

Editorial

We are now in second half of second decade of the 21st century. This century has been defined by the scientists as the golden age of gaining knowledge and application technology of that knowledge for benefits of crops, forests, animals and humans.

One of the most important problems of this century is global warming caused by the emissions of nearly 3600 kilo tons of CO₂ greenhouse gas per annum. Developed and developing countries like China (29.5%), USA (15%), EU-28 (10%), India (6.5%), Russia (5%), Japan (3.5%) and Germany (2%) are the main culprits. If we consider the per capita emission of carbon (in metric tons) is very high in rich countries like USA (16.5), Saudi Arabia (16.8), Canada (15.9), Australia (17.3), Russia (12.4) and South Korea (12.3); but it is low in China (7.6) and India (1.8). The huge amount of CO₂ in the atmosphere does not allow the solar heat to be radiated out in space, instead each molecule of the gas is radiating the absorbed heat back to earth causing global warming. At present the average temperature of the world is about 1^oC which is higher than the temperature prevailing before the industrial revolution in Europe. Along with the world warming we are facing erratic climatic conditions like drought, excess rain and increased numbers of cyclones and typhoons causing large scale devastations of human settlements in coastal regions. The already existing problem has been made more challenging by the Paris conference (December, 2015) on Climate Change. It resolved that zero carbonization following the Kyoto protocol is not possible now, but the culprit countries and others also agreed to decrease the emission of the gas as far as possible so that the global warming would not exceed 2^oC by 2025. This is a fallacious resolution. We are already experiencing the awful effects of 1^oC rise in temperature. What would happen when it would be 2^oC ?

Carbon emission is mostly resulting from generation of electricity for domestic and various industries and transport industry. Fossil fuels like coal petroleum and natural gas are burnt to produce electricity in thermal power plants. Transport industry also uses petroleum and/or diesel. About 815 Kg of CO₂ is produced to generate one megawatt of electricity per hour and 362 Kg of CO₂ by burning petroleum to generate same amount of energy. The statistics in essence indicates that 1.1 Kg of CO₂ is produced to generate 1 KW/ hour. To achieve zero carbonization we need alternative energy sources. France uses nuclear, hydro-electric, solar and wind power for 90% of its energy requirement. Holland uses wind, solar and ocean's wave power for generation of major amount of her energy needs. India's use pattern is similar to America ; mostly fossil fuels, but she also uses hydro-electric, solar and wind power.

It is of interest that religious leaders are now speaking out. The pope Francis in his encyclical letter (Laudato Si') on may 24, 2015 has mentioned that most global warming in recent decades is due to the great concentration of greenhouse gases like carbon dioxide and others released mainly due to human activities. He further stated that "Many who possess more resources and economic and political powers seem mostly to be responsible for the pollution and climate change. There is an urgent need to develop policies so that as early as possible the emission of carbon dioxide and other greenhouse gases can be drastically reduced, for example, substitution for fossil fuels and developing sources of renewable green energy" Pope Francis also made scathing remarks about laissez faire economists to mobsters, drug lords, illegal organ harvesters and human traffickers. All are part of a "throwaway culture," the Pope argues, that treats human beings as just another commodity to exploit. The pope further criticized modern capitalism — especially aspects of the free market — in "Laudato Si." On 17 June the Lambeth Declaration on Climate Change — signed by representatives of the Church of England, Muslims, Sikhs, the Catholic Church in England and Wales, the Methodist Conference and Jewish communities — spoke of the same urgent need for action. The scientific evidence that climate change is exacerbated by our activity is utterly compelling. It matters not where your political allegiances lie: climate change threatens us all. It is a threat to the whole of the natural world and we are just one species among thousands, but we are the only species that has the power to do something about it. Strangely, only a few have raised their voice in India about the great danger of uncontrolled emission of carbon dioxide in the atmosphere.

One of the most important alternative energy sources could be the use of prodigiously diverse microorganisms and microbial technology. Brazil (no.1) and USA (No.2) are producing huge amount of ethyl alcohol by yeast fermentation technology using starchy/cellulose plant materials. Alcohol is used to produce motor vehicle fuels gasohol (50:50:: Petrol: Alcohol); even Brazil is aiming using 100% alcohol for vehicular transport. Algal bio-diesel and fungal bio-diesel have been reported by USA and Russia respectively. Several types of Microbial fuel

cells have been developed that can use sewage water with organic pollutants for bioelectricity production. Several microbes have been discovered that can perform dual functions bio-remediation of organic pollutants and bioelectricity generation. It is apparent from the above discussion that only man and his scientific endeavor can ameliorate the global warming

To day world population is 6.5 billion and by 2050 it would be about 9 billion. We would have to feed and clothe this extra billion of population. To get more farmable land we would have to cut down forest leading to disturbance of ecosystems of the world. Here also the messiah would be the diverse microorganisms; directly as food like single cell protein (SCP) from yeasts, algae and bacteria, and single cell lipid (SCL) from some fungi and algae. Mushrooms eating would provide a balanced amount of carbohydrate and protein. Fungi and bacteria would be used for production many fermented food and food products.

With the increase in temperature, activity of the existing microbial pathogens would be accelerated and several new pathogenic microbes would appear. We need to combat them with newer drugs. We need to develop effective antibiotics and other drugs for combating diseases of crops, animals and man. Special attention should be given to develop devices for combating multi drug resistant pathogens like tuberculosis, Malaria, HIV and others. Cancer is likely to be in epidemic form by 2025. Several fungal products are now successfully used for combating certain types of cancer. Classical examples are Taxol and its derivatives produced by *Taxomyces* sp. isolated from the bark of *Taxus* plant, and Lentinan produced by the mushroom *Lentinus edodes*. Intensive research is going on all over the world to understand acellular microbes like viruses, viroids and more interestingly the Prions that are auto replicating proteins and deadly pathogenic to animals and humans. Trillions of trillions of trillions of Unculturable cellular microbes are now known by metagenomic study of environmental samples collected from extreme environments like hot springs , extreme saline water, and from arctics' snow crusts. These organisms would hopefully when deeply investigated would provide us drugs, food sources and other beneficial products.

Finally, attention of all microbiologists of all branches are drawn to the call of the Ministry of Science and technology Department of India to the fact that in India Scientific temper is quite low in India and even many scientists lack it. The concept of scientific temper and the use scientific Methods for accretion of knowledge has become low in India as compared to that of Western countries and even that of China and South Korea . We, especially the younger microbiologists need to come out of this lag. Scientific temper of a person is denoted by his knowledge about the cause eclipses, his belief in astrology, numerology and the concept of Vastu and diverse other superstitious beliefs. If we, the microbiologists can acquire knowledge following scientific temper and scientific method and utilize trillions and trillions of microbes for human benefit, the current century would be the golden age of Microbiology and biotechnology.

In the backdrop of this information, a National Symposium on "Biodiversity of Microbes and its Impact" was organized by The Indian Mycological Society in collaboration with the Department of Botany, Calcutta University and held on February 18-19, 2016. Some of the deliberations of the symposium have been included in this issue.

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