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follow the policy that I have followed of increasing the intake. It can be either one chunk, one dose in the morning, or even better three doses throughout the day, increasing the intake until a laxative effect is observed, speeding up the rate of elimination of waste material from the bowel. So my suggestion is every person who wants to have the best of health should increase the intake of vitamin C to somewhat less than the amount that causes significant looseness of the bowel.

Q How do you think your opponents will remember you?

A Molecular biologists will of course remember me as one of the founders of molecular biology, and chemists in general will remember me as one of the founders of modern chemistry, changing it from a pretty descriptive to a far more rational sort of science, and physicians will remember me as having been at least in part, responsible for the revolution in medicine in which there is a great improvement in human health and in control of disease through the use of vitamin C and other vitamins. This will include my opponents, although the opponents may have died off by that time.

Excerpts from interviews with Tony Edwards for QED BBC Television, and with Patrick Holford at the Power of Prevention conference.

Linus Pauling

The Last Interview

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Dr Linus Pauling - The last interview

Q When you published 'Vitamin C and the Common Cold' what did you expect that to do to medical thinking?

When my book was published near the end of 1970, I thought the medical profession and ordinary people would be pleased. They would be pleased that they no longer were suffering the miseries of the common cold and related diseases and the physicians would be pleased in that they were no longer bothered by patients with the common cold for which they didn't have any very good treatment anyway, but could concentrate on more serious illnesses. So I was astonished at the reception that I got when the Professor of Medicine at Mount Sinai College of Medicine wrote to me complaining about my statement that vitamin C, three grams a day would provide considerable protection against the common cold.

I checked the medical literature to find what evidence there was at that time. I found four controlled trials, recently well-conducted trials, involving what I would describe now as rather small amounts of vitamin C per day of between 200mg and a 1,000mg per day. I think that the best one of these four early trials was done by

food, as 500mg tablets and that puts extra lysine molecules in the blood. They enter into competition with the lysyl residues on the wall of artery and accordingly count to prevent the lipoproteinA from being deposited or even will work to pull it loose and destroy the atherosclerotic plaques.

Q Do you think the treatment of lysine and vitamin C can reverse the atherosclerotic process?

A I think so. Yes. Now I've got to the point where I think we can get almost complete control of cardiovascular disease, heart attacks and strokes by the proper use of vitamin C and lysine. It can prevent cardiovascular disease and even cure it. If you are at risk of heart disease, or if there is a history of heart disease in your family, if your father or other members of the family died of a heart attack or stroke or whatever, or if you have a mild heart attack yourself then you had better be taking vitamin C and lysine.

Q How do you decide how much vitamin C is right for you and, if you take 3 grams should it be split throughout the day?

A In my opinion adults should be taking at least 2 grams a day. There is much evidence about increased health with 2 grams a day, and of course even more with 4 or 6 grams a day. Even an extra 60mg had been shown to add value in cutting down the death rate from heart disease, cancer and other diseases. Now my feeling is as people grow older they ought to be increasing their vitamin C and perhaps they should

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How exactly does lysine help to prevent cardiovascular disease?

A Many investigators contributed to showing that lipoprotein A is what is deposited in plaques, not just LDL, but lipoprotein A. If you have more than 20mg/dl in your blood it begins depositing plaques and atherosclerosis so the question then is what causes lipoprotein A to stick to the wall of the artery and cause these plaques? Well countless biochemists and other chemists are pretty smart people and they discovered what it is in the wall of the artery that causes lipoprotein A to get stuck to the wall of the artery and form atherosclerotic plaques and ultimately lead to heart disease, strokes and peripheral arterial disease. The answer is there is a particular amino acid in a protein in the wall of the artery - lysine, which is one of the twenty amino acids that binds the lipoprotein A and causes atherosclerotic plaques to develop. I think it is a very important discovery.

Well, now, if you know that there are residues of lysine, lysyl residues, that hold the lipoprotein A to the wall of the artery and cause hardening of the arteries, then any chemist, any physical chemist would say at once that the thing to do is to prevent that by putting the amino acid lysine in the blood to greater extent than is normally. Of course you get lysine normally in your food. Meat in particular contains a good bit of lysine. And you need lysine to be alive, it is an essential amino acid, you have to get about a gram a day to keep in protein balance, but you can take lysine, pure lysine, a perfectly non toxic substance in

Dr Ritzel, the physician for the school system in Basle, Switzerland. he gave 270 schoolboys at a winter ski camp either a gram of vitamin C per day, in a capsule or a placebo. It was a randomized double-blind, controlled trial and with each boy the nurse made sure that the boys swallowed the capsule so that he didn't have the trouble that other investigators have of the boys, boys especially, not swallowing the capsule but instead, trading them back and forth so that you, the investigators, didn't know which one had received the vitamin C and which the placebo. The result was 63 per cent less illness with the common cold for the boys who received the vitamin C compared to those who received the placebo. Well, this was a very good trial.

In a paper by a Professor of medicine at the University of Helsinki, Finland about vitamin C and the common cold, he mentioned the publication of my book and said that he had decided to check the medical literature to find out how many studies had been carried out since 1970 on the effectiveness of vitamin C against the common cold. He decided that he would accept only studies in which at least 1 gram a day of vitamin C was given, some of the studies involved 2 grams, perhaps one involved 3 grams a day but mostly they were 1 gram a day of vitamin C in which a placebo was given to half of the subjects and the studies that were randomized and double-blind so that neither the physicians nor the subjects knew which persons were getting the vitamin C. He found 38 clinical trials had been carried out since 1970 satisfying these requirements. 37 of the 38 trials lead to the conclusion that vitamin C had a protective effect

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greater than the placebo and a number of these, a dozen of these clinical trials had high statistical significance at $p=0.001$ - that means 99.9 per cent confidence that the result wasn't just a statistical fluctuation, a chance result.

There is no doubt now that vitamin C in large doses has value against the common cold. My recommendation is not 1 gram a day, or 2 grams a day of vitamin C but at the first sign of a cold, take a gram of vitamin C or 2 grams and then an hour later, if the symptoms still exist - if you're still sneezing, or your nose is running or feel shivery, take another 1 or 2 grams of vitamin C. Keep doing that until you forget because the symptoms have gone away and this will stop a cold in almost every person who follows the regimen.

Q What do you feel about the major criticism that anything over 100mg of vitamin C is a waste of money and goes down the drain because it's eliminated by the body?

A The evidence shows that this is just not true. I myself, twenty years ago or more, read this statement, probably made by Fred Stare, professor then at Harvard School of Public Health, and I decided to check. I was taking 10 grams per day of vitamin C. I collected my urine for 24 hours and analyzed it myself for the vitamin C content. Instead of nearly 10,000mg being eliminated in the urine, 9850mg, I found only 1,500mg, 15 per cent of the dose that I was taking during this trial, so the statement just is not true. Of

you could achieve in the bloodstream by giving a large oral intake. This result was published in Proceedings of the National Academy of Sciences.

Long before Dr Jarwalla did this work, I had written to the president of Wellcome, the manufacturer of AZT, saying that we had some evidence that high dose vitamin C helped to control the disease and perhaps if it were given along with AZT it would be more effective than AZT alone. For one thing, we know with other chemotherapeutic agents, that high dose vitamin C helps control the side effects.

I got no answer.

Only a small fraction of people who are HIV positive develop AIDS. I don't know that any study has been made, such as has been made with some other diseases, to determine whether the ones who then go on to develop full-blown AIDS are people who are low in plasma ascorbate, plasma vitamin C. Maybe that they are. At any rate, I think that HIV positive people should be taking vitamin C up to the bowel tolerance level and that people who have developed AIDS should be taking very large amounts, again up to their bowel tolerance level. It is much cheaper, of course, to take fifty grams a day, that's only a dollar a day, two cents a gram, \$365 dollars a year. AZT used to cost about \$10,000 dollars per person. Vitamin C costs very little in comparison with AZT.

Q Now you are recommending vitamin C and lysine for the treatment of cardiovascular disease.

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as 10 grams of aspirin a day and it's my memory that the LD50, the amount that would kill 50 per cent of patients, is 28 grams of aspirin and that's why many people commit suicide by taking an overdose, a whole bottle full aspirin tablets. So I think that's a good description of conventional medicine.

I'm not against drugs when they are properly used and have said so over and over again. We advocate for every patient with cancer taking high doses of vitamin C as an adjunct to appropriate conventional therapy and I agree with Dr Cameron that surgery - he was a surgeon - surgery is often the best treatment for a malignant condition if the malignant tumor can be removed and sometimes, for a few kinds of cancer, chemotherapy is known to have much value and, for some kinds, high energy radiation has value even though chemotherapy and high energy radiation have pretty serious side effects, are damaging to the body as a whole, nevertheless, the benefit may outweigh the disadvantages.

Q Tell us about the work of your associate Dr Jariwalla on HIV?

A I was very pleased that Dr Jariwalla should have carried out some work in our laboratory on vitamin C and human immunodeficiency virus. They carried out experiments on the virus growing in cells in the laboratory and showing that there were as much as a 99 per cent suppression of the development of the virus in the cells when you had high, large amounts of ascorbate, vitamin C, in the medium - amounts that

course, some of the ingested ascorbate remains in the intestinal contents and doesn't get into the blood stream. It may be as much as a third. Some evidence indicates that perhaps as much as a third remains in the intestinal contents. Well, this does good, protecting the lower bowel against cancer by destroying carcinogens that are present in the fecal material and also does good because of the laxative effect of bringing water into the bowel so that the volume of the waste material is larger. There's also a smaller surface area which helps speed up the process of elimination of this material. The rest of it, two thirds perhaps 6.5 grams when I was taking 10 grams a day, gets into the blood stream but only 1.5 grams is eliminated in the urine. So we can ask what happens to the other 5 grams? The answer I'm sure, in fact we have direct experimental evidence for it, is that vitamin C is rapidly converted into other substances, oxidation products and these other substances, these oxidation products have been shown to have greater value against cancer than vitamin C itself. So if you take large doses of vitamin C you produce large amounts of these other substances, the value of which is still under investigation. We have been studying it for fifteen years.

Q Why has your work on nutrients been countered. Is it Ignorance, Is it prestige, Is it money interests? Why is it being suppressed?

A Well I have thought about that a great deal. Most scientists in general have accepted my idea and ideas of other pioneers. Of course I took over my ideas

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mainly from Irwin Stone and other early investigators of vitamin C. So scientists have said usually "Well Linus Pauling has been right so often in the past, he's probably right about this too". But then an ordinary physician, has the duty of dividing his time and energy for the proper care of his patients. He doesn't have time to read the literature, the scientific and medical literature, and think about a question such as whether there is something new and significant that has been discovered. He has to rely on medical and nutritional authorities and I blame them for having been lazy and biased, and not really willing to keep up with new developments. But why are they biased? Well I decided, 40 or 50 years ago, that when they were trying to understand the action of drugs and also of nutrients, they realized that you give a drug in the amount as large as possible so that its toxicity does not kill a patient in the hope that it will save the patient's life. And there are certain drugs that have great value in protecting against certain diseases. There is no doubt that these drugs have great value. Doctors and investigators have worked hard to determine what the proper dose of a drug is. Now with vitamin C for example, I am sure they said we know what vitamin C does. It keeps people from dying from scurvy and investigators have studied human beings enough to know how much vitamin C they need to give in order to prevent the development of scurvy. It isn't much, just a little pinch each day so they say we know the answer with vitamins just as with drugs. And the answers are the RDAs, 60 mg a day of vitamin C to prevent scurvy, and 2mg of a day of thiamin, vitamin B1, to prevent beriberi and so on. What they

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did not do was to ask this question: here is a substance which has no known toxicity, which can be taken in 1000 times the RDA, the amount that stops people developing scurvy, without causing harm to a person. Is there a possibility that very large doses of vitamin C and the B vitamins and vitamin A, beta-carotene and vitamin E, would have much additional value in improving the health of the people? Twenty-five years ago, when I became interested in vitamins, it was just that question that interested me. I looked in the medical and nutritional literature to find out how much vitamin C a person should take in order to be in the best health, perhaps to control diseases other than scurvy. I couldn't find anything and the result, of course, is for 25 years I have devoted much of my life and time and energy trying to find the answer to the question - how much of these very powerful and important substances should we take to be in the best of health?

Q How would you compare your vision of orthomolecular medicine and conventional medicine?

A One of my colleagues in the field of orthomolecular medicine invented the word 'toximolecular' medicine to describe conventional medicine and this seems to me to be good in that conventional medical practice relies heavily on drugs, all of which essentially are toxic substances. It's hard for me to think of an example of a drug that is like the vitamins in having nearly zero toxicity. With aspirin, some patients with severe arthritis are advised by the physician to take as much

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