



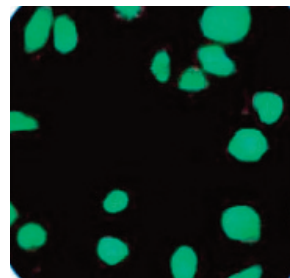
Apoptosis, also referred to as "programmed cell death" or "cell suicide," originates from a combination of Greek words that can be loosely translated as "falling off." Apoptosis is a physiological process essential for the development and function of the human body and other multicellular organisms. Millions of cells routinely die in the bone marrow and intestines every hour. It is estimated that approximately 50-70 billion cells die due to apoptosis every day in an average human adult.

# The Benefits of Micro-nutrients in inducing Cancer Cell Death

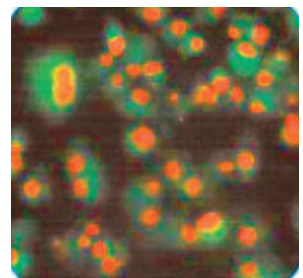
The cellular life cycle (cell division and formation of new cells, their function, and eventual death) of the trillions of cells in our body is a tightly controlled process. Normally, cells "commit suicide" when they are no longer needed. Such suicide – or apoptosis – occurs by activating a specific program within the cells, leading to their destruction without damaging surrounding cells and tissues. Apoptosis is crucial during embryonic development and in growth of adult tissues, e.g., the process of separation of fingers and toes in a developing fetus. Menstruation – sloughing of the inner lining of the uterus – requires apoptosis. Our body routinely entrusts apoptosis to eliminate faulty white blood cells that could cause autoimmune diseases, or to eliminate abnormal cells which could lead to cancer or leukemias.

The development of abnormal cells into cancer is dependent on several factors, one of which is their ability to escape apoptosis. Cancer cells not only multiply uncontrollably, they successfully dodge this

natural mechanism of death. Cancer cells hijack the cell machinery and stop apoptosis by blocking the activity of a particular gene – p53. This protector gene first stops the division of abnormal cells, and



**WITHOUT Micronutrients:**  
living cancer cells are coloured green



**WITH Micronutrients:**  
dying cancer cells are coloured orange

**A hallmark common to every form of cancer cell is their ability to live forever. This disorder is caused by an error in the "software program" of cancer cells. Our studies document that micronutrients can "reprogram" cancer cells and make them commit "suicide", a process which is called apoptosis.**

## The Benefits of Micronutrients in inducing Cancer Cell Death

then initiates either their repair or destruction if the damage is severe. Normally, the p53 gene activates specific apoptotic proteins from the Bcl2 family and the Caspases enzymes that initiate and continue the process of apoptosis. The malfunctioning of the p53 gene results in rapidly growing and aggressive cancers. Restoration of the normal process of apoptosis is one of the avenues being explored for anti-cancer treatments. Several drugs, including Aspirin and other non-steroidal-anti-inflammatory-drugs (NSAIDs), are being researched in cancer cells for their usage as apoptosis inducers.

We explored the potential of micronutrients in inducing apoptosis in different cancer cell lines. Cancer cells are typically immortal, but our results show that a specific micronutrient combination is capable of triggering metabolic and genetic changes that kill cancer cells by inducing their natural cell death cycle. We observed that apoptosis was induced in leukemia cells by increasing the activity and levels of the p53 gene and another pro-apoptotic protein

(Bax protein), as well as simultaneously decreasing the action of anti-apoptosis proteins (Bcl-2 alpha)<sup>1</sup>. In another study, we observed that apoptosis increased with increasing doses of micronutrients<sup>2</sup>.

The pharmaceutical drugs with similar pro-apoptotic action act indiscriminately, inducing apoptosis in cancer cells and healthy cells alike. These drugs can cause brutal side effects including drug-resistance and fatal liver failure. To assess the safety of the micronutrient combination we also tested it on normal cells. The normal cells did not show increased apoptosis, proving the cancer cell-selective action of micronutrients<sup>3</sup>.

**Although apoptosis is vital for destroying abnormal cells it is also important in maintaining optimum health, thus requiring a precise balance between cell formation and destruction. Based on our research, the micronutrient combination is a safe and effective way to achieve this balance.**

1. S. Harakeh, M. et al., *Apoptosis induction by Nutrient Synergy in HTLV-1 positive and negative malignant T-cells, Leukemia Research 2006, 30: 869-881*

2. M W Roomi, et al., *The Anti-Cancer Effect of a Novel Nutrient Mixture by Inhibiting MMPs Expression, Invasion and Inducing Apoptosis in Chondrosarcoma Cell Line SW-1353Vol 1, No 2 (2012)*

3. M.W Roomi, et al., *Induction of Apoptosis in the Human Prostate Cancer Cell Line DU-145 by a Novel Micronutrient Formulation, Open Journal of Apoptosis, 2015, 4: 11-21*

## Important Health Information for All

This information is provided to you courtesy of the Dr. Rath Research Institute. Led by two former colleagues of two-time Nobel Laureate Linus Pauling († 1994) this Institute has become a leader in the breakthrough of natural health research in the field of cancer, cardiovascular disease and other common diseases. The Institute is a 100% subsidiary of the non-profit Dr. Rath Foundation.

The groundbreaking nature of this research poses a threat to the multi-billion dollar pharmaceutical "business with disease." It is no surprise that over the years the drug lobby has attacked Dr. Rath and his research team in an attempt to silence this message. To no avail. During this battle, Dr. Rath has become an internationally renowned advocate for natural health saying, "Never in the history of medicine have researchers been so ferociously attacked for their discoveries. It reminds us that health is not given to us voluntarily, but we need to fight for it."

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