Parkinson & lesser emissions

An airport for flying cars, to cater to 'air-taxi' service, said to be 'all electric and zero-carbon', coming up near Coventry, in the UK

S ANANTHANARAYANAN

The blame for many contemporary ills is pinned on the petrol-driven automobile. And the effort the world over is to replace the internal combustion engine with electric motors. Would the solution create problems no better than the ones it solves?

The IC engine was a Godsend, for it replaced the horse. And in doing so, it not only overcame the limitations of horse-drawn transport, but also relieved towns and cities of the growing menace of horse dung. A menace that would have become insurmountable as a result of the prosperity that steam power had created.

London, in the late 1800s, had over 11,000 carriages, public transport vehicles, carts, wagons, buggies — all drawn by horses. The average draft horse produces 10 kg of dung every day. It worked out, every month, to thousands of tonnes, which could not be cleared — and if it were, would soon fill the dumping place. "London was carpeted with a warm, brown matting", said a commentator, and the *Times* of 1894 saw the prospect of London being "buried under nine feet of manure."

The reason it did not happen is that the IC engine took the place of the horse, in cities and the countryside. The motor car needed no loads of hay, and it produced no dung. And then, the IC engine permitted greater speeds and could haul heavier loads. The result was a leap in economic activity, and the still greater role for transport. Where the rise in horse-drawn traffic was caused by rising economic activity, it was the IC engine that set off the spiral that dominated the 20th century.

The result, as we know, is carbon dioxide build-up and global warming. It is not automobile smoke alone that is responsible, of course. Rising populations, electricity generation for industry, lighting, heating and cooling, all contribute. But what keeps everything together is the IC engine. And the electric vehicle, which would create less carbon dioxide, is seen as the icon of a new, sustainable order.

The questions that have been raised are two-fold. The first question is this, how much, finally, would carbon dioxide emissions reduce if we shifted to the EV? With "greener" (in fact, they are just "less brown") electricity generation in many countries, the carbon dioxide economy of running an EV becomes positive in those countries. Exceptions are where the bulk of electricity comes from coal, and India is a leader. But even in the other countries, electricity is generated partly using coal, and the rest using oil or natural gas, with only a part from sources like hydro or wind energy.

Even solar energy has a large brown component, the fact that coal is burned in manufacture of solar panels — it takes the panels 15 years of generating non-polluting solar power to work off the cost of production. The worldwide effort to promote solar power may hence create so much carbon dioxide that it may be too late before the benefits are visible.

Granting that EVs have their merits, however, the second question that arises is whether the main problem that the world faces is one of carbon-free transport or one that is created by other economic activity. The changeover in transport to the EV could create in people a sense of "something being done" and divert attention from the other domains. And worse, even in the matter of transport, it could create new interests, the EV industry, and draw attention away from initiatives like promoting public transport.

The EV is being promoted as "carbon free". This would attract users and investment and may lead to an increase of vehicles on the road and increase individual car use. Even in regions where the EV is clearly better than the IC engine, the EV still has its carbon stamp. Increase in the number of cars on the road could hence negate the gains of the EV. And

Does economic activity rise to mop up the energy saved by innovation?

promotion of the EV as "green" motive power could push up other activity which, thankfully, does not exist today.

Pertinent, in the context, is the post by the World Economic Forum, an international non-governmental organisation based in Geneva, promoting a so-called "airport for flying cars", coming up in November 2021 near Coventry, United Kingdom. The report says that it is the first of many more of its kind, to cater to the air taxi market, said to value $ (United States) 500 billion in the U S alone. And the facility is said to be "all electric and zero emission".

Quite apart from the truth of the claim of "zero emission", even in respect to the fuel used by the air taxis, we can see here the manufacture of the taxis, the batteries, construction of new airports and then roads and local transport for the air taxi passengers. Apart from further activity to sustain the $ (U S) 500 billion market. Does this not look like an instance of technology that could be a solution in one field of activity branching out to create another universe, which is clearly far from sustainable?

The context of Parkinson's law was bureaucracy, the staffing of the Colonial Office in England, which grew as fast as England's colonies were shrinking. The message was the human tendency to increase assets and authority regardless of purpose, in fact, in response to the lack of purpose. But does this law have application in the current context of human activity seeking to consume "to the hilt" all new resources of energy?

It can be said that the problem in the 19th century was the rising consumption, in step with rising production made possible by steam power, rather than the limitations and problems of the horse as a means of transport. And then, increase in coal mining, oil extraction and energy consumption through the 20th century. Would the world have been different if the effects that such developments had on the environment been realised? And should we now take heed of similar effects, when we embark on expansion, in the name of "green electricity"?

One may demand to know who are we to pose this question when we are the ones responsible for the crisis that the world is in. But we need to see that where we stand today is different from where we were a century ago. Global warming became apparent by the mid-1900s and today it is well documented. We are aware that it is important to hold the warming to 1.5 °C, and the method is to contain emissions.

In the context of bureaucracy, when modern methods increase efficiency, organisations get around Parkinson's law by constant vigil, even moving to less working days in a week. And when technology discovers ways to deliver energy with less emissions, it is for us, in the same way, to see that we do not convert the gains into greater consumption.

The writer can be contacted at response@simplescience.in

PLUS POINTS

Gut matters

Researchers at the Indian Institute of Science Education and Research-Bhopal have shown the differences in the type of gut bacteria between Indian and Western populations. The variations arise from the differences in the diet patterns in these two regions — the Indian diet being richer in carbohydrates and fibre than the Western.

Vineet K Sharma, associate professor, department of biological sciences, IISER-Bhopal, along with his collaborators from South Dakota State University, United States, has also elucidated the relationship between gut bacteria and inflammatory diseases such as irritable bowel syndrome. The research on the gut bacterial enterotype in Indian population has been published in the *Nature* portfolio journal *Biofilms and Microbiomes* in a paper co-authored by Sharma along with his research scholars, Vishnu Prasoodanan, Ashok Sharma, Shruti Mahajan, Darshan B Dhakan, and Abhijit Maji from IISER-Bhopal and Joy Scaria from Animal Disease Research and Diagnostic Laboratory, South Dakota State University.

The human gut contains 300-500 types of bacteria that are necessary for our survival. These bacteria help in digestion, protect us from infections and even produce essential vitamins and neurochemicals. In 2011, German scientists classified human beings into three "enterotypes", depending on the kind of bacteria that dominates the gut — *Prevotella*, *Bacteroides* or *Ruminococcus*

In the largest gut metagenome study from India, the IISER team studied the bacterial profile of 200 gut samples taken from people from several Indian locations — Madhya Pradesh, Delhi-National Capital Region, Rajasthan and Maharashtra, Bihar and Kerala. The researchers found that the Indian gut microbiome has the highest abundance of the *Prevotella* genus of bacteria, in particular a species called *Prevotella copri*. This bacterium also dominates the guts of other populations that consume a carbohydrate- and fibre-rich diet, such as the Italian, Madagascarian, Peruvian and Tanzanian. The gut microbiomes of people from Western countries like the U S are dominated by *Bacteroides*.

To understand the functional roles of the *Prevotella* type bacteria, the researchers performed genomic analyses and found that the bacteria contained specific locations ("loci") in their genomes that are responsible for metabolising complex plant carbohydrates and fibres. It is thus logical that this type of bacteria predominates the gut microbiome of healthy Indian and non-Western populations that consume a diet rich in plant-carbohydrates and fibres.

Another interesting observation by the team was that other *Prevotella* species such as *P. intermedia* and *P. nigrescens* were found in the guts of the Western population. Such bacteria are usually found in the mouth, which points to a mouth-gut axis. These bacterial species are inflammatory and have high virulence and antibiotic resistance genes. These species make the Western population more susceptible to gut inflammatory diseases.

Speaking about the practical implications of the work, Sharma said, "Our insights would help in the development of new probiotics and prebiotics for different health-related conditions associated with the gut which is much needed for non-Western populations."

Spectacular sky

British stargazers braved the autumn chill last Wednesday evening to take in the spectacular green flare of the northern lights over the night sky.

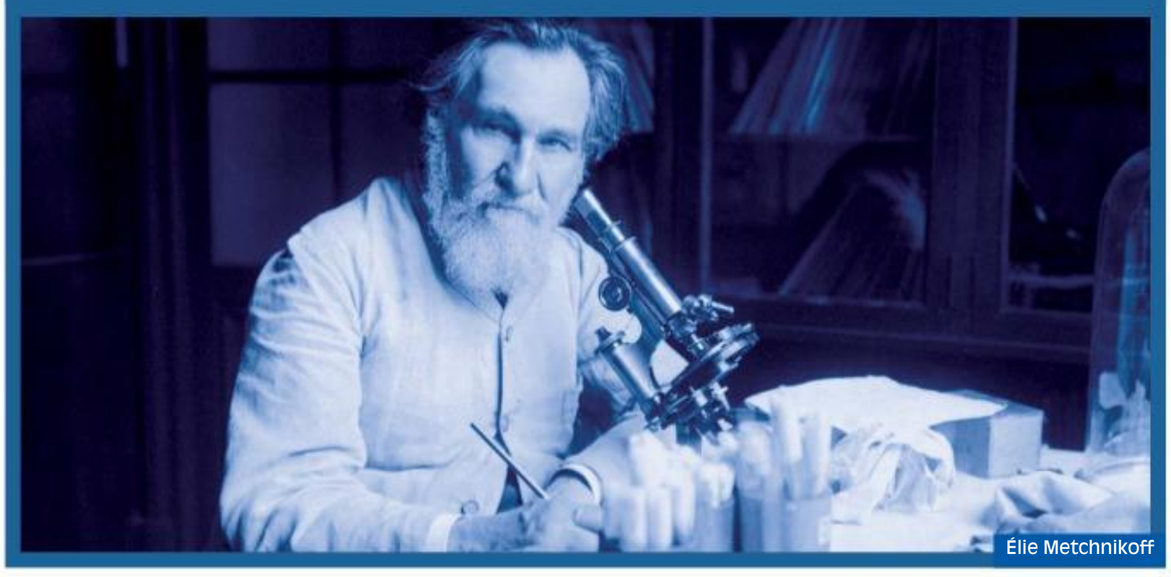
A common sight over the Arctic, northern Canada, Scandinavia and Russia, the aurora borealis is rarely seen over the United Kingdom but was this time spotted as far south as Devon, with the Met Office attributing the phenomenon to a "coronal mass ejection" from the Sun.

The light flares playing out across U K's northern skies are usually only visible at higher latitudes, close to the poles. A particularly strong reaction might be visible further south, dependent on cloud cover and light pollution levels in the air.

—The independent

UNDERSTANDING IMMUNITY

Without the development of microbiology, no medical science could have progressed



Élie Metchnikoff

TAPAN KUMAR MAITRA

The successes of medical microbiology in the field of the aetiology of infectious diseases naturally determined the necessity of studying the mechanism of defence reactions, or immunity. In working out this extremely important theoretical and practical problem, a great contribution was made by outstanding scientists.

The biological theory of immunity marked a new stage in the development of medicine. As a result of long-term investigations, Russian immunologist Élie Metchnikoff studied the process of intracellular digestion in some animals brought about by mesodermal cells. His experiment in 1882 on the transparent larvae of starfish showed that the mesodermal cells protect the body of these ani-mals from injections of foreign matter. These investigations served as the basis for suggesting that similar cells (leucocytes, cells of the spleen and bone marrow, etc.) possess a defence mechanism against pathogenic microbes which have penetrated the bodies of humans and animals.

The study of phagocytosis became the basis for understanding the processes of inflammation. Metchnikoff showed that inflammation is an active reaction against pathogenic microbes. It provides the defence of the body and was obtained during the process of evolution-ary development of animals and humans.

Metchnikoff paid much attention to determining the causes of early aging, and the struggle for human longevity. He laid the foundations for the study of microbial antagonism, which was later applied in the production of antibiotics. In 1903, Metchnikoff, together with the French micro-biologist Pierre Paul Émile Roux, worked out a method for reproducing exper-imental syphilis. He also studied tuberculosis, the nature of malignant tumours, and many other problems of biology and medicine.

Metchnikoff's scientific and social activity aroused the suspicion of the Tsarist government. A world-renowned scientist at the height of fame, he was forced to leave his native land. For 28 years, until his death in 1916, he worked in Paris at the Pasteur Institute. The list of his works containing 322 titles effectively speaks of the scientist's creative activity.

Metchnikoff's study of the problems of phagocytosis was the starting point for the appearance of a number of works which demonstrated that in the defence reactions of the body an important role is played by certain substances in the blood serum, secreted by special cells under the influence of microbes and their toxins.

In 1888, scientists Roux and Alexandre Yersin established that the causative agent of diphtheria produces a biological toxin, and they determined its importance in the development of the disease. In 1890, German scientist Emil von Behring and the Japanese Kitasato Shibasaburo, by means of successive injections of small doses of tetanus and diphtheria toxin into animals, prepared the corresponding immune sera which could protect the animals from lethal poisonings with toxins. At the Pasteur Institute, Roux obtained an anti-diphtheritic serum and used it for treating diphtheria in children. These discoveries provided the basis for the production of medicinal sera against botulism, anaerobic infections, venomous snake bite, etc.

On the other hand, German scientist Paul Ehrlich (1854-1915) created the theory of humoral immunity from which arose a prolonged difference of opinion dividing scientists into two schools — supporters of Ehrlich and his opponents headed by Metchnikoff. The controversy stimulated a rapid series of investigations of the problems of immunity, the results of which were of great practical importance. More improved laboratory diagnostic methods of infectious diseases were devised, and vaccines were obtained against enteric fever, cholera, plague, and other diseases.

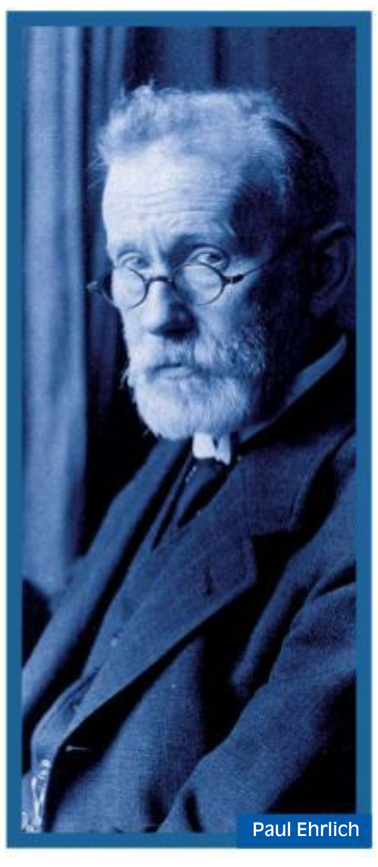
Due to widespread discussions, it was established that insusceptibility to infectious diseases depends on cellular as well as humoral immunity. In 1908, Metchnikoff and Ehrlich were awarded the Nobel Prize for elab-orating the science of immunity. The scientists who discovered the causative agents of several infectious diseases have performed a great service for the advancement of medical microbiology.

In the 20th century, important investigations were made in the field of specific prophylaxis of infectious diseases. In 1924-1925, Gaston Ramon devised a method for the preparation of anatoxins (toxins rendered non-toxic by formalin). With their help, immunisation against diph-theria and tetanus was successfully carried out. Vaccine preparations were received from live, but attenuated, causative agents of tubercu-losis (Albert Calmette and Camille Guerin, 1919), plague (Georges Girard and Jean Robic, 1931), and several other vaccines.

In the last 30 years, the development of the genetics of microorganisms and viruses, as a result of which the biochemical mechanisms of heredity and variation were revealed, should be considered a new stage in microbiology. The genetics of bacteria and viruses is of great impor-tance in the origin of a new field of science — molecular biology.

The success of microbiology contributed to the development of the study of infectious diseases, epidemiology, virology, immunology, sur-gery, hygiene, etc. It can be said without exaggerating that at present there is no medical science which could have progressed without the development of microbiology.

The writer is associate professor and head, department of botany, Ananda Mohan College, Kolkata



Paul Ehrlich