is no less ecologically sound than current crops for similar purposes. Being several orders of magnitude more concentrated, crude oil is superior, freeing scarce arable land from having to be planted. Toxic by-products, and in particular, emissions of aromatic hydrocarbons and related chemicals that are harmful to humans, are no worse when crude mineral and plant oils are comparatively processed/combusted *(Zou L, Atkinson S, Environ Technol, 24(10), 2003)*. Mineral oil does take longer to biodegrade, but is either considerably purer or more concentrated and hence is expected to degrade more slowly. **Under ideal conditions, mineral hydrocarbons are completely decomposed to carbon dioxide and water** *(Muratovba A, Turkovskaia O, Prikl Biokhim Mikrobiol, 37(2), 2001); (Cloesen C, Kabuya A, Physical and Chemical Properties of Environment Friendly Lubricants, Research RW No 2174, Univ Liege); (Plohl K et al, Acta Chim Slov, 49:279, 2002)*.

Mineral oils are used extensively in several food industries as machine lubricants and as food separator coatings. Due to its self-limiting laxative effect, there are no extraordinary toxicological problems associated with the use of mineral oils within a food processing/packaging setting, the only possible nutritional implications being reduced uptake of fat-soluble vitamins in the digestive tract *(Seventeenth Report of the Joint FAO/WHO Expert Committee on Food Additives, World Health Org Tech Rep Ser No 539, 1974); (FAO Nutrition Meetings Report Ser No 53, 1974)*. Furthermore, all so-called "toxic oil syndromes", eg over 2500 deaths in Spain, have been from crop oils, not mineral oils *(Hard G, Hum Exp Toxicol, 19(3), 2000); (Closa D et al, Lipids, 36(10), 2001); (Posada de la Paz M, Epidemiol Rev, 23(2), 2001); (Posada de la Paz M, Environ Health Perspect, 111(10), 2003); (Sanchez-Porro Valades P et al, J Clin Epidemiol, 56(7), 2003)*.

Mineral oil has been **ignorantly criticised as 'smothering the skin'** and isolating it from oxygen. Under highly 'oxidative susceptible' conditions, this is what sebum does. To quote an expert: *"The only way to stop harmful oxidation, is to stop the oxygen supply" (J Loliger, Natural Antioxidants, In: J Allen & R Hamilton, Rancidity in Foods, Appl Sci Publ, Lond, 1983)*. **Smothering is one of the main functions of sebum**, which is invariably stripped from the skin by the artificial practice of washing. **Plant oil also smothers the skin, but rather than protecting it from oxygen, actually provides a chemical substrate for formation of the worst forms of oxygen - reactive oxygen species, including free radicals**. **Mineral oil** has an immediate barrier-repairing effect in de-lipidised skin *(Loden M, Am J Clin Dermatol, 4(11), 2003)* and **does not represent a substrate for bacteria and free radical attack as non-fossilised plant oils do**.

This brings me to the main reason for selecting **mineral oil** above all others for the formulation of our spreading/carrier cream fractions, namely its **superior resistance to oxidation**, compared with all plant oils of suitable viscosity. Unlike the nearly fully saturated fatty acids of animal fats that are solid at room temperature, plant fatty acids are typically unsaturated and liquid at room temperature. **Relatively saturated plant fats/oils such as jojoba, olive or coconut are simply too sticky to be used without the addition of highly unsaturated oil. Even minimally unsaturated fats exposed to warmth and atmospheric oxygen (21%) will quickly oxidise and become toxic.** It has been well-stated that *"the polyunsaturated oils are recommended for use in paints and varnishes* (far better than mineral oils), *but skin contact should be avoided" (Raymond Peat, PhD, Unsaturated Vegetable Oils: Toxic, referencing Lynch R, "Utilization of polyunsaturated fatty acids by human diploid cells aging in vitro," Lipids 15(6), 1967)*.

Plant oil fatty acids may be saturated (single carbon bonds), mono-unsaturated (one double carbon bond) or polyunsaturated (two or more double carbon bonds), **the degree of saturation determining the degree to which each type resists oxidation**. Highly reactive carbon fragments arise from breakdown of fatty acids as hydrogen splits from carbon in the unsaturated fatty acid group. These unstable fragments with their unpaired electrons - free radicals (superoxide anions, hydroxyl radicals, peroxyl radicals, hydroperoxides and peroxinitrite anions) - are powerful oxidisers serving as initiators and promoters of further oxidation by extracting hydrogen from other plant oil/animal/skin fat molecules to trigger chain-reactions of reactive oxygen species that 'on' (as opposed to 'in') the skin are not controlled by cellular anti-oxidative enzymes.

Lipid hydroperoxides are primary products of the oxidation of oils and fats, including free fatty acids, triacylglycerols, phospholipids and sterols. One type of free radical likely to be formed on and in the skin is fatty acid hydroperoxide, formed through three different mechanisms, namely ***autoxidation*, *photo-oxidation* and *enzymatic oxidation***. Under mild reaction conditions, hydroperoxides are formed through autoxidation, a free radical chain reaction between unsaturated lipids and oxygen to form hydroperoxides, which undergo further reactions with or without the participation of other compounds. The formation of hydroperoxides from unsaturated fatty acids is accelerated by exposure to light, either by direct photo-oxidation (in the absence of photosensitisers) or by photosensitised oxidation of unsaturated fatty acids.

Photosensitised oxidation of lipids is an important pathway for the formation of hydroperoxides from unsaturated fatty acids, with hydroperoxides being formed in the presence of oxygen, light energy and a photosensitiser. **Vegetable oils may contain natural photosensitisers such as chlorophyll that yields singlet oxygen and free radicals in the presence of visible light and can severely oxidize lipids, producing several cytotoxins in oils and fats that may harm the skin** *(Frankel E, Prog Lipid Res, 19:1, 1980); (Fakourelis N et al, J Food Sci, 52:234, 1987); (Lee E, Min D, J Food Sci, 53(6), 1988); (Frankel E, Lipid Oxidation, The Oily Press Ltd, Dundee, 1998)*. Even a trace of chlorophyll can catalyse the destructive processes *(Krinsky N, Pure Appl Chem, 51:649,1979); (Krinsky N, Free Rad Biol Med, 7:617, 1989); (Bradley D, Min D, Crit Rev Food Sci Nutr, 31:211, 1992); (Gunstone F, J Am Oil Chem Soc, 61:441, 1984)*.

One of the most important characteristics of **chlorophyll** is the absorption of visible light between 400-500 nm and 600-700nm. Singlet oxygen and free radicals generated from triplet oxygen by such light excited **photosensitisers** play important roles in the formation of toxic volatile compounds in organic materials, with eg total yield in **lard** with 5 ppm chlorophyll added under natural light for 48 hours being 19 times greater than without chlorophyll *(Lee J-H, Photo-oxidation and Photosensitized Oxidation of Linoleic Acid, Milk, and Lard, Dissertation, Ohio State Univ, 2002); (Lee J, Min D, Photoxidation and Chlorophyll Photosensitized Oxidation of the Volatile Compound Formation from Lard. IFT, Chicago, 2003)*. Given that a mere 5ppm of chlorophyll was added to lard, one of the most saturated fats, one can appreciate the magnitude of the problem with eg fresh **olive or avocado oil**, containing up to 10 ppm chlorophyll and being considerably less saturated than most oils routinely constituting the bulk of the majority of so-called natural products.

Photosensitisation results from absorption of light energy and formation of toxic oxyradicals that disrupt living systems by reacting with proteins, nucleic acids, lipids and other biomolecules critical to cell function. Excited state sensitisers can even interact with biomolecules directly, causing damage without the need for oxygen. Over 200 natural **furanocoumarins** (including psoralens, thiophenes, polyacetylenes, citral, quinoline alkaloids, isoquinoline alkaloids, beta-carbolene alkaloids, benzophenanthrene alkaloids and hydroxycinnamic acid derivatives) have been identified in plants. **In the presence of light, these compounds form excited states that can react directly with and damage DNA** as well as crosslink. *(Berenbaum M, in: Oxidative Stress and Anti-oxidant Defences in Biology, Ahmed S, ed, Chapman & Hall, NY, 1995)* Such damage can also arise from similar reactions with unsaturated lipids *(Specht K et al, Photochem Photobiol, 47:537, 1988)*. Additionally, **furanocoumarins are capable of interacting with oxygen to produce singlet oxygen, superoxide anion radicals and hydroxyl radicals** *(Larson R, Marley K, In: Oxidants in the Environment, J Nriagu & M Simmons, (Eds), John Wiley & Sons, NY, 1994)*.

Organic compounds possessing photosensitisers cannot be detoxified in plant oils or in oils in which such sensitisers have dissolved where such oils remain on the skin, unable to be absorbed due to excess fixed oil in which so dissolved and hence are unable to be detoxified by the body. **Plant food photosensitisers** include, but are certainly not limited to the following: ***angelica, anise, buckwheat, carrots, celery, citrus fruit (esp. limes), dill, fennel, fig, parsley, and parsnip***. **Contact allergens include: *allspice, artichokes, bay (laurel), cardamom, cayenne pepper, chicory, cinnamon, cloves, garlic, horseradish, lettuce, mango, nutmeg, pineapple, onion, potato, radish, rocket, thyme, tumeric, vanilla.*** *(Marzulli F, Maibach H, J Soc Cosmet Chem, 21:695, 1970); (Magnus A, Dermatological Photobiology, Blackwell Scientific Publications, Oxf, 1976); (A Rook et al, Eds, Textbook of Dermatology, Blackwell Sci Publ, 1988); (Pathak M, Clin Dermatol, 4:102, 1990); (J Guin, Ed, Practical Contact Dermatitis, McGraw-Hill, NY, 1995); (I Kocheva, In: Photoimmunology, J Krutmann & C Elmets, Blackwell Science, Oxford, 1995)*

Enzymatic oxidation results from **hydrolytic reactions catalysed by lipases from plant cells**. Most plants contain enzymes capable of catalysing the direct oxidation of lipids with molecular oxygen. Crushing, macerating or pressing these tissues, as is standard practice during the preparation of crude "natural cosmetics", initiates lipid-oxidising lipolysis via the enzymes lipoxygenase and cyclooxygenase, which are widely distributed throughout the plant and animal kingdoms and have affinity for especially free fatty acids, but also for triglycerides and are able to **catalyse co-oxidation reactions**, capable of initiating oxidation of other compounds that can interact **with oxidisable substrate such as carotenoids, chlorophyll, vitamins C and E, thiols, proteins or other lipids**. *(Spiteller G, Exp Gerontol, 36:1425, 2001)*

The rate of reaction between water and fat can become significant if a suitable catalyst is present and the temperature is appropriate (as on the skin). Typical catalysts are lipase enzymes and acids. Usually **lipase comes from bacterial contamination** and/or animal cells (as on the skin, especially with a stubbornly inadequately preserved crude natural product) or alternatively lipoxygenases introduced from plant matter (which is always high in genuine natural products). **Lipids contaminated by bacteria and subsequently warmed (as on the skin) is the ideal condition for hydrolytic rancidity**, where triglycerides are hydrolysed to fatty acids, leading to lipolysis and the generation of toxic by-products, including butyric, hexanoic and octanoic acids and pungent lauric and myristic acids from other formulating oil ingredients.

Hydrolytic rancidity is a degradation process whereby triglycerides are attacked by moisture, lipase and other enzymes and/or moulds *(Rügheimer S, Marula oil, M.Sc. Thesis, Univ Namibia, Windhoek & Stellenbosch, In prep., 2001).* **Marula nut oil** is a good example of how a relatively oxidatively stable oil can nevertheless participate in processes that destroy the biological integrity of essential fatty acids, damage cellular membranes and macromolecules, in particular proteins and also microstructures such as DNA, leading to cellular damage, premature visible aging, inflammatory skin disorders and skin cancers.

These breakdown products should be removed via refining procedures and neutralisation of the free fatty acids, but results in significant losses that ultimately affect the cost of the oil as an ingredient for manufacture. *(De Greyt W & M Kellens, Refining Practice, in Hamm W and R Hamilton (Eds), Edible Oil Processing, CRC Press, 2000).* Again the question arises as to exactly at what stage of 'processing' an oil becomes no longer natural? It is anyone's guess whether crude 'organic' or refined Marula oils are used as ingredients in so-called natural products, the crude oil option being a quality and safety compromise for the sake of some stubborn philosophical position and the refined oil option, whilst representing the safer choice, also representing a sell-out of proclaimed 'natural' principles. The bottom line is that again here is a major safety compromise in rejecting truly stable and hence safe mineral oil in favour of a problematic plant oil.

Lipid hydroperoxides are **enzymatic oxidation end products** that are extremely unstable in the presence of transition metal ions or vitamin C, breaking down to alkoxy and other free radicals and reactive oxygen species that decompose lipids and **form several *cytotoxic and genotoxic breakdown products* – conjugated dienes**, **aldehydes** (eg Malondialdehyde & 4-hydroxynonenal)**, enals, acyloins, carbonyls, epoxides, esters, furans, lactones, ketones** (eg ethane, pentane & ethene)**, polymers, alcohols, oxo- and hydroxy acids, and saturated and unsaturated hydrocarbons** that are capable of participating in a wide range of pathological activities, substantially damaging cell membranes and DNA and initiating premature aging, mutagenesis and carcinogenesis *(R Hamilton, The Chemistry of Rancidity in Foods, In: Allen J & R Hamilton, Rancidity in Foods, Appl Sci Publ, Lond, 1983); (Esterbauer H et al, Atlas of science: Biochemistry, 1:311-319, 1988); (Spitz D et al, Biochem J, 267(2), 1990); (Esterbauer H et al, Free Radicals Biol Med, 11, 81–128, 1991); (Eckl P et al, Mutation Res 290, 183–192, 1993); (Comporti M, Free Radic Res, 28(6),1998); (Girotti A, J Lipid Res, 39, 1529–1542, 1998); (Marnett L, Carcinogenesis, 21:361, 2000); (Kalka K et al, Skin Pharm Appl Skin Physiol 13:143, 2000); (Hwa Lee S et al, Science, 192, 15 June, 2001); (Bhasin G et al, Cancer Lett, 183(2), 2002); (Udilova N et al, Food Chem Toxicol, 41(11), 2003)*.

Pro-oxidants are the opposite of antioxidants and since **many anti-oxidants can paradoxically function as pro-oxidants** under varying conditions, **exogenous anti-oxidants applied topically cannot be relied upon to quench the destructive oxidative chain reactions accompanying lipid oxidation.** In particular many anti-oxidant vitamins [and even anti-oxidative enzymes *(Morliere P, Santus R, Eur J Biochem, 256, 184, 1998); (Heck D et al, J Biol Chem, 278(25), 2003)*] can function as pro-oxidants, especially under extracellular conditions (eg on the skin) *(Rice-Evans C, The Role of Antioxidants in Biological Systems, In: Advances in Applied Lipid Research, JAI Press, 1996); (Frankel E, Lipid Oxidation, The Oily Press Ltd, Dundee, 1998)*. Clearly, **the more plant oils are applied to the skin, the more reactive oxygen species are generated and the greater is the degree of dermal cell, collagen and elastin damage**, especially since exogenous lipids lack the benefit of cellular anti-oxidative enzyme controlled oxidation protection.

Vitamin C in excess of normal cellular concentrations **can act as a pro-oxidant**, capable of **inducing free radical damage, including cell death, nuclear fragmentation and internucleosomal DNA cleavage**, mainly in the presence of even traces of iron (a ubiquitous pollutant, especially in urban air and hence constantly depositing on the skin) or alcohol (produced during the breakdown of plant oils and found in very high concentrations in some cosmetics as a 'natural preservative' and itself also a recognised carcinogen) *(Laudicina D, Marnett L, Arch Biochem Biophys, 278:73,1990); (Stadtman E, Am J Clin Nutr, 1125S, 1991); (Trommer H et al, Pharm Res, 19(7), 2002); (Kaneko T et al, Arch Biochem Biophysics, 304(1), 1993); (Porter W, Toxicol Ind Health, 9:93,1993); (Frankel E et al, J Agric Food Chem, 42:1054, 1994); (Frankel E, Lipid Tech, 7:77, 1995); (Buettner G, Jurkiewicz B, Radiat Res 145:532, 1996); (Almaas R et al, Eur J Pediat, 156(6), 1997); (Podmore I et al, Nature, 392(6676), 1998); (Carr A, Frei B, FASEB J, 13(9), 1999); (Paolini M et al, Life Sci, 64(23), 1999); (B Halliwel, J Gutteridge, Free Radicals in Biology & Medicine, Oxford Univ Press, 2000); (Lee S, Science, 292(5524), 2001); (Fisher A, Med Hypothesis, 61(5-6), 2003)*.

Vitamin E in excess of normal cellular concentrations **makes lipoproteins more reactive towards radical oxidants and oxidative conditions eg exposure to light and this can result in pro-oxidant activity** *(Jung M, Min D, J Food Sci 55: 1464, 1990); (Kagan V et al, Free Radic Res Commun, 16(1), 1992); (Bowry V et al, Biochem J, 288:341, 1992); (Neuzil J et al, Free Rad Biol Med, 22(1-2), 1997); (Walke M et al, Photochem Photobiol, 68(4), 1998); (Podmore I et al, Nature, 392(6676), 1998); (Upston J et al, FASEB J, 13(9), 1999)*. When topical vitamin E was evaluated in cultured human normal fibroblasts exposed to natural ultraviolet A radiation, pre-treatment of cells with all topical forms of vitamin E resulted in an increased susceptibility to cytotoxic photo-induction of DNA single-strand breaks and longer persistence of damage, and hence increased mutagenic/carcinogenic risk *(Nocentini S et al, J Photochem Photobiol, 73(4), 2001)*.

Beta-carotene (& other carotenoids eg lycopene) in excess of normal cellular concentrations, especially with other antioxidants and UV, **acts as a pro-oxidant**, via formation and decomposition of lipid hydroperoxides, **increasing production of reactive oxygen species and toxins, promoting cellular and tissue damage and exacerbating pre-existing skin cancers** *(Terao J et al, J Food Process Preserv, 4:79, 1980); (Faria J, Mukai M, J Am Oil Chem Soc 60:77, 1983); (Burton G, Ingold K, Science, 244:569, 1984); (Warner K, Frankel E, J Am Oil Chem Soc, 64:213, 1987); (Suzuki T et al, J Jpn Oil Chem Soc, 38: 486, 1989); (Kigoshi M, Niki E, In: K Yagi et al, Eds, Oxygen Radicals, Elsevier Science Publ, Amsterdam, 1992); (Palozza P et al, Free Rad Biol Med, 19:887, 1995); (Palozza P et al, Free Radic Biol Med, 22(6), 1997); (Zhang P, Omaye S, Toxicol, 146(1), 2000); (Obermüller-Jevic U et al, FEBS Lett, 509(2), 2001); (Zhang P, Omaye S, Toxicol Vitro, 15(1), 2001); (Palozza P et al, Free Radic Biol Med, 30(9), 2001)*.

Selenium in excess of normal cellular levels is also **capable of pro-oxidant** cytotoxicity (especially to DNA) and this action results from the pro-oxidant catalytic activity of the selenide anions, including reaction with thiols, such as glutathione (which can also act as a pro-oxidant), producing oxidative-stress inducing super oxide anions, hydrogen peroxide and other reactive oxygen species, especially when intracellular methylation reactions and antioxidant defenses are exceeded *(Chaudiere J et al, Arch Biochem Biophys, 296:328, 1992); (Spallholz J, Free Radic Biol Med, 17(1), 1994); (Ursini F, In: Oxidative Processes and Antioxidants, R Paoletti, Ed, Raven Press, NY, 1994); (Spallholz J, Biomed Environ Sci, 10(2-3), 1997); (Wirth T, Molec, 3:164, 1998); (Shen C et al, Proc Am Assoc Cancer Res, 40:360, 1999); (Barceloux D, Clin Toxicol, 37:145,1999); (Stewart M et al, Free Radic Biol Med, 26:42, 1999); (Shen H, Free Radic Biol Med, 28(7), 2000); (Shen C et al, Cancer Epidemiol Biomarkers Prev, 10(4), 2001); (Shen H et al, Free Radic Biol Med, 28(7), 2000); (Chen W, Biochem J, 370(Pt 3), 2003); (Wycherly B et al, Nutr Cancer, 48(1), 2004).*

Protein oxidation is an important area of gerontological and oncological concern having associate relevance to the present topic, yet is generally disproportionately overshadowed by the topic of lipid oxidation *(Vladimirov I et al, Biofizika, 15(2), 1970); (Vladimirov Y et al, Photochem Photobiol, 11(4), 1970); (Roshchupkin D et al, Biofizika, 18(1), 1973); (Starke-Reed P, Oliver C, Arch Biochem Biophys, 275(2), 1989); (Stadtman E, Science, 28:257, 1992); (Grune T, Biogerontol, 1(1), 2000); (Friguet B, et al, Ann N Y Acad Sci, 908:143, 2000); (Merker K, Grune T, Exp Gerontol, 35(6-7), 2000); (Grune T et al, The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 56:B459-B467 (2001); (Stolzing A, Grune T, Clin Exp Dermatol, 26(7), 2001); (Rogers K et al, Free Radic Biol Med, 32(8), 2002); (Shringarpure R, Davies K, Free Radic Biol Med, 32(11), 2002); (Wondrak G, J Investig Dermatol, 121(3), 2003); (Poppek D, Grune T, Gerontol Geriatr, 37(3), 2004)* and must regrettably remain so (for now) for the sake of brevity.

Confirming my own pioneering concerns regarding the problems of plant oil lipid peroxidation and in particular, the associated anti-oxidant pro-oxidation, recent clinical and experimental data confirms that *supplementation of the complex and 'intricately balanced natural antioxidant defence system' with anti-oxidants demands due caution (Young A, Lowe G, Arch Biochem Biophys, 385(1), 2001); (Bondet V et al, J Am Oil Chem Soc, 77:813, 2000); (Black H, Front Biosci, 7:d1044, 2002)*. The old adage "prevention is better than cure" must surely apply here regarding the application to the skin of anything but traces of fixed plant oils (as opposed to volatile, eg essential oils, which are not unsaturated, do not oxidise and being volatile, progressively evaporate relatively quickly, quickly reducing their risk and are therefore safer than fixed oils) which clearly represent unacceptable oxidation rates and oxyradical risks. Not only do oxyradicals and their products damage and age the skin and underlying tissues, they far more seriously represent considerable carcinogenic risk (a phenomenon so well established that I am not even going to reference it).

The phenomenon of lipid breakdown by-products causing systemic toxicity, premature aging and skin and organ cancers is of major concern to me, yet is not even on the radar of the so-called organic natural manufacturers, who can do no better than cry wolf at imaginary hazards from natural substances that don't suit their marketing philosophy, yet ironically represent the only way to safely formulate natural personal care products. **A considerable number of genotoxic and cytotoxic consequences arise from applying oils to the skin** *(M Simic and M Karel, Eds, Autoxidation in Food and Biological Systems, Plenum, NY, 1980); (Petrakis N et al, Cancer Res, 41:2563, 1981); (Levin D et al, Proc Natl Acad Sci, USA, 79:7445, 1982); (Bird R et al, Mutat Res, 101:237, 1982); (W Pryor, (Ed), Free Radicals in Biology, Academic Press, NY, 1982); (Cambell M, Fantel A, Life Sci, 32:2641, 1983); (Ames B, Science, 224, 18 May, 1984); (Marnett L et al, Mutat Res, 148:25, 1985); (International Agency for Research on Cancer, IARC Monograph on Evaluation of the Carcinogenic Risk of Chemicals to Humans, Vol, 39, IARC, 1985); (Ames B et al, Science 236, 17 April, 1987),* making concern over one carcinogen already removed from mineral oil totally absurd.

Besides lipid peroxidation, many atoms in the organic molecules of biological systems can become free radicals, including **sulphur, carbon, halogens, nitrogen and phosphorus** *(Gulumian M, Spec Med, April 1994)*. Even the pro-oxidant production of reactive oxygen species by eg **sterols**, (exogenously & endogenously) can be significant in the cell damaging and tumour promoting action of UV-A light on skin *(Albro P et al, Photochem Photobiol, 66(3), 1997); (Lasch J et al, Biochim Biophys Acta, 1349(2), 1997)*. For the sake of brevity, I have limited discussion to oxygen and lipids (with a mere mention of proteins). Clearly no formulator or manufacturer is applying the level of research and caution that Gaia Research bring to bear on the Gaia Organics ranges of personal care products. Sadly, even if they were to learn from our research, their stubborn marketing philosophy would still largely prevent them from avoiding said hazards. Adding more antioxidative vitamins and compounds in an attempt to limit the harm, might serve instead to actually compound several toxic breakdown pathways and possibly even initiate several new hazards.

There is considerable research attesting to the protective effects of antioxidants, but these studies are in isolation from a full complement of product ingredients and involve animals, since human (and animal) tests are unethical. Not only does the use of antioxidants carry risks of pro-oxidative damage; they also carry specific risks of tumour promotion. **Vitamin E acts as a tumour promoter at high concentrations**. **Vitamin C** at high concentrations further amplifies the promoting effect of high concentrations of tocopherols. The process whereby tumour promotion by vitamin E occurs is simply as a result of alpha-tocopherol acting as a free radical scavenger, with the formation and transfer of the alpha-tocopherol free radical center to the surrounding lipids, resulting in lipid oxidations *(Mitchel R, McCann R, Cancer Detect Prev, 27(2), 2003)*, clearly a vicious circle and not rendering vitamin E as a viable solution to lipid oxidation and carcinogenesis. Do any manufacturers, besides Gaia even know of, let alone consider said dynamics?

It is clearly impossible to stabilise plant oils over and above the proportion of these that are assimilable and hence relatively quickly isolated from unlimited oxygen, chemicals and UV-light, in the skin cells themselves within the first 15 minutes or so following application. After approximately 15 minutes, fatty acid degradation and chain reaction hydrolysis and oxidation begins to build exponentially in a chain reaction of ever-increasing toxins, first on the skin and shortly thereafter, transferred within the cells themselves and eventually the underlying tissues and circulation within the body itself. Gaia Organics' cream-based products are formulated in such a way as to ensure that the carefully selected and limited bio-active components in the formula will have no lipidic competition for skin assimilation and so will be fully assimilated within the critical first 15 minutes following application. Likewise, Gaia Organics' non-cream-based personal care products deliberately incorporate sufficient high-purity viscous-stable white mineral oil to serve to isolate any residual plant oils from the 21% of atmospheric oxygen to which the skin and applied oils is always exposed.

Fortuitously, **mineral oil even possesses moderate UV-A and UV-B photo-protective effects** at relatively low viscosities *(Lebwohl M et al, J Am Acad Dermatol, 32(3), 1995); (Boyvat A et al, Photodermatol Photoimmunol Photomed, 16(4), 2000); (Fetil E et al, Eur J Dermatol, 12(2), 2002),* thereby further limiting said toxic processes at the extreme of the interface between the complex physiology of the skin and the hostile external environment, rather than attempting to absorb and contain the harmful UV-energy within. **Mineral oil, being a hydrocarbon, has no penetrative affinity for proteins *(Rele A, Mohile R, J Cosmet Sci, 54(2), 2003)* and so cannot oxidise and transfer reactive oxygen species to cells as plant oils inevitably do.** Furthermore, the occlusive effect guaranteed by mineral oil is wanted in barrier-impaired skin following the common act of washing off of the protective sebum *(Ghadially R et al, Effects of petrolatum on stratum corneum structure and function, J Amer Acad Dermatol, 26:387-396, 1992).*

Manufacturers of products using plant oils in the formulation of their base cream are hard pressed to stabilise and preserve these even in the cool and oxygen limiting product container, let alone the several hours that such products will remain in contact with the skin and air whilst concurrently exposed to UV-light. Most of the world's major cosmetic houses use mineral oils. I doubt that they were particularly mindful of plant oil-caused reactive oxygen species posing pro-aging and skin cancer risks to consumers, as much as they had commercial concerns over rancidity and spoilage. Most still add significant or token amounts of plant oils out of ignorance or as marketing hype, so the mere use of mineral oil is not a guarantee that the product is not toxic or will not become toxic on the skin. Gaia Research uses plant oils and antioxidants in its topical products, but only as cell-targeted actives, not in base spreading/carrier components, where cream formulations are used. These actives and all other ingredients are formulated in an informed and calculated minimalist, yet optimising approach, based on abovementioned considerations, ensuring that Gaia's products are earth, people and animal friendly, by dedicated intention and design.

A ranking of the relative risk from all the classes of ingredients in Gaia Organics' personal care products might be valuably instructive. These are from highest to lowest risk as follows: fixed & volatile (essential) plant oils (long and short term respectively); anti-oxidative vitamins; alcohol and herbal extracts; synthesised coconut oil ingredients; nutrients/co-factors; kelp; fruit acids; crude oil sourced petroleum inerts; silver & parabenzoate preservatives. I am no more an apologist for petroleum-based products than for the existence of toxic plants or for mankind's abuse thereof. Natural alternatives are too tragic to contemplate, since given radiant body and solar heat, ambient warmth, UV-light and the 21% atmospheric oxygen, and also botanical and organic components and nutrients, including anti-oxidants, addition of any plant lipid molecules will inevitably become actively involved in destructive and toxic process as oxidants, pro-oxidants, free radical initiators, donors, substrates, catalysts, promoters and synergists to the degree that such products are so-called organic/natural, a situation which our selection of inert natural spreading agents and minimalist target active ingredients is specifically designed to avert.

The notion of such products being *"skin-foods"* and being *"capable of being eaten, so as to be harmless"*, is certainly romantic, but nevertheless silly, indeed deleterious, as attested to above. I could have no objection to the maceration of fruit and salad vegetables with an oil dressing in a food processor and applying this as a masque for a 15 minutes, away from the warmth and light of the sun, but trying to preserve even a fraction of this in a container or even an ampule, would be futile, let alone actually stopping it from decomposing on and otherwise harming the skin. The skin in no way approximates the digestive tract in terms of the absence of light or the relative absence of oxygen and in the absence of digestive secretions is unable to process nutrients. Skin can absorb small molecules, but unlike the digestive system, the skin is not selective regarding beneficial vs. harmful substances, a digestive tract at least having the liver to filter and neutralise toxins. Said toxins lead not only to skin damage but can also lead to oxidative damage of physiological structures in the entire organism *(Trommer H & Neubert R, J Pharm Pharmaceut Sci, 8(3), 2005)*.

Assimilated skin toxins bypass the liver, potentially causing significant toxicological and immunological ramifications. Several foods contain toxicants, including antivitamins (to eg A, B6, D, E, K); enzyme inhibitors (to eg cholinesterase and glucose-6-phosphate dehydrogenase); physiological disorganisers and disrupters (eg hemagglutinins, saponins, lathrogens, nitrates, oxalates, phytates, cyanogenic glycosides, irritants, allergens, photosensitisers); hormonal disrupters; antimetabolites (especially amino acids, eg canavanine); numerous alkaloids (eg solanine); numerous mycotoxins (eg aflatoxins), as well as numerous other toxins produced by plants, mainly as defensive chemicals (allelochemicals) against predators and competitors *(Yamaguchi M, World Vegetables, AVI Publ, 1983); (M Rechgcigl, Ed, Handbook of Naturally Occurring Food Toxicants, CRC, 1983); (Ames B, Science, 221:1256, 1983); (Ames B et al, Proc Natl Acad Sci, 87:7777, 1990); (S Colegate, P Dorling, Plant-Associated Toxins: Agricultural, Phytochemical & Ecological Aspects, CAB Intl, 1994); (J Harborne, B Baxter, Eds, Dictionary of Plant Toxins, Wiley, 1996).*

The greatest risks to the skin, for the reasons mentioned, are oxidising or oxygen–rich products. The latter do have potential, mainly for infection control and wound healing, in particular if based on dissolved oxygen rather than reactive oxygen compounds. An interesting cliché is that *"the skin must breath"*. Although the skin has greater similarity to the lungs than the digestive system as far as oxygen concentration is concerned and oxygen is indeed taken up by the epidermis, this is exclusive only for the uppermost layers to a depth of between 0.25-0.40mm that is without vasculature and is 'almost' exclusively supplied by atmospheric oxygen (O2) and or water (H2O), much of this (0.15mm) is dead and dying cells without any oxygen consumption and the remaining layers are served by blood transfer in healthy individuals. *(Stücker M et al, J. Physiol, 538(3), 2002)* Oxidation susceptible topical plant oils consume and render reactively toxic all oxygen afforded an opportunity to come into contact with the skin as atmospheric oxygen dissolves in the water fraction of aqueous cream or a water/oil emulsion and migrates to the skin, with the effect that plant oils lead to not only oxidative damage by oxygen free radicals and reactive oxygen species, but also lead to molecular oxygen (O2) starvation (hypoxia) of skin cells not receiving oxygen via the deeper vasculature.

Sincerely

Stuart Thomson, Director, Gaia Research

POSTSCRIPT: HOW TO EVALUATE OTHER INGREDIENTS IN SO-CALLED ORGANIC NATURAL PRODUCTS

Several questionable ingredients not exposed during the above defence of the proven safe natural Gaia Organics ingredients (SLS/SLES, Parabens and Mineral oil) so maliciously criticised by manufacturers and vendors of 'holier than thou' product ranges came to light just prior to going to print with this 'Consumer Awareness' project. In additional to the undesirability or inferiority of the alternatives already exposed herein *(Cocamidopropyl betaine, Grapefruit seed extract adulterated with triclosan and benzethonium chloride, Silver chloride, and Marula oil)*, these additions include the synthesised chemicals: *Capric/caprylic triglyceride, Carbomer, Cetearyl alcohol, Cetrimonium chloride, Decyl glucoside, Dimethyl-aminoethanol, Glyceryl stearate, Lauryl glucoside, Methyl Sulphonyl Methane, Montmorillonite, Panthenol and Stearic Acid* as well as several questionable endocrine disrupting botanicals, including some cheap highly oxidisable inappropriate unsaturated vegetable oils and hazardous essential oils. Several of these ingredients merely fail the claimed 'organic' and 'natural' selection standards, others again fail the claimed safety standards and Gaia Research will be assessing and exposing these in future updates to this 'Consumer Awareness' series. Readers are invited to forward additional ingredients for inclusion and are also invited to subscribe to this ongoing series by submitting their e-mail address for 'hot off the press' updates or their postal address for infrequent (annual) updates to director@gaiaresearch.co.za, PO Box 2147, Knysna, 6570 or 044-532-7765. Thank you for your attention and interest. Please visit our update page: ***'The Free Radical'*** at *www.gaiaresearch.co.za/freeradical.html* for future developments.

Stuart Thomson, Director, Gaia Research Institute

SODIUM LAURYL ETHER SULPHATE VS COCAMIDOPROPYL BETAINE: THE REAL FACTS

By Stuart Thomson, Director, Gaia Research Institute.

Many manufacturers and distributors of so-called natural and/or organic personal care products claim to have made an informed choice to use Cocamidopropyl betaine (CAPB) rather than Sodium lauryl ether sulphate (SLES) as a foaming agent in their products, are often disparaging of their competitors use of SLES and usually fraudulently miscontextualise or even fabricate misinformation regarding the safety of SLES. Cocamidopropyl betaine (CAPB) is an non-ionic, amphoteric surfactant, foaming agent and emulsifier used in the formulation of rinse-off shampoos, liquid soaps, gels and cosmetic and household cleansers due to its reputation as being a milder (less irritating) agent than most older and many contemporary alternatives, including Sodium laureth sulphate (SLES), especially from the point of view of being less stinging to the eyes.

Made from coconut oil, with petrochemical ingredients, Cocamidopropyl betaine is a quasi-natural substance, as is SLES. Being notably milder to the eyes quickly led to its preferential use in baby shampoos and to manufacturers claiming their product to be milder and safer than that of their competitors who were using Sodium laureth sulphate/Sodium lauryl ether sulphate (SLES). This in turn led to consumer advocates, doctors, consumers and patients assuming that a less irritating product such as a baby shampoo would be safer for the skin, causing more to formulate with, recommend and to seek out CAPB based products over those containing SLES. Cocamidopropyl betaine is a tamed version of a harsher older surfactant, Cocamide DEA, as is Sodium lauryl ether sulphate (SLES) a tamed version of the harsher older Sodium lauryl sulphate (SLS).

Cocamidopropyl betaine does however have a dark side that surfaced along with increasing consumer usage, namely its identification and confirmation as a contact allergen, something that Sodium lauryl ether sulphate (SLES) is not. Furthermore, like SLES, which its detractors, based on its early manufacturing standards and also current industrial grades, but not necessarily in its modern cosmetic grade incarnation, point out, Cocamidopropyl betaine contains several allergenic impurities including carcinogenic **nitrosamines**, *(Haz-Map, Natl Inst Health, USA, 20 July, 2004)*, making a double mockery of SLES-critical manufacturer's claims of a better safety profile for CAPB. Since its introduction, Cocamidopropyl betaine been increasingly revealed, like SLES, to be a skin sensitiser, but moreover, unlike SLES, CAPB has increasingly been identified as a **significant cause of allergic contact dermatitis**, to the extent of being voted **'Contact Allergen of the year 2004'** by a committee of international experts *(Mowad C, Adv Dermatol, 20:237, 2004)*.

With reports of confirmed allergenic dermatitis caused by Cocamidopropyl betaine having first been recorded more than a decade ago, CAPB is now unquestionably documented and acknowledged as one **of the most frequent** (SLES does not even feature) **causes of dermatitis of the head, neck and face in humans and especially so of the eyelids and lips of infants, where its use can lead to intractable inflammation and scaling** *(Korting H et al, J Am Acad Dermatol, 27(6 Pt 1), 1992); (Peter C et al, Contact Dermatitis, 26(4), 1992); (Taniguchi S et al, Contact Dermatitis, 26(2), 1992); (Fowler J, Cutis, 52(5), 1993); (Angelino G et al, Contact Dermatitis, 32(2), 1995); (de Groot A, et al, Contact Dermatitis, 33(6), 1995); (de Groot A, Clin Dermatol, 15(4), 1997); (Angelini D et al, Contact Dermatitis, 39(4), 1998); (Brand R et al, Australas J Dermatol, 39(2), 1998); (Lin-Hui S et al, Contact Dermatitis, 38(3), 1998); (Armstrong D et al, Contact Dermatitis, 40(6), 1999); (Krasteva M et al, Europ J Dermatol, 9 (2), 1999); (Yasunaga C et al, Environ Dermatol, 7(1), 2000); (Hashimoto R et al, Environ Dermatol, 7(2), 2000); (Mowad C, Am J Contact Dermatitis, 12(4), 2001); (McFadden J et al, Contact Dermatitis, 45(2), 2001); (Foti C et al, Contact Dermatitis, 48: 194, 2003); (Moreau L et al, Dermatitis, 15(3), 2004); (Goosens A, Bull Soc Belge Ophtalmol, 292, 11, 2004); (Brey N, Fowler J, Dermatitis, 15(1), 2004); (Fowler J et al, Am J Dermatol (15(1), 2004); (Shaffer K, 15th Ann Meet Am Contact Dermatitis Soc, Wash, 5 Feb, 2004); (Agar N & Freeman S, Australas J Dermatol, 46(1), 2005); (Marriott M et al, Contact Dermatitis, 53(2), 2005); (Bloom M, Recognising contact dermatitis, Dermatol Times, June, 2005).*

End of Part 1

COCAMIDOPROPYL BETAINE:* *HOW MUCH DO WE KNOW ABOUT ITS TOXICOLOGICAL PROFILE?

By Stuart Thomson, Director, Gaia Research Institute

In my earlier analysis, I exposed the dark side of this 'mild' detergent as a significant contact allergen. How much is known about other potential toxicological aspects of this relatively new alternative to SLES? The answer is surprisingly little, so whilst some manufacturers prefer to formulate within the known limits already so well-established for SLES, others put their faith in newer chemicals and take refuge behind the paucity of toxicological data backing these whilst criticizing their more responsible competition by mis-contextualising the abundance of reliable toxicological data available on SLES to enable the safe use of these as was the case already in the mid 80's *(CIR, Cosmetic Ingredient Review Expert Panel, Final report on the safety assessment of sodium laureth sulfate and ammonium laureth sulfate, J Am Coll Toxicol, 2(5), 1983)* and which 3 decades later, still has an exceptional safety profile when used within known limitations.

The same cannot be said of Cocamidopropyl betaine (CAPB), which more than a decade ago had and still has serious gaps in its toxicological database, including how readily it is absorbed into the body, how easily the body can change it to other substances and whether the body can excrete it or not. Although for humans, the most likely route of exposure is through the skin, no dermal sub-chronic toxicity testing or studies on the absorption, distribution, metabolism and excretion of CAPB are on record. There are no studies of reproductive, or developmental toxicity. There are also no chronic systemic or neurotoxicity studies. In fact, not only have no studies evaluated its acute toxicity in humans by any route of entry, it is also not known at all how long-term (chronic) exposure to CAPB is even likely to affect humans. *(CIR, Cosmetic Ingredient Review Expert Panel, Final report on the safety assessment of cocamidopropyl betaine, J Am Coll Toxicol 10(1), 1991); (HSDB, Cocamidopropyl betaine, Hazardous Substance Data Bank, National Library of Medicine, Wash, DC, 1994); (EPA, Health Hazard Summaries, Environmental Protection Agency, 1998)* During the only acute oral toxicity study in rats, diarrhea and wet posterior were the outward signs of toxicity *(FND Amides Robust Summaries, Dec 2001)*, not uncommon presentation in infants.

Other than the allergenic contact dermatitis eventually determined epidemiologically, little is known of the topical toxicity of Cocamidopropyl betaine (CAPB) other than that the irritation/sensitization/ allergenic responses of humans to dermal exposure are associated with chemical impurities, which can include toxic **nitrosamines**, which until these were routinely eliminated from the manufacturing of SLES a decade ago, was one of only two then criticisms of SLES (the other being 1,4 Dioxane), yet this potential problem with CAPB still remains today. Although CAPB was not carcinogenic in a skin-painting study in mice, that study was not considered thorough enough to be conclusive regarding the cancer-causing potential of CAPB. It has been established that CAPB is potentially irritating to the eye. Laboratory animals exposed to varying concentrations exhibited not only swollen eyelids, but also conjunctival and corneal irritation. *(Cosmetics Ingredient Review Compendium, Cosmetic ingredient safety assessments, Washington DC, 2003)* The passage of time has not improved the topical safety profile of Cocamidopropyl betaine, which despite neglect of safety/toxicological data, today looks rather dodgy compared to the trusty old SLS/SLES.

Cocamidopropyl betaine, being synthesised from coconut oil using petrochemicals, falls short of its false model "organic" claims and from an ecological perspective, CAPB is slightly less toxic to fish and algae than is SLES for chronic toxicity. However, from an acute toxicity perspective, it is four and three times more toxic to fish and algae respectively than is SLES. *(EPA, Estimating concern levels for concentrations of chemical substances in the environment, EPA, 1984); (EPA, CAPB Environmental Hazard Summary, Environmental Protection Agency, 744-B-98-001, June 1998)*

Given these shocking states of affairs, how do the likes of **Esse, Naturebabes and Enchantrix** have the gall to point fingers at far safer SLS and SLES formulations, let alone in good conscience arrive at 'holier than thou' claims of safety for such products, especially when some are fraudulently marketed as organic and natural and are targeted at **infants** and toddlers with such pretence?

RISK POTENTIAL OF TOPICAL EXPOSURES TO EUCALYPTUS OIL IN CHILD-CARE PRODUCTS

By Stuart Thomson, Director, Gaia Research

It seems to be an increasingly common practice these days for the ignorant to take the health of consumers into their hands. Nowhere is this more apparent than in the sphere of so-called natural health and healing, a sector that I have been actively involved with for the past 25 years. Even with personal care products, the area of my professional focus for the past 15 years, there are evident very real risks of consumers suffering harm from such products, not only from the mass-production cosmetics and toiletry industries, but alarmingly, also from the so-called natural products sector.

A case in point is the use of **Cocamidopropyl betaine** (CAPB) by **Esse, Naturebabes/Tom-eTots** and **Enchantrix** in preference to SLES and the use of **Eucalyptus oil**. **Naturebabes/Tom-eTots**, manufactured by **Esse's Trevor Steyn**, comprise of a **Baby** Cream Wash, **Baby** Gel Wash, **Baby** Shampoo, **Baby** Lotion and a Bum Lotion, several with CAPB and all with Eucalyptus oil, affording quadruple exposure. In addition, there is a **Baby Range** including **Eucalyptus essential oil**.

Eucalyptus oil can cause skin irritation and contact dermatitis *(Mitchell J, Rook A, Botanical Dermatology, Greengrass Vancouver, 1979); (Spoerke D et al, Vet Hum Toxicol, 31:166, 1989); (Webb N et al, J Paediatr Child Health, 29:368, 1993); (Indian Pharmacopoeia, Vol. 1, Government of India Ministry of Health and Family Welfare, Delhi, 1996)* and is furthermore is known to have **skin tumour promoting activity** *(Roe F et al, Food Cosmet Toxicol, 3:331, 1965)*.

Several plant-derived essential oils, currently so popular as additives to bland, (usually rancid sweet almond, wheat germ or marula) massage oils have epileptogenic properties (without a history of or existing epilepsy), including Eucalyptus oil, which due to its highly reactive monoterpene ketones, is a powerful convulsant. Topical application of Eucalyptus essential oil is recorded in the paediatric medical literature as inducing systemic toxicity, expressing as slurred speech, generalised muscular contraction, ataxia, muscle weakness and **toxic seizure, progressing to unconsciousness** with severe complications and generally poor outcome. Seizures are more frequently reported in children than adults and **transient coma can be induced in infants by exceptionally low concentrations**. *(Chun L, Hawaii Med J, 11(2), 1951); (Darben T et al, Australas J Dermatol, 39:265, 1998); (Burkhard P et al, J Neurol, 246(8), 1999); (IPCS, Eucalyptus Oil (PIM031) International Programme on Chemical Safety, - WHO, UN EP, 2005)*

The Medline Plus Medical Encyclopedia lists eucalyptus oil as a poisonous ingredient, the application of which can cause symptoms of muscle weakness, shallow (possibly rapid) breathing, rapid heartbeat, dizziness, drowsiness, **convulsions, seizures and unconsciousness**, and advise that as emergency home treatment the body be washed with soap and water before calling emergency services. If there is survival past 48 hours, this is considered as a good sign that recovery will occur *(Johnson C, The Medline Plus Medical Encyclopedia, US Natl Lib Med, 2005)*.

Eucalyptus oil preparations should be kept out of reach of children and not be applied to the body and face, especially the nose of infants or young children *(Whitman B et al, J Paediatr Child Health, 30(2), 1994); (Blumenthal M et al, eds, The German Commission E Monographs, Am Botanical Council, Austin, TX, 1998)*. So high was paediatric Eucalyptus oil poisoning in the indigenous region of Australasia, that preventive countermeasures were considered, including discouraging vaporiser use for respiratory infections among young children and altogether discontinuing the use of eucalyptus oil as a therapeutic agent *(Day L et al, Aust N Z J Public Health, 21(3), 1997)*. **Pediatric Eucalyptus oil preparations were officially suspended by the World Health Organisation more than a decade ago** *(WHO Pharmaceuticals Newsletter, 10:2, 1994)* and are now subject to **Schedule-5 substance classification** (National Drugs and Poisons Schedule Committee, Meeting 36, Therapeutic Goods Administration, 2002).

Please see ***www.gaiaresearch.co.za/freeradical.html*** for our ongoing investigations and exposé of so-called 'organic', 'natural' and 'safe' personal care products, undertaken in the public interest.