

Chris Anthony

HOME

NEWS & WEATHER

UNIVERSITY

SCIENCE *General*
My research

INDIA *General*
My pictures

MUSIC

FAVOURITES shopping, friends,
DIY, entertainment,
Southampton etc

BOOKS

TRAVEL & HOLIDAYS

FAMILY

MEDICAL

PHOTOGRAPHY

BIRDS

SEARCH ENGINES

All engines
Google
YouTube
Stumbleupon

MY NET PROVIDER

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ppt Powerpoint
doc Word
xls Excel
pdf Acrobat Reader [download free]
jpg Opens direct
html Opens direct;
For **BIGGER** text
Click Ctl plus +
Normal text click Ctl plus 0

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accelerator

HOME

Alternative medicine and Nutritional Therapy

For the best available Good health advice, and information on Trials of drugs and treatments, go to my main [Medical Page](#)

Go Back to: [My Main Science page](#) [My Research and Teaching](#)

I have produced this page, like many others, for my benefit but hope that others will find it helpful. It comes from my annoyance with the way in which alternative medicine enthusiasts, nutritionists, conspiracy theorists and journalists mislead us, often for their personal profit. I had often wished I had a quick source of facts and arguments to use when discussing such topics. I have now collected some of the material I have found useful.

Contents of this page:	Alternative therapies	Nutritional supplements; Therapy & fallacies	Important writers websites
	Anti-quackery sites	Excellent books	

Summary of alternative therapies

These summaries are taken almost verbatim from the book [Trick or Treatment](#) by Simon Singh and Edzard Ernst [see [above](#)]. Their conclusions are based on the best reviews available [many from the [Cochrane Collaboration](#)]. Their [Website](#) is being developed at present.

General Advice on alternative therapies: [quoted verbatim]: Too many alternative therapists remain uninterested in determining the safety and efficacy of their interventions. these practioners also fail to see the importance of rigorous clinical trials in establishing proper evidence for or against their treatments. and where evidence already exists that treatments are ineffective or unsafe, alternative therapists will carry on regardless with their hands firmly over their ears.

Despite this disturbing situation, the market for alternative treatments is booming and the public is being misled over and over again, often by misguided therapists, sometimes by exploitive charlatans,

We argue that it is now time for the tricks to stop, and for the real treatments to take priority. In the name of honesty, progress and good healthcare, we call for scientific standards, evaluation and regulation to be applied to all types of medicine, so that patients can be confident that they are receiving treatements that demonstrably generate more good than harm.

If such standards are not applied to the alternative medicine sector, then homeopaths, accupuncturists, chiropractors, herbalists and other alternative therapists witll continue to prey on the most desperate and vulnerable in society, raiding their wallets, offering false hope, and endangering their health.

The four main types of alternative or complementary medicine

[This section is followed by brief summaries of all other alternative medicines \(click here\)](#)

Accupuncture

Accupuncture is an ancient system based on the noton that health and wellbeing react to the flow of a life force (Ch'i) through pathways (meridians) in the human body. Accupuncturists place fine needles into the skin at critical points along the meridians to remove blockages and to encourage a balanced flow of the life force. they claim to be able to treat a wide range of diseases and symptoms.

Conclusions: The traditional principles are deeply flawed, as there is no evidence at all to demonstrate the existence of Ch'i or meridians. The reviews show that it is no more effective than placebo for any condition except possibly for some types of pain and nausea [and here the evidence is only borderline].

Homeopathy

Homeopathy is a system for treating illness based on the premise that like cures like. The homeopath treats symptoms by administering minute or non-existing doses of a substance which in large amounts produces the same symptoms in healthy

individuals. Homeopaths focus on treating patients as individuals and claim to be able to treat any ailment, from colds to heart disease.

Conclusions: There is a mountain of evidence to suggest that homeopathic remedies simply do not work, which is not surprising as they typically do not contain a single molecule of any active ingredient. Any observable effects are due to the placebo effect.

Chiropractic Therapy

A form of treatment developed at the end of the nineteenth century, which involves manual adjustments of the spine. Although some chiropractors focus on treating back pain, many others also treat a whole range of common illnesses, such as asthma. The underlying theory claims that manipulating the spine is medically beneficial because it can influence the rest of the body via the nervous system.

There are 2 groups of chiropractors: *'Straight'* chiropractors are fundamentalists who believe in 'subluxations' and 'innate intelligence' and the ability of spinal manipulation to treat all diseases. *'Mixers'* concentrate on problems directly related to the spine.

Conclusions: In summary, the scientific evidence suggests that it is only worth seeing a chiropractor if you have a back problem. Even then, Singh and Ernst offer this important advice if considering a visit to a chiropractor:

1. Do not use a 'straight chiropractor' (identified by their claims with respect to anything other than back problems).
2. If the problem is not resolved (or no further improvement is obvious) within 6 sessions then stop and consult your doctor for advice. Chiropractors have a reputation for lengthy and expensive treatments.
3. Do not allow a chiropractor to become your primary healthcare provider. Note that many carry the title of Doctor but this does not mean they have graduated from medical school; it generally means Doctor of Chiropractic.
4. Avoid chiropractors who rely on unorthodox techniques for diagnosing patients, such as applied kinesiology [these practitioners are usually 'straight' chiropractors].
5. Check the reputation of your chiropractor. They have been shown to be markedly more likely to be involved in malpractice, fraud and sexual transgressions than are medical doctors.
6. Try conventional treatments before turning to a chiropractor for back pain. they are likely to be cheaper and just as effective.

Risks associated with Chiropractic therapy: these can be considerable and should be considered very seriously especially if a child is involved. There is an excellent extensive discussion of these risks [and of other alternative therapies] in [Trick or Treatment](#).

Herbal Medicine

Herbal medicine is one of the oldest and most widespread form of treatment; it involves the use of plants and plant extracts in the treatment and prevention of a whole range of diseases. Based on local plants and traditions, it continues to play a major role in healthcare in Asia and Africa. In recent decades, herbal medicine, (also called phytotherapy) has become one of the fastest growing forms of treatment in the rest of the world.

Conclusions: By contrast with acupuncture, homeopathy and chiropractic manipulation, there is no doubt that some herbal medicine is effective. Much of modern pharmacology has evolved from the herbal tradition. Note that the word *drug* comes from the Swedish word *druug* meaning dried plant.

What has to be considered here is the difference between scientific development of herbal extracts and what might be called 'alternative herbal medicine'. Alternative herbal therapists continue to believe that Mother Nature knows best and that the whole plant provides the ideal medicine, whereas scientists believe that nature is just a starting point and that the most potent medicines are derived from identifying and sometimes manipulating key components of a plant.

Most alternative herbal medicines have not been tested for efficacy or safety to the same level as have conventional drugs. We have to ask: which herbal remedies work, and are they safe. There are valuable Tables summarising results of studies on 30 herbal remedies and aspects of their safety in [Trick or Treatment](#) [some are listed in the Table below].

It should be noted that for many diseases and conditions there are no effective herbal remedies, including: cancer, diabetes, multiple sclerosis, osteoporosis, asthma, hangover and hepatitis.

Example of herbal remedies for which there is evidence of efficacy

This lists the best 25% of the tested herbal remedies from the Tables given in [Trick or Treatment](#). The amount or quality of the evidence of efficacy for the remaining 75% of other remedies were poor or medium.

Note: the risks may be slight; they are given as examples. In many cases [not always listed here] there is a possibility of interaction with other drugs. If you are on any medication a medical doctor should be consulted before using herbal medicines.

Herbal remedy	Condition treated	Known risks
Devil's claw	musculoskeletal pain	interaction with anticoagulants
Echinacea	treatment and prevention of common cold	linked with asthma
Garlic	high cholesterol	may lower blood sugar
Hawthorn	congestive heart failure	may amplify effect of blood pressure and heart medications
Horse chestnut	varicose veins	could interact with anticoagulants and antidiabetic drugs
Kava	anxiety	associated with skin problems and liver damage
Ma huang	weight loss	contains ephedrine which stimulates the nervous and cardiovascular systems and can cause hypertension, myocardial infarction and stroke
Red clover	menopausal symptoms	associated with bleeding, and may interact with anti-coagulants, the contraceptive pill and other drugs.
St. John's wort	mild to moderate depression	can seriously interfere with other drugs
TOP		

Brief summaries of other alternative therapies

These are almost direct quotes from the excellent summaries that form the Appendix in [Trick or Treatment](#). Note that the conclusions refer to *evidence* on the effectiveness of the therapy but often there has been little research.

Alexander Technique

This is a therapy based on relearning correct postural balance and coordination of body movements; [Website](#)

Their Conclusion: The little evidence is inconclusive, but it might generate benefit for some health problems [especially chronic back pain], provided patients are sufficiently committed and wealthy. No serious risks associated. It is strongly recommended by musicians helping postural problems etc. A 2008 paper has convincing evidence about back pain ([BMJ](#). 2008 Aug 19;337:a884. doi: 10.1136/bmj.a884)

Aroma Therapy

Plant essences ['essential oils'] are applied to the skin with massage or used during a bath or just in air.

Conclusion: It has short-term 'de-stressing' effects which can contribute to enhanced wellbeing after treatment. No evidence that it can treat specific diseases. Minimal risk.

Ayurvedic Tradition

Ancient Indian system of healthcare which involves bringing about balance between body and mind.

Conclusions: This complex system cannot be easily evaluated. Some elements are effective [eg yoga has proven benefits for cardiovascular health]. There are some encouraging findings for some herbal compounds but others are essentially untested, or overtly dangerous.

Colonic Irrigation

Enemas are used to 'cleanse the body of toxins', administered via the rectum.

Conclusions: None of the waste products of our body 'poison' us; they are eliminated through a range of physiological process [unless suffering from a severe medical condition]. Colonic irrigation is unpleasant, ineffective and dangerous. In other words it's a waste of money and a hazard to our health.

Crystal Therapy

It is claimed that crystals can move, absorb, focus and diffuse healing 'energy' or 'vibrations' within the body, enhancing the patient's self healing ability.

Conclusions: Not in accordance with our understanding of physics, physiology or any other field of science. No evidence that wearing crystals, or crystal therapy is effective for any condition. No risks associated but if used as an alternative to life-saving treatments crystal therapy would be life-threatening.

Detox

Detoxification ['detox'] is the elimination of accumulated harmful substances from the body. Conventional detoxification may be essential after ingestion or injection of poisons. In alternative medicine, however, it is suggested that products of normal metabolism accumulate and make us ill or that too much indulgence in unhealthy food and drink generates toxins that can only be eliminated by a wide range of alternative treatments.

Conclusions: Detox is a scam. The body has wonderful systems for removal of potentially harmful waste products. After over indulgence drinking plenty of water, resting and eating sensibly is enough. There is no evidence that any treatment is beneficial, and some can be harmful. The only substance that is removed from a patient is usually money.

Feng Shui

This is the Chinese art of placing objects [in home or office etc] in order to 'optimize the flow of life energy' which is thought to influence health and wellbeing.

Conclusions: Feng shui is not biologically plausible; its basic tenets of Ch'i and yin and yang make no sense in the context of modern science. There is no evidence that feng shui does anything but enrich those who promote it.

Food Supplements

These are supplements to increase intake of vitamins, minerals, fatty acids, amino acids etc to maintain or improve health, fitness or wellbeing.

Conclusions: Note that regulation of labels is lax. Medical claims are not allowed but manufacturers can do a good job of implying that a particular supplement is good for treating some particular condition. Some are beneficial [eg fish oil for reducing risk of heart disease], many are harmless and some are dangerous, especially if they are used for a medical condition instead of consulting a doctor.

Hypnotherapy

Hypnotherapy is the use of hypnosis, a trance-like state, for therapeutic purposes. Autogenic training is a self-hypnotic technique.

Conclusions: People who are suggestible respond best. Many studies show that it is effective in reducing pain, anxiety, reducing phobias and the symptoms of irritable bowel syndrome. It is not effective for smoking cessation. It is clearly useful for some patients and there is no serious risk but it is not appropriate for people with severe mental problems.

Magnet Therapy

Magnets, worn as wrist bands, leg straps etc are promoted for many conditions, mostly to alleviate chronic pain.

Conclusions: Serious trials have provided no evidence that they offer medical benefit, and there is no reason why they should.

Massage Therapy

There are many types of therapy, some of which are conventional while others are more exotic.

Conclusions: Massage is beneficial for some musculoskeletal problems, especially back pain, anxiety, depression and constipation. It improves wellbeing in most patients. Adverse effects are rare. Exotic forms of massage are unlikely to provide extra benefit.

Osteopathy

Similar to some chiropractic therapy but more gentle and uses more massage. Vertebral joints are rarely moved outside their normal range of motion so there is less risk.

Conclusions: Effective for back pain but it would be sensible to move to cheaper equally effective physiotherapy if there is no significant benefit.

Oxygen Therapy

Although used in conventional medicines in well-defined situations, as a therapy it is more controversial. It may be administered as normal oxygen or as ozone [extremely toxic], and may be applied in a variety of ways.

Conclusions: Alternative oxygen therapy is not supported by evidence and is potentially harmful.

Reflexology

Massage of the feet based on the idea that particular areas of the foot correspond to inner organs.

Conclusions: The biological basis is completely implausible. It cannot be used to diagnose health problems nor to treat any condition. It is expensive and is no better than a simple foot massage.

Reiki

Reiki is a system of spiritual healing or 'energy' medicine similar to laying on of hands.

Conclusions: It has no basis in science and the trial evidence fails to show effectiveness for any condition. There are no direct risks unless it is used to replace effective treatments for serious problems.

Relaxation Therapies

These are designed to generate what is known as the 'relaxation response'.

Conclusion: Effective for reducing stress and anxiety and maybe for some other conditions. Not effective for controlling chronic fatigue syndrome, irritable bowel syndrome, dyspepsia and epilepsy.

Shiatsu

This is like a Japanese synthesis of accupuncture and massage. the therapist uses his thumb to apply strong pressure on accupuncture points. It can be painful.

Conclusions: Virtually no trials but unlikely to be more effective than conventional massage. Injuries can occur because of the high pressure used. For example there are reports of retinal and cerebral artery embolism associated with Shiatsu massage to the neck or head.

TOP

Nutritionists and Nutritional Therapy; the fallacy of dietary supplements being essential for health
TOP

Brief summary

Myths unravelled: vitamin c; glucosamine; omega 3; fish oil; antioxidants

PQQ

Brief summary of this topic followed by summaries of specific supplements and links to good evaluations of their efficacy.

Nutritionists promote the idea that to maintain good health it is essential to have a good diet which is achieved by taking regular dietary supplements which are also promoted as a form of alternative therapy for many (nearly all) medical conditions. This is known as Nutritional Therapy.

Nutritionists and Nutritional Therapists are different from dieticians and those working in the science of nutrition. They often have no science qualifications but have false or unrelated qualifications or have qualifications from their own 'Institutes'. For example Patrick Holford has a BSc in psychology; his 'qualification' in nutrition or related subjects is DipION, awarded by the Institute for Optimum Nutrition which he founded, and where many other nutritionists were trained. Another well-known nutritionist is Gillian McKeith whose 'PhD' was bought from a non-accredited US University – as was the PhD of Ben Goldacre's cat. Most well-known nutritionists (eg Patrick Holford) have their own companies selling nutritional supplements as essential for general health.

Nutritional claims can be advertised, whether tested or not, but medical claims cannot be written on the

pill bottles [as there is no medical evidence this is illegal]. They are promoted by the websites, and books of the nutritionists and by uncritical journalists in newspapers or on TV. There is very little evidence for any therapeutic or preventative functions for the supplements they sell. In this way they are similar to other alternative medicine systems. Of course there is a problem that good scientific controlled experiments are often difficult in nutritional studies. But there have been excellent studies of some important nutritionists' claims: for example, the use of vitamin C to prevent colds; fish oil to improve children's intelligence; antioxidants to prevent cancer (see sections below).

The books and web sites of nutritionists will have a lot of sound advice but this is available from all good books on diet and on government websites. We do not need a nutritionist to tell us that we should eat plenty of fruit and vegetables, we should not overcook them, we should take plenty of exercise etc.

An excellent book on how supplements and treatments should be evaluated, and on how industries selling dietary supplements (and pharmaceuticals) cheat in their 'science' claims, is [Bad Science by Ben Goldacre](#). He has won numerous awards, including "Best Freelancer" at the Medical Journalists Awards 2006, the Healthwatch Award in 2006, "Best Feature" at the British Science Writers Awards twice, for 2003 and 2005, and the Royal Statistical Society's first Award For Statistical Excellence in Journalism. He also has a useful and amusing (searchable) [website](#) which exposes the absurdities published on this topic.

Another excellent source is David Colquhoun's [Improbable Science site](#).

For general advice on dietary supplements and health the [excellent NHS site](#) provides information on what vitamins etc are required, where you will get them in your diet and any known problems.

The most reputable source for reviews of studies of the efficacy of medical or 'nutritional' treatments is the Cochrane Collaboration. They publish systematic reviews which can be read online or downloaded as pdf files. The home page of [their library](#) has an alphabetical list of everything or the collection can be searched on the home page. Full details of reviews are given together with useful 'plain language summaries'. Some of their conclusions are discussed below.

TOP

Some myths unravelled

Vitamin C prevents colds; it does not.

[The Cochrane plain language summary](#): "Regular ingestion of vitamin C had no effect on common cold incidence in the ordinary population. However, it had a modest but consistent effect in reducing the duration and severity of common cold symptoms. In five trials with participants exposed to short periods of extreme physical stress (including marathon runners and skiers) vitamin C halved the common cold risk. Trials of high doses of vitamin C administered therapeutically, starting after the onset of symptoms, showed no consistent effect on either duration or severity of common cold symptoms. However, only a few therapeutic trials have been carried out, and none have examined children, although the effect of prophylactic vitamin C has been greater in children. One large trial with adults reported equivocal benefit from an 8 g therapeutic dose at the onset of symptoms, and two trials using five-day supplementation reported benefit. More trials are necessary to settle the possible role of therapeutic vitamin C, meaning administration immediately after the onset of symptoms".

Chondroitin and glucosamine for arthritis (From [David Colquhoun's site](#) (not now available):

Chondroitin doesn't work April 8th, 2007).

"Sales of chondroitin and glucosamine are a worth billions of dollars, but the evidence that they work has never been good. A new meta-analysis of clinical trials now shows that chondroitin on the symptoms of osteoarthritis is "minimal or nonexistent". (Reichenbach S and others. Meta-analysis: Chondroitin for osteoarthritis of the knee or hip. Annals of Internal Medicine 146:580-590, 2007]. It is the same old story. Early trials were small and badly-designed. They seemed to show some effect, which was wildly exaggerated by the supplement hucksters to push sales. Eventually somebody does the trials properly, and it is found that there is little or no benefit.

Glucosamine shows a similar trend. Glucosamine is a synthetic chemical, but it is not a licensed medicine in

the UK. It is marketed as a “food supplement”, not as a drug. It is not approved for prescription on the NHS. The latest Cochrane review does not entirely rule out some benefit, but again the effects seem to get smaller as the trials get better.

Omega-3 PUFA (as in Fish oil and some vegetable oils) and cognitive function

The results of the available studies show no benefit for cognitive function with omega-3 PUFA supplementation among cognitively healthy older people. Omega-3 PUFA supplements may have other health benefits, and consumption of fish is recommended as part of a healthy diet.

[Link to full Cochrane review.](#)

Omega-3 PUFA for prevention of cardiovascular disease

The Cochrane review shows that it is not clear whether dietary or supplemental omega 3 fats (found in oily fish and some vegetable oils) alter total deaths, cardiovascular events (such as heart attacks and strokes) or cancers in the general population, or in people at risk of, or with, cardiovascular disease. When the analysis was limited to fish-based or plant-based, dietary or supplemental omega 3 fats there was still no evidence of reduction in deaths or cardiovascular events in any group.

[Link to full Cochrane review.](#)

Fish oil capsules and children's IQ

No evidence of any effect. The possibility of an effect has become part of general knowledge as a result of a so-called trial in which Durham school children were given capsules in periods before GCSE exams to see if their results were better than predicted. This was an uncontrolled and farcical experiment whose results were kept secret (no effect). This is described in full in Goldacre's book and the subject well-aired on [his website](#).

Antioxidants. Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases

This is a good example of a thorough Cochrane review. Its conclusion is: The current evidence does not support the use of antioxidant supplements in the general population or in patients with various diseases.

[Link to this Cochrane Review.](#)

I have included the full summary of conclusions to illustrate the thoroughness of the Cochrane reviews.

"The present systematic review included 78 randomised clinical trials. In total, 296,707 participants were randomised to antioxidant supplements (beta-carotene, vitamin A, vitamin C, vitamin E, and selenium) versus placebo or no intervention. Twenty-six trials included 215,900 healthy participants. Fifty-two trials included 80,807 participants with various diseases in a stable phase (including gastrointestinal, cardiovascular, neurological, ocular, dermatological, rheumatoid, renal, endocrinological, or unspecified diseases). A total of 21,484 of 183,749 participants (11.7%) randomised to antioxidant supplements and 11,479 of 112,958 participants (10.2%) randomised to placebo or no intervention died. The trials appeared to have enough statistical similarity that they could be combined. When all of the trials were combined, antioxidants may or may not have increased mortality depending on which statistical combination method was employed; the analysis that is typically used when similarity is present demonstrated that antioxidant use did slightly increase mortality (that is, the patients consuming the antioxidants were 1.03 times as likely to die as were the controls). When analyses were done to identify factors that were associated with this finding, the two factors identified were better methodology to prevent bias from being a factor in the trial (trials with 'low risk of bias') and the use of vitamin A. In fact, when the trials with low risks of bias were considered separately, the increased mortality was even more pronounced (1.04 times as likely to die as

were the controls). The potential damage from vitamin A disappeared when only the low risks of bias trials were considered. The increased risk of mortality was associated with beta-carotene and possibly vitamin E and vitamin A, but was not associated with the use of vitamin C or selenium. The current evidence does not support the use of antioxidant supplements in the general population or in patients with various diseases".

[TOP](#)

[TOP](#)

PQQ (Pyrroloquinoline quinone) For an extensive new page on everything about PQQ, including debate on its possible role in human metabolism go to my [new PQQ page](#)

This is a subject close to my own heart. I was one of the first scientists to discover PQQ (in 1967) as an essential component of bacterial enzymes. This aspect of PQQ is covered extensively in my new pages on everything about PQQ: [Click Here](#)

PQQ as a nutritional supplement

History PQQ (Pyrroloquinoline Quinone) was first discovered as the prosthetic group (coenzyme) of enzymes oxidising sugars and alcohols **in bacteria**. As more enzymes that use PQQ in this way were discovered they become the subject of International Symposia. The first was in 1988. (I organised one in Southampton in 2002, published in Biochim. Biophys. Acta, Vol 1647, 2003).

Enzymes that use PQQ are called quinoproteins. These are analogous to flavoproteins in which riboflavin derivatives take the place of PQQ. Flavoproteins are essential oxidising enzymes in mammals which cannot make riboflavin; this is therefore a vitamin and must be present in the diet. If PQQ-containing enzymes occur in humans then PQQ is likely to be a water soluble B vitamin. However there is no evidence for such enzymes in humans and there is no evidence that PQQ is a vitamin.

Is PQQ a vitamin? In 2003 the Journal Nature published a paper claiming on wrongly interpreted data that PQQ is a new vitamin. This received wide publicity and led to hopeful development of PQQ as a vitamin (by, amongst others) Mitsubishi company. When I pointed out to Nature the completely false foundation (based on misinterpretation of molecular biology databases) they agreed that they must publish a rebuttal both of the molecular biology conclusions (by me) and the nutritional conclusions by Rucker. This led Mitsubishi to market PQQ as a *nutritional supplement* rather than a vitamin. The story of all this is described at length in [my research pages](#), which include references and downloadable pdfs.

The marketing of PQQ as a nutritional supplement PQQ is now marketed widely as a supplement with claims for a wide range of benefits. These claims are based on many nutritional investigations of PQQ and many studies on the effect of PQQ in isolated cells or tissues or whole experimental animals (mice and rats). The website claims of the marketers are often factually incorrect, wildly exaggerated and have many misunderstandings about biochemistry and physiology.

For unbiased examination of supplements I strongly recommend the website [Examine.com](#) which is an "independent organization that presents un-biased research on supplements and nutrition. We currently have over 25000 references to scientific papers". This is an excellent website that examines claims for nutritional supplements and has a lengthy valuable [discussion of PQQ](#).

PQQ and health. Response to an article in Life Extension Magazine Feb 2011

"Generate Fresh Mitochondria with PQQ. Scientists Discover the "Other CoQ10". By Perry Marcone
[Link to the original article](#)

I am writing this response at some length. The same responses are relevant to many PQQ sellers

The article quotes important work by Rucker and colleagues. In early studies, he showed that germ-free mice fed chemically-defined diets thrived more if provided with PQQ. He has been at the forefront of this

sort of work and his paper [relating PQQ to mitochondrial genesis](#) is the one quoted by the article in Life Extension. We should note that this paper studied the effect of PQQ on isolated cell cultures of mouse liver cells. It requires a lot of extrapolation to conclude that PQQ may have an effect on mitochondrial generation in humans and even more to conclude that PQQ as a nutritional supplement will have an effect on ageing. But of course it may achieve this.

It should be remembered that even if PQQ does have such effects this is not evidence that it has a 'normal' role in human physiology – it is probably only acting as a 'drug'. By its chemical nature it reacts powerfully with free radicals and so is an antioxidant. [Also note that there is no evidence that antioxidants in the diet have any benefit at all].

Some specific comments on the article:

The paragraphs in italics are taken direct from the article, given in the order in which they appeared.

1. The most exciting revelation on PQQ emerged early in 2010, when researchers found it not only protected mitochondria from oxidative damage—it stimulated growth of fresh mitochondria!

This refers to the Rucker study which used liver cells in tissue culture. This is important interesting work but it does not show that dietary supplementation with PQQ in animals/humans will lead to mitochondrial production.

2. Pre-clinical studies reveal that when deprived of dietary PQQ, animals exhibit stunted growth, compromised immunity, impaired reproductive capability, and most importantly, fewer mitochondria in their tissue. Rates of conception, the number of offspring, and survival rates in juvenile animals are also significantly reduced in the absence of PQQ. Introducing PQQ back into the diet reverses these effects, restoring systemic function while simultaneously increasing mitochondrial number and energetic efficiency.

Note that to see these effects animals were often reared in extreme unnatural conditions [that is ok as this was the 'cleanest' way of showing effects]. Less effect is likely to be seen in animals if given PQQ in normal conditions. This is not surprising because there is a lot of PQQ in many foods, especially if bacteria have been involved in their production; for example vinegar has a lot of PQQ because it is made using bacteria that use a PQQ quinoprotein to oxidise alcohol to the active component of vinegar – acetic acid.

3. As the primary engines of almost all bioenergy production, the mitochondria rank among the physiological structures most vulnerable to destruction from oxidative damage. PQQ's formidable free radical-scavenging capacity furnishes the mitochondria with superior antioxidant protection.

Firstly, we should not confuse mitochondrial activity with regeneration [the subject of Rucker's paper].

Free radicals are inescapable occasional products of reaction with oxygen in the final step in energy production. We have evolved thus far by avoiding damage by these free radicals which are happily mopped up by mitochondrial enzymes with that sole purpose. There is no reason to think that "superior antioxidant protection" is needed.

4. At the core of this capacity is an extraordinary molecular stability. As a bioactive coenzyme, PQQ actively participates in the energy transfer within the mitochondria that supplies the body with most of its bioenergy (like CoQ10).

This is **completely untrue**. Although it is true that coenzyme Q actively participates in energy transfer within mitochondria, PQQ has not been shown to have any function whatsoever in mitochondria. In bacteria it **does have** this function. During methanol oxidation for example the first step in energy production is catalysed by a PQQ containing enzyme that is so important that it constitutes 5-10% of the cell's protein. PQQ enzymes have only been described in bacteria.

5. Unlike other antioxidant compounds, PQQ's exceptional stability allows it to carry out thousands of these electron transfers without undergoing molecular breakdown. It has been proven especially effective in neutralizing the ubiquitous superoxide and hydroxyl radicals..... A consistent finding in the scientific literature is that nutrients like PQQ provide more wide-ranging benefits than conventional antioxidants the general public relies on.

As mentioned above, PQQ is a powerful antioxidant and it is stable and so of course will 'neutralise'

free radicals. But there is no evidence that this ability of PQQ can be relevant to health. There is good evidence that antioxidants in the diet have no positive health benefit and may have slight negative effect. [This is published as a Cochrane Review.](#)

6. *According to the most recent research, "PQQ is 30 to 5,000 times more efficient in sustaining redox cycling (mitochondrial energy production) . . . than other common [antioxidant compounds], e.g. ascorbic acid."*

This is terrible. Redox cycling is a chemical process that was proposed as a way of *measuring* PQQ in a test tube. It not relevant in any way to "mitochondrial energy production".

7. *In a revolutionary advance, an essential coenzyme called pyrroloquinoline quinone or PQQ has been shown to induce mitochondrial biogenesis—the growth of new mitochondria in aging cells!*

PQQ is **not** an essential coenzyme in animals [see above]. The studies of PQQ and mitochondrial genesis that stimulated this article were on liver cells in lab culture, NOT ageing cells, or whole animals or humans.

Comments provoked by website of Dr Al Sears

Dr. Al Sears heavily markets PQQ (Pyrroloquinoline Quinone) through his anti-aging supplement line, most notably in a product called Ultra Accel II . In his alternative medicine and copywriting campaigns, Dr. Sears promotes PQQ as a "NASA nutrient" capable of multiplying and growing fresh mitochondria—the energy-producing engines inside human cells.

His website is not online but I have kept this as a good example of the 'duplicity of such market driven medics.

"Vitamin by any other name"

"Those diet dictocrats are at it again... We have strong evidence that there's a nutrient that really should be classified as a vitamin. Why don't you know about it and why isn't it currently called a vitamin? Because they want to make a drug out of it so they can patent it and profit from it"

Really! His website is selling PQQ with claims for all sorts of medical effects. This would not be allowed if it were being marketed as a drug (as nothing has been properly tested or proven). As a nutritional supplement he also cannot make his claims on the bottles but he does it on this website. He sells huge numbers of supplements and sells many books.

As with other websites the claims of the marketers are often factually incorrect, wildly exaggerated and have many misunderstandings about biochemistry and physiology.

The questions that must be considered:

Is there any evidence that PQQ is essential in the human diet?

Is the nutritional evidence on lab animals relevant?

Is there any evidence that PQQ has a 'normal' role in human metabolism?

To what extent can conclusion based on studies of isolated cells be used as a basis for nutritional supplementation.

Some facts

There is a huge amount of information about the 'natural' role of PQQ in bacterial enzymes.

There is relatively little evidence for PQQ ever having a normal role in biochemistry or physiology of humans.

The concentrations of PQQ measured in humans are tiny.

Studies of rats with a low PQQ diet have a very special diet that contains tiny amounts of residual PQQ that is very much lower than in any normal diet without added PQQ (such as we would typically eat). The rats with added PQQ are given amounts of PQQ that are more than 100 times (g/Kg body mass) that are sold as supplements (typically 20mg).

PQQ is certainly a powerful anti-oxidant because it can remove free radicals. This is 'merely' a result of its orthoquinone structure. It does not mean that it has any normal function in this respect.

Mitochondria have their own antioxidant system for removing free radicals that might damage them.

There is no evidence that antioxidants in the diet are a good thing. In fact there is evidence that they may be harmful.

Much of the literature on PQQ as a potential supplement and as being important in normal metabolism is funded by those with a huge commercial interest as suppliers of PQQ (eg Mitsubishi); this is of course does not suggest the science is poorer for this (although the scientists may be richer).

There have been no controlled proper studies on effects (good or bad) of dietary PQQ supplements.

In my judgement

There is no reason to think that PQQ supplements will do good or harm.

Most effects seen in mammalian systems are using PQQ as an experimental 'drug' and do not prove that it has any physiological function.

The majority of claims for benefits in PQQ marketing were not made by those publishing the work that is quoted as evidence.

[TOP](#)

Links to sites that deal with dubious claims and quackery

[QUACKWATCH](#) (highly recommended)

[Badscience.net](#) Ben Goldacre's site, with text of his excellent *Guardian* column too.

[Health Watch](#) (UK)

[Sense about Science](#) an independent charitable trust to promote good science and evidence in public debates.

[ebm-first.com](#): A nice site about the follies of CAM run by an Edinburgh housewife who has suffered from it

[The James Randi Educational Foundation](#)

[The National Council Against Health Fraud](#) (USA)

[ADBusters](#) (see especially the [spoof adverts gallery](#))

[The Richard Dawkins foundation for Reason and Science](#)

[The skeptic's dictionary](#)

[The skeptics' society](#)

[CrankDotNet](#): cranks, crackpots, kooks and loons on the net

[Francis Wheen's Top 10 Delusions](#)

[The Toadstool Millionaires](#): A Social History of Patent Medicines in America before Federal Regulation, James Harvey Young

[The Medical Messiahs](#): A Social History of Health Quackery in Twentieth-Century America James Harvey Young

TOP

Important writers and websites

Ben Goldacre Web Site [Bad Science](#)

Ben Goldacre is an award winning writer, broadcaster, and medical doctor who has written the weekly *Bad Science* column in the *Guardian* since 2003. He appears regularly on Radio 4 and TV, and has written for the *Guardian*, *Time Out*, *New Statesman*, and the *British Medical Journal* as well as various book chapters.

He has won numerous awards, including "Best Freelancer" at the Medical Journalists Awards 2006, the [Healthwatch Award](#) in 2006, "Best Feature" at the British Science Writers Awards twice, for 2003 and 2005, and the Royal Statistical Society's first Award For Statistical Excellence in Journalism (£250 and an engraved crystal paperweight!).

His recent book [Bad Science](#) [2008] is an outstanding contribution to education **[Summary below]**.

His website [Bad Science](#) contains many of his *Guardian* articles and relevant blogs. It has a very useful index to topics on the left hand side and the articles include many relevant links.

Here are a few examples:

[Alternative medicine](#); [Acupuncture](#); [Herbal remedies](#); [nutritionists](#); [Brain gym / Dyslexia miracle cure](#); [Detox](#); [MMR](#); [MRSA](#); [Mobile phone masts/suicide rates](#).

Simon Singh Web Site

Simon Singh is an author, journalist and TV producer, specialising in science and mathematics.

His recent [2008] book **Trick or Treatment** (with Professor Ernst) is an excellent review of alternative medicine; [see below](#) for full description and summary.

His site includes many discussions of maths, physics, education in science; it also includes science book reviews and even a section for [jokes and cartoons](#).

NB: these three writers have all been sued or threatened with legal action as a result of their honest criticisms [on our behalf] of bad science, especially in relation to some nutritionists and alternative therapists.

Simon Singh was sued for libel by the British Chiropractic Association; Singh holds that chiropractic treatments for asthma, ear infections and other infant conditions are not evidence-based. He won the case ([see Wikipedia account](#)). The Sense About Science campaign against libel laws, originally launched in June 2009 as the "[Keep Libel Laws out of Science](#)" campaign, was a pivotal movement that successfully transformed the landscape of free speech and scientific debate in the United Kingdom. Driven by high-profile corporate lawsuits that threatened to silence researchers, the campaign ultimately forced major legislative reform via the Defamation Act 2013.

David Colquhoun Web Site: [Improbable Science](#)

Professor D Colquhoun, FRS held the established (A.J. Clark) Chair of Pharmacology at UCL, and was the Hon. Director of the Wellcome Laboratory for Molecular Pharmacology. He is now an Honorary Fellow of University College, London. [His University College site](#).

He is a fearless enemy of bad science [especially when used to support alternative medicine] and of bad administration.

His [Improbable Science](#) site includes an outstanding, informative, authoritative blog section. I found it best to click on the site and scroll down.

A few examples: The absurdity of University courses in alternative medicine; MMR; Bad science and medicine on the BBC; Degrees without science; homeopathy; fish oil; [The dilemmas at the heart of alternative medicine](#).

A stimulating and joyful read is the [Laughter Section](#).

[Sense about Science Website](#).

Sense About Science is an independent charitable trust. They respond to the misrepresentation of science and scientific evidence on issues that matter to society, from scares about plastic bottles, fluoride and the MMR vaccine to controversies about genetic

modification, stem cell research and radiation.

Recent and current priorities include alternative medicine, MRI, detox, radiation, health tests, the status of evidence in public health advice, an educational resource on peer review and the public language of science.

The James Lind Library **The Website**

Explains and illustrates the development of fair tests of treatments in health care. The principles of fair tests are explained in essays containing many examples. The text of '*Testing Treatments*' – a 100-page book published by the British Library in 2006 – is available here without charge, in the original English, and in Arabic, Chinese, and Spanish translations. To illustrate the evolution of fair tests of treatments from 1550 BCE to the present, the *James Lind Library* contains key passages and images from manuscripts, books and journal articles. The website also contains many commentaries, biographies, portraits, doctoral theses and other relevant material about the history of fair tests.

TOP

BOOKS

TOP

I strongly recommend these books. I found them particularly useful for providing the facts and fallacies relating to alternative medicine, nutritionists' rubbish, conspiracy theories

Bad Science. Ben Goldacre: Read [reviews](#) on amazon [£3.60].

He is a full time medic in NHS and writes the 'Bad Science' column in *The Guardian*.

Dedicated '*To whom it may concern*'.

This book includes outstandingly clear discussions of what makes Good Science in relation to testing the claims of nutrition industry, cosmetics, homeopathy, [etc].

1. Introduction to bad science

2. Brain Gym: A mixture of sensible advice with absolute rubbish pseudo-science. I could not believe it is officially recommended in schools.

3. Rubbish cosmetic ingredients

4. Homeopathy

5. The placebo effect

6. The nonsense du jour. 'Nutritionists': "members of a newly invented profession who must create a commercial space to justify their own existence, and foster your dependence on them. Their profession is based on a set of very simple mistakes in how we interpret scientific literature; they extrapolate widely from 'laboratory bench data' to make claims about humans; they extrapolate from 'observational data' to make 'intervention claims'; they 'cherry-pick'; and lastly they quote published scientific research evidence which seems, as far as one can tell, not to exist".

7. Dr Gillian McKeith PhD. "She is an empire, a prime-time TV celebrity, a best-selling author. she has her own range of pills etc. Scottish Conservative politicians want her to advise the government. The soil Association gave her a prize for educating the public. BUT to anyone who knows even the slightest bit about science she is a joke". NB: Her PhD was bought from a non-accredited college by correspondence course.

8. 'Pill solves complex social problem'. Will fish-oil pills make my child a genius [NO].? Analysis of badly flawed 'experiment' on efficacy of fish oils to improve the IQ of children in Durham. [The 'treated' children did relatively worse than others].

9. Professor Patrick Holford. Founder of the 'Institute for Optimum Nutrition'. He failed to complete his M.Phil in nutrition at University of Surrey. A good old fashioned quack, selling pills of no known value and odd bits of meaningless equipment. His book includes claims that vitamin C is more effective than AZT in treatment of AIDS. The 'Professor' title is not valid. this is an excellent analysis of how we can be hoodwinked by quotations of apparent scientific studies of nutrition.

10. The doctor will sue you now. Matthias Rath sued Ben Goldacre and the *Guardian* for libel. He lost. An 'Alternative therapist',

He claimed multivitamin pills are more effective than drugs in treating HIV/AIDS. He was mainly responsible for Mbeki's policy of not treating South African AIDS patients with drugs [killing hundreds of thousands as a result].

11. Is mainstream medicine evil. Discussion of drug trials - good and bad.

12. How the media promote the public misunderstanding of science. He deals here with the 3 categories of Science stories: the wacky stories, the 'breakthrough' stories, and the 'scare' stories. "Each undermines and distorts science in its own idiosyncratic way".

13. Why clever people believe stupid things. Why it is not safe to let our intuitions and prejudices run unchecked and unexamined. The value of statistics.

14. Bad stats. How statistics are misused and misunderstood [especially by journalists]. This is an excellent [easy] introduction to statistics and the dangers of not understanding them. Includes how Dr Spock 'killed' thousands of babies.

15. Health Scares. Discussion of the MRSA (superbug) scandalous hoax, and the MMR scare; both created for good stories by journalists.

16. The Media's MMR Hoax. An extensive analysis of this.

TOP

Testing treatments: better research for better health care. [2006].

Imogen Evans, Hazel Thornton and Iain Chalmers.

This book can be downloaded free from the [James Lind Library](#).

From Foreward by Nick Ross: "This book is good for our health. It shines light on the mysteries of how life and death decisions are made. It shows how those judgements are often badly flawed and it sets a challenge for doctors across the globe to mend their ways. Yet it accomplishes this without unnecessary scares; and it warmly admires much of what modern medicine has achieved. Its ambitions are always to improve medical practice, not disparage it".

Acknowledgements

Foreword by Nick Ross

Introduction

1 New – but no better or even worse

2 Used but inadequately tested

3 Key concepts in fair tests of treatments

4 Dealing with uncertainty about the effects of treatments

5 Clinical research: the good, the bad, and the unnecessary

6 Less research, better research, and research for the right reasons

7 Improving tests of treatments is everybody's business

8 Blueprint for a revolution

References

Additional resources

Index

TOP

Trick or Treatment? Alternative medicine on trial. Simon Singh and Edzard Ernst.

Read [reviews](#) on amazon [£6.29]. [Trick or Treatment website](#).

[Dr Simon Singh](#) is a particle physicist and is a broadcaster and author on Science.

[Professor Edzard Ernst](#) is the world's first professor of complementary medicine. His site is excellent against cheating platitudes etc. For a nice jokey article on data-free alternative medicine go to [Who Needs Data?](#)

Many great books by [Prof. Ernst](#) are available on Amazon They cover this sort of topic:

"There are, in fact, two things, science and opinion; the former begets knowledge, the latter ignorance". The list below comes from Trick or Treatment (I think)
1. How do you determine the truth. <i>"Truth exists - only lies are invented" [Georges Braques]..</i> 2. The truth about acupuncture. <i>'There must be something to acupuncture - you never see any sick porcupines' [Bob Goddard].</i> 3. The truth about homeopathy. <i>"Truth is tough. It will not break, like a bubble, at a touch; nay, you may kick it about all day, like a football, and it will be round and full at evening". [Oliver Wendell Holmes].</i> 4. The truth about Chiropractic Therapy. <i>"...at the heart of science is an essential balance between two seemingly contradictory attitudes - an openness to new ideas, no matter how bizarre or counterintuitive, and the most ruthlessly sceptical scrutiny of all ideas, old and new. This is how deep truths are winnowed from deep nonsences" [Carl Sagan].</i> 5. The truth about herbal medicine. <i>"The art of healing comes from nature and not from the physician. therefore, the physician must start from nature with an open mind". [Paracelsus].</i> 6. Does the truth matter? <i>"It makes good sense to evaluate complementary and alternative therapies. for one thing, since an estimated £1.6 billion is spent each year on them, then we want value for our money". [HRH The Prince of Wales].</i> The appendix: Rapid guide to alternative therapies [a single excellent page each]. The conclusions are based on the best reviews available [many from the Cochrane Collaboration]: Alexander Technique; Alternative Diagnostic Techniques; Alternative Diets; Alternative Exercise Therapies; Alternative Gadgets; Anthrosophic Medicine; Aromatherapy; Ayurvedic Tradition; Bach flower Remedies; Cellular Therapy; Chelation Therapy; Colonic Irrigation; Craniosacral Therapy (or Cranial Osteopathy); Crystal therapy; Cupping; Detox; Ear Candles; Feldenkreis Method; Feng Shui; Food Supplements; Hypnotherapy; Leech therapy; Magnet Therapy; Massage Therapy; Meditation; Naturopathy; Neural Therapy; Orthomolecuar Therapy; Osteopathy; Oxygen Therapy; Reflexology; Reiki; Relaxation Therapies; Shiatsu; Spiritual Healing; Traditional Chinese Medicine. I have summarised many of these in the section below on Alternative Therapies Final message [quoted verbatim from Trick or Treatment]: Too many alternative therapists remain uninterested in determining the safety and efficacy of their interventions. these practioners also fail to see the importance of rigorous clinical trials in establishing proper evidence for or against their treatments. and where evidence already esists that treatments are ineffective or unsafe, alternative therapists will carry on regardless with their hands firmly over their ears. Despite this disturbing situation, the market for alternative treatments is booming and the public is being misled over and over again, often by misguided therapists, sometimes by exploitive charlatans, We argue that it is now time for the tricks to stop, and for the real treatments to take priority. In the name of honesty, progress and good healthcare, we call for scientific standards, evaluation and regulation to be applied to all types of medicine, so that patients can be confident that they are receiving treatements that demonstrably generate more good than harm. If such standards are not applied to the alternative medicine sector, then homeopaths, acupuncturists, chiropractors, herbalists and other alternative therapists witll continue to prey on the most desperate and vulnerable in society, raiding their wallets, offering false hope, and endangering their health.
Voodoo Histories: The role of the Conspiracy Theory in Shaping Modern History.
David Aaronivtch. Author, Broadcaster, travel writer and Times columnist
Read Reviews on amazon [£12.99].
This is was written "to provide ammunition for those (like myself) who have found themselves at the wrong end of a conversation about moon landings or twin towers".
In addition to these two 'conspiracies' he covers most of the commonly quoted conspiracies including Pearl Harbour ['arranged' by Roosevelt], the assassinations of the Kennedy brothers and Martin Luther king, the death of Marilyn Monroe, David Kelly, McCarthyism, The Protocols of the Elders of Zion, and more.
TOP

HOME

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THANKS for help to [Hugh Anthony](#) and [Carl Gore](#)

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