
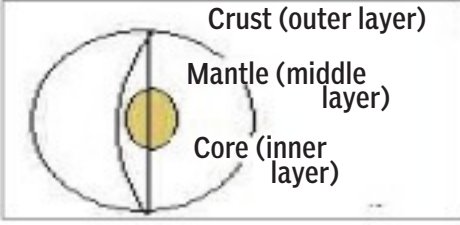
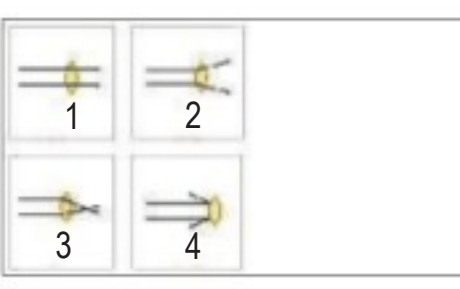
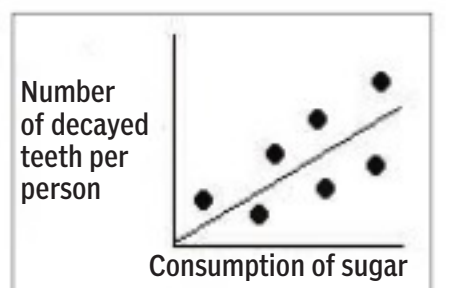
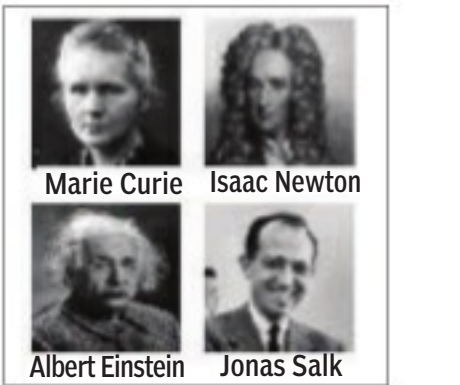


Spreading the word

A US SURVEY SHOWS THAT MUCH OF BASIC SCIENCE IS STILL UNCLEAR TO THE AVERAGE CITIZEN, WRITES S ANANTHANARAYANAN

	This object in space, which an icy core and a tail of dust and gas that extends for millions of miles, is: a. A star b. A comet c. An asteroid d. A moon	86 per cent got this right
Waves used to make cell phone calls are:	a. Radiowaves b. Sound waves c. Light waves d. Gravity waves	72 per cent got this right
	Which layer of the earth is hottest? a. The outer — crust b. The middle — mantle c. The inner — core	78 per cent got this right
Which of these is the main way that ocean tides are created?	a. The rotation of earth on its axis b. The gravitational pull of the sun c. The gravitational pull of the moon	76 per cent got this right
What does a light year measure?	a. Brightness b. Time c. Distance d. Weight	72 per cent got this right
Shimla is at a higher altitude than Mumbai. Which of these is true?	a. Water boils at a higher temperature in Shimla than in Mumbai b. At a lower temperature c. At the same temperature	34 per cent got this right
	Which picture best shows what happens when light passes through a magnifying glass? 1 2 3 4	46 per cent got this right
The loudness of sound is determined by which property of the sound wave?	a. Frequency b. Wavelength c. Velocity or rate of change d. Amplitude or height	35 per cent got this right
	a. In recent years the level of tooth decay has increase b. Some people brush their teeth more often than others c. Eating more sugar cause tooth decay d. People are eating more sugar these days	63 per cent got this right
Which of these elements is needed for creating nuclear energy and nuclear weapons?	a. Sodium chlorite b. Uranium c. Nitrogen d. Carbon dioxide	82 per cent got this right
	Which of these developed polio vaccine? a. Madam Curie b. Isaac Newton c. Albert Einstein d. Jonas Salk	74 per cent got this right
A study on how the study of the planets could affect human behaviour is called?	a. Astrology b. Astronomy c. Alchemy c. Meteorology	73 per cent got this right

As science and technology increasingly dictate how we live, it is tempting to say that a general appreciation of the sciences is the key to a rational and, hence, better lifestyle. On the other hand, we know that there are other factors, historical and cultural, apart from physical, that have worked for affluent societies and it is also not always clear that these societies consistently chart the best course for themselves. But the merits of being well informed in the sciences cannot be denied and a leading public opinion survey body in the USA has conducted a trial to assess how much of simple, everyday science the average US citizen knows.

The Pew Research Centre is an independent organisation in Washington, DC, that collects and provides information about social issues and analyses of media data, opinion and media reports. The current study surveyed more than 3,200 randomly chosen US adults who were asked to answer 12 simple, multiple choice questions chosen to represent high school learning and subjects that are there in the news. "As science issues become evermore tied to policy questions, there are important insights that come from exploring how much Americans know about science," lead author Cary Funk, an associate director of research at the Pew Research Center, said.

The survey, as described in the box, showed that most Americans could answer questions about names and concepts, like who developed the polio vaccine, or about comets or nuclear energy, but did not fare well with terms and applications, like what makes a sound wave loud, or how altitude affects the boiling of water. And the 12 questions were followed by others about sex, age and education level, which allowed the scores to be analysed according to these categories.

The average was 7.9 answers right — with eight right answers being the most common score. As can be expected, higher scores were found with higher levels of education, but even among the educated there was considerable failure in questions of applications — we can see that about 60 per cent went wrong in the questions about boiling water, magnifying lens and loudness. Although postgraduates did well, in the category "some college" the mean scores were 9.1 and 7.5 out of 12 for men and women, respectively. Incidentally, the answers are: 1-b; 2-a; 3-c; 4-c; 5-c; 6-b; 7-3; 8-d; 9-c; 10-b; 11-d; and 12-a.

A glance at the questions shows that they would need editing and change before they could be applied to gauge, for instance, the level of science knowledge in India. In our country, again, the level of literacy is lower and there is the question of language and

medium, as well as the questions of health, hygiene and the environment being, perhaps, more relevant than a question about the comet! But a scientific temper among people is important and a survey to arrive at an objective measure, which could be monitored, would be relevant and more revealing than only statistics of enrolment in schools, the number of graduates and so on.

An effort in this direction with an interesting twist was unwittingly carried out back 1974 as part of project work in a BSc (Statistics) course. A class in a Chennai college surveyed housewives in a pocket in the city to assess their level of science knowledge. One of the questions set, for instance, was, "An electron is?" with the choices of answers as: (a) an atomic particle, (b) an insect, (c) a laboratory instrument, (d) a tumour. While the purpose of the project was an exercise in designing the survey and the analysis of numbers, 300 housewives actually filled in questionnaires and the result was an average score of some 30 per cent of the questions answered correctly.

This survey, which had been done in early 1974 to submit the report by March, happened to be repeated later in the year, taking care to use a different set of subjects along with some from the first lot. To the students' surprise, the results were significantly better. As no error was apparent in the method used, the improvement was intriguing — till it was realised that in May 1974 India had carried out its first nuclear test at Pokharan. Maybe it was this event, which was all science and had been part of the market chatter since May, that had affected how much attention was paid to matters of science, it was suggested.

Unfortunately, these surveys were not rigorous or documented and this suggestion remains mere conjecture. An event like this, which was something momentous in India in 1974, would form part of the cultural milieu of any region. The USA has had over a century of great technological advance, including the space programme and putting a man on the moon. In addition, a survey of 3,748 scientists by the American Association for the Advancement of Science says 87 per cent of scientists believed they should actively participate in public policy debates and 98 per cent of them they have at some time, either through the press or through social media, engaged with the public about their work.

But still, other AAAS studies show wide gaps between scientists and US adults in key areas like whether GM foods or food grown with pesticides are safe, or the causes of global warming, and there is also a strong movement in the USA to teach the *Book of Genesis* along with the theory of evolution in schools. This clearly means cultural and commercial influences would be strong even in advanced societies. Which is not to undermine the importance of understanding science, but it emphasises the need for a dissemination of science to keep alive the torch of reason and the methods of experimentation and verification at a time when survival of the race depends on making the right choices.

THE WRITER CAN BE CONTACTED AT simplescience@gmail.com

PLUS POINTS

Robot replacements



Robots make cocktails, ordered via a tablet, in the bionic bar on board the Royal Caribbean's latest cruise liner, *The Anthem Of The Seas*, a 4,905-passenger ship docked in Southampton. It is billed as the most technologically advanced cruise vessel ever.

Scientists have created a huge in-depth analysis of what jobs are under threat from robots — with salesmen, chefs and even models all in the firing line. They have assembled a full list of all the things robots are good and bad at and say that about 35 per cent of jobs are likely to have been taken on by robots in the next 20 years.

Some professions — such as therapists, personal trainers and teachers — are safe from the coming apocalypse but those people in jobs that call for repetitive skills, the manipulation of data or manual entering of information could find themselves without employment. The full list of probabilities is given at the end of Carl Benedikt Frey and Michael A Osborne's report, *The Future of Employment*.

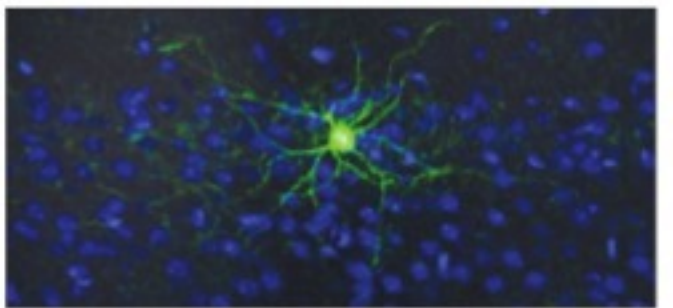
The researchers calculated all of the various advantages that humans have over machines and said jobs that rewarded those traits were more likely to be safe from being stolen. Those traits include creative endeavours such as writing, entrepreneurship or scientific discovery. People in those fields might actually benefit from the robots — entrepreneurs can use technology to "leverage your invention", the researchers point out.

Social interactions are also still highly desired, and something robots aren't especially good at. Humans will still be needed as managers and carers, for instance — at least for the time being, though scientists have been creating robots designed to be friends to lonely people for years. Putting all of those characteristics together let the researchers score the likelihood of robots taking certain jobs. The BBC has created a special tool for finding out exactly how likely a robot is to have your job — online at its Intelligent Machines website.

ANDREW GRIFFIN/THE INDEPENDENT

Molecular changes

The electrical activity of a neuron is considered a fundamental feature of its identity. But new research reveals this attribute is not necessarily fixed, at least in murine cortical inhibitory interneurons. In a paper published in *Science* on 10



Interneuron within the cortex.

September, researchers showed that increasing or decreasing interneuron activity led to molecular changes that ultimately hastened or delayed the cells' electrical discharges.

"This study provides compelling new evidence that even some basic functional properties of neurons, specifically the excitability and firing activity of cortical inhibitory neurons, are profoundly regulated by experience-driven and activity-dependent mechanisms in the adult brain," said neuroscientist Attila Losonczy of Columbia University, who was not involved in the work.

Unlike sensory and motor neurons that connect the central nervous system to the body's organs and tissues, interneurons form connections between neurons. "It's a very, very large and diverse population," said developmental neurobiologist Oscar Marin of King's College London who led the study.

RUTH WILLIAMS/THE SCIENTIST

Desalinating seawater

Researchers at Alexandria University in Egypt have unveiled a cost-effective desalination technology that can filter highly salty water in minutes. It is based on membranes containing cellulose acetate powder, produced in Egypt. The powder, in combination with other components, binds



the salt particles as they pass through, making the technique useful for desalinating seawater.

"The membrane we fabricated can easily be made in any laboratory using cheap ingredients, which makes it an excellent option for developing countries," said Ahmed El-Shafei, an associate professor of agricultural and biosystems engineering in Alexandria University, and an author of the study. The technology uses pervaporation, a technique by which the water is first filtered through the membrane to remove larger particles and then heated until it vaporises. The vapour is then condensed to get rid of small impurities, and clean water is collected.

SCIDEV.NET

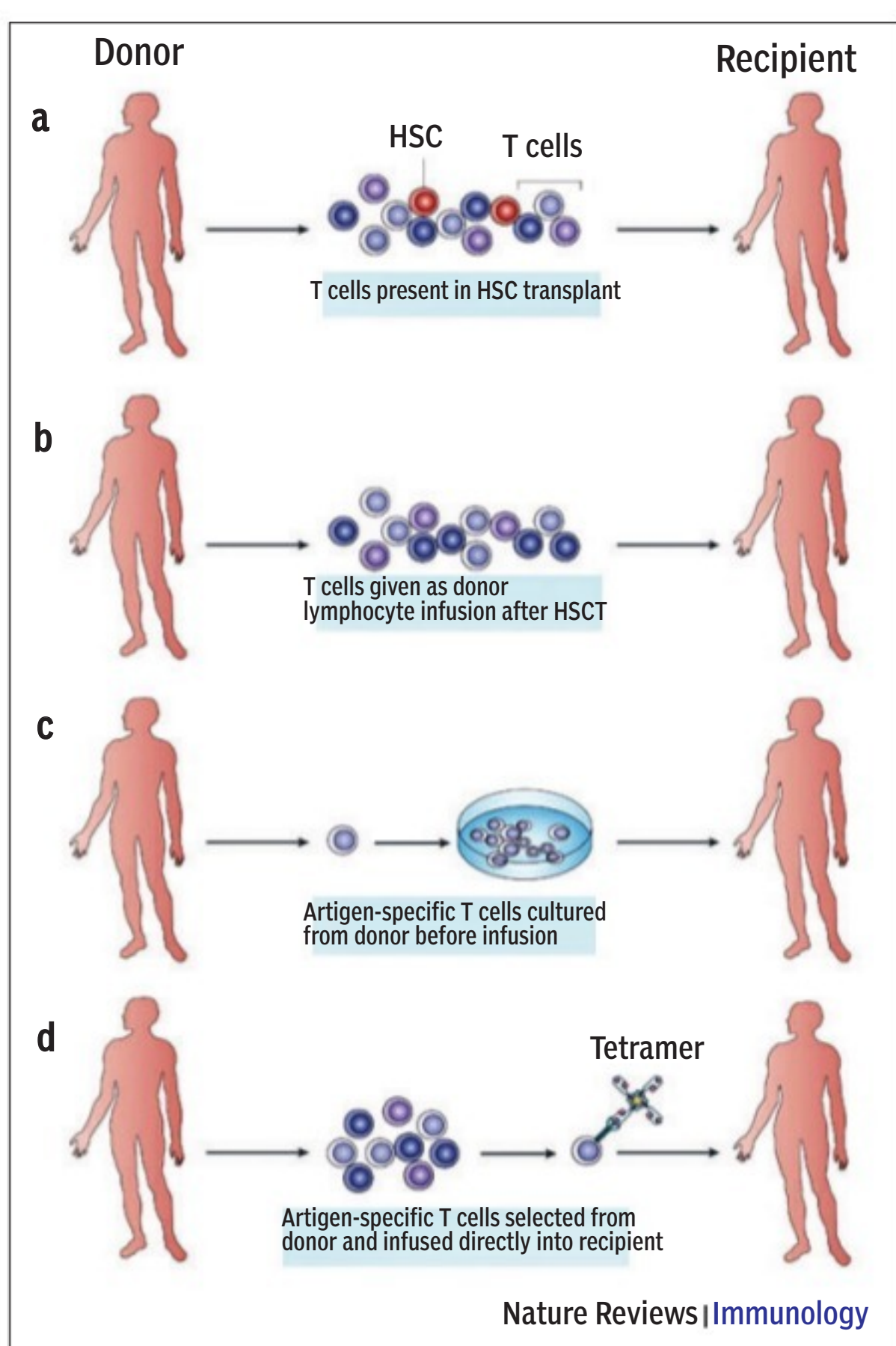
TRANSPLANTATION IMMUNITY

THE PROCESS IS TRIGGERED IN THE EVENT OF A MISMATCH BETWEEN THE TISSUES OF A DONOR AND RECIPIENT, WRITES TAPAN KUMAR MAITRA

The main task of microbiology during the entire history of immunology was to study the mechanisms of insusceptibility and the reproduction of artificial immunity. With the development of surgical techniques in organ and tissue transplantation and increase in the number of deaths from injuries, great efforts are being put into the search for measures by which defence reactions aimed at destroying the grafted transplants (skin, kidneys, liver, heart, etc) would be suppressed.

Transplantation immunity is explained by the fact that the grafted transplant differs genetically from the tissues and organs of the recipient. The donor's genome contains genes that are not present in the recipient — the introduced tissue is genetically heterologous. The synthesis of transplantation antigens is determined by genetic structures, which are called histocompatibility loci (H loci in animals and A/HLA in human beings). Thirteen human histoloci (HLA₁ to HLA₁₃) and 32 additional "working" loci (w₁ to w₃₂) are included in the official World Health Organisation nomenclature.

Transplantation immunity occurs due to a cell reaction of delayed hypersensitivity, though antibodies appear in the recipient. The sensitised lymphocytes exert a cyto-pathogenic effect on cells that differ in one or more genes. Many lymphocytes and lymphocyte-like cells, histiocytes, macrophages and plasma cells gather around the transplant in the vascular walls. The transplant is infiltrated by the lymphocytes and then destroyed by the cells of the infiltrate — its vessels become occluded and it dies



Nature Reviews | Immunology

from ischaemia. The immune lymphocytes destroy the transplanted cell and die themselves. On contact with the transplant or on adsorption of its particles, the host's immune lymphocytes are saturated with the antigens of the transplant. The humoral antibodies against the transplantation antigens combine with the cells. The released intracellular enzymes destroy the cells of the transplant and again free the transplantation antigen. The "enzymatic" destruction of the transplant is therefore accompanied by the simultaneous death of the host's lymphocytes.

The success of transplantation depends on the biological (biochemical and immunological) compatibility of the tissues or organs of the donor and the recipient who must be genetically identical. Total compatibility of tissue cells is only possible between monozygotic twins and between purebred animals produced by inbreeding.

If the donor's and recipient's tissues are not identical, the latter responds by producing transplantation immunity, which leads to the destruction of the transplanted tissue or organ. Transplantation immunity is triggered by lymphocytes as a result of their direct contact with the cells of the transplant without the elimination of antibodies into the blood. The lymphocytes penetrate the transplant tissues, causing its destruction and subsequent resorption. The plasma cells, produced by the recipient organism in large amounts, flood the transplanted organ and clog the small vessels, causing tissue asphyxia. In most cases, the homo-transplants are necrotised and rejected due to transplantation immunity after grafting. The development of transplanta-

tion immunity may be prevented by suppressing the activity of the immunogenic tissues with injections of anti-metabolites (mercaptopyrines or mercaptopterins), adrenal hormones (cortisone), X-ray irradiation, and with the use of other factors. Such measures, however, often lead to grave complications and is not used in clinical practice.

Immuno-depressant therapy in organ and tissue transplantation is accompanied with a suppression of immunological reactivity and sharp increase in the incidence of malignant tumours. In immune-deficiency, the frequency of malignant tumours grows almost a thousand times or even more.

From the analysis of over 150 heart transplantations, specialists have come to the conclusion that the recipient's tissues should differ in no more than two gene groups; in greater incompatibility the chance of "not taking" will be very high.

The principal requirements in organ and tissue transplantation are — completely identical blood groups of the donor and the recipient, maximum tissue compatibility, absence of tissue antibodies at the time of transplantation, careful prevention of infectious diseases, and various complications associated with the use of anti-lymphocytic sera or increased dose of irradiation.

High merit should be attributed to the theories of immunity advanced by Haurowitz and Pauling, Burnet and Fenner, Erne, Scilard, Medawar, Petrov, and others who disclosed the genetic mechanisms of immunity and the cooperation of T- and B-lymphocytes and macrophages in particular.

Immunity, therefore, is among the most complicated reactions occurring at the molecular, cellular and organism levels.

THE WRITER IS ASSOCIATE PROFESSOR, HEAD, DEPARTMENT OF BOTANY, ANANDA MOHAN COLLEGE, KOLKATA, AND ALSO FELLOW, BOTANICAL SOCIETY OF BENGAL, AND CAN BE CONTACTED AT tapanmaitra59@yahoo.co.in