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Vitamin and mineral inadequacy accelerates aging-associated diseases

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I posited, and have buttressed, "triage theory" (1,2): metabolism responds to moderate deficiency of an essential vitamin or mineral (V/M) so that the scarce V/M is preferentially retained by V/M-dependent proteins necessary for short-term survival and reproduction. In contrast, proteins needed for long term health, which I term "longevity proteins" because they defend against the diseases associated with aging, lose the V/M and are disabled. Most of the world's population, including that of the U.S., are moderately deficient in one or more of the ~30 essential V/Ms. Moreover, since the damage from moderate deficiency is insidious, its importance for long-term health is not being appreciated. Strong support for triage theory comes from Joyce McCann's analyses of the literature on proteins dependent on vitamin K (3) and on selenium (4). Both have built into metabolism this trade-off between short-term survival and long-term health and each uses a different mechanism to accomplish this end. Theory and evidence suggest that this metabolic trade-off accelerates aging-associated diseases, such as cancer, cognitive decline, and cardiovascular disease. Importantly, by the official U.S. Institute of Medicine measure of inadequacy, the EAR (Estimated Average Requirement; the RDA is set at 2 SD above the EAR), most of the U.S. population is below the EAR for one or more V/M. Taking these long-term triage effects into account in setting EARs could lead to numerous changes. We have calculated from the NHANES database that the percentages of the U.S. population that are below the EAR are: magnesium 56%; zinc 12%; iron 16% of menstruating women; vitamin B6 49% of elderly women; folate 16% of adult women. The U.S. population also has very low intake of vitamin D, calcium, potassium, omega-3 fatty acids, vitamin K, and probably others, and this is especially true for children, adolescents, elders, and the obese. Longevity proteins, about half of those studied, indicate a mechanism that could be used for prevention by monitoring for insidious damage and suggest the existence of an undiscovered class of longevity V/Ms, which we are discovering. Our Choribar (V/M-dense, low-calorie, high-fiber, fruit-based) markedly improves metabolism in many human trials.

Biography

Bruce N. Ames is a Professor of Biochemistry and Molecular Biology, Emeritus, University of California, Berkeley, and a Senior Scientist at Children's Hospital Oakland Research Institute. He is a member of the National Academy of Sciences and he was on their Commission on Life Sciences. He was on the board of directors of the National Cancer Institute, the National Cancer Advisory Board, from 1976 to 1982. His awards include: the General Motors Cancer Research Foundation Prize (1983), the Tyler Environmental Prize (1985), the Gold Medal Award of the American Institute of Chemists (1991), the Glenn Foundation Award of the Gerontological Society of America (1992), the Honda Prize of the Honda Foundation, Japan (1996), the Japan Prize, (1997), the Kehoe Award, American College of Occup. and Environ. Med. (1997), the Medal of the City of Paris (1998), the U.S. National Medal of Science (1998), the Linus Pauling Institute Prize for Health Research (2001), the American Society for Microbiology Lifetime Achievement Award (2001), the Thomas Hunt Morgan Medal from the Genetics Society of America (2004), and the American Society for Nutrition/CRN M.S. Rose Award (2008). His 540+ publications have resulted in his being among the few hundred most-cited scientists (in all fields).

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