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but not with colchicine and purpurogallin trimethyl ester. H<sub>2</sub>O<sub>2</sub>-induced apoptosis also was inhibited by tropolone. ESR spin-trapping studies showed that tropolone dose-dependently inhibited the formation of hydroxyl radicals produced by the Fenton reaction. When the molar ratio of [tropolone]/[Fe<sup>2+</sup>] was 3 or higher, no hydroxyl radical formation was observed. Thus, the protection by tropolone against H<sub>2</sub>O<sub>2</sub>-induced DNA damage and apoptosis appears to be due to formation of a redox-inactive iron complex.

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## VITAMIN E AND REPRODUCTION IN CULTURED SEA BASS: A BACKGROUND REVIEW

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A vitamin E study was performed on fish of the cultured interest, the sea bass *Dicentrarchus labrax* using a high-pressure liquid chromatography method. The first part of the work was devoted to vitamin E detection in plasma breeders, seminal fluid and eggs, and embryo development of sea bass. In the second part of the study, variations of vitamin E levels during the larval development aspect were examined.

The obtained results show a direct correlation of plasma vitamin E with body size of male and female cultured breeders of sea bass. High vitamin E value was found in their seminal fluid, in eggs before and after fertilization and in embryos during development and at hatching, whereas it was low in death embryos and in embryos with a low survival. During the larval development, the vitamin E content decreased slowly but steadily, during the first four days of the larval growth and progressively increased from the 9th to the 40th day. In teratogenic larvae, the vitamin E contents result significantly higher than in normal larvae.

Accordingly, the data are presented as fish antioxidative defence studies in the reproductive processes and presents an indirect evidence of vitamin E in the sea bass reproduction.

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## WHEN EAST MEETS WEST: THE RELATIONSHIP OF YIN-YANG BALANCE WITH ANTIOXIDATION AND OXIDATION

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In modern western medicine, the balance between anti-oxidation and oxidation is a critical concept for maintaining a healthy biological system. It is interesting to note that a similar concept of balance called yin-yang existed in traditional Chinese medicine (TCM). Such balance was first described in the Chinese medical treatise *Su Wen* written 2500 years ago. The yin and yang, however, do not have any concrete physical meaning in modern science and thus it is difficult to find an equivalent term in western medicine to express this dichotomy. In TCM, yin-yang is a term to express the dual opposite qualities of matter. Maintaining yin and yang in harmony is akin to attaining the homeostatic state. Those with counteractive properties like water, coldness, stillness, inhibition and weakness pertain to yin and those with proactive properties, such as fire, heat, movement, brightness, outward, and upward direction belong to yang. Therefore, anti-oxidation processes that prevent the over-oxidation (stress) can be called yin and energy generating oxidation processes naturally belong to yang. For this point of view, there may be a strong correlation between and the yin/yang balance of TCM and the modern theo-

ry of oxidation/anti-oxidation balance. Our study reported here is to reveal such a correlation.

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## ANTIOXIDATIVE THERAPY: NANOTECHNOLOGY PRODUCT TMA-ZEOLITE REDUCES OXIDATIVE STRESS IN CANCER AND DIABETIC PATIENTS

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Reactive free radicals derived from oxygen have been implicated in numerous pathological processes including inflammation, reperfusion injury, hemorrhagic shock, autoimmune diseases, neurological disorders, diabetes mellitus and cancer. Objective of this study was to determine whether tribomechanically activated zeolite (TMA-Zeolite) with the strong antioxidative properties could affect oxidative stress in cancer and diabetes patients.

Blood samples were taken prior to and one month after continuous intake of TMA-Zeolite from 114 cancer (53 G.I, 40 lung, 21 brain tumors) and 62 diabetes patients. The Randox Total Antioxidant Status (TAS) kit was used to determine antioxidant levels of superoxide dismutase, glutathione peroxidase and glutathione reductase. Free radical analytical system (F.R.A.S.) was used to determine antioxidant effect of TMA-Zeolite.

In cancer patients, a mean TAS prior to TMA-Zeolite treatment was 1.23 mmol/L. One month after beginning of TMA-Zeolite therapy there was a significant increase of 42% ( $p < 0.01$ ) in the circulatory antioxidant levels. At the same time the mean F.R.A.S. values dropped by 26.5% ( $p < 0.05$ ). In diabetic patients TAS levels prior to treatment was 1.26 mmol/L and increased to 1.47 mmol/L after one month of TMA-Zeolite intake. The smaller (15%) increase in TAS in diabetic patients is most likely due to the lower (60%) doses of TMA-Zeolite given to diabetic patients as compared to cancer group of patients.

These results have shown strong antioxidative properties of TMA-Zeolite and its ability to reduce oxidative stress in patients suffering from malignant diseases or diabetes. Preliminary results also indicated an association between the decrease in oxidative stress and an improvement in the clinical status and the quality of life. These findings, however, require future clinical testing.

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## ANTIOXIDANT ENZYME MIMETICS TARGETED TO MITOCHONDRIA

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Mitochondria are a significant source of superoxide, hydrogen peroxide and lipid peroxides within cells. These reactive oxygen species (ROS) contribute to mitochondrial oxidative damage and have been implicated in a number of biological processes, including neurodegenerative disease, aging and apoptosis. However, the significance of ROS in biology and disease is still hotly debated. As part of our research into better understanding the significance of mitochondrial ROS in biology and disease we have developed enzyme mimetics that selectively accumulate within mitochondria in cells. To achieve this we take advantage of the substantial electric potential across the mitochondrial inner membrane. This potential drives the uptake of lipophilic cations into the matrix and can therefore be exploited to deliver molecules to