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Biotech and the global burden of disease

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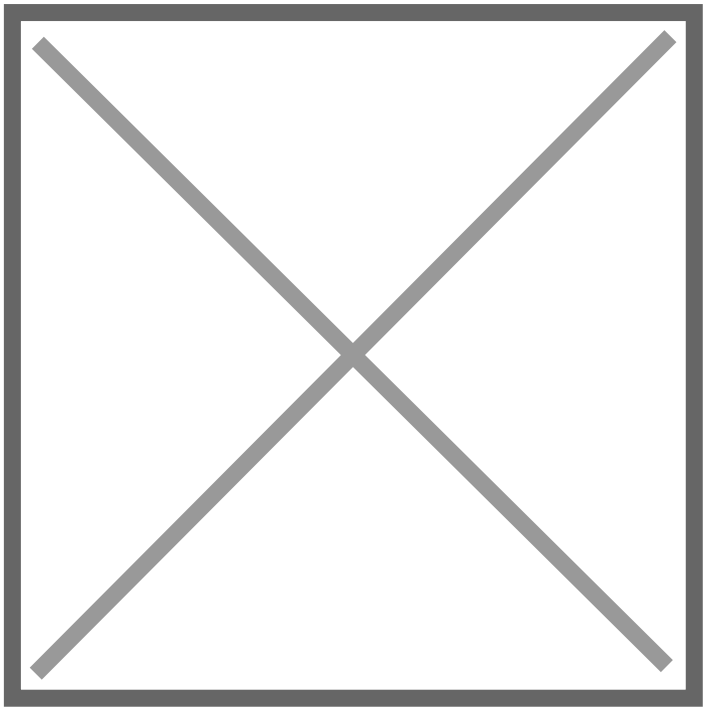
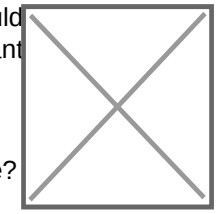


With rapidly increasing consumer awareness, only those technologies will survive in the future that would bring a definable and desirable benefit to the consumer, or help people or government to achieve significant progress. This would be true of biotechnology as of, say, space or new energy targets.



One area where humanity expects a great contribution from biotechnology is in respect of management of diseaseÃ¢â?¬â?•that is, reducing the global burden of disease. What, then, is this global burden of disease? Following a recent study (Ezzati *et al*., *The Lancet*, 2002, Vol. 360, pp.1347-1360), this burden can now be stated in precise terms.

The above study used data collected from 192 countries around the world. The factors listed in Table 1 were identified as the main causative factors for the diseases mentioned against each factor, different countries contributing to a different extent to the total global disease burden on account of a particular factor.

The question we may ask is, where and how can biotechnology contribute to alleviate global suffering on account of the 26 factors mentioned in Table 1. This contribution could be towards prevention of, better and more expedient diagnosis of, and/or cure for a disease. Let me give examples.

To take care of vitamin A deficiency mentioned under item 3 in table 1, we need to be able to provide cheap natural beta-carotene, the precursor of vitamin A, which could be used in mid-day meal program in schools. Shantha Marine is already making inexpensive beta-carotene using a marine algae, seawater and sunlight, in their factory in Tiruchendur, TamilNadu. This is an example of how marine biotechnology can provide inexpensive material to take care of one important global burden of disease. However, this is also an example where it is not only the availability of the material but also a concurrent systems approach on part of the government which would ensure that this material is actually appropriately used, that would be important.

Monoclonal antibodies (MABs) have proved invaluable as agents of diagnosis of a large number of diseases or for determining the genetic susceptibility status of an individual in respect of a disease. It is a pity that, as of now, not a single monoclonal antibody of Indian origin is in the market. We not only need to fill in this lacuna but also develop newer MABs for diagnosis of disorders that are common for us.

Preventive vaccines for diseases such as AIDS, malaria and tuberculosis represent another major need of the time. The production of these vaccines through innovative modern biotechnological routes grounded in imaginative basic research, alone would make them possible and economically feasible.

Those interested in biotechnology and medical health care would be doing a tremendous service if they could collectively prepare a document which would state how biotechnology could reduce the global burden of disease, through development of specific preventive, diagnostic and curative regimens, I believe that *BioSpectrum* is the right vehicle for starting a debate on the above question: that is, how could we, individually and collectively, have biotechnology discharge the above responsibility.

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Factors responsible for the global burden of disease

S No.	Factor	Outcome
1	Underweight	Mortality and acute morbidity from diarrhoea, malaria, measles, pneumonia and selected other group 1 diseases; perinatal conditions from maternal underweight; long-term morbidity from under nutrition
2	Iron deficiency	Anaemia and its sequelae (including cognitive impairment); maternal and perinatal mortality
3	Vitamin A deficiency	Mortality due to diarrhoea, measles, malaria and miscellaneous infection causes of disease (children<5 years); morbidity due to malaria (children<5 years); maternal morbidity and mortality (pregnant women); vitamin A deficiency and its sequelae (all age groups); low birth weight and other perinatal conditions
4	Zinc deficiency	Diarrhoea; pneumonia; malaria in children aged<5 years; adult and pregnancy outcomes
5	High blood pressure	Ischaemic heart disease (IHD); stroke; hypertensive heart disease and other cardiovascular diseases; renal failure
6	High cholesterol	IHD; stroke; other cardiovascular diseases
7	High BMI (Overweight	IHD; stroke; hypertensive heart disease; diabetes; osteoarthritis; and obesity)endometrial and colon cancers; post-menopausal breast cancer; gallbladder cancer; kidney cancer; breathlessness; back pain; dermatitis; menstrual disorders and infertility; gallstones
8	Low fruit and vegetable intake	IHD; stroke; colorectal cancer; gastric cancer; lung cancer oesophageal cancer
9	Physical inactivity	IHD; breast cancer; colon cancer; diabetes; falls and osteoporosis; osteoarthritis; lower back pain; prostate and rectal cancer
10	Unsafe sex	HIV/AIDS; sexually transmitted infections; cervical cancer
11	Lack of contraception	Maternal mortality and morbidity; increased perinatal and child mortality
12	Tobacco	Lung cancer; upper aerodigestive cancer; all other cancers; chronic obstructive pulmonary disease (COPD); other respiratory diseases; all vascular diseases and other medical causes in adults > 30; fire injuries; maternal outcomes and perinatal conditions

13	Alcohol	IHD; stroke; hypertensive heart disease; diabetes; liver cancer; mouth and oropharynx cancer; breast cancer; oesophagus cancer; selected other cancers; liver cirrhosis; epilepsy; alcohol disorders; depression; intentional and unintentional injuries; selected other cardiovascular diseases and cancers; social consequences
14	Illicit drugs	HIV/AIDS; overdose-of-drug-use disorders; suicide and trauma; other neuropsychological diseases; social consequences; hepatitis B and hepatitis C
15	Unsafe water, sanitation and hygiene	Diarrhoea
16	Urban outdoor air pollution	Mortality from combined respiratory and selected cardiovascular causes in adults >30; lung cancer; acute respiratory infection mortality in children <5; cardiovascular and respiratory morbidity
17	Indoor smoke from solid fuels	Acute lower respiratory infections in children <5; COPD; lung cancer, cataracts; tuberculosis; asthma
18	Lead	Cardiovascular diseases; mild mental retardation; anaemia; gastrointestinal effects; nervous and reproductive system effects; social consequences of IQ loss
19	Global climate change	Diarrhoea; flood injury; malaria; malnutrition; dengue fever; cardiovascular mortality; effects arising from population movement
20	Risk factors for injuries	Unintentional injuries; intentional injuries
21	Carcinogens	Leukemia; lung cancer; mesothelioma; cancers of multiple other sites
22	Airborne particulates	COPD and asthma; pneumoconiosis; silicosis; asbestosis
23	Ergonomic stressors	Lower back pain
24	Noise	Hearing loss
25	Unsafe health-care injections	Acute infection with HBV, HCV and HIV; cirrhosis and liver cancer; selected other infectious diseases
26	Childhood sexual abuse	Depression; panic disorder; alcohol misuse/dependence; drug misuse/ dependence; post-traumatic stress disorder and suicide in adulthood; non mental health outcomes such as sexually transmitted diseases, unwanted pregnancies and injuries

Note: Factors 1-4 relate to childhood and maternal under nutrition; 5-9 to other nutrition-related risks and physical activity; 10-11 to sexual and reproductive health; 12-14 to addictive substances; 15-19 to environmental risks; and 20-24 to occupational risks. (Adapted from M. Ezzati *et. al*., *The Lancet*, Vol. 360, November 2, 2002, pp. 1347-1360)