

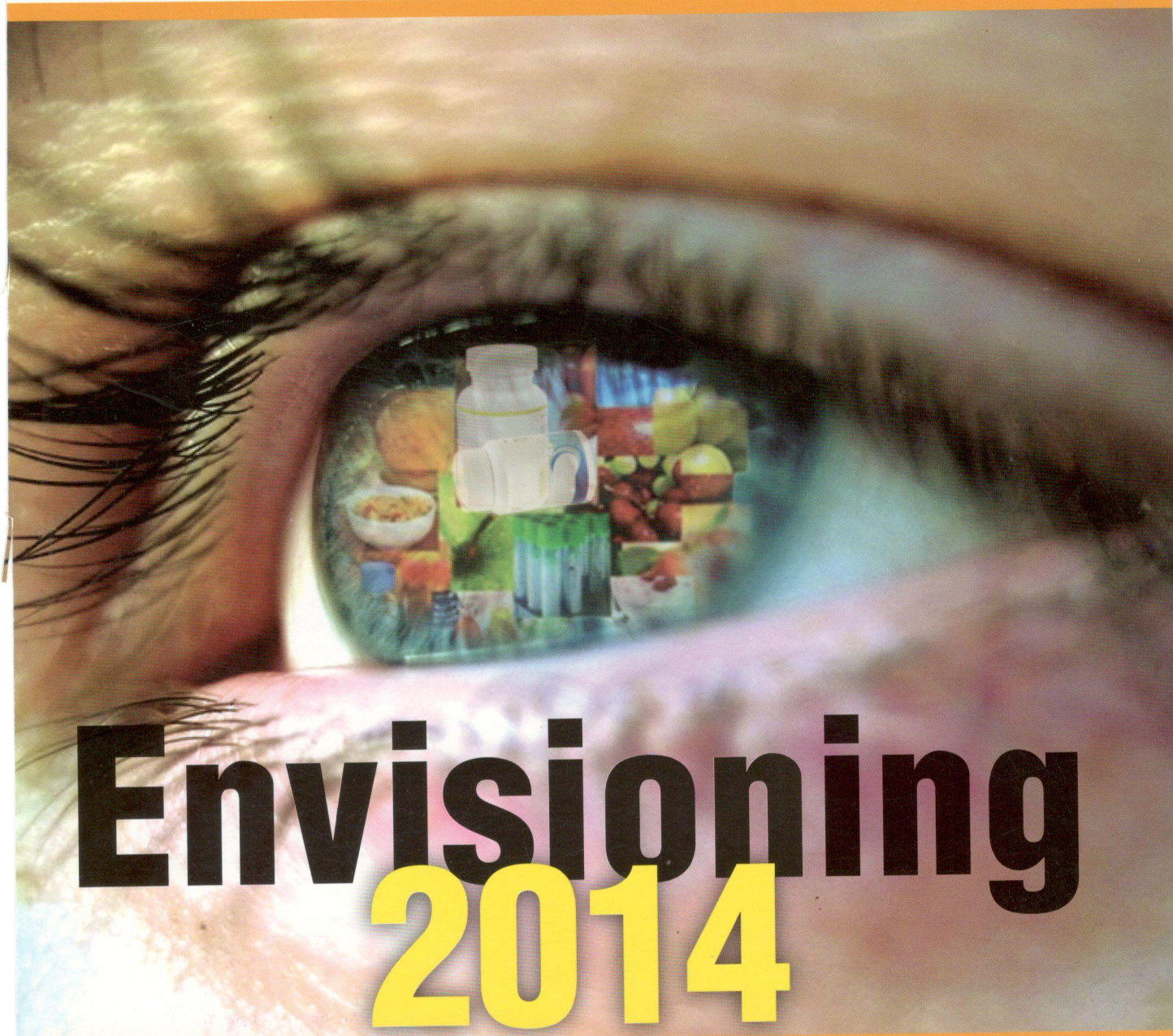
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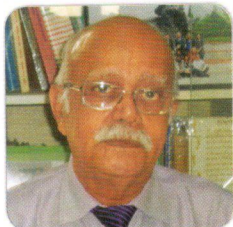


Envisioning 2014

Fraternity to converge
at 9th Nutra India Summit

A pioneer in cellular oxidation:
Albert Szent-Gyorgyi

Are we running away
from UV rays?



Dr Ashok D B Vaidya

Research Director, Kasturba Health Society Medical Research Centre, ICMR Advanced Centre for Reverse Pharmacology in Traditional Medicine, Mumbai

Albert Szent-Gyorgyi

A pioneer in cellular oxidation

"It would take a superhuman ability to explore the deeper foundations of life. What one can do more hopefully, is to investigate just a few of its facets"

Prof Albert Szent-Gyorgyi, a Hungarian scientist, was a pioneer for isolating Vitamin C (ascorbic acid), the deficiency of which causes scurvy. Besides the discovery of Vitamin C he is reputed for his work on energy metabolism of cell. His findings on the topic became the basis of Hans Krebs's citric acid cycle. In 1937, he received the Nobel Prize in Physiology and Medicine for his discovery on "biological combustion, catalysis of fumaric acid as well as isolation and synthesis of Vitamin-C".



Albert Szent-Gyorgyi

Born on December 16, 1893 in Budapest, Hungary, he had no interest in academic work and this too despite being the fourth generation of scientists from his mother's side, the Lenhosseks. But when he was 16 he woke up to the family's scientific heritage and opted to be a doctor. One night at the dinner table he proudly announced his career decision. However, his uncle aware of his previous school records was worried with the idea.

Foundation for Science

After graduating in gymnasium with honours he joined the University of Budapest for his medical degree. His uncle reluctantly let him work in his laboratory for a study on anal epithe-

lium. On this work Szent-Gyorgyi had jokingly said that he "started science at the wrong end". Later he moved up, to hyaloidal bodies of the eye. His papers in early life earned him reputation, which boosted his confidence. He had proven himself worthy by continuing the Lenhosseks tradition. The outbreak of World War I, unfortunately, interrupted his work. He was compelled to join the army. He was disgusted by war and shot himself, claiming that an enemy wounded him. For this act of deception he also earned a silver medal of valor. He was then discharged from the army. About the incident Szent-Gyorgyi said, "I was overcome with such a mad desire to return to science that

one day I grabbed my revolver and in my despair put a shot through my upper arm."

On his return from army in 1917, he received his medical degree and also married Cornelia Demeny. The scarce research opportunities in Hungary compelled him to go to other countries in Europe; he worked with G Mansfeld in Pozsony in pharmacology, with Armin von Tschermak in Prague and Leonor Michaelis in Berlin in electrophysiology. He had to earn personal recommendations for a chance to work in each of these laboratories. In 1922, he became an assistant to H J Hamburger, the professor of physiology at the University of Groningen. It was in Groningen that he got involved in cellular respiration – his lifelong interest.

Serendipitous Isolation of Hexuronic acid (Vitamin C)

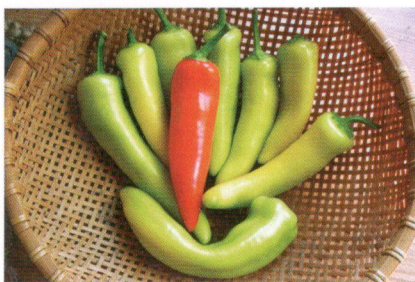
While studying the cellular energy production, Szent-Gyorgyi observed the browning reaction in withering plants. He found that the browning occurs when the plants are unable to prevent oxidation. He found that peroxidase enhanced the browning reaction. The addition of extracts of citrus fruits prevents this oxidative reaction. He set himself to isolate the

antioxidant present in the citrus fruits. Sir Fredrick Gowland Hopkins, father of biochemistry, was impressed with his research on biological oxidation and work on cellular metabolism. As a consequence, he offered Szent-Gyorgyi the Rockefeller Fellowship at the Cambridge University. In 1927 he was successful in isolating the antioxidant from cabbage, orange juice and adrenal glands. He identified the reducing agent as hexuronic acid (C₆H₈O₆). As he noticed that the molecular structure was similar to a sugar he named it in a lighter vein 'godnose'. The editor of the journal, where he submitted the paper, pulled him up for making fun in science.

After work at Cambridge he moved to the Mayo Foundation in the USA. With a huge supply of pigs' adrenal glands he could isolate 25 grams of pure ascorbic acid (hexuronic acid). His global reputation was now established. He moved to the University of Szeged, Hungary, as Professor of Medical Chemistry. His postdoctoral fellow Joseph Svrbely efficiently determined that experimental scurvy in guinea pigs was cured by hexuronic acid. This finally proved the identity of hexuronic acid as ascorbic acid or Vitamin C. Thereafter Szent-Gyorgyi pursued the hunt for the best natural source of Vitamin C for its large-scale isolation. One evening when his wife served him paprika (*Capsicum annuum*), he had an idea that it could be a rich source of Vitamin C. He straight away proceeded to his laboratory and isolated significant amount of Vitamin C from paprika.

Biological Oxidation and ATP generation

After the work on Vitamin C, Szent-Gyorgyi's research focussed on cellular oxidation and energy generation. He was keen to understand "how oxygen contributed to oxidation by the flow of electrons". His work was concentrated on the role of dicarboxylic acids involved in the process. He observed that these acids served as



Hungarian Pepper

catalyst during cellular respiration. Szent-Gyorgyi identified many steps of cellular respiration leading finally to Krebs's Cycle. This work also led him to receiving the Nobel Prize.

Muscle contraction and discovery of actin

Szent-Gyorgyi also had a keen interest in the mechanism of muscular contraction. He had identified two contractile muscle proteins – actin and myosin. His research on muscle tissue contributed immensely to the understanding of cardio vascular diseases. Szent-Gyorgyi's work on muscle inspired generations of scientists in studying muscle physiology. Later in 1947, he moved to USA. In USA he set up his laboratory – Marine Biological Laboratory (MBL) — at Woods Hole, Massachusetts. According to him "discovery consists of seeing what everyone else has seen and thinking what no one else has thought".



Biological control of cancer

Szent-Gyorgyi was drawn to study the role of free radicals in the development of cancer. His research focussed on the tissue and biological factors promoting or retarding cancer. His work on retine – as a cancer regressive factor from human urine has been most intriguing and often controversial.

Unique breakfast

Albert Szent-Gyorgyi told a story of his riding a horse in Jamaica with a gentleman from Illinois, "While I enjoyed my sumptuous breakfast he ate an odd-looking concoction, a mixture of yeast and wheat germ. He ate it, he said, because he used to have several grave colds every year, but since he had been eating this mixture he had had none. Having myself suffered from colds a great deal, I started to breakfast on wheat germ too, and since then I have had no colds either. Earlier, I had always been the first to pick up any cold, and had almost died twice of pneumonia. Now I look at other people with dripping noses and think "You should eat wheat germ and take ascorbic acid... My breakfast consists of the following: a sliced banana, over which I poured about two ounces of wheat germ, and then add milk. I finish with tea to which I add a heaping spoonful of a powder I prepare by mixing 80 grams of ascorbic acid with one pound of confectioner's sugar. The heaping spoonful contains about 1 gram ascorbic acid." The discoverer of Vitamin C has provided a very unique formula for the breakfast. This can provide a product – "Szent-Gyorgyi anti-cold cereal."

Szent-Gyorgyi will be an inspirational figure for many scientists working in the field of vitamins, energy transduction, cancer and the conductive properties of proteins. **NS**

(With inputs from Hiteshi Dhama-Shah, Clinical Dietitian and Research Fellow, Kasturba Health Society – Medical Research Centre, Mumbai)