

is therefore required now is the urgent introduction of the hybrid population, which is already having a wider gene pool than their ancestral groups did, into a new sanctuary as an experimental group along with a habitat restoration programme to be strictly monitored at least in the initial stages.

One may note that another sanctuary is proposed with the contingency of excess numbers in zoos in mind. There is no scope for fear that their numbers will overshoot in the wild, because the natural phenomenon of environmental resistance will increase alongside population size, and the latter will drop back as it nears the carrying capacity. In the zoos, contraception methods could be utilized in the eventuality of excess growth of numbers among the individuals of the remainder left behind. In the wild, lions can survive by predation. Yet at present, their numbers are far less than the optimum that our forests can sustain. In zoos maintenance of big carnivores is questioned sometimes from the point of view of the ethical dilemma of killing some animals to feed others. As pointed out above, lions kill to survive. This natural right of the carnivores is not lost simply by reason of their captivity in zoos. Domestic animals which profusely breed and multiply in farms and which are common should be given less importance than the critically endangered tertiary level of

carnivores, which must be conserved at any cost.

There has been a suggestion from some quarters that hybrids should be culled away. One can never support culling healthy and genetically appropriate lions. Culling of healthy animals which have come into existence because of man's activism is not appreciated all over India, where the lion is an object of worship and forms part of mythology, folklore and the state currency. Even if genetically inappropriate and sterile inter-specific hybrid animals like ligons or tignons were to come into being by wrong breeding practices in zoos, the idea of culling would still be abhorrent to the Indian ethos and they would be magnanimously allowed to complete their lifetimes. Coming to individuals stricken down with incurable illness in Indian zoos, euthanasia is resorted to in order to put an end to the suffering. A total extermination of the hybrids, if suggested is a horrible, unscientific proposition, to say the least.

According to some assumptions, conservation of biodiversity rules out man's intervention, and the purity of African lions and Asiatic lions should be left untouched. But there have been several instances in which man has intervened to preserve the gene pool. It has been reported that when natural hybridization was widespread, the US authorities intervened in order to save the red wolf, even

as their hybrids were brought under conservation programme. Also natural calamities like floods, droughts and wild fires have prompted man to intervene to protect endangered animals, as has been the case in Northeast India, where artificial mounds are built during monsoons so that wild animals, including rhinos might take shelter from the rising waters of the River Brahmaputra. When fragmentation of habitats took place, the Government took the initiative to build forest corridors linking different segments together, thus facilitating conspecific hybridization. Man's intervention in nature, an inevitable feature of his struggle for survival, is a fait accompli and it is futile to shy away from it at this point of time when conservation of animal populations is at stake.

Despite the fact that among human populations there are marked differences in phenotype, genotype and behavioural patterns across the continents, they have not been treated as separate sub-species. No authority has forced on them the law for reproductive isolation as a measure to maintain genetic diversity. Then why, scientifically speaking, a different standard for animals when man himself is an animal?

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A philosophy for integration of ayurveda with modern medicine: A biochemist's perspective

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Ayurveda – wisdom of life – the Indian traditional medicine, is a science developed mainly by the experience and wisdom of our ancestors. As against this, modern medicine (allopathy) is a recently developed, experiment-based science of well-defined chemicals with known mechanisms of action, and possible side effects and toxicity. As the former is experience based and the latter is experiment-based, the former is regarded as arbitrary and the latter as a more exacting science and hence has wider acceptance. Therefore, there is a need to put ayurveda on a firmer

scientific footing and to reap its full benefits integrating with modern medicine.

To the human body all medicines are just chemicals/molecules. Living organisms are unique in that they are self-replicating, self-adjusting, self-repairing and self-evolving systems. The human body is dynamic. All the molecules in our body are being continuously replaced by new molecules from the food that we eat. There are over 40-odd constituents (essential vitamins, amino acids, fatty acids and minerals) that are a must in our daily

food for this process. Only when proper molecules are supplied through our food in ample measures day after day, can one expect that a healthy body will be built and sustained. Medicines are secondary to health; vital nutrients in food are primary to health.

According to the second law of thermodynamics, cosmic force drives the universe towards increase in entropy. Life is order and death is disorder. 'Life is defeating entropy and death is victory of entropy, which is more natural'. Hence life is a miracle and aging, disease and

death are certainty. Thus eating is as much a way of acquiring order, as it is a way of gaining energy for defeating entropy to sustain life.

Living organisms are not at equilibrium. Rather they require a continuous influx of free energy to maintain order in a universe bent upon maximizing disorder. Metabolism is an overall process through which living systems acquire and utilize the free energy they need to carry out their various functions. They do so by coupling the exergonic reaction of nutrient oxidation to the endergonic reactions required to maintain the living state. Plants acquire free energy from the sun through photosynthesis in which the light energy powers the endergonic reactions of carbon dioxide and water to form carbohydrates and oxygen. Animals, on the other hand, acquire their free energy by oxidizing the food constituents from other organisms, through photosynthesis. The free energy generated is coupled to the endergonic reactions through the synthesis of high-energy phosphate compounds such as ATP. The catabolic products from food provide the building blocks for rebuilding the body with the help of its own DNA.

Photosynthesis and respiration are oppositely acting processes that act in concert to keep life in balance. Interestingly, both act to produce internally reducing molecules, NADH and NADPH, the driving force that sustains life. NADH is primarily the driving force to generate ATP, to meet the energy requirement. NADPH is the driving force for the synthesis of proteins, carbohydrates, lipids and nucleic acids to meet the growth requirements.

Life originated in primordial earth's conditions, which included a reducing atmosphere in contrast to today's oxidizing atmosphere. The primary elements carbon, hydrogen, oxygen and nitrogen that go to form the living system, largely existed in different forms than the present. Carbon existed as methane, which now exists as

carbon dioxide. Hydrogen existed as hydrogen gas and today it exists as water. Oxygen existed as water and today it exists as oxygen gas. Nitrogen existed as ammonia and today it exists as nitrogen gas. It is particularly interesting to note that even today in the predominantly oxidizing atmosphere the entire metabolic process of the living system is tuned to create primarily the reducing molecules like NADH, NADPH, etc. to sustain life. The process infuses dead molecules with life and breath using the DNA.

The very act of respiration to derive energy from food for sustaining life, inevitably produces about 2% of reactive oxygen radicals called free radicals. Free radicals can attack and damage almost any vital molecules and structures in our body, irreversibly and permanently, causing disease and death. Free radicals are excellent examples of entropy at work. The breakdown of orderliness is inherent in the physical make-up of the universe and it is the core reason why our bodies deteriorate, and age over time. When entropy gains the upper hand, intelligence must wane.

The body has to constantly fight through the antioxidant defence systems and antioxidants in food to destroy these free radicals, that are continuously being produced in our body. There are several proteins and enzymes like superoxide dismutase, glutathione peroxidase, catalase, etc. and smaller molecules like vitamins C and E, that are efficient in scavenging free radicals. However, when the free-radical load increases beyond the antioxidant capacity, oxidative stress results, thus hastening the aging process and leading to various health problems that one is genetically predisposed to. The best way to deal with this is to keep the free-radical load to minimum.

With the complementary styles of functioning of plants and animals, the life on this planet is in balance. Plants accumulate more reduced molecules,

whereas animal-derived food would contain more oxidized molecules. Therefore, vegetarian food is a healthier option.

From the above account it is clear that reduced molecules (antioxidants) capable of scavenging free radicals, provide vital support for life to go on. It is also clear that the plants are a richer source of such reduced molecules. Ayurveda has an immense store of knowledge acquired over thousands of years of experience, as to which plant has better healing capacity for certain organs and for specific diseases. Although it may have specific healing power, it may also provide the vital life-support as antioxidant.

If our contention that herbal medicines provide vital support to life through their antioxidant activity is right, then this provides a simple tool for its validation. There are several chemical methods that are available to measure total reducing power or antioxidant activity. The use of cyclic voltametry for measuring the reducing power is an attractive proposition. The method can not only give the total antioxidant capacity in any ayurvedic formulation, but the voltammogram can also provide some clues on the types of molecules present.

The opinion expressed here is a biochemist's viewpoint, to integrate modern medicine with our ancient traditional medicine. This is the need of the day. We would be naive to suggest that herbal medicine rests on simply its antioxidant capacity. Of course, they are likely to contain many ingredients that may have direct medicinal value. However, its antioxidant power may also be significantly contributing to its healing power, which is readily measurable.

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