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FREE RADICALS AND DIETARY ANTIOXIDANTS

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A free radical is any chemical species (capable of independent existence) possessing one or more unpaired electrons, an unpaired electron being one that is alone in an orbital. Radicals (often denoted by the insertion of the radical dot (·) to indicate that one or more unpaired electrons is present) are generally less stable than non-radicals, although their reactivities vary. The suggestions that free radical mechanisms are involved human diseases continue to fuel interest in antioxidant indications, in particular those from plant extracts. Thus, for example, extracts from rosemary, sage, tea, olives, garlic, onions, grapes, oregano, thyme, yam, mango and vanilla, as well as those from several tropical plants are widely reported. Vitamin E, vitamin C, β -carotene, flavonoids and other polyphenols found in some of these extracts are widely discussed as potential antioxidant prophylactics in cancer chemoprevention. These natural antioxidants can become important *in vivo* only if they are bioavailable and have defined physiological functions. These would include the up-regulation of defence antioxidants, modulation gene expression (with respect to synthesis of DNA repair enzymes), effects on cellular transduction mechanisms, reduction of *in vivo* markers of oxidative stress and/or reduction of disease risks. The chemistry of DNA damage in oxidative stress conditions is widely studied. The most common base lesion is 8-hydroxyguanine. Hydroxytyrosol is one of the naturally occurring phenolic antioxidants found in extra virgin olive oil and in olives. Hydroxytyrosol is a potent inhibitor of tyrosine nitration by peroxynitrite, copper-dependent oxidation of low density lipoprotein and DNA oxidation by peroxynitrite. At equimolar concentrations of peroxynitrite, nitration of tyrosine to form nitrotyrosine is completely abolished indicating complete reaction with and/or scavenging of peroxynitrite by hydroxytyrosol. About 90% of the antioxidant capacity of rosemary extract is

accounted for by carnosol and carnosic acid both of which scavenge the trichloromethylperoxyl (CCl_3O_2) radical, with a calculated rate constant of reaction of $1-3 \times 10^6$ and $2.7 \times 10^7 \text{ M}^{-1}\text{s}^{-1}$ respectively. The potential inhibition of the initiation of skin and mammary tumours are widely documented. The global direction now is to assess the protective effects of natural antioxidants in human health and disease as a function of the levels of markers of oxidative damage. Functional food supplements (including antioxidant products) may be so specifically designed so as to achieve optimum reduction in the risk to specific diseases or maintenance of optimum health status.