

SCIENCE AND ENVIRONMENT FORTNIGHTLY

Down To Earth

Rs 20.00

JANUARY 15, 1999

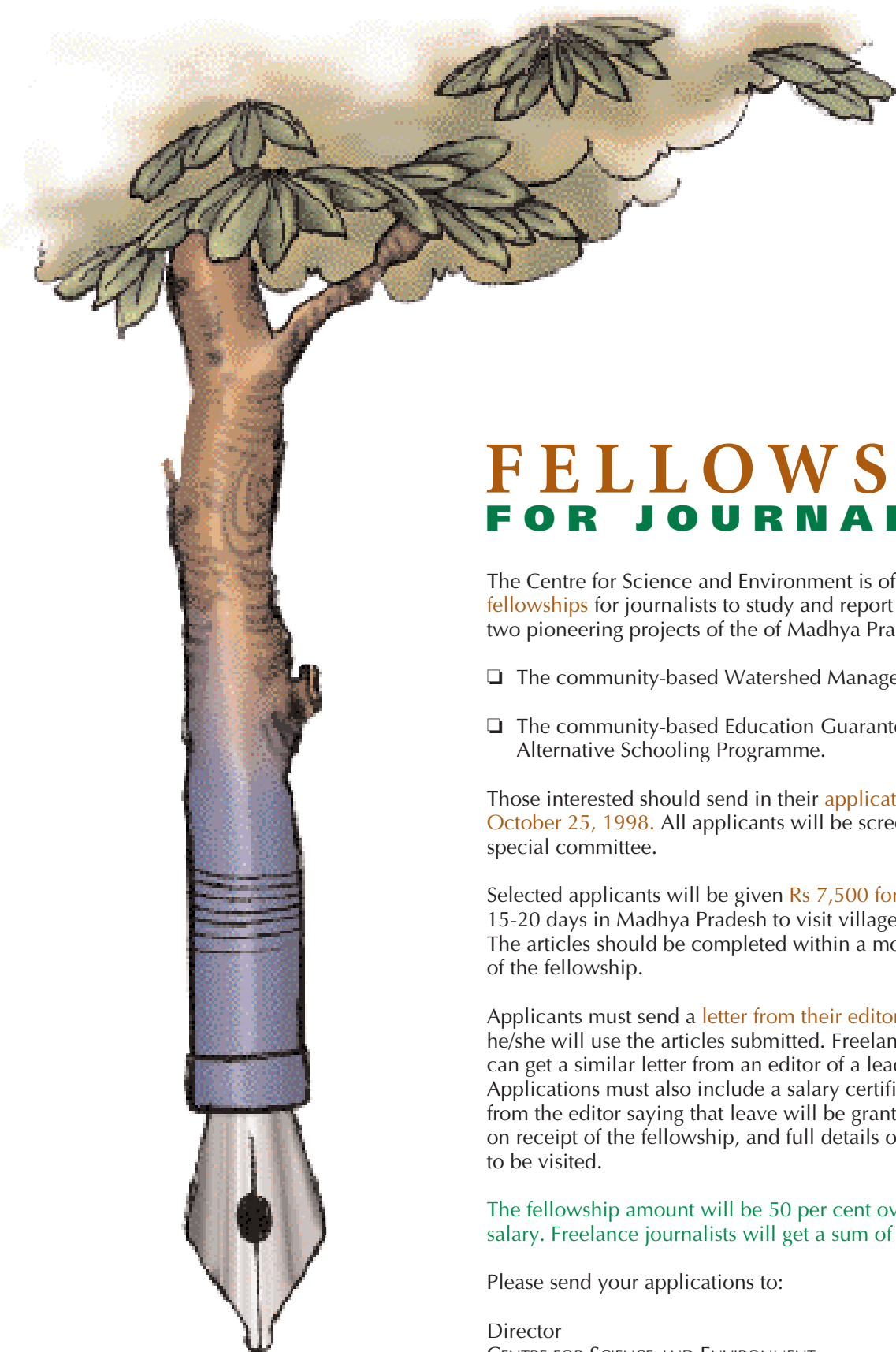
VULTURES ARE DISAPPEARING

BROKEN WINGS



Did Neanderthals suffer from cretinism?
Timber trade across Indo-Nepalese border
Humans build a castle in space

SUBSCRIBER COPY NOT FOR RESALE
Bangladesh: Taka 58.00 / Pakistan: Rs 58.00 / Nepal: Rs 38.00 / Sri Lanka: Rs 117.00 / Maldives: Rf 28.00 / Bhutan: Ngultrum 24 / Rest of the World (South): US\$ 2.70 / Rest of the World (North): US\$ 3.40



FELLOWSHIP FOR JOURNALISTS

The Centre for Science and Environment is offering **one month fellowships** for journalists to study and report the following two pioneering projects of the of Madhya Pradesh government:

- ☐ The community-based Watershed Management Programme
- ☐ The community-based Education Guarantee Scheme and Alternative Schooling Programme.

Those interested should send in their **applications latest by October 25, 1998**. All applicants will be screened by a special committee.

Selected applicants will be given **Rs 7,500 for travel** for 15-20 days in Madhya Pradesh to visit villages and districts. The articles should be completed within a month of the grant of the fellowship.

Applicants must send a **letter from their editor** saying that he/she will use the articles submitted. Freelance journalists can get a similar letter from an editor of a leading paper. Applications must also include a salary certificate, a letter from the editor saying that leave will be granted immediately on receipt of the fellowship, and full details of the places to be visited.

The fellowship amount will be 50 per cent over the existing salary. Freelance journalists will get a sum of Rs 10,000.

Please send your applications to:

Director
CENTRE FOR SCIENCE AND ENVIRONMENT
41, Tughlakabad Institutional Area
New Delhi-110 062
Tel: 699 5778,
Fax: 698 0870, 698 5879
E-mail: cse@sdalt.ernet.in

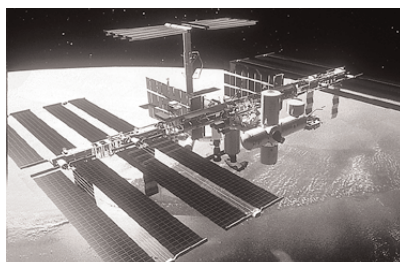


CONTENTS

COVER STORY

Birds of a feather!

Chemical pesticides may be killing vultures, who — like humans — are at the end of the food chain. Are humans next? 29



NEWS

Sky is the limit

Endeavour, the first truly international space station 15

SCIENCE & TECHNOLOGY

In cold storage

Vital organs could soon be 'stored' for transplants at a later stage 50

THE FORTNIGHT

History revisited

Did Neanderthals die due to iodine deficiency? 7



SPECIAL REPORT

Rooted in wisdom

Traditional sciences and technologies still play a vital role in rural India 26



NEWS

Proposals to combat pollution	15
SC on public interest litigation	16
Drug ban in Europe	16
1998: the hottest year	16
Fossil discovery	17
USA is not taking back the toxic waste it dumped in Haiti	18
Spain to increase nuclear power	18

SPECIAL REPORT

Polluters flourish despite a Supreme Court order	21
Basmati rice: the aroma is fading, not the controversy	22
Destroying a forest	24

TRADITIONS

How rain was harvested in a Madhya Pradesh hill-fort	40
--	----

SCIENCE & TECHNOLOGY

Truth about climate change	42
Antarctica: a barometer for climate change	43
A heart-warming discovery	44
Hard manual labour can keep breast cancer away	47
Helping the blind 'see'	47
The importance of redundant genes	51
Calcium's undiscovered uses	51
How limbs were formed	52
An eco-friendly air-conditioner	54

INTERVIEW

Kamal Pareek, a mechanical engineer who used to work at the Union Carbide plant in Bhopal, on the gas tragedy	56
---	----

CROSSCURRENTS

Carbon emissions and the World Bank	57
-------------------------------------	----

REVIEWS

Indian science: bereft of sense	60
---------------------------------	----

STATISTICS

Rising temperatures on Earth	62
------------------------------	----

COVER PHOTO: PRADIP SAHA



VINEET KATARIA / CSE

Dying Darjeeling

The article "Small towns, big mess" (*Down to Earth*, Vol 7, No 13; November 30) was a study limited to eight towns. But many more Indian towns can be compared to the towns you have studied. Here I would like to mention Darjeeling, a tourist town often referred to as the queen of hill stations.

Over the past few years, Darjeeling has become an urban nightmare. Deforestation and unplanned construction have aggravated the problem of landslides during monsoons. The town lacks a proper sewer system and one often sees open drains overflowing into the streets. No one is bothered about waste disposal either. Traffic has grown by leaps and bounds. The roads remain narrow and filthy. These are just a few problems ailing the town. But no one seems to be concerned — neither the residents nor the government.

DEVI BASNET
Darjeeling

Green crusader

The interview with Justice Bhagwati Prasad Banerjee (*Down To Earth*, Vol 7, No 11; October 31) made interesting reading. The efforts of the judge in making Calcutta green are laudable. One of the main sources of noise pollution in the city is the loudspeaker used during religious functions. The courts have done well to prescribe the noise limits for different times of the day. Still, a great deal of noise pollution persists in Calcutta. This is because although our laws are stringent, the implementation is weak. The implementing agencies must be brought to

book for not taking appropriate action.

However, I do not agree with Justice Banerjee's statement that there is no information on the health effects of pollution. Many organisations have carried out detailed investigations to prove that pollution-related deaths are on the rise in cities. The courts would do well to go through such information and take up an activist role in curbing pollution. Their role is important because the state has failed in this direction.

P S DEY
Received on email

Damp squib

This is with reference to the article 'No Armageddon, this' (*Down To Earth*, Vol 7, No 14; December 15). I too, like thousands, stayed awake to watch the promised "spectacular display of God's own fireworks". But it turned out to be a big let-down. Although it was clearly visible in China, in India, we could see only a few of those so-called "shooting stars".

It amazes me that even with all the modern equipments and satellites, astronomers could not predict the exact time of the meteor "shower". It took place 16 hours early. Let's hope the scientists are accurate in predicting the next shower.

RAVI S SHANKER
New Delhi

Bureaucratic bane

The Sukhomajri experience has once again shown that whenever bureaucrats and officials interfere in a people's project, they destroy all the hard work of the community ('Sukhomajri at the crossroads', *Down To Earth*, Vol 7, No 14; December 15). Rajiv Gandhi once said that for every rupee spent for development, only 30 paise reaches the common man. There are numerous examples where officials have diverted funds that were to be used for development. The solution lies in giving power to the people. The success of the conservation programme in Jabua, Madhya Pradesh have shown how communities, when they are empowered, can deliver

when the *babus* fail. The article rightly says: "...the changes... will survive only if the government has a healthy attitude towards them."

PRITHA SEN
New Delhi

International Symposium on Reducing the Impact of toxic chemicals on Asian economic, public, and environment health -- first one to be held on the Bengal Basin in March 1999

A one-week symposium comprising of two conferences will begin on March 2, 1999 — the first one will be held at the Engineering Institute on March 2-4 in Dhaka, Bangladesh. The following one will be held on March 6-9, 1998 at the Vishwa Bharati in Santiniketan, West Bengal, India.

Please send an abstract (of not more than 500 words) of your proposed paper to GRA on or before January 20, 1998 for panel review to:

Dr. Rash B. Ghosh or Dr. Derek Whitworth
PO Box 11553, Berkeley, CA 94712
Ph: 510/841-3253 Fax: 510/841-1201
E-mail: ghosh_research@msn.com



National Seminar on

Low Level Electromagnetic Field Phenomenon in Biological Systems.

On: 3-4 Feb, 1999.

Venue: Delton Hall, IETE Building, 2 Inst. Area, Lodhi Road, New Delhi-110 003

For details contact:

Prof. J Behari 2) Ashis Sanyal
SES, JNU, New Delhi-67 Director, DoE,
Tel: 011-6172438 6, CGO Complex
Fax: 011-6165886 Lodhi Road, ND-3
E-mail: behari@jnuniv.ernet.in Tel: 4362528

CSE ONLINE

www.cseindia.org



- About us
- Down To Earth
- Environment and you
- Environmental resources
- Campaigns
- Publications

Search through fifteen years
of research and documentation
Books. Journals. Images. Videos

Down To Earth welcomes contributions from readers. You can send your contributions to Anil Agarwal, Editor, *Down To Earth*, 41, Tughlakabad Institutional Area, New Delhi - 110 062.

LEADER

And justice for all

A stay order issued in public interest by a court must outweigh the public interest of completing a project in time



JUSTICES Sujata V Manohar and B N Kirpal of the Supreme Court (SC) have in a major ruling — which aims to check the abuse of public interest litigation (PIL) — stated that the public must be compensated if a project meant to benefit is delayed by an interim order of a court. The judges ruled that the public must be compensated both for the delay

in implementation of the project and the escalation in cost resulting from such a delay. The judges were setting aside a Mumbai High Court order through which the execution of the Khaperkheda Thermal Power Station Project was delayed.

The judgement came in response to a plea filed against a ruling of the Bombay high court by a private company. The company had been given the contract for supply, manufacture, design, erection and commissioning of the power plant.

A rival company had lost the bid and moved the high court, which stayed the operation of the Maharashtra government's letter of intent in favour of Raunaq International Ltd.

The judges noted that there was no overwhelming public interest in stopping the project and that stalling the project was a "major detriment to the public" because construction of the two power stations was held up on account of this dispute.

Saying that the high court had seriously erred in granting the stay, SC cautioned courts against entertaining PILs, which could result in delays and are detrimental to public interest. The judges went further: the party at whose instance the interim orders were obtained must be held accountable for their consequences. They must provide for the reimbursement of costs to the public in case the litigation started by such an individual or body fails. The public interest of holding up a project must outweigh the public interest of completing it on time.

This leads to another question. How does this ruling affect legal actions initiated by environmental activists all over the country? How do we decide that they outweigh the public interest of completing those projects in time? The court must clarify this in detail otherwise vested interests will start advocating a ban on PILs from environmental activists. And at the moment it is only the courts that are listening to them. ■

Fire and water

Water is a burning issue in India



WATER means life. It also means death. Three men were recently charged with setting on fire a woman corporator of Navi Mumbai. The reason: water. Corporator Meena Bhagwan More was attacked by the men, workers of another political party. They first doused her with a can of kerosene, then set her on fire. More is in hospital with

80 per cent burn injuries. A tussle over the location of a water pump led to her immolation.

The incident merely shows that water, or the lack of it, has become a very serious issue in Indian cities. Is the problem lack of water, or poor distribution, or the systems inability to manage water? Today water and its supply has become a burning issue in India. Water shortages are chronic. Supply is no longer decentralised. Queues for water are a common sight. How serious is this crisis? If the price one has to pay for bottled drinking water is any indication, it is high time some serious rethinking is done. Bottled water is almost as expensive as milk in the national capital.

India's ability to manage water has taken a severe beating. Indians have a glorious tradition when it comes to managing

and harvesting water. Like rain the supply of water in India was always decentralised. Ancient Indians used tanks to store rainwater and produced intricate systems based on the use of checkdams, ponds and storage structures to manage the local watershed. It was this management of water which resulted in India being one of the world's most prosperous countries. Huge urban centres came up, even in the desert state of Rajasthan. They all had one thing in common. The municipal corporation and the pipeline were both conspicuous by their absence.

The struggle to get control of water merely shows that political party workers have realised that water means votes. What happened in the Navi Mumbai slum was startling. While the woman corporator was trying to get the pump installed in front of her residence, Congress workers succeeded in getting the site changed to another part of the colony, where the residents had more loyalty for the Congress. She threatened to move heaven and earth to oppose the installation. The Congress workers reacted by setting her on fire.

It is high time that the policy makers and political heavyweights in India realise that water is a very important issue. Best left outside the purview of the bureaucracy. It is time to give power to the people, so they can control water. ■

A million mutinies



IT WAS an amazing dialogue. I was annoyed, irritated, enraged. The setting was a mock public hearing organised by Tarun Bharat Singh to enthrone the vil-

lagers who had picked up the courage to tell the government off. The unofficial bench consisted of a retired judge, retired government officials, and people from the civil society like me. The question was: were the villagers of Hamirpura correct in disobeying government orders?

The background to the dialogue was incredible: while all Indians, including river-worshipping Hindus, are hell-bent on destroying every single river of the country, here was a village, which through the dint of its water harvesting work, together with a number of upstream villages, has recharged the groundwater to such an extent that a small rivulet that was lying dead for over 50 years is now flowing round the year again. Amazing. Brilliant.

To my mind, they have shown greater wisdom (*margadarshan*) than, say, India's military scientist, Abdul Kalam. They are the true Bharat Ratnas, telling India how to manage its ecological security in the 21st century. But no appreciation from the rotten government for them. In the mid-1980s, people started building *johads*, traditional structures to harvest rainwater. The irrigation department immediately flexed its muscle. Every stream, channel or *nala* belongs to us, it said, and how dare you build a structure across it? After the villagers dared to go ahead and revive the river, they came along to say that all the fish now belong to the government and calmly auctioned it off.

This is an official loot of nature. The government destroys natural resources; when villagers revive these, it reasserts its ownership. But, in this case, it so happened that the villagers of Hamirpura were life-worshippers and did not want any fish to be killed. They told the Rajasthan fisheries fellows to buzz off. You will get the fish over our dead bodies.

Were they correct? What right do people have over their resources?

With a Father of the Nation who talked about the country as a collective of half-a-million Village Republics, the answer would have been obvious for India. But, no. The judge said the villagers must learn to work with the government, which must control the river. It flows, after all. There are interests of several villages involved. It has to take care of them. An ex-bureaucrat who came along said, "You know, you people are good guys. So, I guess you can do what you want. But I can tell you that there are so many bad guys around. We can't let them take over our natural resources. Government must have control."

For me, it was a pain to listen to these trite and banal arguments, which, given today's situation, verge on being downright fraudulent. Tell me one instance when the government has ensured proper sharing or use of river waters in the country? Delhi imperiously rips off water from the farmers of Haryana. India bullies Bangladesh with impunity. Point out one instance where the government has actually kept rogues under control. Most of the times, it is itself in cahoots with the rogues. I politely asked the judge, "If I, with all my education and influence, find it so difficult to deal with the corrupt and arrogant bureaucracy, you are asking these poor villagers to deal with it?"

I told the villagers that they must not only fight for the right over their natural resources; they must also fight for laws that allow them to do so. When a Britisher had once asked Gandhiji, "What do you think of the Western civilisation?" the wonderful old man had replied, "I think it is a good idea." I told the villagers that if we were to ask him

today, "What do you think of Indian governance?" I am sure he would hang his head in shame and say, "I think it is good idea."

I suggested to the villagers that they should form a River Parliament of all the villages along the river so that having revived it, they can take care of it. They can then become the governors of the river. And this is nothing dramatic. All over the world there are nearly one thousand rivers that straddle more than one nation. And efforts are being made to manage these rivers through river basin associations. What can be done for international rivers can also be done for inter-village rivers. And they can tell the government to buzz off.

I told the judge that if we want to face the challenges of the 21st century, we will have to start 'reinventing government' very fast. Indian bureaucrats have become so incompetent that they today do not even understand, let alone study, what is meant by governance. Yet these characters are supposed to govern.

The manner in which the government has neglected the problems of poverty and illiteracy and left millions of people to wither away — and is now leaving many millions more to die of pollution — is absolutely incredible. The Indian political-bureaucratic system has killed probably 50 million people in 50 years of independence and will continue to murder at even higher rates in the future. It is a delusion that there is even a government today.

The judge said, "You are making the villagers Naxalites." "No, Gandhians," I said. Even the best of Indian intellectuals are so enamoured of *Raj Shakti* (state power) that they have no idea what *Lok Shakti* (social power) can do. But that is what we have to build. My deepest respects for the village of Hamirpura. ■

— Anil Agarwal



The government destroys natural resources; when villagers revive these, it reasserts ownership. This is an official loot of nature

PALEONTOLOGY / NEANDERTHALS

For want of iodine

An iodine-deficient diet may be responsible for the Neanderthals' disappearance

THE fossil record of Neanderthals abruptly ends about 30,000 years ago. Why Neanderthals suddenly went extinct is a topic of much debate even today. Some experts suggest that they may have lost a "fight" with the more technologically-advanced Homo sapiens, while others say interbreeding with them diluted their characteristics. Over the ages, there have been many more explanations.

Jerome Dobson, a geographer at the Oak Ridge National Laboratory in Tennessee, USA, offers yet another explanation. He claims to have found evidence suggesting that the cause of their extinction may have been iodine. The skeletons of Neanderthals bear signs of physical deformities and possibly impaired mental health, says Dobson. According to him, an iodine-deficient diet may have been responsible for the physical differences between the Neanderthals and the modern humans.

The findings suggest that Neanderthals could have been anatomically similar to modern humans. But what made them different from modern humans is a history of iodine-deficiency diseases, like cretinism. In modern

humans, an iodine-deficient diet may lead to goitre, an enlargement of the thyroid gland. Worse still, it may cause cretinism which leads to physical and mental retardation because of the failure of the gland to develop.

According to the World Health Organisation, at present, about 750 million people suffer from goitre and 5.7

million people are cretins around the world. It is estimated that 30 per cent of the world's population is at risk of iodine-deficiency diseases.

While examining the differences between coastal and inland populations, it struck to Dobson that Neanderthals mainly inhabited iodine-deficient areas in interior Europe. He examined 300 Neanderthal skeletons in museum collections around the world and compared them to 17 cretin skeletons in Basel, Switzerland, and Philadelphia, USA. A careful study of the skeletons and medical descriptions revealed too many similarities, says Dobson. For instance, cretins had bulging brow ridges like the Neanderthals. Similarly, they seemed to suffer from many degenerative joint diseases that afflicted the Neanderthals too. Thus, he concluded that iodine made all the difference in Neanderthals' physical and mental being.

Dobson's analysis leaves open two theories for experts to probe into: continuity or replacement. The former suggests that the Neanderthals may have changed their diets to include more iodine-rich foods and certain Neanderthal physical traits did not persist though their genes continued into later European populations.

The replacement theory suggests that "iodine deficiency among Neanderthals may explain why they were so easily replaced by Cro-Magnons", modern humans who arrived in Europe 40,000 years ago. ■

Neanderthals: deformed by disease



USE ME!

A Chinese man empties trash into containers marked for recycling outside a Beijing apartment. The containers were installed by one of the environmental organisations working in China. There has been a mushroom growth of environmental groups in China in recent years



EUROPEAN COMMISSION / POLLUTION

A limit on benzene

THE European Commission (EC) is about to approve plans to clean up air quality. It plans to impose strict limits on benzene and carbon monoxide emissions. The new benchmarks will force European governments to curb benzene and carbon monoxide emissions from vehicles and industrial plants, said a senior EC official. The commission is currently evaluating how much



these measures would cost, but legislation could be approved next year, said J Huntington, a member of environment commissioner R Bjerregaard's team.

The plans are designed to cut atmospheric benzene, a suspected carcinogen, from 40 micrograms per cubic metre to five micrograms per cubic metre by 2010. Carbon monoxide emissions would be reduced to 10 micrograms. If approved, national governments would have to enact domestic measures to meet the national requirements, said Huntington. ■

JAPAN / POLLUTION

Dicey waters

NINE out of 10 Japanese waterways are contaminated with hormone-disrupting chemicals, according to the country's Environment Agency. A survey conducted by the agency found that 11 such chemicals are polluting 93 per cent of the 130 rivers, lakes, marshes, ground-water and marine sites sampled. Nonyl phenol, used in the manufacture of surface-active agents, resins and plasticisers, was found in 76 per cent of sites

tested, with concentrations reaching 7.1 micrograms per litre in the Nikko River in central Japan.

Bisphenol A, the plastics additive responsible for disrupting sex hormones in laboratory animals, was found in 68 per cent of waterways, and di (2-ethyl-hexyl) phthalate, another plasticiser, was recorded at 55 per cent of sites. The survey tested for 22 suspected hormone-disrupting compounds, but the agency said it could not yet fully assess the extent or causes of the pollution. Further research is planned to evaluate the impact of the contamination. ■

UK / HEALTH

Good news for diabetics

THERE is good news for Muslims suffering from Type 2 diabetes. A new anti-diabetic drug, NovoNorm, will particularly help diabetic Muslims who can now observe *Ramzan*, the month of fasting, without any serious health implications. According to Mohan Pahwa, director of the Institute of Transcultural Health in London, "Many Muslims with Type 2 diabetes have had to adhere to relatively set meal-times. This is because previous medication would act on sugar levels for the whole day, whether the patient ate or not. This left them feeling tired, irritable and disoriented."

NovoNorm helps diabetics who want greater flexibility in their eating habits. Patients have to take a tablet only when they are going to eat, irrespective of whether they have two or four meals a day. NovoNorm also lowers blood glucose levels. ■

OMAN / RIVER BLINDNESS

Learning from camels

OMANI scientists believe that camels may hold a clue to a treatment for river blindness, a debilitating disease that affects millions of people each year in the developing world. Immunological studies by Oman's Suhan Qaboos University researchers show that the camels have a highly-evolved immune system which allows them to combat a parasite very similar to the river blindness-causing filarial worm *Onchocerca volvulus*, which causes river blindness in humans.

Eugene Johnson, who is leading the research, told Oman's *English Observer* newspaper: "The camel has a very unique protective measures to get rid of the parasite. We are

US / GLOBAL WARMING

Human disaster

NEW research by US scientists has reinforced the argument that people, rather than natural events, are causing global warming. Tom Wigley and colleagues at the National Centre for Atmospheric Research in Boulder, Colorado, USA, analysed last 115 years' global climate data and concluded that man-made greenhouse gas emissions are the main cause of the 0.6° celsius rise in mean temperature over the last 10 years.

"These results provide another important piece in the jigsaw puzzle of climate change, strengthening yet further our confidence that there has been a discernible human influence on climate," Wigley said. The researchers took account of natural events such as volcanoes and sunspots in their calculations. Volcanoes throw out dust that cause a greenhouse effect, and sunspots and solar flares increase the radiation that heats the planet. Although the Sun's activity does affect the Earth's temperature, the atmosphere would have to be six times as sensitive to solar changes as it currently is for the Sun to be the sole cause of global warming, they say. ■

studying their immune systems to get an insight into how we may stimulate the human immune system to do something similar." The team hopes their findings will lead to the discovery of a vaccine against the disease, said Johnson. River blindness is the world's second largest cause of infectious blindness, afflicting over 20 million people. Although 95 per cent of all cases occur in east and west Africa, the parasite is also endemic in Latin America and parts of the Yemen. ■

Eye to eye: Contagious river blindness meets its match



AP/PTI

FRANCE / GENETICS

French say no

FRANCE has decided to suspend a judgement on whether it will allow the planting of genetically-altered corn, dashing industry hopes that the French market would soon be open to the products. France's Council of State, which monitors administrative law, had been due to decide in December whether to let Swiss life sciences firm, Novartis, market the modified seeds in the country. However, the court decided that a decision was impossible due to the legal complexities of the case. Instead of granting permission, the court referred the case to the European Court of Justice. Only a European Court could establish whether a ban in France breached European Commission legislation which approves the use of genetically-modified maize, said the council.

Novartis said it regretted the decision and other industry groups attacked the move. AGPM, an association of maize producers, said it "deplored the persistent indecision" surrounding maize crops. Environmental group Greenpeace said the move strengthened the case for a Europe-wide moratorium on genetically modified crops. "We are very happy. The ban could last several months, possibly a year," said Bruno Rebelle, director general of Greenpeace, France. ■

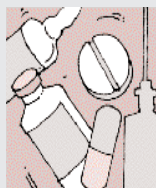
ITALY / FLOODS

Saving Venice

A PLAN to use flood barriers to save Venice from flooding is likely to be abandoned because experts say it will harm the environment. The project was decided in the aftermath of the devastating floods in 1966 when the Venice lagoon's natural defences were badly breached by a storm surge.

The city's council had called for world experts to give their opinion on the project. The project was given a green signal by the experts in January last. Flood barriers were to be built at the three mouths of the lagoon. The project was then handed over to Edo Ronchi, Italy's environment minister, a leading member of country's Green Party. But Ronchi is strongly opposed to the project and he is certain to reject the project. ■

MONEYMAKERS



REVAMPING PROZAC: US firm Eli Lilly is revamping its blockbuster anti-depressant drug Prozac in a bid to fight off competition from generic drug makers. The Indianapolis-based company has struck a deal with a small drug firm, Sepracor, to reformulate the anti-depressant. A molecularly-altered version of Prozac, based on a single chemical isomer instead of two, could potentially reduce side effects, said Eli Lilly. The reformulated product could also qualify for separate patent protection. If the new compound makes it to the market, Eli Lilly could extend the patent on its most commercially successful drug for a decade, analysts said.

SOLARIS 7 LAUNCHED: Sun Microsystems India Private Ltd announced the launch of its next generation software, the Solaris 7 for Intel and SPARC computers. Bhaskar Pramanik, managing director, Sun Microsystems India, said that Internet had made rapid progress in information technology. He added that Solaris was easy to administer, had a security code, could support any device and was compatible with euro currency and Y2K requirements.



RTV LAUNCHED: Hindustan Motors launched their first rural travel vehicle (RTV) at the inauguration of India's premier agri-business show, Agro Tech '98, in Chandigarh. Equipped with four cylinders, 1955 cc and 56 HP diesel engine, the RTV can seat 15 persons or carry a load up to 1.5 tonnes. Besides, it has been provided with a synchronised gearbox which offers five high and five low gears. The RTV is being manufactured in collaboration with OKA Motor Company of Australia.

ANTI-INFECTIVE COMPOUNDS: Two new anti-ineffective compounds, to fight infection, have been developed by pharmaceutical major Wockhardt Ltd. H F Khorakiwala, chairperson of the company, said that global tie-ups were being sought for further clinical studies of the compounds, after the evaluations were completed. The firm's new discovery programme, that has screened over 600 molecules, is focused entirely on anti-infectives. Wockhardt has already filed international patents for three technologies involving novel drug delivery systems. The company has invested over Rs 100 crore in research and development in the last five years and has committed over 10 per cent of its sales towards research.



AGRO-COMMODITY EXCHANGE: Mahindra and Mahindra (M&M) is all set to float a joint venture company with Punjab government for setting up hi-tech agro-commodity exchange (Agro ComEx). The joint venture will provide valuable service to farmers and boost the state economy by generating employment opportunities. M&M will provide required services to the Agro ComEx at commercial rates in areas of engineering design, project management, construction software development, hardware selection, sourcing and networking.

NON-CONVENTIONAL ENERGY: US-based company Selco has set up a 100 per cent subsidiary in India. It has targeted six lakh households to market its Solar Home Systems (SHS). Out of over 10 million unelectrified households in the country, Selco has targeted 600,000 in Andhra Pradesh, Karnataka, Tamil Nadu and Kerala. The company has already sold and installed more than 750 home lighting systems. It has already set up operational offices at Mangalore and Dharwar in Karnataka, which oversee five solar service centres.

THE SOUTH

ASIA & THE PACIFIC

VIETNAM: Vietnamese farmers are going through a bad time due to persistent drizzle that has affected supply of coffee in the



ANIL AGARWAL / CSE

Coffee growers face problems due to persistent rains in Vietnam

province of Dalak. "The weather is now dangerous for the coffee business," said a trader. He said the drizzle in Dalak had disrupted the drying process. Dalak accounts for 60 per cent of the country's coffee crop. According to authorities, 50 to 60 per cent of Vietnam's 1998-99 coffee crop had been harvested but rainy weather remained a big obstacle.

Harvesting of coffee crop in Vietnam started in October and will last until January. An international coffee trader in Ho Chi Minh city said bean moisture was higher than the normal but it was still acceptable and no mould had been found in the recent shipment.

Vietnam is one of the world's top exporters of robusta, widely used in the production of instant coffee.

Meanwhile, trade in rice, another important crop in Vietnam, remained sluggish as harvesting suffered due to persistent rain. Farmers predicted harvesting could start in Vietnam's Mekong Delta rice bowl in January. The harvest in the northern Red River Delta is expected to begin around a month later.

THAILAND: Leptospirosis, a disease transmitted by rat urine, has claimed at least 22 lives in rural Thailand and made hundreds sick. Leptospirosis, otherwise known as Weil's disease, has centred on the northern province of Prae and the northeastern province of Surin, said health officials.

An official in the Surin province of Thailand said 12 people had succumbed to the disease in 1998 and about 90 had hospitalised. He added the trend is on the rise and the provincial health office is monitoring the outbreak. In 1997 the disease killed 20 in the province and made 349 people ill.

Puchong Veerapalin, chief of Prae provincial health office, said the death toll in his province had risen to 10, while 121 were ill. Leptospirosis is a bacterial disease spread by rats and other rodents. Humans can contract it via scratches or other wounds when walking in contaminated water or by being bitten by an infected creature.

The officials blamed diseased rat urine for the outbreaks and said most victims were infected through cuts and scratches caused by rice

stalks or sharp grass. "The health office is campaigning for rice farmers to put on boots when they go to farm or wait until the rice fields dry up before entering the areas," the Surin health official said.

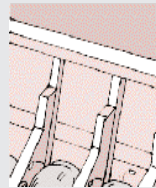
Leptospirosis is caused by hooked organisms that burrow into organs like the kidneys, lungs and liver. It leads to jaundice, meningitis and kidney failure, but is curable if detected early.

CHINA: Chinese officials are calling for a crackdown on the dumping of medicines by drug manufacturers engaged in price wars. "The practice should be banned," said a spokesperson for the State Economic and Trade Commission.

The root of the problem lies in the current price war caused by a nationwide overproduction of medicines by domestic manufacturers, he said. Huge differences in production

SOUTH ASIA

WORLD COMMISSION ON DAMS: The World Commission on Dams began its first South Asian hearing on large dams and their alternatives in Colombo, Sri Lanka. The hearing was originally scheduled to be held in India. It could not take place because the Indian government refused permission. Chairperson of the commission Kader Asmal said the hearings were planned to provide the commission with facts which would help it to prepare a report. The report will be advisory in nature and will seek to influence international opinion on the future of large dams, said Asmal.



POLLUTION CONTROL MEASURES: The Bangladesh government has announced new measures to combat environmental pollution. The government's National Environment Committee (NEC) has decided to ban the use of polythene by new industries and has requested ministries to limit its use. Plastic is a major contaminant of the country's environment, said the committee. The NEC has also decided to phase out the import of two-stroke engines in an attempt to reduce the levels of thick black smoke which cause air pollution. The NEC has also asked to take steps to improve the quality of lead-free fuel.



SAVE ARNA: Thanks to poaching and a series of natural calamities in Nepal, the endangered Arna, or the wild buffalo, is on the verge of extinction. Experts say Koshi Tappu, Arna's only sanctuary, will be a thing of the past unless steps are taken to check unscrupulous traders and flood control measures are introduced. Most worrying is the non-availability of areas suitable for trans-location to save the animal.

costs across the country means that drug manufacturers are competing on unequal terms and a number of firms are resorting to dumping excess drugs. The price war must stop as it will end up hurting majority of the industry, the spokesperson said. He asked companies to adhere to the unified prices set by the state for certain medicines. "It is wrong to sell these medicines at either lower or higher prices than those set by the state," he said.

AFRICA

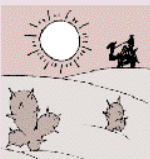
SOUTH AFRICA: Researchers have found the oldest complete skeleton skull of a human ancestor — a four-foot-tall ape-creature who died some 3.6 million years ago in South Africa (SA). The skeleton was found in a cave near the capital Johannesburg.

Temporarily christened as Little Foot, the figure will be formally named as soon as palaeontologists are sure of its sex. South African scientists, led by Ron Clarke, a British palaeontologist at the University of Witwatershed, SA, said the find could provide new clues on when the ape-like progenitors of humans first came down from the trees.

The specimen had heels adapted for standing upright, walked on two legs and used distended big toes to climb trees. Its life would have been 'similar to that which is led by chimpanzees today,' said Clarke.

The find will help understand the link between humans and apes. This is the first time that skulls and skeletons have been found together. "Now we will be able to see how these

UNITED NATIONS



The United Nations Environment Programme (UNEP) has called upon various governments to closely work with the Convention to Combat Desertification, a body fighting for reversal of dryland degradation. "The most effective actions for preventing dryland degradation are often the same actions needed to protect biological diversity or minimise the risk of climate change," said Klaus Toepfer, executive director of UNEP. He was speaking at the Conference of the Parties to the Convention in Nairobi, Kenya. Representatives of various countries are exploring ways to promote financial and technological

support to programmes for combating desertification.

The United Nations Food and Agricultural Organisation (FAO) has warned that the world financial crisis is threatening improvements in food security in Latin America and Asia. FAO said since the beginning of the decade, the number of people suffering from hunger in the world has grown, despite reduction in relative terms. According to a recently launched report on the state of world's food and agriculture, there are 828 million chronically-malnourished people in the developing world. The worsening of the situation was due to damage caused to harvests by climatic phenomena and foreign trade restrictions which ban importation of food, said the report.

creatures moved — the length of their arms in relation to their legs," said Clarke. Little Foot will provide important evidence to the critical parting of ways between hominids and African apes five to seven million years ago.

LATIN AMERICA & THE CARIBBEAN

MEXICO: Greenpeace, an environment organisation has accused the state-owned petroleum company, Petroleos Mexicanos (Pemex), of violating conservation laws by dumping vast amounts of toxic wastes into swamps and forests on the Gulf Coast. "Pemex is the main environmental criminal in Mexico," said Alejandro Calvillo, a Greenpeace director.

The suit was filed after a campaign by school-children and politicians forced Texas authorities to halt construction of a nuclear waste site across the border near El Paso. Now, environmentalists have begun

focusing on the hazards posed at home by illegal toxic waste sites.

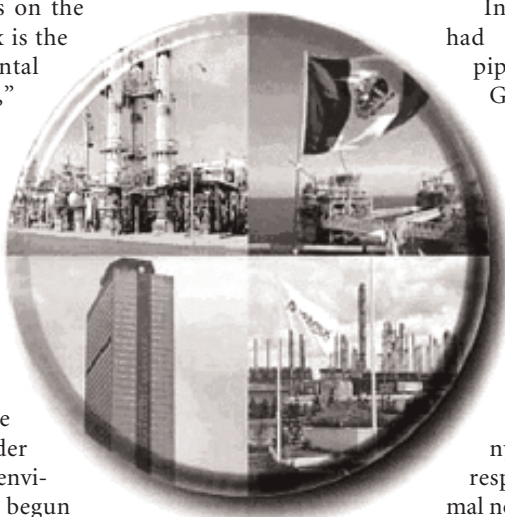
In August, villagers in Veracruz state on the Gulf Coast were surprised when Pemex workers emptied 55-gallon drums of toxic petroleum waste off a flatbed truck into a marsh. According to the Greenpeace activists, the Pemex workers have confessed that they had carried 200 barrels of waste from the company's refinery to the same site over several days.

C L Baumgarten, a lawyer with the Mexican Centre for Environmental

Law, who prepared the suit for the Greenpeace said Pemex officials, if found guilty, could face fines totalling to US \$70,000 or prison terms lasting for three to six years. Pemex, which provides as much as one-third of Mexico's tax revenues and is one of the country's most powerful institutions, have rarely been punished for environmental malpractice. "They commit environmental crimes that are rarely reported and for which they are never charged", said Baumgarten. Accusation of environmental neglect are not new to Pemex.

In 1992, gasoline that had leaked from Pemex pipeline in the sewers of Guadalajara province exploded, killing at least 190 people.

A spokesperson of the company, Fernando Martinez, said he did not want to comment on the suit. Avoiding further queries, he added that it is the company's policy not to respond until it gets formal notification.



INDIA / SPACE

Midnight hit

ON December 13, 1997 at 3 am, K Ramulu of Vissannapeta village in the Krishna district of Andhra Pradesh heard a rumbling sound in the sky followed by a big thud. He found a heavy object lying on the gunny bag which he had spread on his roof. Ramulu, fearing that it was a bomb called the police, who handed it over to the revenue authorities. Expertise of the Geological Survey of India (GSI) was sought to determine what the object was. According to the senior geologist, C Rama Mohan, the 1.3 kg rock was an "aerolite", one of the three types of meteorites, made of silicate.

According to the A K Moitra, director petrology division of the GSI, meteorites provide a wealth of information about the solar system and outer space which cannot be collected from studies on terrestrial material. He said till now no human being has been killed by a falling meteorite. Some meteorites happen to be carbonaceous, indicating possibility of extraterrestrial life, since carbon is essential to life. ■

INDIA / POLLUTION

Heavy metals in water

GROUND water survey by the Central Ground Water Board in Delhi has revealed the presence of heavy metals like cadmium, chromium, lead and iron in excess of the prescribed standards. This was revealed by the Union agriculture minister, Som Pal. The minister said that the government had contemplated several short-term and long-term measures to tackle the problem.

The presence of heavy metals in water are responsible for diseases like meningitis. In some areas, the heavy metal levels was 100 per cent more than the prescribed tolerance limits.

The minister said that natural hydrogeological conditions and improper disposal of municipal waste and industrial effluents were responsible for the presence of metals. ■

More metal than water



RUSTAM VANIA / CSE

A bi-monthly *Down To Earth* supplement

GobarTimes

ENVIRONMENT FOR KIDS

THE
SURVIVAL
GUIDE

Get your
GobarTimes
FREE
with
Down To Earth

An ecomag without the usual greens.
But with things like gobar and vanishing genes
Jungles on platters and countries on barter
Someone else's decisions on our matters.
So...
You want to be different from the herd?
Be savvy on Earth - matters? Be not a-feared
With dirty tales of politics green
Where none's really bothered to keep the Earth clean
Where forests are fenced
On which people depend...
Read GT from DTE to see what it means.

**Let's learn environment.
Some other things, some other way.**



Featuring:

attitudes, culture, lifestyles ● posters with a difference ● the wisdom of pandit Gobar Ganesh ● the hot news and the cold facts on environment ● competitions, quizzes, and do-it-yourselfs

INDIA / TIGER

Big cats are fine

DESPITE accusations that the tiger population is being revived, the actual numbers of big cats across India stand at 3,232. Though the Union government is yet to release the 1997 Tiger Census Report, the Worldwide Fund for Nature-Tiger Conservation Programme (WWF-TCP) made available the figures provided by the 16 state governments to the Centre. Madhya Pradesh recorded the maximum of 927 tigers followed by Uttar Pradesh with 475 and Assam listing 458. The 1993 estimate had shown 3,750 tigers in 21 states as compared to 4,334 in 1989.

The director of the Project Tiger, P K Sen said the results of the prestigious project to save the tiger were not very encouraging, but added that the project was not a failure. "Declining management standards, increasing incidents of poaching and inadequate budgetary allocations are hampering the conservation programme," said Sen. The tiger population at the launch of Tiger Project was just 1,827, informed Sen. ■

INDIA / ZOO

Autonomy for Delhi zoo

THE National Zoological Park in Delhi may soon be granted autonomy. The Union ministry of forest and environment will soon form a committee which will look into the modalities of the process. "A zoo might be a low priority area for the government. But an autonomous body will ensure better functioning and accountability of staff in park," said S C Sharma, director, wildlife preservation. He said autonomy of the zoo will cut procedural delays, ensure constant monitoring and quick decision-making in the administration.

However, Sharma ruled out privatisation of the zoo. The committee will work out modalities of opening membership to the zoo for all sections of the society. The autonomy of the park will mean souvenir shops, more restaurants, better maintenance of the lawns, which in turn is expected to increase the revenue

INDIA / AIDS

NGO-AIDs cell disbanded

THE NGO-AIDS cell functioning under the Centre for Community Medicine (CCM) at the All India Institute of Medical Sciences was suddenly closed down after its coordinator Shankar Chowdhary went on a deputation elsewhere. The cell was operating since 1991.

Various non-governmental organisations (NGOs), who were sponsored by the cell for spreading AIDS awareness, have been adversely affected by the closure. However, a new AIDS education and training cell is now working in place of the earlier one. The NGO-AIDS cell no longer exists as the project was over in September-October 1998, and since the funds of the cell were not handed over, we are not in a position to entertain any request for funds, said the coordinator of the new AIDS Education and Training Cell, Bir Singh.

It is said that constant friction between the faculty members has resulted in the present situation. Chowdhary has also been accused of leaving without giving any proper account of the fund. ■

and insure better incentives for the staff.

At present the funds are allotted to the zoo on the year-to-year basis. According to Sharma, the autonomy will also increase the tenure of the director and his responsibilities. ■

Waiting for autonomy



ARVIND YADAV / CSE

IN COURT

ALMATTI DAM: The Supreme Court has allowed Karnataka government to go ahead with the construction of 26 crest gates on Almatti dam despite serious objections of Andhra Pradesh. The court, however clarified, "The work to be carried out by Karnataka at the dam will be at the risk and cost of Karnataka and shall be without prejudice to the right of Andhra Pradesh, both in suit and the injunction application". Andhra Pradesh had objected to the raising of the dam height by Karnataka from 509 metres to 524 metres on Krishna river, saying it would affect the flow of water to the state.

STERLITE UNIT SHUT DOWN: The Madras High Court has given an interim order directing the plant of Sterlite Industries in Tuticorin, Chennai, to close down. Allegations of environmental hazards posed by the plant, reports of gas leaks and deaths have dogged the copper smelter plant since its inception in 1997. The court orders were based on a report published by National Environmental Engineering and Research Institute (NEERI), Nagpur. Environmental groups have continuously been protesting against setting up of the plant since 1995. They argue that the plant has been contaminating groundwater, leaving it unpotable.

TRADE IN HUMAN HAIR: The Delhi High Court has expressed strong displeasure over varying stands taken by authorities on the trade of human hair. The court has directed the Municipal Corporation of Delhi to carry out an inspection and state within one week whether the trade was going on in certain localities of the city. The court was reacting on a public interest litigation filed by the Movement for Improvement of Landscape Environment and Society. The Delhi Development Authority had stated that trade of human hair was being carried out in certain localities of Delhi like Jwalapuri and Nehru Vihar.

FOLLOW UP

On November 5, 1998, a major breakthrough in organ transplant was achieved by two independent teams of scientists from the University of Wisconsin in Madison and the John Hopkin's University School of Medicine in USA. From human embryos and foetuses, they cultured human embryonic stem cells which had the capacity to multiply rapidly and grow into any sort of tissue or organ that the body requires for transplants (*Down To Earth*, Vol 7, No 14). However, the scientists warn that a lot has to be done before the findings are put into use. Doubts still persist whether they are able to grow these cells into the required or specific type of cells. According to Roger Pederson of the University of California, "No one knows how to make a stem cell differentiate to form a specific tissue. We do not know the magic words to create each tissue."

Latest research reveals that these tissues may change in ways that may make them even more susceptible to cancer. Moreover, human cells that are cultured for long periods need to be thoroughly checked and screened before they are used as tissue grafts. So far, no problems have emerged with mouse stem cells, but this does not mean that the safety measures have to be neglected.

The two teams are still doubtful about the ability of the cells to form any tissue as they promised not to clone individuals or create a "human chimera", (a cross species hybrid that could be made by injecting human cells into an embryo of another species) due to ethical concerns.

But they believe that these cells have the right properties. They contain a high level of telomerase, an enzyme which is believed to be the precursor of organs and is required for cells to divide indefinitely. They also have the ability to form cells which are the representatives of the three main types of tissues: endoderm, mesoderm and ectoderm.

INDIA / SMUGGLING

Jackal heads seized

THREE jackals' heads were seized at the Anna International Airport in Chennai by the police. They were about to be smuggled to Malaysia in a small bag, the top of which was covered with ornamental beads. The heads were handed over to the wildlife officials. According to the police, the accused, Bala Kanil, has been a regular visitor to Singapore, Malaysia and Sri Lanka for the last three

years. Wildlife officials suspect the animals were trapped and killed a month ago. Kanil has been involved in the business for the last five years, the officials said.

According to the wildlife officials, smuggling of animals and birds is taking alarming proportions. They also said that connivance of government officials with the smugglers cannot be ruled out. Steps should be taken to have the baggage of the air-passengers checked on a regular basis to curb smuggling, they said. ■

INDIA / LEPROSY

Call to fight leprosy

THE Indian Leprosy Foundation (ILF) has distributed grants totalling Rs 11 lakh to various leprosy projects and hospitals in four states — Kerala, Tamil Nadu, Andhra Pradesh and Karnataka.

Speaking at the function organised by ILF, Tamil Nadu home secretary R Poornalingam said, "The non-governmental organisations (NGOs) have a role

to play in the leprosy eradication programme. They must help remove the mistrust among the people for government schemes and also the misconceptions about the disease."

Nearly 3,000 field-level workers were involved in identifying cases throughout the state, said Poornalingam. The number of leprosy patients all over India in 1982 was 40 lakhs and they were brought down to 5 lakhs at the end of March 1998. ■

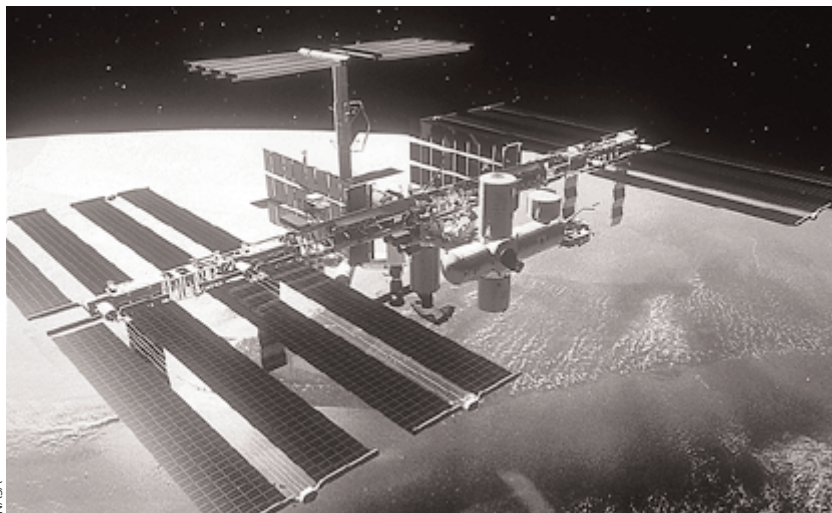
COMMENT



RUSTAM VANIA

Castle in the air

The first truly international space station will soon become a reality



NASA

Multinational venture: a station in space

A FLAWLESS countdown, a false dawn over much of Florida, gasps and cheers from onlookers marked the launch of space shuttle *Endeavour*, aptly named as it is humankind's first attempt to make a room with a view in outer space. The space shuttle blasted off from the Kennedy Space Centre in Florida, USA, on December 4 to begin the orbital construction of the US \$60 billion international space station, indeed an endeavour by 16 nations to conquer the cosmos.

The space station, which is scheduled for completion in 2004, will boast of a permanent laboratory in a realm where gravity, temperature and pressure can be manipulated to conduct numerous scientific and engineering experiments that are impossible down here on Earth. The space station will be a test bed for future technologies and a laboratory for research on new, advanced industrial materials, communications technology, medical research and much more.

Nearly 250 miles above Earth, the nine astronauts aboard the shuttle got to work soon after their landing. It took Colonel Jerry Ross of the US Air Force

and James Newman, a physicist, three space walks totalling 21 hours and 22 minutes to complete the construction work in the outpost. Most of the space-work was dedicated for the construction of the space station's *Zarya* and *Unity* modules. Before their return to Earth, the astronauts had managed to release two building blocks of the international space station to the orbit. It is for the first time two separate blocks are orbiting the Earth on their own.

In January 2000, an international crew of three will begin living aboard the space station, starting a permanent human presence in space. The crew has been undergoing training for the mission since late 1996 and includes International Space Station Commander Bill Shepherd, a US astronaut, *Soyuz* commander Yuri Gidzenko and flight engineer Sergei Krikalev, both Russian cosmonauts. The first crew will spend three months aboard the station. When they arrive, the station will consist of three modules: the Russian Service Module serving as living quarters and onboard control centre, the US-

funded and Russian-built *Zarya*, a module providing supplementary power and propulsion functions; and the US-built *Node 1*, a connecting module that provides the attachment points for future US segments.

Controllers of the space station's flight at Mission Control, Houston, USA, and at the Russian Mission Control Center in Korolev, outside Moscow, will now spend the next five months monitoring the station.

Endeavour and two types of Russian rockets will conduct 45 missions to launch and assemble more than 100 elements which will be needed to complete the station. In all, 460 tonnes of structures, modules, equipment and supplies will be placed in orbit by the year 2004. It will require an estimated 159 space walks to build and maintain the space station which will eventually stretch as long as a football field.

The space station is the largest scientific cooperative programme in history, drawing on resources and the scientific expertise of 16 nations. The US is leading the global community in the construction of the space station. The project is so complex that no one nation could tackle it alone. The US, Canada, Japan, Russia, Brazil, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the UK have come together in one of the largest non-military joint efforts in history. The programme involves more than 100,000 people at space agencies and hundreds of companies around the world. ■

Plans galore

The Union and the Delhi governments pledge to tackle air pollution

THE newly-appointed chief minister of Delhi, Sheila Dikshit, soon after assuming office met Union minister for environment and forests Suresh Prabhu to



THE HINDU

Setting an agenda: Delhi chief minister Sheila Dikshit and Union environment minister Suresh Prabhu (extreme right)

Abusing PILs

The Supreme Court makes the petitioner in a public interest litigation accountable

To check the growing abuse of public interest petitions, the Supreme Court has said, "The public must be compensated both for the delay in implementation of the project and the cost escalation resulting from such a delay."

Justice B N Kirpal and Justice Sujata V Manohar, while setting aside a Bombay High Court verdict through which the execution of the Khanperkheda thermal power station project was delayed, said that the party at whose instance interim orders were obtained must be made accountable for the consequences.

The apex court ruled that an interim order could not only cause undue delay in the completion of the project, but also escalate the costs. The court ruled: "When a stay order is obtained at the instance of a private party or even at the instance of a body litigating in public interest, any interim order which stops the project from proceeding further, must provide for the reimbursement of costs to the public in case the litigation started by the individual or body fails."

examine the progress in the implementation of the white paper on environmental pollution in Delhi. In what can be said as the first serious effort made by the chief minister and the Union minister, the duo have pledged to solve the problem of air pollution in the capital.

They have reiterated the steps outlined in the white paper, prepared by the former Bharatiya Janata Party government, to combat air pollution in Delhi. These steps include increasing the number of compressed natural gas outlets and supply of unleaded petrol in Delhi; banning of loose 2-T oils; implementing the programme of pre-mixed fuel from December 31, 1998; and setting up of two fuel testing laboratories. In addition, Dikshit has also directed the state chief secretary to hold regular monthly monitoring meetings with the Environment (prevention & control) Authority to oversee compliance of Supreme Court directives on Delhi pollution.

However, undue importance has been attached to the ban on biomass burning, which is already in force in Delhi. Experts say that it has sent confusing signals about the official priorities in dealing with the matter. They are puzzled by the figures which have been flouted without supportive studies that burning of garbage emits 28 per cent of the city's air pollution followed by vehicles at 25 per cent. Even officials in the Central Pollution Control Board (CPCB) have denied knowledge of such data to *Down*

To Earth. According to CPCB, vehicular pollution contributes up to 70 per cent of the total air pollution in Delhi.

In view of the official information available, controlling vehicular emissions should top the agenda for action and the political leadership must not get misled about issues and priorities, point out experts. "Without a clear set of priorities, the planners are getting lost in a maze of action points which is breeding more complacency and inaction," says Anil Agarwal, director of the Centre of Science and Environment, New Delhi. ■

Bad drugs

The European Union votes to ban four widely-used antibiotics in animal feed

AMID growing fears that antibiotics used in animal feed could lead to drug-resistant diseases among humans, European Union (EU) agriculture ministers voted to ban four drugs. Scientists recommended the ban after a Dutch farmer was found to be infected with the same drug-resistant bacteria as his chicken, indicating that the organisms could jump the species barrier. The European Commission, the EU's executive, had said that antibiotics could weaken the effectiveness on people of drugs which contain them.

The ban is part of the EU's "safety-first" approach to food prompted by the

Warming the world

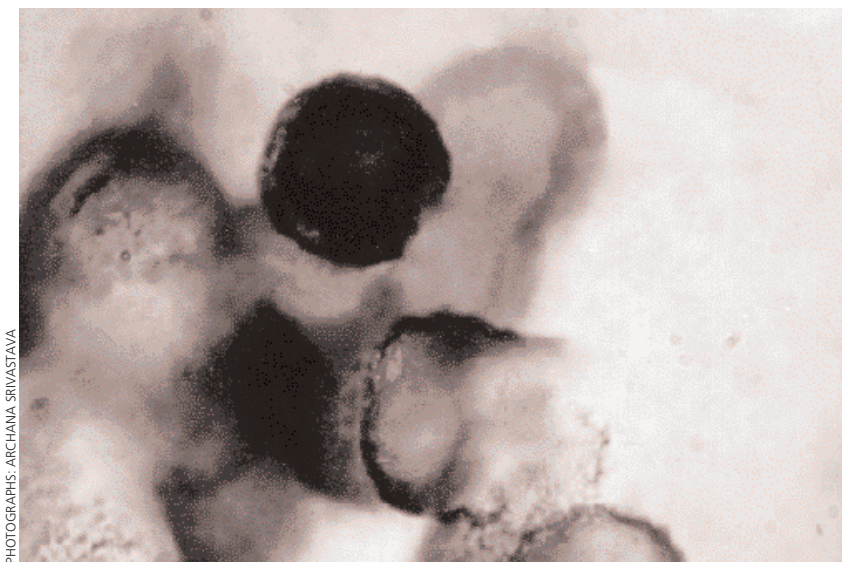
Scientists say that 1998 was the hottest year in the past 1,200 years

A study by the National Oceanic and Atmospheric Administration (NOAA) shows that 1998 was likely to be the warmest year in the Northern Hemisphere in the last 1,200 years. Scientists also believe that the heat wave was due to carbon dioxide and emissions from the burning of fossil fuels like coal and oil.

The findings contradict the argument that there was a warm period in the Middle Ages. "What we have found is that the medieval warming period didn't exist," says Jonathan

controversy over BSE or the “mad cow” disease. In Europe, about 15 per cent of antibiotics go into animal feed. Companies that manufacture them stand to lose several million dollars, said a spokesperson of the European Commission. Despite intense lobbying from drug manufacturers Pfizer and Rhone-Poulenc, 15 EU ministers voted for the ban. Ministers from Spain, Belgium and Portugal abstained.

The ban will affect the most commonly used animal antibiotic, Tylosin phosphate, along with Virginiamycin, Bacitracin Zinc and Spiramycin. Experts say that the EU must be able to make a sound scientific argument for banning the drugs or face possible action by the US in the World Trade Organisation. Two companies, including Pfizer, are expected to appeal against the ban. ■



PHOTOGRAPHS: ARCHANA SRIVASTAVA

Rewriting history: the 3.2 billion-year-old blue-green algae (above) and Singhbhum (right) where it was found



Fossil find

Scientists find the oldest life form in Indian geological history

ARCHANA SRIVASTAVA LUCKNOW

SCIENTISTS at the Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow, have discovered a 3.2 billion-year-old fossil of blue-green algae in Singhbhum, north Orissa. They say that this could be the oldest life form in Indian geological history.

The search for the oldest biological

remains began in 1992. The scientists had submitted a proposal to the department of science and technology (DST), in 1992 to conduct a search for the oldest lifeform in the country. A year later, the DST approved the project. Says Principal investigator P K Maithy of BSIP: “We had originally planned to work in Sharwar, Karnataka, but were asked to conduct the study in Singhbhum, Orissa, a place rich in iron ore dating 3.4 to 2.8 billion years.” The investigating team comprised Maithy, S Kumar of the department of geology, University of Lucknow, and R Babu of BSIP.

The scientists made five field trips to collect scientific information from the Kaisa and Barbil iron ore formation in Singhbhum. There they noticed cherts, a hard, dense rock formed of amorphous silica, which are best suited for fossilisation. But location of the actual site was a problem as the area extended to over 500 sq km. “It is only while driving through the agricultural fields in Borvil that we saw iron ore deposits and also cherts. There we found the fossils spread over 200 metres and a depth of two metres,” says Maithy. Further investigation revealed that the biological remains belonged to the blue-green algae.

The scientists believe that the findings will help in understanding the evolutionary trends and biotic implication of the microbial community in relation to environment and mineral deposition during and the earlier part of the Proterozoic era. ■

Harvesting rain water

Up to 80 per cent of Chennai's water requirement can be met by harvesting rain water, says a study

Harvesting and recycling rain water can meet up to 80 per cent demand for water in Chennai, according to a study by Alacrity, a Chennai-based housing development company.

The report “Self Reliance in Water — the Alacrity Experience”, says that harvesting rain water will reduce the dependence for water on the Chennai Metro Water Supply and Sewage Board. It will also recharge groundwater aquifer and reduce the adverse effects of sea water intrusion.

“The average rainfall in the city in the past 36 years works out to 128 cm,” it says. This water, not only causes flooding, but runs wastefully into the sea. “If this abundant quantity of water is tapped and stored... households will be closer to self reliance in their water needs.”

Overpeck, head of NOAA climatology programme in Boulder, Colorado. “There may have been a relatively brief period of warming for 100 years or less in Northern Europe around 1300. But the pattern was regional not global,” he adds.

Another study by the National Science Foundation refutes the belief that global warming may help farmers by increasing their crop yields. The study shows that global warming may actually decrease crop yields by stimulating the growth of weeds and insects. Jim Detling, a researcher at the Colorado State University said that for each centigrade degree rise in average temperature, the growth of a common type of grass in Colorado pasture lands decreased by one-third.

Dump and forget

The US refuses to take back the toxic waste it dumped in Haiti



WITNESS FOR PEACE

A protester holds a placard urging the United States to stop dumping toxic wastes in Haiti

ELEVEN years ago, about 4,000 metric tonnes of toxic incinerator ash was dumped from the city of Philadelphia, USA, near the town of Gonaives in Haiti. The waste was to be shipped back to the US in mid-November 1998. But the Caribbean Dredging Excavation, the company entrusted with collecting the ash, has withdrawn its equipment from the area. "The company cannot load the ash as it has nowhere to unload in the US," says Kenny Bruno, a Greenpeace campaigner.

Three US states — Pennsylvania, south Carolina and Virginia — were originally chosen as sites to dump the ash. Now, port authorities in these states have refused permission to dump the waste. US state department officials say that they cannot be blamed as they have not broken any laws. The US has yet to ratify the Basel Convention on the Transboundary Movement of Hazardous Waste, which bans the export of toxic waste from industrialised countries to developing countries.

"The poorest country in the hemisphere should not pay to clean up waste it never wanted from the one of the richest countries in the world," said the spokesperson from Greenpeace. An official from the mayor's office in

Gonaives said that Dredging was motivated by the lack of commitment shown by the Philadelphia municipal authorities towards repatriation of the ash. However, officials in Philadelphia insist that they were not responsible for sending the waste to Haiti.

When the US off-loaded the ash, there was an immediate outcry from environmentalists. A long campaign by environmental groups led to an agreement where it was decided that the waste would be sent back to the US in mid-November. It was also decided that the cost of the clean-up would be primarily met by the New Jersey-based trash hauling company, Eastern Environmental Services. Incidentally, the director of the company was originally part of a corporation that signed the contract with the freighter, Khian Sea, to dispose of the ash.

Many environmental groups have asked the Haitian government to compensate the local people who are reportedly suffering due to the contamination of the toxic ash. They say that many workers, who were hired to transport the toxic materials, have since died. ■

View from Spain

Upgrade Spain's nuclear plants to meet Kyoto Protocol targets, says its environment minister

SPANISH environment minister Isabel Tocino has said that increasing nuclear power output might become a part of Spain's climate change policy. In a paper presented to parliament, the minister said that upgrading nuclear resources was one way Spain could meet its Kyoto Protocol commitments.

Spain is the first European Union

(EU) member state to consider nuclear power as a tool in its climate change policy, said a spokesperson of the EU. No country, except Finland, has plans to build new nuclear power stations. Germany and Switzerland have already decided to phase out nuclear energy.

Environmental groups have accused Tocino of being a "mouthpiece" for the nuclear lobby. Around 30 per cent of Spanish electricity consumption comes from nuclear power. By upgrading existing plants, the country could produce 1,000 MW of extra energy by the year 2002, which is equivalent to an additional plant. Spain's per capita greenhouse gas emissions are well below the EU average. Under the protocol, it has committed to limit the growth in emissions by 15 per cent above 1990 levels by the period 2008-2012. However, recent figures show that emissions have already risen by that amount.

The paper presented by Tocino lists a range of policy options without any ranking or indication of the government's preferences. Apart from nuclear power, they include increasing energy efficiency, decreasing coal use, increasing natural gas use, developing renewable energy sources and improving public transport. ■

Out of bounds

Schools in Tehran are closed due to pollution

Iranian authorities ordered elementary schools in Tehran to close on December 14, due to an alarming rise in air pollution levels in the city. For a long time, environmentalists had been warning about the increasing air pollution levels in the city. "I hope parents will advise their children to stay at home and do their homework," said Hussein Mozaffar, the education minister of Iran.

Earlier, the government had warned people, especially the elderly and those suffering from allergies and children, to stay away from central Tehran as pollution levels had gone "beyond dangerous levels". Environmentalists say that this situation had been created primarily by old vehicles which do not have catalytic converters.

A FAST CHANGING WORLD.

DO
YOU
KNOW
WHERE
YOU
STAND?



SURVIVE BY MAKING INFORMED CHOICE.

REPORTING THE CHANGE, EVERY FORTNIGHT, SINCE 1992



Yes! I want to subscribe

SCIENCE AND ENVIRONMENT FORTNIGHTLY

DownToEarth

www.downtoearth.org.in

MORE THAN A DECADE OF PUBLICATION

☐ *As a gift ☐ For myself ☐ For my institution

(Please Tick below 1, 2 or 3 year subscription)

Term	@ Rs 20 cover price	You Pay	You Save
☐ 3 Years (72 Issues)	Rs 1440	Rs 720	Rs 720 (50%)
☐ 2 Years (48 Issues)	Rs 960	Rs 528	Rs 432 (45%)
☐ 1 year (24 Issues)	Rs 480	Rs 288	Rs 192 (40%)

Please add Rs 65 for outstation/non-Delhi cheques and allow 2-4 weeks for delivery

BEST OFFER
SUBSCRIBE UPTO
3 YEARS AND GET
T-SHIRT
+
ONLINE VERSION
WITH ARCHIVES
ABSOLUTELY
FREE!

(Please write in BLOCK LETTERS)

Name: Mr/Ms _____

Designation _____ Institution _____

Department _____ Area of Interest _____

Profession: ☐ Student ☐ Researcher ☐ Forester ☐ Civil servant

☐ Media ☐ Academician ☐ Environmentalist ☐ Businessman

☐ Architect ☐ Others (please specify) _____

Address: ☐ Office ☐ Residence _____

_____ City _____

State _____ Country _____ Pin _____

Ph _____ Off _____ Res _____

Fax _____ E-mail _____

I wish to pay by ☐ Cash/MO ☐ Cheque/Demand draft (add Rs 65 for outstation/non-Delhi cheque)

DD/Cheque No _____ Dated _____ payable to **Society for Environmental Communications.**

Credit Card: ☐ Visa ☐ MasterCard ☐ Amex ☐ Diners Rs _____

Credit Card No _____ Valid till _____ Date of Birth _____

**For Amex card holder DBC code _____

***Card Verification Value No _____ Date _____ Signature _____

For online subscription payment please login at website www.downtoearth.org.in

*For gift subscriptions add receiver's name & address on a separate sheet

**Four digits on the top of the card number

***Last three digits on the reverse of credit card Foreign subscribers please login to our website www.downtoearth.org.in to pay by Credit Card/Bank transfer

ATTENTION RENEWING SUBSCRIBERS

Please fill your customer code

Please fill this order form and mail or fax to:

SOCIETY FOR ENVIRONMENTAL COMMUNICATIONS 41, Tughlakabad Institutional Area, New Delhi-110 062

Ph: 91-11-2995 5124, 2995 6394, 2995 6110 Fax: 91-11-2995 5879 Email: subscribe@downtoearth.org.in

Carry on polluters

Some factories in Delhi are flouting a Supreme Court order to relocate polluting factories. Meanwhile, over 50,000 workers have been rendered jobless. Most have not been compensated

JAMAL KIDWAI

THERE is a notice in bold, red lettering on the gate of Super Leathers Industry, a tannery in the Nangloi area of Outer Delhi. It says that the factory has been closed following the July 8, 1996, order by the Supreme Court (sc), which directed the closure and relocation of 168 polluting industrial units in Delhi by November 30, 1996. Take a walk around the boundary wall and there is another notice at the back of the premises which announces business as usual: A K Leathers. The name has changed. What has not changed is the dark grey sludge — replete with dangerous chemicals — that flows mockingly towards the Najafgarh *nullah*, which in turn will empty into the Yamuna.

There are other polluting units that flout the apex court with impunity. Some estimates say that about 50-60 per cent of the 168 units are still functioning. While this may be an exaggeration, A K Leathers is definitely not an isolated case. Moreover, the factories that have shut down in accordance with the order have created another problem: the workers feel cheated.

The 168 units were found to be polluting or operating in non-conforming areas, violating the Delhi Master Plan-2001. The order was passed in response to a public interest petition by lawyer M C Mehta. Those factories which could not relocate and wanted to shut down were to pay one year's salary as compensation to the workers. The order rendered 50,000-odd workers jobless.

On December 4, 1996, the court made an amendment. Now, if the management decided to close the factory, it had to pay a compensation equal to six years' salary to the workers. If the factories were relocated within the National Capital Region (NCR), the workers had the option of shifting with the industry or taking a compensation equal to one year's salary.

On December 31 1996, two hours before his retirement, Justice Kuldeep Singh made a significant amendment to the December 4, 1996 order, extending the NCR region to five states: Rajasthan, Himachal Pradesh, Punjab, Haryana and Uttar Pradesh. The court stated: "The land prices in Delhi have risen to such an extent that the vacated land if developed again will generate enough profit for the industrialist to build factories elsewhere." Some of the closed units have an enormous amount of land, making it more profitable to shut down than to relocate. Just three mills — Swatantra Bharat Mill, Shri Ram Foods and Fertilisers, and Birla Textile Mill — have a total of 9,60,000 sq metres of land, estimated to be worth Rs 4,000 crore.

Workers were shocked. On December 16, 1996, Seil Foods and Fertiliser Industries (SFF) had already notified that it was shifting to Rajpura in Punjab. Till the December 31 order, Rajpura was outside NCR, which meant that the company would have had to pay six year's salary to the workers. Now, the workers were left with the only option of either taking one year's salary as compensation or going all the way to Rajpura. Manuji Rai, one of the workers who agreed to shift to Rajpura says he was not taken to the new factory by the management.

According to Arun Daur of Hind Mazdoor Sabha, a trade union with socialist affiliations: "Actually, the orders suited the industrialists. They have not only escaped paying the cost for the years of neglect of the environment but also stand to gain from the sale of land which

Some estimates say about 50-60 per cent of the 168 units are still functioning



Front to back: the closed main gate of Super Leathers Industry in Nangloi (top), and the back gate, which announces A K Leathers

they purchased at throw-away prices." Daur feels that this amounts to neglecting the workers who have been working in unhealthy conditions for years and have lost employment.

Two years after the court order was delivered, the only workers who have received compensation are those who worked at the Ayodhya Textile Mill, a government-owned industry. Hardwar Dubey of the Bandi Karkhana Sanyukt Samiti, a collective of workers formed in the aftermath of the judgement, alleges that the petition was filed in connivance with the industrialists.

There is another catch: 70 per cent of the workers do not figure in the muster rolls of the factories, according to *The order that felled the city*, a report published by the Delhi Janawadi Adhikar Manch, a collective of individuals and groups working on issues related to human rights in Delhi. The workers are either on contract or daily wages workers. They are not eligible for compensation. For example, Nova Steels Ltd of Loni Road employed 252 workers; none of them were permanent, the report says.

Some factories, such as SFF, started sub-contracting — getting their product manufactured in other units — after they closed shop. In other words, they are sub-contracting the pollution. ■

LOOKSLIKE BASMATI *but...*

India is losing the pride of many a pulao — the aroma and taste of basmati rice. What are scientists and legal experts fighting about?

INDIRA KHURANA DEHRADUN

PATENTING of basmati rice by Ricetec Inc of the US has been in and out of the news since February 1998. In response to a public interest petition filed in the Supreme Court, the Attorney General of India says Indian scientists and the best legal brains in the US are wracking their brains on the issue.

Well, they may as well go home. The very characteristics of basmati — the aroma, the softness and the sweetness — are being lost. The victory, if at all, of India's attempts at winning over patent rights from the US will be Pyrrhic if the product itself ceases to exist.

Area under traditional basmati cultivation around Dehradun, the ideal environment for fragrant basmati, has declined. High-yielding varieties (HYVs) have replaced the traditional ones. What may be left behind is a long-grained rice that looks like basmati, but lacks the aroma and the sweetness, rendering the very need of geographical appellation of basmati redundant.

The grain and the chaff

Not so long ago there were many aromatic varieties of rice, collectively known as basmati (*bas* means smell in Hindi). Some have already been lost, including *Anjana*, *Anjani*, *Ram Jawain*, *Raat ki Raani*, *Durga Pasand*, and

Mukhmalti. The government has done nothing to preserve these.

Discussions on the quality of basmati range from banal to effusive prose. Fussy basmati eaters from Dehradun look down upon basmati grown in Punjab and Haryana. Connoisseurs go a step further: they insist on basmati from Majra, a village in district Dehradun, because this is where the aroma is.

Legend has it that basmati seeds were introduced into Dehradun from Afghanistan around 1840. According to Prakash Bharadwaj of Majra, whose family has cultivated basmati for eight generations now, the variety then spread to adjoining villages. However, basmati from Majra ruled the roost. Now, most of Majra is a commercial jungle. Land prices have shot through the roof.

Farmers say that the characteristic aroma is due to the local conditions; low temperature (22°C to 27°C) during flowering and grain development, use of farm yard manure, good soil fertility, irrigation, direct sowing, and lighter soil and upland conditions. "Basmati from areas around Dehradun is known for its sweetness, softness and aroma. High-yielding varieties have none. The reason

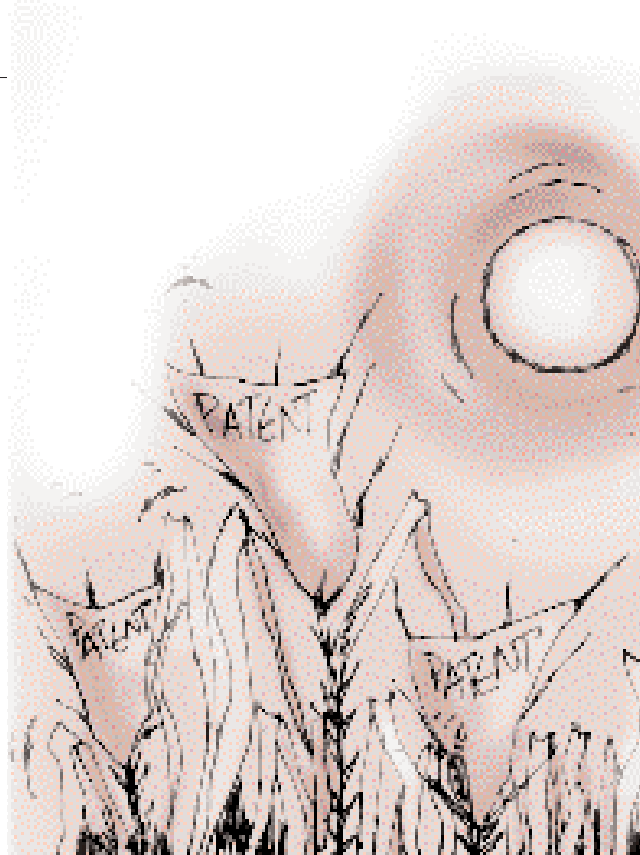
for these qualities is also the water comes from forests, dissolving nutrients from forest produce," says Vijay Jain of Dehradun, who trades in basmati. Jain is confident that real quality basmati cannot be grown anywhere else. He procures roughly 80 per cent of the basmati grown in and around Dehradun. Agricultural practices also add their bit — basmati gives a better aroma when directly sown rather than transplanted.

Decline in variety

Results of a survey by Indian Rice Research Institute, Cuttack, are disturbing. Though the area under basmati cultivation in Dehradun district increased from 100 hectare (ha) in 1990 to 1,500 ha in 1996, almost 80 per cent of prime rice-growing area has been swallowed by urbanisation. Majra is an example.

Some rice exporters have bought farms along the Delhi-Dehradun highway. They cultivate HYVs of basmati. The aroma of these is much inferior to that of the traditional basmati grown in native farming areas.

"Unwary buyers are often duped by suppliers who mix a handful of Dehradun basmati with basmati from



The pleasure of basmati rice is in smelling, tasting and seeing. Now there is only the sight of basmati. Nothing for the nose or the tongue



Haryana and Punjab,” says R K Mishra, a resident of Dehradun. While India does not recognise the importance of geographical appellation, Kuwait, the biggest exporter of basmati rice from India, has a legislation insisting that the exported basmati must be from the sub-Himalayan region, namely, in and around Dehradun.

Why are we losing the aroma

The reasons vary from the cultivation of HYVs and the absence of government seed conservation programmes to depletion of forest cover and the use of fertilisers, says Anil Gupta of the Indian Institute of Management, Ahmedabad.

In the absence of a proper seed conservation programme, propagation of HYVs by government agencies is eliminating the finest gene pool of local varieties of aromatic rice. The pure strains are either getting lost or getting mixed with other, inferior varieties.

Chemical fertilisers have also taken their toll. Most local rice varieties are tall and susceptible to lodging (grain falls before ripening). Application of nitrogen fertilisers may improve growth but aggravates the lodging problem. And also disease. “With the use of fertilisers we now face increased (plant) diseases,” says Jain.

The availability and the use of organic manure has declined, forcing farmers to use nitrogen fertilisers. Also, farmers believe that urea adversely affects the aroma. “The quality of basmati that my grandfather produced on our fields was so much better that I do now,” rues Jain, who uses nitrogen fertilisers. “I have no choice. I have to get yields. Besides I do not have many cattle on my farm now,” he says.

Soil quality also matters, though exactly how it does is not known. Farmers feel that the decline in forest cover has also adversely affected quality. The topsoil is no longer enriched by forest litter and microbes. Moreover, farmers are sometimes forced by economic circumstances to undertake mixed cropping and cash crop cultivation, which drastically reduce soil fertility.

If the government is fighting the patenting of India’s natural resources and heritage, it should first make sure that the resources exist and will continue to do so. Unless some steps are taken to revive the fragrant basmati, we could well end up fighting over history. ■

A farmer’s dilemma

The moment one enters Dudhli, a village in district Dehradun, the aroma of basmati fills the air. Villagers recall that during wedding feasts, when rice was procured from Majra, passers-by stopped their bullock carts — seduced by the aroma — and partook of the wedding feast.

But that was then. Hari Singh, a farmer, is sceptical of basmati’s future. He grows basmati for sale and another variety, *kasturi*, for domestic consumption. “It is more filling,” he says, adding, “Besides it does not lodge or break as much as basmati does on separating the husk.”

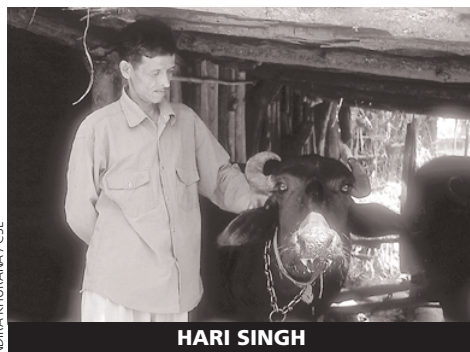
Profits from basmati cultivation no longer commensurate with the labour and input costs. “If we are lucky we get a harvest of 250 kg a year. Normally the yield is about 150 kg,” Singh says.

His neighbour Virendra Singh agrees. “We sell our rice at Rs 11 per kg,” he says. “Cultivation in one *bigha* of land costs us Rs 700. Thus the profit we make if we get a bumper crop of 250 kg is Rs 2,000

per *bigha*. At the end of 5 months, it is just not enough.”

Credit from institutional sources is not available. Often, farmers with small holdings are in a critical situation. “We can get credit from traders who buy our rice, but only at a price. We pledge our forthcoming rice crop at the rate of Rs 6-7 per kg at the time of borrowing, even when at the time of harvesting the procurement rate is Rs 11,” says Bhagirathi Devi, Singh’s wife. “I wish we could get some loans from the government,” she adds.

As usual, the middleman benefits, not the farmer. “When the crop is harvested, the situation is desperate, and the market price is low. When the rice reaches the mandi, the price increases,” says Singh.



HARI SINGH

NIDRA KHURANA / CSE

CAUTION: only loggers allowed

*How do you
destroy a forest?
Cover it under
Project Tiger and
alienate the local
people. An
example from
Bihar*



Railroad blues: the railway track in the northern Bihar forest and the resultant water logging

PHOTOGRAPHS: MANISH TIWARI / CSE

MANISH TIWARI WEST CHAMPARAN (BIHAR)

CORRUPT forest officials, timber mafia, and poor government planning have led to extensive destruction of the only remaining natural forests in northern Bihar. The 91,000-hectare (ha) Valmiki Tiger Reserve (VTR) in the district of West Champaran on the Indo-Nepal border is fast losing its forest cover due to rampant felling of trees.

The Gandak river, which serves as the boundary between India and Nepal, has also changed its course, washing away about 2,500 ha. "More than one lakh valuable trees have been washed away from the forests. Forests worth Rs 142 crore have been destroyed due to water-logging," reveals Ashok Prasad, conservator of forests (CF), VTR. Besides, the shifting of the river has been beneficial for Nepal. About 2,200 ha of the forest land now falls on the Nepalese side of the river. This land has now virtually become a no man's land, a haven for timber smuggling. The government, however, has turned a Nelson eye, leaving the forests at the mercy of international smugglers. There are allegations of Pakistan's Inter State Intelligence's (ISI's) involvement in this heavy destruction of forests. "It seems smugglers are operating from the land now in the Nepalese territory," says A K Sinha, divisional forest officer, VTR (Range-I).

Some forest officials from this reserve have already been implicated

in Bihar's biggest forest scam during 1983-94. "This forest scam would be to the tune of Rs 100 crore," says J L Srivastava, the forest official who unearthed the scam. More than 20,000 *sal* trees have been felled in this period. And the culprits roam scot-free.

The forest department here hardly receives any funds for conservation efforts. It does not even have the money to provide salaries to the staff. Since 1994, when the forest was included in the Project Tiger, fund flow has virtually stopped. The decision to include the forests in Project Tiger is proving to be devastating. There have been no funds since 1994 for regeneration of forest cover, protection of wildlife and providing employment to villagers totally dependent on the forests. Assistant conservator of forests (ACF) Aswini Kumar says the field staff have not received salaries for the last 10 months and the forest guards for 15 months. "We do not have our own money to send accused to jail or bring the seized materials to our offices," says Buwaneshwar Khan, a ranger.

Also, a major portion of the forests has been declared 'core area', where the entry of tribals and forest dwellers is prohibited. People from the 142 surrounding villages — mostly tribals or belonging to the Tharu community — have been deprived of their rights to collect firewood and fodder. In the absence of employment, they have start-

ed collaborating in the destruction of the forests.

"This has created major socio-economic problems and forced villagers here to become dacoits or fall into the hands of foreign agents," says Sinha. "Bihar forest policy today alienates local people. The government should provide work to these villagers. Otherwise the problem will go out of control," says Vipin Shukla, a local leader of the Congress party.

Sinha says that villagers are now resorting to anti-forest activities and helping smugglers in logging and poaching operations for their survival. He blames the bureaucratic style of functioning for the present crisis. "The delay (in getting funds) is a major source of corruption as officials make false vouchers without executing the project. It is now happening with most of the projects in Bihar," says Prasad.

Forest destruction

Though it is said that foreign agencies have been sponsoring terrorism in the Indian territory, their alleged involvement in forest destruction is absolutely new. "The forest department has recently seized foreign arms and choppers. Foreign agencies are providing sophisticated arms and ammunition to jobless villagers and instigating destructive activities," says Sinha. He says that Munna Khan and Laila, two international criminals, smuggle trees such as

khair, sal, sagwan, and cane from Madanpur range of the forest to different parts of Nepal. They operate from Susta (see box: *Unfriendly river*). "The government knows about these activities on the Indo-Nepal border and is making efforts to stop them from making inroads into the Indian territory," a Central Bureau of Investigation (CBI) official told *Down To Earth*.

But the forest department does not have resources and manpower to fight against the criminals, says Prasad.

Corruption

The Bihar government has constituted a committee to investigate the forest scam. The committee headed by Zahir Hussain, Speaker of Bihar Legislative Assembly, found many serious irregularities in the forest department. The committee's report confirms that the then managing director of Bihar State Forest Development Corporation (BSFDC), and other forest officials were involved in large-scale logging. Two other BSFDC officials, the director (marketing) and finance advisor, were also held responsible for heavy losses to the exchequer. The report points out that BSFDC had bought seeds of the *karanch* tree worth Rs 68 lakh and later sold them for a mere Rs 82,000.

Though Hussain recommended stern action against these officials, nothing significant has been done against them. "Interestingly, many other officials who know about their involvement in the scam are being forcefully transferred from the VTR," reveals A S Raman, member, Wildlife Advisory Committee of Bihar. The government has now initiated a CBI inquiry against the BSFDC officials who have been charged with corruption.

A senior forest official told *Down To Earth* the inquiry period of 1984-93 is bound to confuse the investigators. He points out that large-scale logging was carried out in 1993 and more than 15,000 trees were felled.

"The investigation should technically be conducted within one year of felling the trees. But the CBI has been asked to probe the matter after five years. It would be difficult now for CBI to get correct picture of the whole scam," says Kumar. Another forest official alleges that a former Bihar forest minister was involved in the logging operations. "The minister only worked for

destruction of the forests and to accumulate wealth," the official says.

"The police are playing a key role in illegal felling and poaching operations. Many police stations in the area receive money for allowing illegal logging," says Prasad. The officer recalls intercepting a police jeep that was taking away medicinal plants from the forest area.

Problems galore

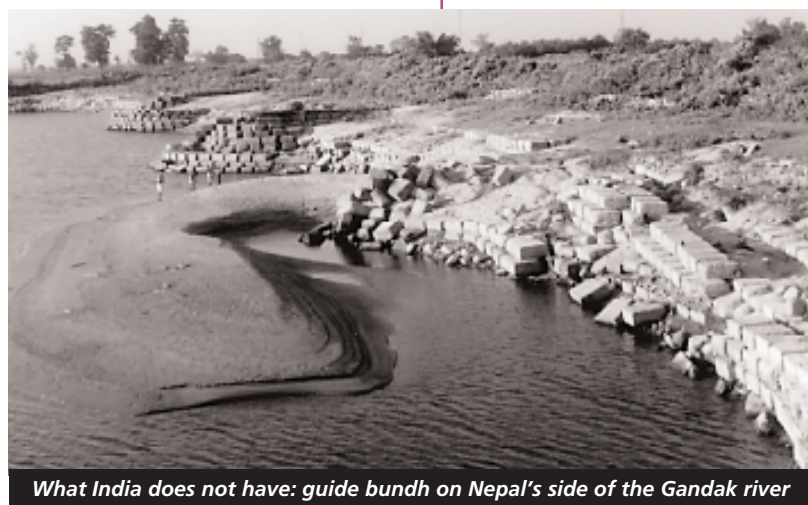
Despite several reports sent to the government subversion in the area by foreign agencies, erosion of the forest land by the Gandak river, and water logging problems, it has not even bothered to send fact-finding teams to the area.

An example of the bureaucratic indifference is the Bagha-Chitawni rail line that connects Bihar and Uttar Pradesh. In 1993, a three-km-long and

Unfriendly river

The mainstream of Gandak river is the boundary between India and Nepal near the Valmiki Tiger Reserve (VTR) on the western side. The government of India constructed a barrage in 1964 and also planned to construct guide *bundhs* on both sides of the river to save the bank from erosion. While a guide *bundh* has been constructed on the Nepal side, the Bihar government failed to do that. Since then, more than 2,500 hectares of forest land have been washed away by the river.

In this process, a big island has been formed within the Indian territory of the river belt called Susta.



six-metre-high *bundh* was constructed to lay the railway track. It blocked two streams, Rohua and Kotraha, leading to water-logging. Prasad cites a survey conducted in 1996 that showed that about 1,691 ha of forest land was submerged. Destruction to forest resources was to the tune of Rs 142 crore; environmental losses were to the tune of Rs 860 crore. "Even after several reminders, the government of India is silent," says Prasad.

Then there is the issue of mining operations on the banks of the Pandai river in the tiger reserve. "We had opposed the Central government's move to give licences for stone mining in the area. But it did not bother to check the facts before issuing licenses," says Prasad. There are allegations that major logging and poaching operations

"The change in mainstream is still taking place towards the Madanpur forest area in the VTR and several lakh trees have been swept away by the river over the years, besides destroying wildlife habitat," says Ashok Prasad, conservator of forests.

go on in the name of mining. Prasad recommends an environmental impact assessment before giving permission for mining operations in the reserve.

West Champaran has also witnessed a rampant proliferation of saw mills. According to Sinha, there are 80 saw mills and 12 plywood mills operating in the district today. Of these, only 35 licences for saw mills have been renewed and three for plywood mills. ■

popular SCIENCE

Traditional science and technologies are crucial to the everyday life of a large part of India. But will the traditions hold on?



Stalls of products manufactured through rural acumen at the Third Congress on Traditional Sciences and Technologies

JITENDRA VERMA / CSE

S SAHAYA JEEVAN AND
JITENDRA VERMA VARANASI

ABOUT three decades ago, Nuka Raja, a farmer of Bhimavaram village in east Godavari district of Andhra Pradesh, used to sow only traditional crops. The crop yield was low, but sufficient. In the 1980s, a tobacco company persuaded him to switch to tobacco, promising fertilisers, pesticides and a loan. Many other villagers also shifted from traditional crops to commercial crops. Soon, they lost their native seeds, which was only one of the problems. "Commercial crops have given us only diseases," says Surya Babu of Tungamadagulu village

of the same district.

But these villagers, unlike others, were smart enough to realise the value of traditions. They reverted to age-old practices. "Earlier, we used to have around 26 crop varieties in our region," says Raja. With the help of a local organisation, they recovered six seed varieties. Now, they maintain their own seed banks and encourage others to do the same. "We give seeds to only those who are sincere. In turn, they have to follow our local exchange system," says Babu.

Raja and Babu are not exceptions. They represent an emerging trend: India's rural technologies *have* a chance

of survival — though faint — despite the charging juggernaut of industry. People who are excavating the past for solutions to present problems are not restricted to agriculture. They can also be noticed in the sectors of health and industry. These people are using traditional systems of knowledge on a modest scale in the face of tremendous obstacles. The presence of these systems across the country reflects their life-supporting social roles for millions untouched by modern science.

There was clear evidence of this — and more — at the Third Congress on Traditional Sciences and Technologies of India held in Varanasi, Uttar Pradesh,

from October 28 to November 2. The congress gave a scientific look to traditional sciences. It was organised by the Patriotic and People-Oriented Science and Technology Foundation (PPST), Delhi, and the Gandhian Institute of Studies (GIS), Varanasi. The congress was attended by a large number of artisans, peasants and intellectuals from all over the country. Over 300 papers dealing with thirteen subjects were presented.

Tradition is nothing but indigenous knowledge and practice special to a particular society and civilisation. However, there is a general misconception that traditional knowledge is outdated. It is considered incompatible with modern systems. Tradition, here, is seen as retrograde, because it harbours much that seems harmful in the modern context. It is set in opposition to modernity and is considered incompatible with modern science.

Agriculture, industry and health

There are numerous examples of traditional science continuing to serve life-supporting functions in everyday life of the masses. Farmers are turning back to organic cultivation, having burnt their fingers with modern agricultural methods. D Bharamgoudra is a farmer from Karnataka. Much against his father's wishes, he switched from

organic farming to chemical farming three decades ago. "In the beginning, we got good yields. But gradually, not only did the yield come down but various diseases and pests crippled my crop," he says.

A thought-provoking paper highlighted how agriculture in India came to grief during the Green Revolution and the subsequent import of modern technological packages which had been formulated under different ecological and socio-economic conditions. "Although the Green Revolution provided food security and solved the problem of foodgrain in deficit areas, the economic and ecological costs of these technologies became difficult to sustain," says H S Shankar, who is with the department of engineering, Indian Institute of Technology (IIT), Mumbai.

Dharampal, eminent historian and author of *Indian Science and Technology in the 18th Century*, points out that most of the agronomic practices of Green Revolution proved to be seriously unfit for the heterogeneous characteristics of India's ecology and economy. In a majority of cases, new varieties of wheat, rice and other cereals surpass local varieties when managed with traditional practices. It has been realised that traditional farming and cropping systems were not products of ignorance but stemmed from ecological rationale.

Shankar discussed the ill-effects of chemicals and fertilisers commonly used in the farming sector, which have spoiled the soil's health. The farmers are forced to use costly inputs, he observes. The solution, he notes, lies in the traditional system of organic farming for which the necessary resource materials, which are cheaper and environmentally-friendly, are abundantly available in and around the farm-sects.

Since time immemorial Indian farmers have been following the concept of managing pests and diseases through local technology, Shankar emphasised. P Narayanaswamy of Annamalai University, Chidambaram, presented a paper on the various traditional practices of pest control which were in high use in early periods in Tamil Nadu for possible use as an alternative to chemical pesticides. Nearly 1,000 such practices were compiled and documented crop-wise and pest-wise.

Papers presented in the industry sessions point out that India has neglected

the science of the common people in the name of industrialisation. In the section devoted to the Indian health care systems, a paper by P M Unnikrishnan of Bangalore argued that Ayurveda and the other Indian medical systems are treasure houses of ideas and perspectives in the emerging scenario of the complex



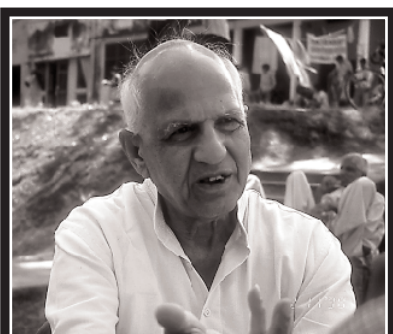
FARMER'S BIBLE

An ancient manual from Kerala could offer solutions to modern agricultural problems

Krishi Geeta (song of cultivation) is an ancient treatise, a primer on agriculture still followed by the farmers of Kerala. It has existed as an oral tradition for many generations. It is as relevant today as it was when it was written. According to belief, the *Krishi Geeta* has existed from the days of the mythological figure Parasurama.

It has four sections. The first records different seed varieties of paddy, fruits, roots and herbs. The second prescribes suitable agronomic practices for different crops, including methods of storage of agricultural produce and the importance of water conservation. This is further discussed in the third section, with emphasis on weather and rainfall patterns. The fourth section provides details of the timing for planting and harvesting of different crops. It also provides a detailed description of cattle, their features and how they can be used in agriculture. The document depicts the diversity in crop varieties present in Kerala in the earlier times.

"Now we hardly find these varieties," says Regi Thomas, senior research fellow at the Indian Institute of Technology, Mumbai, who has worked on *Krishi Geeta*.



S. JEEVAN/CSE

The Green Revolution proved to be seriously unfit for the diverse features of India's ecology and economy

— **Dharampal**
Eminent historian

challenges of health. There is, for example, Ayurvedic ophthalmology, treatment of jaundice by medicinal plants and time-tested cures from nature, pointed out Anuradha Singh of the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi. Traditional cures are being patented increasingly by transnationals, involving *neem*, turmeric and *isabgol*, among others. "This is because these traditional cures are finding wider acceptance. But the government is doing precious little to save these traditions, says Ashis Nandy of the Centre for Developing studies, New Delhi.

However, indigenous systems of medicine have not been able to make as strong an impact as the modern health system. "The people who are working on local traditions have to strengthen the belief of the local people," says Anuradha Singh, who coordinated the health section in the congress.

A team of professors from the Agricultural College in Bapatla, Andhra Pradesh, make a case for the comprehensive compilation of indigenous

Traditional systems play life-supporting roles for millions of people in rural India who are untouched by modern science

knowledge in agriculture and health care. Documenting local knowledge can go a long way in providing solutions to many problems and also help preserve traditional technology, says Yogesh Ghokle of the Centre for Ecology Studies at the Indian Institute of Science (IIS), Bangalore. The centre is documenting systems of traditional knowledge. "We are publishing about 60 registers from different parts of the country to document the rich biodiversity that exists in the country. We want to document this knowledge or else these treasures will be lost forever," says Ghokle.

A repository for the traditional

India's scientific traditions are as old as its civilisation, and all of it has not been

lost to the modern onslaught. Speaking to *Down To Earth*, Dharampal said: "History suggests that around 1750, about 73 per cent of the world's industrial production came from India and China. And even in 1820, they were producing about 60 per cent of the world's industrial production."

"We have to realise that *Lok Vidya* (knowledge of the people) is still present in a large number of people in India," says Vijay Cheriari of PSPT. Traditional sciences bear a closer relationship with those values, ideas and philosophies, he observes. "To understand traditional sciences and technologies is to understand people, whether in India or anywhere in the world," says Nandy.

But why have these traditions declined in India? Dharampal says the biggest blow came to these sciences after India's independence. With increasing emphasis on modern sciences, these traditions were relegated to the back seat.

Challenges ahead

Most of the delegates at the congress knew the problems facing traditional sciences, but had no solution to offer. "Villagers are looking at the cities and are adopting 'alien' technology. We need to educate them," says V Ramchandran of Vivekananda Vikas Kendra in Calcutta, West Bengal. But Sunil Sahasrabudhey of GIS disagrees.

"We should stop disorganising these people. Let them find their own solutions," he argues.

K Karunakaran, vice-chancellor of the Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya in Satna, Madhya Pradesh, points out it is important to strengthen the belief of the people, as they are confused in today's competitive world. "Often we talk about intellectual curiosity when we talk about the rural science. We are not really pushing the issue. We need social entrepreneurship rather than dollar entrepreneurship," he adds. Nandy notes that the people have knowledge and require only a platform to raise their issues. "If they do not get proper incentives, they will collapse," says Dharampal. ■

MOTHERS INDIA

The traditional midwife performs a vital role in rural India

Dai (traditional midwives) belong to one of the oldest traditions of India. The midwives are often more than mere functional figures; they reach into the mind and consciousness of a pregnant woman, providing vital mental and physical support. Despite no support from the government, the midwives have maintained their wisdom to a large extent.

In Tamil Nadu, some midwives use a herb for the confirmation of pregnancy. The leaves are soaked overnight in the urine of woman seeking confirmation. White spots on the leaves the next day indicate pregnancy. Traditional midwives possess immense knowledge which has not been explained scientifically.

"Nothing has been done to promote them," says Susheela, who works with Sahyog, a non-govern-



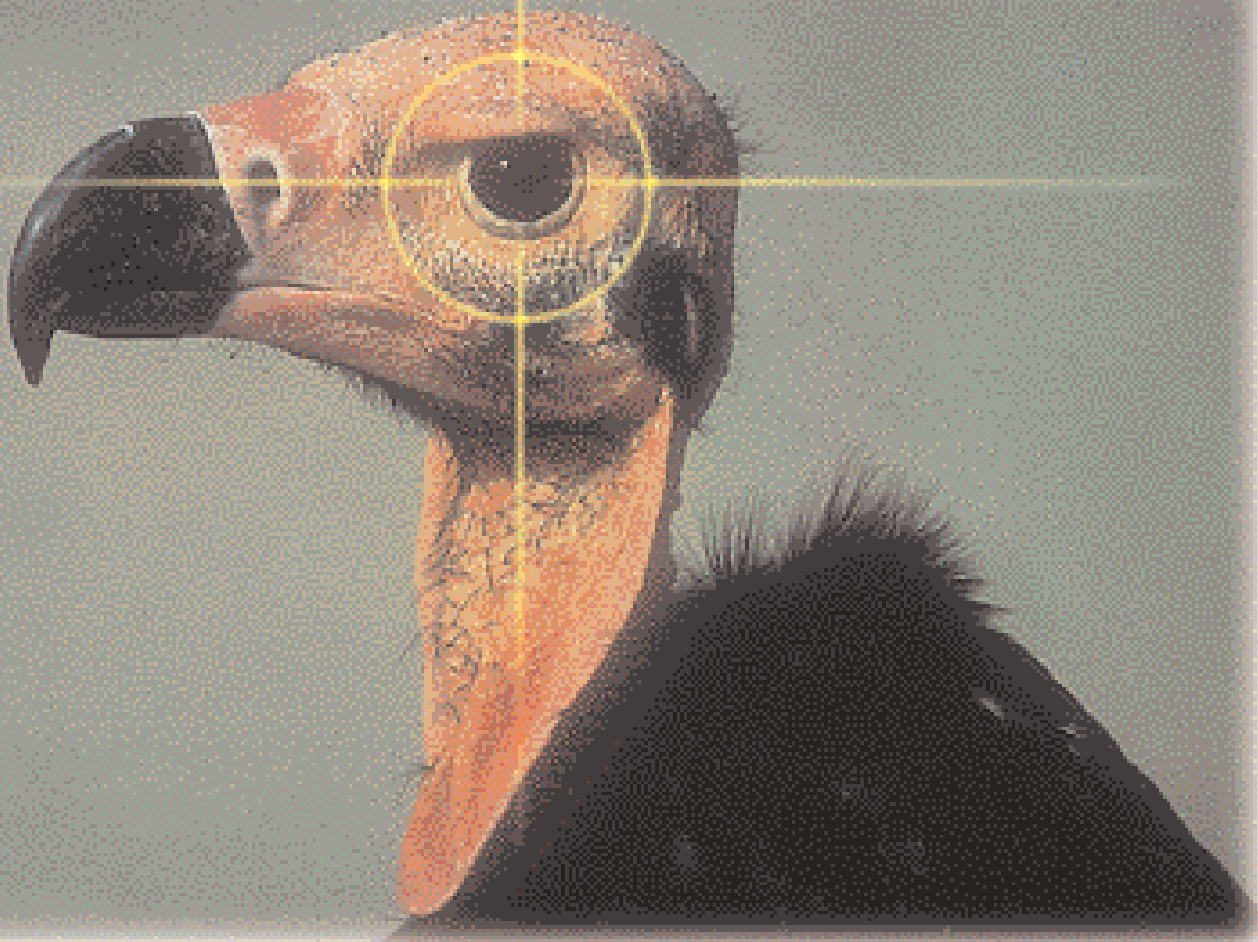
mental organisation (NGO) in Almora, Uttar Pradesh.

It is estimated that there are about 7,00,000 midwives in the country. Even official sources state that about 50-60 per cent of births in rural India are attended by *dai*.

A *dai* usually comes from a particular community — from castes such as *nai* (barber). She learns about childbirth and related issues from elderly women. Most of the midwives are accomplished herbalists and healers.

"There is an urgent need to recognise the potential of traditional midwives in improving health of women and children," says Smita Bajpai of Chetna, a NGO from Ahmedabad, Gujarat.

WHAT'S EATING THE VULTURE?



RAJESH BEDI

There were **2,000 vultures** in Bharatpur's Keoladeo National Park during the 1980s. In 1998 experts could spot only **four**. Ornithologist Asad Rahmani fears that the vulture is disappearing throughout India. To find out the reason for this decline, the **Centre for Science and Environment** sent its toxicologist Amit Nair to collect **carcass samples** — food for the vulture — from the park. They had **high levels** of chemical pesticides. Like vultures, humans are also at the **end** of the food chain. The pesticide threat is very **real** to humans as well. *Down To Earth* analyses

FLIGHTS INTO OBLIVION

The vulture is disappearing in India. Nobody knows why. Some experts blame pesticides

ON OCTOBER 3, 1998, the Centre For Science and Environment (CSE), New Delhi, received a letter from Asad R Rahmani, director, Bombay Natural History Society (BNHS), Mumbai, mentioning a drastic decline in the vulture population of the Keoladeo National Park in Bharatpur. Rahmani wrote how, within a short span, the number of vultures in the region dropped from 2,000 to just four. He cited observations of his colleague Vibhu Prakash, senior scientist at BNHS's research station in Bharatpur, who says in the 1980s it was natural to find as many as 350 vulture nests in Bharatpur. But in 1998, Prakash found only four. Sudden

declines in bird population is not new for Bharatpur. Between 1987 and 1990, says a BNHS report, some 18 *sarus* cranes and over 50 ring doves were found dead in the region. More birds dying within the park premises is also a strong possibility. CSE sent its environmental toxicologist Amit Nair to Bharatpur to collect samples of animal carcasses — vultures' primary food source. In 1990, Nair had analysed vulture tissue samples for pesticides and found 0.485 parts per million (ppm) of dichloro diphenyl trichloroethane (DDT) and 0.061 ppm of hexachloro cyclohexane (HCH or BHC) in the birds' bodies. This time, eight carcass samples were sent for analysis to the Facility for Ecological and Analytical Testing at the Indian Institute of Technology, Kanpur. All samples had high levels of DDT and BHC (see box: *Poison in plenty*). Many experts and ornithologists believe that such pesticides may be to blame for the fall in Bharatpur's vulture population.

However, some villagers in Bharatpur allege that the



Muslim community is poisoning cattle for their hide. There seems to be little truth in these allegations. Traces of BHC have been found in the carcasses. BHC, till 1997, was legally used for agriculture. Villagers in the area cultivate mustard using large quantities of pesticides. Mustard cake is used as a cattlefeed. Also if the Muslims were indeed poisoning cattle on a large scale, there would have been a riot in Rajasthan. Therefore, deliberate poisoning of cattle on a mass scale seems improbable.

Ornithologists have reported dwindling vulture populations in other Asian countries such as Laos, Cambodia, Vietnam and Thailand, too. "There have been reports that cattle carcasses are now being left unattended (in these countries) due to the absence of vultures," writes Rahmani in his note on decreasing vulture population. Though Vietnam and Thailand banned the use of DDT, hexacyclochlorohexane (HCH), aldrin and other such organochlorine pesticides in

1992 and 1996 respectively, these are still being used there and in the neighbouring countries, including Laos and Cambodia. In India, absence of baseline data makes assessments of such population declines next to impossible, he adds.

There can be several factors behind avian population decline, such as habitat destruction, epidemics, hunting, trapping and the occasional food shortage. None of these could be responsible for such drastic declines as witnessed in Bharatpur, and are secondary causes, believe ornithologists. "Pesticides are probably responsible for the recent decline in vulture and other bird populations in India," says Nair. Residues found in the brain tissues of dead birds indicate that these chemicals could indeed be the killers.

So there is reason to believe that there could be a strong link indeed between pesticides and dwindling vulture populations. Vultures, other birds of prey and humans depend on meat as one of their food sources. So if pesticides are affecting vultures through dead animals, they could get to humans, too. But how do pesticides, sprayed on agricultural fields, affect vultures? And how are humans at risk? The answer, explains Tariq Aziz of the WWF-India, lies in the food chain.

"The food chain is a mode for carrying not only food but also pesticides," he says. "Pesticides find their way into the water where they affect the lower-level organisms. Then, as these are devoured by the other creatures, the chemicals affect them too," Aziz continues. "Intake and effects of the chemicals increase several times along the food chain. Assuming a fish's daily diet is a million planktons — each already contaminated by pesticides in the water. Now if a human or a bird eats some four-odd fish a day, it will definitely have more of the poison."

Is this decline in vultures an ominous sign? Are these birds like the canaries kept by the 19th century miners? Back then, coal miners would not enter the mines unless they had a canary with them. If the mines had methane inside, the bird would succumb first and the men knew it was time to run. Perhaps, there is a similar message for us in the recent vulture deaths.

POISON IN PLENTY

CSE confirms the presence of pesticides in animal carcasses, vultures' main food source

A survey conducted by the Centre for Science and Environment (CSE), New Delhi, in December 1998 confirms the presence of high levels of pesticides such as HCH and DDT in cattle and pig carcasses collected from areas surrounding the Keoladeo National Park, Bharatpur (see table: *Vulture cuisine*). Eight samples were collected, of which three were from Saidpur and Dharapur villages, close to Bharatpur. The other samples were collected from Azadpur, Nangloi, Alipur and Najafgarh areas in Delhi and from Mathura in Uttar Pradesh.

Analysis of eight samples was completed at the Facility for Ecological and Analytical Testing at the Indian Institute of Technology, Kanpur. The results are alarming.

- The levels of DDT found in the samples varied from 0.011 ppm to 0.632 ppm. The mere presence of DDT is of great concern as its use in agriculture has been banned in India.
- HCH levels were higher than DDT in all samples. Average HCH levels in Delhi samples were twice higher than in samples from Bharatpur. One pig sample from Mathura had twice as much HCH as the samples from Delhi.
- Among the various forms of HCH, the most toxic forms, alpha-HCH and beta-HCH, were found to be higher than the other forms. These forms initiate physiological and biochemical malfunctions in animals and birds, including the vultures that feed on carcasses.
- Dieldrin was found in three out of four sample collected from Delhi. It could not be detected in the samples from Bharatpur. Dieldrin is a very potent poison for birds. It can cause severe brain damage resulting in death.

VULTURE CUISINE

Leg-muscle samples of carcasses collected by CSE and analysed by Indian Institute of Technology, Kanpur, show high levels of pesticides

Carcass sample	Sample collected from	DDT (ppm)	Total BHC (ppm)	Dieldrin (ppm)
Buffalo	Saidpur (Rajasthan)	0.073	0.236	nil
Buffalo	Saidpur (Rajasthan)	0.632	0.314	nil
Buffalo	Dharapur (Rajasthan)	0.190	0.291	nil
Pig	Mathura (Uttar Pradesh)	0.486	1.071	nil
Buffalo	Azadpur (Delhi)	0.131	0.839	0.011
Buffalo	Nangloi (Delhi)	0.011	0.471	0.002
Buffalo	Alipur (Delhi)	0.175	0.577	nil
Buffalo	Najafgarh (Delhi)	0.078	0.212	0.008

THE SILENT KILLER

Pesticides kill insects. Then, they poison animals and birds. Humans are hardly out of reach

The pesticide threat first emerged in the West, the US in particular. In the early 1930s, the Dutch elm disease spread across the US. A fungus disease spread by beetles, it proved fatal to trees, blocking their water-conducting vessels. In 1954, US farmers began spraying DDT to kill the beetles in a bid to curb the disease. But the pesticide soon affected robins, killing thousands of birds.

Then, in 1963, came *Silent Spring*, a landmark book by environmentalist Rachel Carson, which detailed how increased pesticide use affected bird population in the US, sometimes wiping out entire population and even species. Her emotive assessment of the situation — how birds no longer heralded the onset of spring — rang alarm bells across the nation. Many conservation measures were suggested and some adopted to ensure spring the welcome it has always enjoyed — birds returning home after spending their winters in warmer locales. But these have not been enough. Though a few pesticides, such as DDT, dieldrin and chlordane, have been banned by the US and several European nations, the developing world is still at risk as these chemicals still enjoy widespread applications in these parts. India, for instance, has always persisted in using these deadly pesticides such as DDT even in its 'so-called' health programmes.

Toxins in the air...

Among the chemicals usually used as pesticides, organochlorines, including DDT, HCH, aldrin, dieldrin, chlordane, are proven killers. DDT and dieldrin are the most dangerous because of their subtle and widespread effects on birds and the so-called 'benefits' they confer on human food supplies. To add to the problem, DDT, dieldrin and chlordane also belong to a class of chemicals called endocrine disrupters. These disrupt development of the immune, nervous and endocrine systems and are of serious concern as they affect cellular and molecular processes that regulate developmental, endocrine and immunological functions. Many of these even mimic and interfere with male and female hormones, modifying development and reproduction.

Throughout the late 1950s and the 1960s, US scientists experimented with DDT. These experiments indicated that when juvenile roosters were injected with the chemical, it led to reduced size of the male genitals (testis) and induced female appearance. In birds, DDT compounds may affect embryonic development by reducing egg shell thickness, as in the case of ducks, or by direct effects on the embryos. When eggs of Californian gulls (*Larus californicus*) and western gulls (*Larus occidentalis*) were injected with methoxychlor and DDT, these caused feminisation of male embryos. Endocrine disrupters also change mating and parenting behaviours in birds, say experts. Birds often eliminate organochlorines and heavy



metals by sequestering them in their eggs, a phenomenon that, as mentioned, jeopardises the developing embryos. During the egg-laying period, the eggs receive half of the contaminants that are in the females' bodies (see cartoon: *Dark duck tales*).

Moreover, DDT and its breakdown products, classified as Persistent Organic Pollutants (POPs), are chemicals that take hundreds of years to disappear from the environment. These have even found their way to the polar regions borne by winds. They have caused serious health problems in human, bird and animal populations. Early leakage that might have contaminated land will continue to be a major threat for many years from now.

Organochlorines are severely detrimental to the survival and reproduction of wildlife, especially that of birds such as vultures, which are often indicate contamination in the environment. The first to get affected by the chemicals are vultures and other birds of prey, being on the top of food chain. Barbara Rutherford, policy coordinator, Water Pollution and Toxics at the Switzerland-based WWF international, once assessed the pesticide threat as "one of the great difficulties in identifying exactly how these chemicals (endocrine disrupters and other pesticides) affect birds, animals and humans is that the pattern of effects varies between species and compounds". "General conclusions can be drawn, however," she adds, "even one very low dose of an endocrine disrupter at

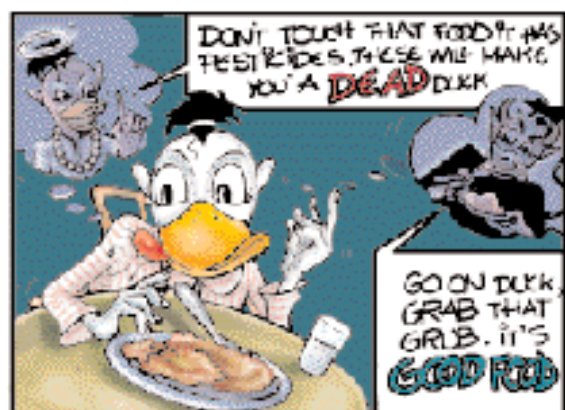


Vulture populations have declined drastically throughout Asia. Some experts believe that pesticides could be responsible for this



Dark
Duck
Tales

SERIAL
ARTIST
GAY CHAKRA
ILLUSTRATION
RAJAT
SATYAN



FATAL FOOD

Indians consume dangerous amounts of pesticides through their food everyday

The average daily diet of an Indian contains 0.27mg of DDT, reported *The Hindu* in 1991. Since then, researchers and scientists believe this amount has gone up much further. But systematic, all-India studies are lacking. Despite these hurdles, The Pesticide Trust's book *The Pesticide Hazard: A Global Health and Environment Audit*, published in 1993, has managed to cull information that is sure to frighten every Indian citizen. In India, where infant milk formula in Punjab, Gujarat and Mumbai had DDT in all four samples tested, can anyone be safe?

- The United Nations-sponsored Global Monitoring Programme chose India as part of a 10-nation survey for studying pesticide residues in human breast milk. The results are frightening: studies of 50 women showed DDT and BHC residues at least four times higher than those in other countries.
- A similar study of breast milk and maternal blood serum of 25 women from Delhi, tested three days after delivery, revealed high levels of aldrin and dieldrin.
- A government study detected pesticide residues in vegetables. Seven out of eight chillies studied contained 100 to 160 times the permissible levels of malathion and other pesticides.
- Out of 104 samples of cereals, pulses, milk, eggs, meat and vegetables analysed, 108 contained pesticides, 88 had traces of more than one pesticide and 69 had residues more than the permissible limits.
- Cereal and cereal produce in Punjab, Haryana, Uttar Pradesh (UP), Delhi, Mumbai and Andhra Pradesh (AP) showed DDT in 53 per cent of 1,651 samples.
- Pulses in Punjab and AP had DDT in 25 per cent of 171 samples, vegetables had DDT in 27 per cent of 2,154 samples and fruits had DDT in 14 per cent of 90 samples.
- Meat in Delhi Punjab, AP and UP had DDT in 96 per cent of 134 samples and HCH in 90 per cent.
- Milk in Delhi and AP had DDT in 95 per cent of 980 samples, HCH in 90 per cent and dieldrin in one per cent.

MILK OF UNKINDNESS

A 1996 study in Delhi found pesticide residues in mother's milk, blood, and in infant blood (in milligram per litre (mg/l))

Pesticides Detected	Breast Milk	Maternal Blood	Newborn Infant Blood
DDT	1.270	0.271	0.135
BHC	0.327	0.050	0.033

- According to WHO Acceptable Daily Intake(ADI) for DDT is 0.005 mg per kg of bodyweight.
- A mother in Delhi on an average passes on 1.27mg of DDT in every litre of her milk. If her baby weighs 3kg and consumes 500ml of milk daily, it will ingest 0.21 mg of DDT per Kg of bodyweight everyday.
- This is **42 times** greater than the recommended ADI.

Death in the food chain



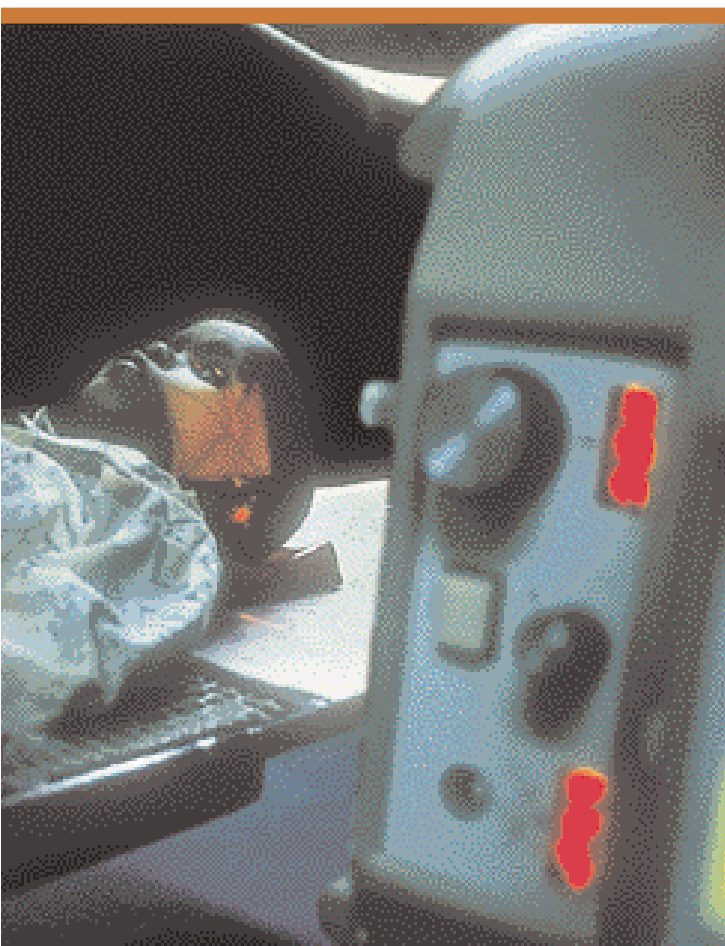
a crucial stage in the development of an embryo is sufficient to cause irreparable damage.” Further, Rutherford points out that the effects are transgenerational — the gap between intake and effects could be as large as two generations.

...and within us

Studies conducted in Sweden, Canada and the US revealed a strong link between the incidence of a certain type of cancer called Non-Hodgkin's Lymphomas (NHL) and the use of pesticides. In Sweden for instance, frequent use of herbicides, such as 2,4-dichlorophenoxyacetic (2,4-D) has been estimated to increase the risk of contracting NHL by 200-800 per cent.

According to N K Mehrotra, who was with the Industrial Toxicology Research Centre (ITRC) in Lucknow, India, organochlorines such as toxaphene, HCH, strobane, dieldrin and DDT are all known to cause lymphatic cancer in rats and mice, and most certainly in humans, too. Distressingly, these affect both birds and humans through the same channels: vector control, residues in food and in the environment.

In India, there is ample evidence that pesticides have affected birds and humans alike. And most Indians already have these chemicals inside them. A 1993 study conducted by the Indian Council of Medical Research (ICMR) found alarming levels of pesticide in some 2,205 cow and buffalo milk samples collected from 12 states over a period of seven years (*Down To Earth*, Vol 5, No 13). Detectable residues of alpha, beta and



gamma isomers of HCH — or BHC, a pesticide known for its extreme toxicity — were found in 87, 85 and 85 per cent of the samples respectively (See box: *Fatal food*). The percentage of samples exceeding the scientifically-approved tolerance limits were 21, 24 and 28 in the case of alpha-, beta- and gamma-HCH, respectively. The worst contamination was detected in samples of Andhra Pradesh (AP), Bihar and Uttar Pradesh. Dietary intake of beta-HCH was about twice the acceptable daily intake (ADI) among the high-income urban population in AP. DDT residues were detected in about 82 per cent of the samples. Some 37 per cent had DDT traces above the tolerance limit. Maximum levels of DDT residues were found to be 44 times the tolerance limit. States that recorded the maximum DDT levels were Maharashtra, with 74 per cent samples above the tolerance limit, Gujarat, with 70 per cent, AP, with 57 per cent, Himachal Pradesh, with 56 per cent and Punjab, with 51 per cent.

Even infant milk formula and bottled milk had pesticide residues. Of some 186 samples of 20 commercial brands of infant milk formula available in the market, 70 per cent showed DDT contamination and 90 per cent had HCH-isomers. The results are frightening: children fed on instant formula would absorb quantities of beta-HCH that are 90 per cent more than the ADI.

CHEMICAL CATASTROPHE

Pesticides can render birds sterile. Migratory birds can lose sense of direction. The recent history of the world is full of many such examples

PESTICIDES are essentially products of urbanisation and agricultural modernisation. As cities began growing, lands — once home to birds — were put to intensive agricultural use. To increase crop yield, farmers used pesticides liberally. Owing to the formidable gap between their intake and effect, it took scientists more than half a century to realise that these chemicals were being far from benign in their effects.

Silent wings

- Today, scientific literature is full of instances of the adverse effects of pesticides on birds. Take DDT, once the most popular pesticide, for instance. Its most use occurred in California where, between 1949 and 1957, it was applied just thrice in Clear Lake to control gnats. It not only eliminated its intended targets, but brought the population of Western Grebes (*Aeschmophorus occidentalis*) from a thousand breeding pairs to zero as well. It then went on to suppress the bird population for years to come.

- There are many such instances of organochlorines and endocrine disrupters affecting birds. In the 1980s, experts discovered that since 1950, sex ratios in certain population of North American gulls and the Caspian Tern (*Sterna caspia*) became skewed, favouring females. Homosexual pairings accounted for less than 10 per cent of the breeding pairs on Santa Barbara Island, California, between 1972 and 1980.

These pairs were associated with abnormally large number of eggs laid. After much research, scientists found the unbalanced sex ratio to be the result of feminisation of male embryos through exposure to DDT and its metabolics. The most disproportional sex ratios and the highest incidence of homosexual pairing in Western Gulls occurred in a local DDT 'hot spot' in Los Angeles, California.

- In the mid 1980s Black-billed magpies (*Pica pica*) suddenly suffered local population declines for no apparent reason in many parts of the US. However, extensive research revealed the true story: the birds were suffering from contamination by a organophosphate pesticide called femphur. The pesticide was usually used to control warbles or fly larvae in cattle. Poured on backs of cattle, it kills the larvae in the cattle's bloodstream. It was an effective way to eliminate the insects. The only problem was that it remained active long after its application.

The magpies were its first or primary victims. It claimed Red-tailed Hawks (*Buteo jamaicensis*) that fed on the magpies as its secondary victims. Soon, reports of many

Pesticides disrupt metabolic functions in birds, alter mating behaviour, lead to thinning of their egg shells and render them sterile



such primary and secondary bird deaths poured in from all parts of the country. Research soon proved that as a pour-on, fempfur would pose severe risks to the birds and it was described as a chemical with “extreme toxicity” (*Ecological Applications*, Vol 7, No 4).

- In migratory birds, organophosphates can interfere with their ability to orient themselves in the proper direction for migration. When consumed, these chemicals are stored along with the birds’ fat reserves. During the long migratory flights, the fat reserves are used up and the chemicals are ‘liberated’, disorienting the birds.

- The Californian condor, once common in California and its suburbs, lost a formidable percentage of their population, and by 1982, there were just 20 left. Now, none exist in the wild and only 50-60 in captivity. Accumulation of pesticide content in body tissues, lead poisoning through gun-shot carcasses and poisoning through baited rodent pests have been forwarded as some of the primary causes of this drastic decline.

- The us’s national bird and a long-standing symbol of power and elegance, the bald eagle, now classified endangered, continues to fall prey to endocrine disrupting chemicals through their food sources such as contaminated fish. As in all their victims, these chemicals led to premature cracking of the bald eagle egg shells.

- The UK, like its transatlantic neighbour, suffers from similar afflictions. The UK’s indigenous grey partridge is a bird of arable landscape. Nick Sotherton, research manager for the Farmland Ecology Unit of the UK-based Game Conservancy Trust, writing in *Pesticide News*, says that in the last 40 years, these birds have suffered drastic population losses. These chicks feed on insects. Pests, contaminated by pesticides and herbicides, are believed to be the main factor in chick losses.

- Reports of bird deaths due to pesticide intake pour in from all corners of the world. In another such instance, the UK reported a drop in the last 20 years of more than 75 per cent in song thrush population, found mainly on its lush farmlands. The culprits — an easy guess — are pesticides used against slugs and snails — food thrushes depend on.

- In Vienna, a massive bird mortality accident occurred in Tuleca County from late December 1991 to early January 1992. Thousands of birds died, and an autopsy of 943 bodies revealed carbofuran, a maize seed dressing, as the cause of death.

- South Africa (SA), too, has reported several pesticide-related bird deaths. “Cranes and other bird species are being affected by extensive use of these chemicals,” reported the SA newdaily *Antidote* in 1993. “Farm workers in Overberg, South-Western Cape, scatter grain soaked in pesticide to kill guinea fowl.

This has proved to be a major factor behind numerous blue crane (*Anthropoides paradiseus*) deaths,” it reported. The paper listed the organochlorine dieldrin as one of the major killers.



INDIAN SCENARIO

A crippling lack of data prevents researchers from reaching conclusions

MORE studies are required to confirm the number of vulture/bird death reports in India. However, it has been known that urbanisation and deforestation have been responsible for a gradual decrease in several species of birds of prey. Scientists and ornithologists say that in southern India, where domestic livestock carcasses are rare and cannot be depended upon as primary food source, vultures have suffered population losses. But they are yet to explain their decline in North India.

Sprayed to death

“Global comparison of organochlorine concentrations indicated that resident birds in India had the highest residues of HCHs and moderate to high residues of DDTs,” reads a recent report from the department of environment conservation at Ehime University, Japan. It adds that migratory birds which spend their winters here may also have formidable



Pesticides have found their way into the food chain. It's only a matter of time before their effects on humans begin to manifest themselves

amounts of these chemicals. Experts speak of numerous instances of pesticide poisoning in Indian birds.

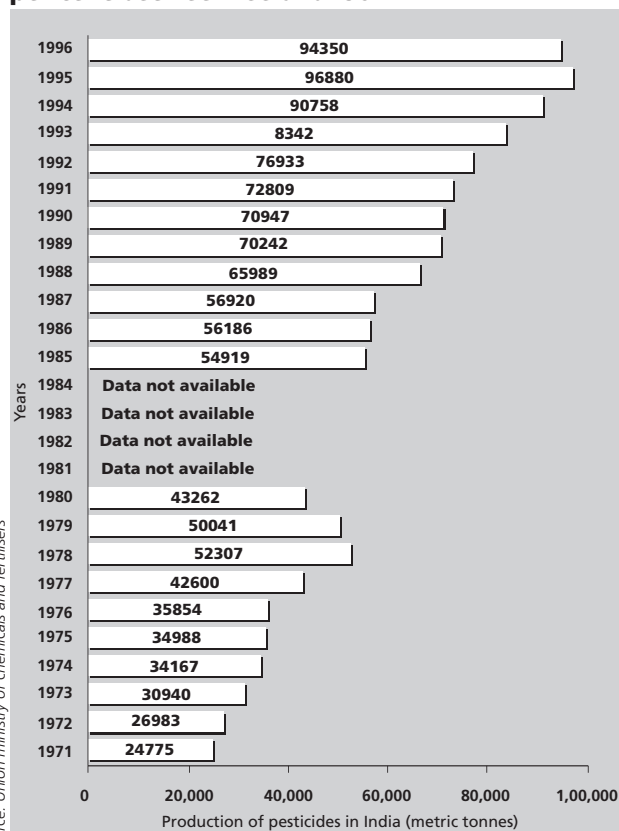
Cranes, says George Archibald of the International Crane Foundation (ICF) have been affected by the pesticide menace: "Pesticides like DDT are the major culprits. These have fatal effects on the cranes (*sarus*) which adorn the agricultural fields of north India." The *sarus*, quite adaptable, lives close to human habitation and depends on food grain as its primary food source. This is why they are found in the agricultural land of north India. But its feeding grounds have become their killing fields. The cranes eat grains treated with pesticides which proves fatal. This either kills them or affects their calcium metabolism by making the shells of their eggs thin. This eventually hampers the propagation of the species, Archibald explains.

V S Vijayan, director of the Coimbatore-based Salim Ali Institute of Natural History and Ornithology, confirms the *sarus* deaths. The farming community around Bharatpur uses aldrin, a banned organochlorine, to protect their mustard crop. Later, mustard oil cakes contaminated with the chemical are used as cattle feed. The *sarus* gets the pesticide somewhere along the food chain. "We had also detected organochlorine residue in eggs and bodies of colonial nesting birds such as grey heron, cattle egret, spoon bill, painted stork and several others," says Vijayan. An ITRC study confirms the presence of these chemicals in cattle feed. The study found significant levels of organochlorines, HCH and other toxins in commercially-produced cattle feed available in the country.

Deformed and thin egg shells of the lesser fish eagles were found at the Corbett National Park, India, from 1991 to 1996 by Bombay-based ornithologist Rishad Naroji. Eggs from seven nests monitored during this period did not hatch, many young birds were found dead in the nest. "The species is seriously threatened at Corbett and is likely to be similarly affected throughout its range in India," says Naroji. He voices his suspicions, "One reasonable guess would be that the birds have been affected by pesticides. Significant levels of dieldrin

MORE OF A MENACE

Union ministry of agriculture data show pesticide consumption in India fell by more than 25 per cent between '88-'89 and '96-'97. Yet pesticide production grew by more than 30 per cent between '88 and '96



ANAND SINGH RAWAT

Greener pastures? A *sarus* crane looking for food in a pesticide-sprayed field



RAJIV BEDI

were found in the egg shells based on a quantitative analysis.” Further, the waters of river Ramganga, the park’s lifeline, have high levels of this pesticide, he says.

A 1997 paper by Naroji in the *Journal of the Bombay Natural History Society* says the higher reaches through which Ramganga flows are covered with terraced cultivation where farmers used pesticides on a large scale. “The contaminants probably run off into the water system during the heavy monsoon which the region experiences. This is a matter of great concern as even other animal species in the river could be getting affected,” he says, “But we do not know, due to lack of research and information in this area.”

While information about decline in vulture population from most parts of India is sketchy, Naroji says there is definitely a decline in southern India. This could be due to efficient disposal of carcasses and cleaner eating habits, he says. As far as North India is concerned, he says: “They have definitely suffered losses in some areas.” He cites the Bharatpur phenomenon and says the decline is very likely due to pesticides. “All around the world and in India too, aldrin and dieldrin has been banned. But in Bharatpur, farmers still depend heavily on aldrin,” says Naroji. He questions whether these pesticides are past surplus or if they are still being manufactured in India.

Bharatpur is in Rahmani’s mind too. Perturbed by the population crash, he thinks that apart from pesticides, there could also be the chance of an unknown avian disease. “But this,” he says, “has to be proved by a proper study.” And the lack of studies on avian deaths remains the single biggest hurdle in assessing the effects of pesticides. Extensive research is indispensable, agree experts, if we are to save not only the birds, but ourselves too from this chemical bane.

According to Rahmani, vultures and cranes are not the only birds being affected. Rahmani cites the instance of the ring-tailed fishing eagle which disappeared from Bharatpur as a breeding species. “There is no proper study on the effect of pesticides on birds and wildlife so we think the problem does not exist in India. Only through studies will we know the magnitude of this problem. At present, ignorance is bliss,” he laments.

Among Indian states, West Bengal has witnessed a recent decline in birds of prey such as eagles, harriers and vultures, informs Kushal Mukherjee, founder-member of the Calcutta-based environmentalist group, *Prakriti Sansad*. A journal by the *Sansad* notes: “One big reason for the death of predatory birds is the use of pesticides. Poisonous chemicals like DDT enter their bodies when they feed on smaller animals and reptiles like frogs and snakes. These smaller animals eat insects whose bodies contain these insecticides.”

A study on the effect of pesticides on birds was done by S K Maitra and his team from the Reproductive Endocrine Physiology Laboratory of the Burdwan University, West Bengal, during 1987-91. The study concentrated on grain-eating birds like parakeet, *munia* and weaver bird in the state. Maitra notes long-term effects of organophosphate insecticides: “It does not cause mortality at low doses but causes damage to reproductive system.”



AMIT SHANKER / CSE

LOSING THE POETS

What can we do to save the birds and ourselves from the chemical menace?

WHEN noted British author Aldous Huxley finished reading *Silent Spring*, he was distraught. “We are losing half the subject matter of poetry,” he remarked. He was not quite right. The chemicals have found their way up the food chain and after the birds, humans could be next. Huxley might well have added that not only is the subject matter of poetry being lost but there is a good chance of losing the poets as well. The pesticide threat is very real, and any delay in tackling it could prove to be a very expensive mistake.

The US, one of the first countries to suffer pesticide-related avian deaths, was also one of the pioneers in spearheading a legal fight against pesticides. The first signs that the chemicals were not being entirely benign in their effects came soon after the US Green Revolution. Research indicated that despite all the hype, high-input agriculture, based on the application of these chemicals, was in no way an improvement over traditional low-input agriculture. *Silent Spring*’s poetic language and the touching tales of bird deaths and environmental degradation led to the birth of environmental activism in the country. Since then, public and government awareness has increased, and the US has taken several steps in curbing the use of pesticides.



Alarming levels of these chemicals have already been found in human breast milk and sources of human food, such as vegetables

The US Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is a sign of hope. FIFRA ensures that all pesticides carry extensive instructions as well as cautionary advises to prevent deaths of unintended targets. But apart from this act, the US has taken several other steps to curb decline in avian population. The country has adopted legal measures to prevent habitat destruction and use of potentially harmful pesticides. Methods suggested by conservationists include raising public awareness about the beneficial activities of birds and the need to protect them. Ecological studies, a must before other steps can be adopted, are not so rare in the US. Consequently, the country is well prepared to fight the threats to avian population.

India's own silent springs

Acts like FIFRA seem to be a distant dream in India and other Asian countries where the basic prerequisites — extensive studies — are conspicuous by their absence. Right now, India lacks information required to take any step to curb pesticide poisoning not only in birds and animals but in humans as well. Studies like the one conducted by the ICMR are extremely rare. More studies, agrees Rahmani and other experts, should be encouraged. Though time-consuming, only these can pave a way for legal action, bans and our own equivalent of the US's FIFRA.

As far as government policies to curb the pesticide menace are concerned, India, continues to turn a blind eye. Banned pesticides, as Archiebald and Vijayan point out, are often used with impunity and ignorance by the farming community,



A victim of pesticides? A cancer patient in a Delhi hospital



resulting in frequent bird deaths. Lack of research and public interest limits the number of such reports and subsequent investigations. The government, say environmentalists, should recognise the toxic pesticides and not only ban them but launch campaigns to illuminate the farmers of the dangers of pesticides. Pesticides should not be included in health programmes, as they have been in the past. Further, the government should meticulously regulate the pesticide industries.

By 1996, India's pesticide industry had an installed capacity of 1,16,000 tonnes per annum of which about 70,000 tonnes was in the organised sector. The rest, comprising 500-odd units, belong to the small-scale sector. It is doubtful if the government actually has any appreciable control over these smaller manufacturers. With liberalisation, restrictions on pesticide manufacturers were lifted, and now, no license is required to manufacture most toxic pesticides except aluminium phosphide, dimethoste, quinalphos, carbyl, phorate and fenitrothion. And though government data show a decline in pesticide consumption, production has risen significantly (see graph: *Growing menace*).

By 2000, says a Planning Commission study, India's pesticide consumption would be some 1,18,000 tonnes. What the study leaves out is the fact that if pesticides are used indiscriminately, numerous bird and animal species stand a good chance of being wiped out forever. "Ignorance is bliss for the politician and the bureaucrat. Apart from the influence of industrial lobbies which may operate underhand, India's overt governance systems themselves are incompetent," says a leading environmentalist. This manifests itself best in the fact that there are very few studies on pesticides and their impacts on humans and wildlife.

But in India, pesticides may not be the only threats to vultures. Recent newspaper reports have revealed how quacks in northern parts of the country were using vulture remains as 'medicines'. Villagers were being offered up to Rs 3,000 — a significant amount by Indian standards — for vulture bodies. This led to massive vulture-hunting sprees and consequential, the birds suffered tragic population declines in these regions. Not only the government needs to be educated about the importance and value of preserving these birds but the people as well. Non-governmental organisations should take up these issues at grassroots level, telling villagers and farmers why we need to protect the birds. Environmental education, almost non-existent in schools in the rural parts of the country, could also go a long way towards developing a nation of well-informed, environmentally conscious citizens. There is no quick way out of this mess. Studies, well-planned policies and firm control and regular monitoring of the pesticide industry seem to be the only answers in sight. The canary once saved the lives of thousands of farmers. We should do the same for these winged friends, if not in gratitude then at least because they are truly wonderful creatures. But till the government and the people do not wake up, every can of pesticide sprayed on the fields will take India a step closer to its own silent spring. ■

Based on a note provided by Asad R Rahmani, director, Bombay Natural History Society, and inputs provided by Padma S Vankar of IIT, Kanpur; Karim Ahmed of World Resources Institute, Washington, DC; Ranjita Biswas, Calcutta; and Kazimuddin Ahmed, Priti Kumar, Amit Nair, Manish Tiwari and N Venugopalan of CSE. Copy written by Arnab Ray Ghatak



A *water* HARVEST

Catch rain where it falls. No one knew it better than the people living in Mandu, a hill-fort town in Madhya Pradesh, 1,400 years ago



Remains of the Kapoor tank which supplied water to Jahaz Mahal

RICHARD MAHAPATRA MANDU

IN THE hill-fort of Mandu, Madhya Pradesh, lie the ruins of a 1,400-year-old civilisation ruled by numerous dynasties, including the Mughals. Cocooned in these ruins, at 633.7 metres above sea level, is also a sophisticated and need-based water harvesting system. Devoid of groundwater, the hill-top town depended on rain for water supply throughout the year. The system comprised more than 1,200 water tanks, catching rainwater and supplying it through channels to the entire fort. Today, all that remains of the system are a few tanks and the main water passages carrying water to different dwelling sites.

Retracing the system in the ruined monuments is like cruising in the labyrinth of time. Old-timers and guides are your navigators. The Archaeological Survey of India, the so-called keeper of India's heritage sites,

has come out with a tourist guide of Mandu. But it does not talk about the ancient wisdom that made Mandu a prosperous town. Nor is there any effort to document the marvels of this water harvesting system.

There are 70 monuments in this fort town which are accessible. But traces of the ancient water supply system can be found only in five of them. In these five monuments, there are about 700 small and big water tanks.

How the system worked

Each and every monument had its own system of supplying water depending on the architecture. There was a main water tank which served as the catchment area. It was usually 20 to 30 feet deep and the width depended on the

requirement of the respective dwelling. Water from the main tank was carried inside the building in two ways.

Firstly, through underground channels directly linking the main tank to the small cisterns inside the building.

Secondly, water was transported to the building through roof-top tanks. Using a pulley system mounted with silver baskets and manned by two people 24 hours a day, water was transported to roof-top tanks (located at the top of the wall). These tanks were in turn connected to pipes inside the pillars of the monument. Through these pipes, water was supplied to the entire building for domestic, gardening and various other purposes. The pillars were interconnected, hence water flowed throughout the building.

In between buildings and inside buildings there were many cisterns where water from the main tank was stored and again channelised to other

The water harvesting system comprised more than 1,200 water tanks

rooms inside. These cisterns worked as step-up transformers for water transportation. It worked as stopover for the water thus creating force for further channeling of water smoothly. Around such cisterns were built rooms which are used during the summer. The water kept the room cool.

Jahaz Mahal

One of the most elegant monuments in Mandu, the Jahaz Mahal (ship palace), still has traces of the water supply system. It is another matter that one has to connect all of them logically to picture the system.

The palace is located between two tanks, Munj and Kapoor, which have a total capacity of 25 lakh litres. The ground floor of the palace has three large halls with corridors in between and narrow rooms at the extreme ends. There is a beautiful cistern near the northern hall which is connected by a water channel from a roof-top tank placed on the first floor of the palace. This tank, now ruined, used to store 54,000 litres of water. The 150-foot-long channel passes through hollow pillars at some places.

The cistern, which was mainly used for bathing purposes, is also connected by a serpentine water channel. The channel was deliberately built in such a way to allow water to flow sluggishly for a "royal bath". For the convenience of non-swimmers, a flight of steps up to the water level was constructed in one of the sides of the cistern.

The Munj and Kapoor tanks were interconnected through an arched underground channel, which exists even today. As the rainfall was not equally distributed and the terrain was undulating, the water level in the two tanks was not always equal despite the underground balancing system. So a causeway between the tanks was laid out at the water level. These two channels ensured equal distribution of water between the two tanks.

To meet the drinking water requirements, there are two wells called Ujala and Andheri Baolis (bright and dark wells respectively). The bright well is in the backyard of the Jahaz Mahal, while the dark well is inside the palace itself. The 265-feet-deep Ujala well has two flights of steps leading to water level. There are a few pillars and landings inside the well for the convenience of



water carriers. There is also a pulley system in the well. It is believed that bullocks were used to operate the pulley.

The Andheri well was used more as a cooling plant for the rooms in the palace. Besides, there are three tunnels which connect the well to the royal bathroom called Hamam Ghar. The first passed above a cooking stove for hot water. The second tunnel was meant for steam and the third supplied cold water.

Sadly, the knowledge has died with the fort. Its revival seems distant. The new inhabitants of Mandu still depend on rainwater. In summer months, the town suffers from an acute shortage of water. A single water tank now supplies water to the 40,000-odd residents. But the long queue in front of a water point near the Jahaz Mahal is oblivious to the age-old tradition of water harvesting that made this hill-top town prosperous centuries ago. ■



Grooves constructed to tap and regulate rainwater (top); a roof-top water channel which carried water from the main water tank to the cisterns and ponds inside the fort (above); Andheri Baoli, a multi-purpose well inside the Jahaz Mahal (below)



Worst case scenarios

Climate change will not be gradual, but a swift and sudden process

Heat before the cold

Volcanoes triggered the deep freeze that has covered polar regions with ice for millions of years, say US geologists. For years, researchers have debated the causes of the latest series of ice ages, which began roughly 2.6 million years ago. Among the prime suspects were periodic changes in the tilt of the Earth's rotation axis and its orbit. Another contender was tectonic changes. The raising of the Himalayan Plateau was among several such changes that could have triggered off changes in air and water circulation, redistributing heat around the Earth. However, David Rea and Libby Prueher of the University of Michigan, USA, say that while these factors readied the planet for eventual glaciation, volcanic eruptions pushed the climate "over the edge". Ocean cores from the North Pacific show glaciation started within 3,000 years, much faster than possible if the trigger was orbital or tectonic. Also, there was ash in the cores. "All around the North Pacific, volcanoes started firing off," says Rea (*Geology*, Vol 26, p 1027).

A victim of bad publicity?

In the last couple of years, climatologists and scientists found a unique scapegoat: the El Niño. Whatever happened, be it crop losses or hurricanes, they blamed El Niño. It has taken a lot of flack lately and some of it due to no fault of its own, says a US researcher. The El Niño of 1997-1998 was widely accused for extreme weather. But a statistical analysis by Ed Harrison from the Pacific Marine Environmental Laboratory in Seattle shows much of the 'wild' weather had causes other than every meteorologist's *bette noir*, the El Niño. Heavy winter rains in California, for instance, were blamed on El Niño, but Harrison discovered that previous El Niños often made California unusually dry. "There seems to be more to the question of what gives us weather anomalies in the US than just El Niño," he says (*Geophysical Research Letters*, Vol 25, p 3959).

WHILE leaders of some 150 countries were negotiating climate deals to curb global warming and climate change in Buenos Aires, Argentina, scientists were busy trying to figure out how global climate will change if the talks fail. Will it be a gradual change from warm to very hot, or a sudden shift in temperatures across our planet? The scientists explored all possible scenarios and came up with a scenario very much possible if we fail to curb emissions of greenhouse gases.

According to most scientists, global warming will not be a gentle 'turning up' of the Earth's temperatures, as climatologists used to think, but rather a sudden shift to a new climate system. "Climate doesn't change smoothly. It happens in jumps and jolts," says Stefan Rahmstorf of Germany's Postham Institute for Climate Impacts Research. In Buenos Aires, he revealed details of a study that builds on his prediction that northwest Europe could cool by several degrees as global warming shuts down the Gulf Stream.

The current has already been weakened by increased flows of freshwater into the North Atlantic, Rahmstorf says. "There is a threshold in the North Atlantic Ocean circulation may abruptly collapse. We may reach that threshold early in the 22nd century but it could be much sooner."

While Europe faces a sudden chill, most of the planet could face equally rapid heating. Abrupt climate change was the historical norm, says Jeff Severinghaus of the Scripps Institution of Oceanography in California, USA. Greenland ice cores, for example, have revealed a sudden rise in average temperatures 14,600 years ago of more than 5°C in less than 10 years (*New Scientist*, Vol 162, No 2160).

"We used to think climate changed gradually, like slowly turning up a dial on an oven," says Severinghaus. "But it is more like a light switch."

The abrupt changes may be intrinsic to the atmospheric system, or triggered by feedback with vegetation. Researchers at the Hadley Centre in Bracknell, part of Britain's Meteorological Office, forecast that in the next 50 years, global warming will force forests to grow much faster, absorbing more than 100 billion tonnes of carbon, a third of current industrial emissions. This should moderate warming. But from about 2050, the warming will also wipe out tropical forests, returning the carbon to the atmosphere and causing 'runaway' warming.

"We used to discuss these scenarios privately. Now we are being more open," says Stephen Schneider of Stanford University in California, USA. If the climatologists are right, waiting for



RAJAT BARAN

cheaper clean-up technologies before tackling the problem of global warming would be a grave error.

Schneider warns that the rate at which greenhouse gases are added to the atmosphere in the next few decades could be as dangerous to climate systems. Worryingly, the latest data on CO₂, revealed by Dan Keeling of the University of California in San Diego, USA, show that in the 1997, the gas accumulated in the atmosphere at a record rate of nearly 2.5 parts per million (ppm).

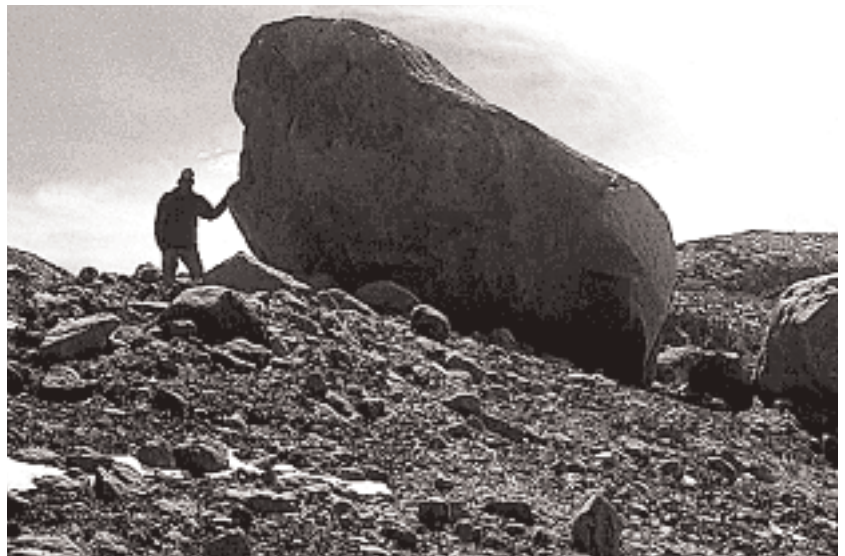
Bob Watson, chairperson of the United Nations Intergovernmental Panel on Climate Change, says the new work on sudden, chaotic climate change will be the central feature of the panel's third report, due to be published before 2001. Its previous report in 1995 contained as little as just two paragraphs on the subject. ■

Cold diversity

Antarctica's larval diversity can warn us of the effects of climate change

THE waters around Antarctica may be teeming with a far greater diversity of larvae than biologists realised. Researchers diving under the ice have discovered 10 times as many different types of larvae as were previously known to be there. They could provide a barometer to check the effects of climate change, say the researchers.

Many bottom-dwelling marine animals, starfish, for instance, have larvae that drift along with the plankton. According to a rule proposed by Danish marine biologist Gunnar Thorson in 1950, the diversity of these drifting larvae should decline from the tropics to the poles as the water gets colder. Polar invertebrates are more likely to produce larvae that stay on the bottom, as food suppliers for drifting larvae disappear in dark polar winters. However, Damon Stanwell-Smith and his colleagues at the British Antarctic Survey in Cambridge, UK, have found an astonishing diversity of larval life drifting in the chilly waters of the Weddel and Scotia Seas, where Thorson's rule suggests there should be only a handful of species. Their two-year survey focusing on the South



Cold as ice: larval activity can warn us of impending the climate change

Orkney Islands netted 131 different types of planktonic larvae in an area where just 12 were known earlier. "Nobody has sampled all year round and no one has looked at larvae in detail," explains Lloyd Peck, supervisor of the study. "Biodiversity is as high as in temperate and may be even tropical latitudes."

Stanwell-Smith collected the larvae while diving around Signey Island, towing a plankton net by hand with the help of a fellow diver. The team took samples every two weeks, even during winters, when the sea was covered with ice. They then grouped the larvae into different types on the basis of their shapes.

The team plans to propose that ideas about the pattern of larval biodiversity on our planet need to be revised. "All the work taught in the university cours-

es is based essentially on three or four surveys by Thorson in the 1930s and 1940s in the North Atlantic," says Peck.

A clear picture of larval biodiversity will help biologists assess any effects resulting from climate change. "If we are going to make big losses in species from climate change, the Arctic is the place to look," says Peck.

"In an environment where animals are adapted to low, very constant temperatures, they will be vulnerable to minute temperature changes." Peck believes a slight but sudden rise in temperature could have a catastrophic effect on the larvae, as there is probably a narrow range of temperatures in which they can develop normally. "Ideas about polar marine systems are changing fast," says David Barnes, marine biologist at University College of Cork in Ireland. ■

Sore success

Breathalysers for diagnosing the cause of a sore throat or serious diseases such as asthma and diabetes will soon revolutionise medicine, predict researchers from Imperial College, London. These devices will look out for chemicals in the breath of patients that are associated with certain infections or illnesses. Respiratory specialist Peter Openshaw says he hopes the team's prototype device — capable of diagnosing sore throats — tells doctors the precise cause of the problem. Oppens says this will prove extremely beneficial for the patient as they will cut down the unnecessary use of antibiotics. Opens and his colleagues believe their device will be ready for clinical tests within two years. The team anticipates a multi-billion dollar market for these devices.

Honey against cancer

Honey contains low-to-moderate levels of disease-fighting antioxidants with the dark-coloured variety containing more antioxidants than do lighter ones, US researchers announced recently. According to researchers May Berenbaum from University of Illinois in Urbana, USA, honey might "play an important — and as yet unrealised — role in providing antioxidants in a highly palatable form." In a nutshell, antioxidants are compounds that are usually found in cells and help 'mop up' free radicals, the damaging by-products of normal metabolic processes. Many medical experts and scientists believe diets high in certain antioxidants vitamins C and E for instance, may help fortify the body and fight serious illnesses such as heart diseases and perhaps even cancer. The Illinois team used laboratory tests to measure the levels of antioxidant in 20 different varieties of American honeys collected by beekeepers across the country. While all of the varieties contained low-to-moderate levels of antioxidants, the dark-coloured varieties had more antioxidant in them than did lighter ones (*Journal of Apicultural Research*, Vol 37, No 3).

HEALTH & MEDICINE

A second chance

Tinkering with the genes can probably give injured hearts a second chance

HEART cells, unlike most cells in the human body, lose their ability to divide and multiply soon after their birth. However, by tinkering with the genes, researchers have created mice whose hearts do not lose this ability. They say the discovery could pave the way for treating heart failure using gene therapy.

Cells with extremely specialised structures, such as neurons and heart cells, find it very difficult to divide. So when heart cells die because of high blood pressure or a blood clot, other cells compensate by growing larger. However, these swollen cells lose their ability to pump blood effectively as their normal, healthy counterparts, and the heart will eventually fail the patient even if he or she undergoes medicine to regulate blood pressure.

Finding a way to make these heart cells divide after a heart injury would be a perfect solution to this problem. At the recently-concluded meeting of the American Heart Association held in Dallas, USA, Robb Maclellan of the Los Angeles-based University of California described his work with genetically-

engineered mice whose hearts lacked a crucial gene called *retinoblastoma*. This is the gene responsible for suppressing cell division in many tissues.

At the age of eight weeks, these genetically-engineered mice had hearts some eight per cent larger than normal mice, due to the on-going cell division. And the heart cells did not stop dividing until the mice were 20 weeks old. Maclellan and his team say they have also identified a protein called MRP1 that appears to block the effects of *retinoblastoma* in heart tissues. They think this protein could be able to initiate cell division in the mouse hearts again.

"There are glimmers of hope in the preliminary results in a number of laboratories," says Loren Field from the Indiana University School of Medicine in Indianapolis, USA. He and his colleagues have demonstrated that overexpression of two genes known as *cyclin D-1* and *TSC2* can prompt heart cells to enter the initial stages of the cell division cycle.

But the most important step will be for scientists to show that heart cells can



A FAST CHANGING WORLD.

DO
YOU
KNOW
WHERE
YOU
STAND?



SURVIVE BY MAKING INFORMED CHOICE.

REPORTING THE CHANGE, EVERY FORTNIGHT, SINCE 1992



Yes! I want to subscribe

SCIENCE AND ENVIRONMENT FORTNIGHTLY

DownToEarth

www.downtoearth.org.in

MORE THAN A DECADE OF PUBLICATION

☐ *As a gift

☐ For myself

☐ For my institution

(Please Tick below 1, 2 or 3 year subscription)

Term	@ Rs 20 cover price	You Pay	You Save
☐ 3 Years (72 Issues)	Rs 1440	Rs 720	Rs 720 (50%)
☐ 2 Years (48 Issues)	Rs 960	Rs 528	Rs 432 (45%)
☐ 1 year (24 Issues)	Rs 480	Rs 288	Rs 192 (40%)

Please add Rs 65 for outstation/non-Delhi cheques and allow 2-4 weeks for delivery

BEST OFFER
SUBSCRIBE UPTO
3 YEARS AND GET
T-SHIRT
+
ONLINE VERSION
WITH ARCHIVES
ABSOLUTELY
FREE!

(Please write in BLOCK LETTERS)

Name: Mr/Ms _____

Designation _____ Institution _____

Department _____ Area of Interest _____

Profession: ☐ Student ☐ Researcher ☐ Forester ☐ Civil servant

☐ Media ☐ Academician ☐ Environmentalist ☐ Businessman

☐ Architect ☐ Others (please specify) _____

Address: ☐ Office ☐ Residence _____

_____ City _____

State _____ Country _____ Pin _____

Ph _____ Off _____ Res _____

Fax _____ E-mail _____

I wish to pay by ☐ Cash/MO ☐ Cheque/Demand draft (add Rs 65 for outstation/non-Delhi cheque)

DD/Cheque No _____ Dated _____ payable to **Society for Environmental Communications.**

Credit Card: ☐ Visa ☐ MasterCard ☐ Amex ☐ Diners Rs _____

Credit Card No _____ Valid till _____ Date of Birth _____

**For Amex card holder DBC code _____

***Card Verification Value No _____ Date _____ Signature _____

For online subscription payment please login at website www.downtoearth.org.in

*For gift subscriptions add receiver's name & address on a separate sheet

**Four digits on the top of the card number

***Last three digits on the reverse of credit card Foreign subscribers please login to our website www.downtoearth.org.in to pay by Credit Card/Bank transfer

ATTENTION RENEWING SUBSCRIBERS

Please fill your customer code

Please fill this order form and mail or fax to:

SOCIETY FOR ENVIRONMENTAL COMMUNICATIONS 41, Tughlakabad Institutional Area, New Delhi-110 062

Ph: 91-11-2995 5124, 2995 6394, 2995 6110 Fax: 91-11-2995 5879 Email: subscribe@downtoearth.org.in

proliferate after an injury, and to follow the progress of the resulting cells to check that they remain healthy, according to Field. "A lot of these genetic manipulations are markedly increasing the number of cells producing DNA in the heart," he says. "But what is the fate of all these cells?"

Michael Schneider of the Houston-based Baylor College of Medicine, who also studies proteins involved in cell division, agrees that it is relatively easy to get heart cells to take the first step towards division and duplicate chromosomes, but that later steps are proving to be more elusive. "The idea that everything would flow like water over a waterfall is not the case here," says Schneider. However, he is confident that researchers will eventually solve the problem.

In another development, French researchers have found that rising atmospheric pressure and plunging temperatures can spell danger for people who are at risk of heart failures. Philippe Amouyel of the University of Lille and his colleagues studied statistics on heart attacks for some 250,000 men. Over a period of 10 years, 2,524 men suffered a total of 3,314 heart attacks. The researchers then compared the timing of the attacks with weather pattern information during that period.

Their study shows that a drop in temperature of 10°C increases the risk of heart attacks by as much as 13 per cent. Extreme atmospheric pressures are also problematic. When the pressure falls below 1,006 millibars or goes up beyond 1,026 millibars, risk of a heart attack rises by a similar amount. The researchers advise people suffering from heart-related problems to ensure "that their houses are well heated in winter". ■

Hard work pays

Hard manual labour may actually reduce the risk of breast cancer in women

WOMEN across the world have been greatly concerned by breast cancer and of late, scientists and researchers have devoted their efforts to find a treatment that prevents the disease. Recently, tamoxifen grabbed headlines as researchers announced that the drug



Hard work never hurt anyone: manual labour can keep breast cancer at bay

could effectively prevent breast cancer in women who are most likely to succumb to the disease. Now researchers have come with another preventive measure: hard manual labour.

When women work hard physically, it is the toil itself, not the lack of energy, that stops menstruation, say US researchers. They have found that the reproductive cycle can stop even if women keep up their energy levels with extra food.

It has been long known that heavy manual labour may cause progesterone levels to drop causing ovulation and periods to stop. Progesterone is the hormone secreted by *corpus luteum*, a small gland that develops in an ovary each month at the site from which an ovum or an egg has been released. The researchers, however, were unsure if this drop in progesterone levels was the body's response to hard work or resulted from the body's lack of energy.

To resolve this, researchers Grazyna Jasienska and Peter Ellison of Harvard University studied 20 women volunteers in a Polish agricultural community. These women work very hard in the fields during the summer months and even though they compensated for all the hard work by eating more during these months, their progesterone levels still dropped. This led the researchers to conclude that the work itself suppresses the reproductive cycle (*Proceedings of the Royal Society B*, Vol 265, p 673).

The researchers give two possible explanations. The first: it is rather

unlikely that extra food was freely available during our evolutionary past, so increased workloads would almost always produce a shortage of energy, "switching off" reproductive systems would spare women the extra burden of pregnancy and give them an evolutionary advantage. Alternatively, a high turnover of energy expenditure and intake may somehow constrain a woman's ability to allocate energy to reproduction.

Exercise is known to lower the risk of breast cancer, probably by lowering the sex hormone levels. The researchers suggest that this may also be why the incidence of the disease is markedly lower in the developing countries. "If we are right, we can predict that as lifestyles change in the developing world and physical workloads fall, the risk of breast cancer will rise," Ellison says.

Alan McNeilly, reproductive biologist at the University of Edinburgh, UK, thinks the study is thought provoking. The link between lifestyle and reproductive cancer is tenuous, he says. "But it is not unreasonable." ■

Electric eyes

Transmitting images directly to the retina may one day help the blind 'see'

WHEN William Gibson, the then-unknown author of cyber-age science



fiction penned *Neuromancer* in the 1980s he had no way of knowing that many of his ideas, would become reality in this century itself. One of his ideas was to eliminate all visual display units and TVs by projecting images directly on to the retina. It sounded strange then, but now, US researchers have predicted that a similar technique could soon help blind people 'see' again.

The team, headed by Mark Humayun at John Hopkins Hospital in Baltimore, USA, successfully transmitted simple electronic images directly to 15 blind peoples' retinas. They report that all 15 patients have been able to see either spots of light or more complex patterns.

"To see light after so long, it was just wonderful. It was blue," says 71-year-old Harold Churchey, talking about his first visual experience after 15 years of blindness. "It was just like switching a light on." Churchey, who has been suffering from the degenerative eye condition retinitis pigmentosa, is one of the 15 patients to whom Humayun and his colleagues have been able to give some fleeting vision.

"It was great," Churchey said. "They showed me the letter 'Headline'. I had trouble seeing the bottom part of it initially, so I thought it was 'u'. But it was very clear."

Humayun had earlier demonstrated that people who lost their sight through diseases affecting their rods and cones — the retina cells that detect light and colour — could be made to see spots of light. He did it by bypassing these cells and electrically stimulating bunches of still-healthy nerve cells, the ganglia, behind the retina with single electrodes. However, he was not sure if the brain could make sense of more than one artificial signal at a time and was worried that the spots of light would merge and become one incoherent blob.

Late in 1998, however, he told a neuroprosthetics workshop at the National Institutes of Health that he had discovered that this was not the case. He tested his patients with a matrix of 25 electrodes on their ganglia, and although this gave poor resolution, it was enough for them to recognise simple computer-generated images of numbers, letters or basic shapes. "Some of these patients have not seen for as long as 40 years," says Humayun. "It takes a while for them to see the letters, but once they pick up even a single dot they make quick progress from then on."

Humayun now plans to develop a permanent device with a high enough resolution to restore basic vision. An external video camera contained within a visor will send television images to a chip embedded in the retina. This will then translate the video signals into minute electrical signals on contact that will stimulate the ganglia (*New Scientist*, Vol 160, No 2159).

The team hopes to improve resolution and image quality so that patients can differentiate, for instance, between a window and a door. ■

Old man's fault

Children born to older fathers are more likely to succumb to Alzheimer's disease

ALZHEIMER'S disease is the commonest form of dementia afflicting millions across the world. Patients with the disease slowly lose all powers of thought and are eventually reduced to vegetables completely dependant on others for their survival. A lot of research has gone to find a cure or, at least, a preventive treatment.

Now, German researchers at the Technical University of Munich say that children born to older fathers have a higher risk of succumbing to Alzheimer's. Older mothers are more likely to give birth to babies with Down's syndrome, and people with Down's are more susceptible to

Alzheimer's disease. Intrigued by the association between these two mental disorders, Lars Bertram and his colleagues wondered if parental age plays any direct role in Alzheimer's.

The researchers studied 206 Alzheimer's patients. Susceptibility to the disease is linked to certain major genes, so the first step was to try to establish each patient's inherited risk. To do this, Bertram and his team found out the incidence of Alzheimer's in each patient's family.

Then they examined groups of patients at each extreme — comparing those least likely to have the disease genes with those who were most likely to have them. They hoped to find an added risk factor among the first group to explain why they developed Alzheimer's.

Patients least likely to have inherited a major disease-carrying gene had fathers who were significantly older than fathers of the second group and fathers of people of the same age who were not suffering from Alzheimer's (*Nerogenetics*, Vol 1, p 77).

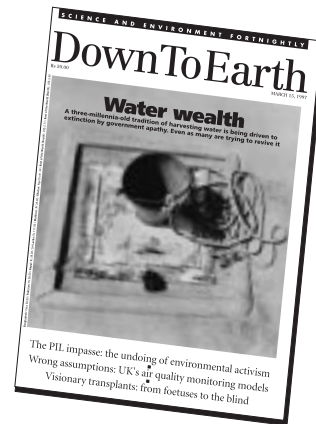
Fathers of this low-risk, low-probability group had been around 35 years old when their child was born, while fathers of the group least likely to have a disease gene were some 31.3 years old at the birth of their child.

As people grow older, suspect the researchers, damage builds up in their dioxynucleic acid (DNA) and gets passed on to their children. "There is an accumulation of environmental factors which somehow affect the genome of the father," says Bertram.

"The findings are extremely interesting," says Simon Lovestone, an Alzheimer's disease specialist at the Institute of Psychiatry in London. ■



AMIT SHANKER / CSE



DOWN TO EARTH?

Finance
Economics
Politics
Markets
Diplomacy
Conflicts
Developments...

...Down To Earth looks at all this but with the eyes of science and environment.

While journalism normally focuses only on specific events, the high points of human endeavour and existence, Down To Earth also adds analyses of the underlying trends and processes to its reportage — the slow erosion that ultimately produces a vast, barren landscape.

The magazine presents an international spectrum of current events, but its global outlook is juxtaposed with a concern born out of Indian reality.

Since learning is best done by listening, Down To Earth will always endeavour to bring reports from farms, fields, forests, factories and laboratories—where the struggle for survival and for progress is at its peak and at its best.

DownToEarth
SCIENCE AND ENVIRONMENT FORTNIGHTLY

**SUBSCRIBE & SAVE MORE THAN 55%
ON COVER PRICE OF Rs. 20/-**

INDIA	@ Rs 20/- Cover price	Discount price	You save	Your FREE gift
☐ 1yr (24 issues)	480	264	45%	Children book
☐ 2yrs (48 issues)	960	455	53%	Children book
☐ 3yrs (72 issues)	1440	642	56%	T-shirt

(Payment for all
foreign orders to
be made by
Credit Card or
Bank Transfer
ONLY)

OTHER COUNTRIES	☐ Bhutan, Bangladesh, Nepal, Pakistan (US \$)	☐ Rest of the World (US \$)
☐ 1yr (24 issues)	26	48
☐ 2yrs (48 issues)	46	77
☐ 3yrs (72 issues)	64	108

Yes, Please send me 24/48/72 issues of Down To Earth at the rate I have checked above.

☐ for me

☐ for my friend

Name _____ Name _____

Address _____ Address _____

☐ Payment of Rs enclosed vide.....

☐ Cheque/DD No.....Dated.....

☐ Please charge Rs/US\$.....to my Credit Card Number.....

☐ Visa

☐ Master card

☐ Amex

Card valid till.....Signature.....

☐ Payment of US\$.....has been made by Bank transfer to
Account No: 320143041 of Society for Environmental Communications at
American Express Bank Ltd, Hamilton House, Block A, Connaught Place, New
Delhi-110001 INDIA

Please add Rs 50/- for outstation cheque

Send payment to:

Society for Environmental Communications
41, Tughlakabad Institutional Area, New Delhi-110 062

Jumping after all these years

DNA can be crazy sometimes. Some of them have an uncanny knack for jumping about, and are called 'jumping genes' for this unique ability. But as it turns out, it seems that these jumping DNAs play a vital role in shaping new species. Some pieces of DNA can copy themselves and leap into new locations on chromosomes, but in mammals, it was thought that most of these jumping wonders are so ancient and mutated that they are no longer mobile. Now Haig Kazazian and his colleagues at the University of Pennsylvania in Philadelphia, USA, say the common house mouse has some 3,000 active mobile elements. By comparing mouse species, they found the number of the 'retrotransposons', the technical name for these jumpers, have multiplied even within the last 100 years. "They are still going like gangbusters," says Kazazian. The jumping genes may have created the genetic differences that led to new species of mice and other animals.

Shapes of life

A gene's DNA sequence reveals which amino acids will appear in the protein of the gene. To guess a new protein's function, scientists compare its amino acids with those of familiar proteins. If two proteins share much of their sequence, then chances are they do similar jobs. But the structure of the protein is also extremely crucial in determining its function. Jacquelyn Fetrow of the California-based Scripps Research Institute and her colleagues can now forecast a protein's function more accurately by guessing its three dimensional structure. They use a software that predicts which of the known 300 proteins shapes the unknown protein can fold into, and assume the actual structure is the most stable of these. The research then pick amino acids that play important roles in other proteins, and decide where on this structure they lie. This reveals active sites, giving a good indication of what the proteins do (*Journal of Molecular Biology*, Vol 282, p 703).

LIFE SCIENCES

Cold cold heart

If everything goes right, it would be possible to 'store' vital organs to be used for transplants much later



Frozen in real time: have a heart, say researchers

JAPANESE researchers are looking towards tiny, long-living animals for some tips on how to make organ transplants work more successfully. Inspired by these ancient life forms, they have even come up with a new technique to store organs for transplants later, they claim.

The team, which successfully revived a rat's heart after 10 days in storage, says their work might one day lead to 'organ banks' like the blood banks of today. These would help surgeons and doctors avoid the frantic last-minute dash to bring suitable organs straight from donors to the operating table.

Current techniques offer some 30 hours of storage time for organs scheduled for transplants. For organs such as hearts and lungs, the time limit is even less — just four hours. The central problem in storing organs for an extended period of time in cold

storage is that water damages cell membranes at these low-temperature freezers. Removing the water from tissues can prove just as damaging.

Looking for a better way to store these disembodied organs, Japanese researchers Kunhiro Seki and his team from Hiratsukashi, Japan, studied creatures called tardigrades. Tardigrades can withstand extreme conditions by losing most of the water in their bodies. Dehydrated, these creatures can then go on to live up to a hundred years or more. When water was added to a dried-out moss kept in a museum for over 120 years, these tardigrades were found

crawling all over it.

To do this amazing feat, the tardigrades use a sugar called trehalose that helps stabilise their cell membrane structures. "This suggested that the physiological mechanism for preservation and resuscitation of tardigrades could be applied to the preservation of mammalian organs," says Seki.

To find out if this was really possible, the team flushed rat hearts with trehalose solution before 'packing' them in silica gel to remove the water from their cells. The hearts were then immersed in perfluorocarbon, a biologically inert compound, and stored in airtight jars at 4°C. Some 10 days later, Seki's team took the hearts out of the jars and resuscitated them. Within 30 minutes, they were beating again. Measurements of their electrical activity suggested that the heart cells had survived, intact.

Seki thinks that the trehalose and

perfluorocarbon replace the water in the cells, preventing tissue damage. He now plans to repeat the experiment with a complete autopsy to confirm that the tissues are preserved. The researchers also plan to demonstrate the procedure with other animal organs and prolong their storage for up to a year. Seki hopes that within a few years, the technique can be upgraded to preserve human organs.

"The implications of this research on transplant patients could be huge," says Vanessa Morgan, chairperson of the UK Transplant Coordinators Association. "It could lead to planned, elective operations rather than emergency surgery." She adds that recipients could have a greater choice of donor organs, improving their chances of a good match. But she warns that the quality of the transplant organs must be maintained during their long-term storage. "The condition of these organs is critical and I would not want to compromise quality for time." ■

Fifth wheel

In the natural world away from the laboratories, redundant genes are not really useless

THE existence of the so-called redundant genes has been a major embarrassment for molecular biology. In a variety of systems, scientists have observed many genes, believed to be important for the functioning of the organism,

could be removed without any apparent ill-effects. Such genes were said to be redundant and many explanations were proposed for their existence, the 'default option' being, of course, that if a gene has no use, it should wither away by accumulating mutations. All along, there was the thought that the working of a gene under laboratory conditions may not be the same as its working in nature; but the attraction of conducting experiments in the controlled environment of the laboratory, combined with the extreme difficulty of doing so in the wild, meant that this thought was given only token acknowledgement.

Now, at least in the case of one organism, Eleonora Ponte and colleagues at the University of Turin, Italy, have succeeded in showing that a gene, supposedly redundant in the laboratory, becomes crucial under natural conditions (*Proceedings of the US National Academy of Sciences*, Vol 95, p9360).

The Ponte group worked with the soil amoeba *Dictyostelium discoideum* and with its mutant version that had lost a gene, known as contact site A (CSA), for making a kind of 'contact site' — a protein that made cells of a certain age stick to one another. Laboratory studies had shown that the CSA gene was dispensable: amoebae that lacked it seemed to do just as well as others that did not. These studies had been carried out using that stock in trade of all microbiologists: glass dishes containing agar-agar as an artificial substratum in place of natural soil.

Ponte and her group asked the very simple question, what happens if on top of the agar layer you sprinkle some soil, thereby making the environment more akin to what is found in nature? The answer was dramatic. Not only does the CSA mutant take longer to develop than the wild type, but it does very poorly when it comes to the crucial test of reproductive efficiency. Firstly, the number of reproductive spores formed by the CSA mutant ranges from 25-50 per cent of the number produced by the parental type. Secondly, when the mutant and the parental types are combined as amoebae in a 1:1 ratio, the resulting spores are on an average 70-80, per cent of the parental type. The mutant seems to get elbowed out of the competition.

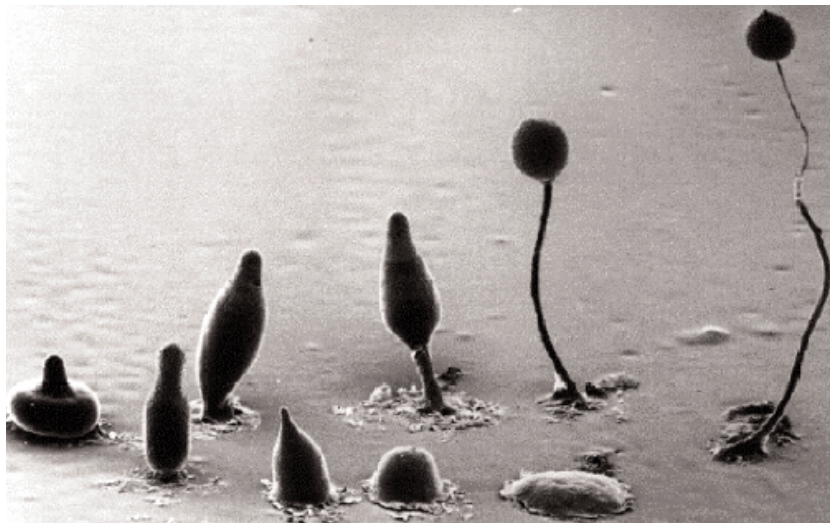
The findings are simple but make an extremely important point. Namely, that when assessing the relative qualities of two organisms of the same type but differing in their genetic makeup, it is crucial to make the test under conditions as natural as possible. The reason is that living creatures have been moulded over the aeons by the forces of natural selection to be adapted to a certain set of circumstances. Hence, tests made under conditions that are drastically different may turn out to be meaningless. ■

Calcium capers

Just better bones? No, calcium plays other, more crucial roles within our bodies

EVERY schoolchild knows that calcium is very important for growth, particularly so as it helps our bodies develop better bones and teeth. Well, it turns out that calcium has 'other' important roles to play too. It is a crucial element in the intricate processes of inter-cellular communication, known as signal transduction, as also between the external world and our sense organs. The intricacy of signal transduction, especially of the part played by calcium, is brought out in an elegant piece of work reported by Sangeeta Chawla and her colleagues from the Laboratory of Molecular Biology in Cambridge, UK, (*Science*, Vol 281, No 2587).

Dictyostelium discoideum: the so-called 'useless' genes are quite useful



Like the pituitary cells, most other cells start dividing when presented with agents known as mitogens. Cell division requires the synthesis of a number of specialised proteins, and that, in turn, depends on 'turning on' the activities of genes that encode those proteins. In short, the mitogen has to 'activate' certain genes, to transcribe. In order to do so, the cell has to first cause its internal calcium levels to increase. The calcium stimulates or rather, activates, the right genes. Cells normally increase their calcium levels in two ways: first, by pulling calcium in from the outside and secondly, by releasing calcium from stores inside themselves. This increase in calcium stimulates a cascade, part of which involves recruitment of a protein known as CBP which, in combination with another protein known as CREB, stimulates gene expression.

Chawla and her team have made the interesting discovery that even though both depend on a rise in internal calcium, changes induced by these two proteins can be differentiated. This is done by separating the calcium signal into two distinct spatial components. One consists of an increase in calcium within the body of the cell, the cytoplasm. The other is a calcium increase caused within the nucleus, which contains the genetic material. It turns out that an increase in cytoplasmic calcium provides the CBP recruitment signal but is unable to stimulate the transcription step which is mediated jointly by CBP and CREB. The latter requires an increase in the calcium level within the nucleus as well as an accessory small molecule known as cyclic AMP (cAMP). Nuclear calcium activates an enzyme that, together with cAMP, influences a specific portion of the CBP molecule that is important for gene transcription.

There are three take-home lessons of this study. Firstly, small molecules can be present at different concentrations at different locations within the same tiny cell that are a thirtieth of a millimetre or smaller in diameter. Secondly, regional differences can be of crucial importance within the living cell. And finally, the same signal coming from the outside is differently analysed in the nucleus and the cytoplasm, and a signal in the cytoplasm does not automatically mean one in the nucleus. There. We go home enlightened. ■

Need a hand?

Geneticists examine how limbs were formed

COMMON sense tells us that limbs of all animals have three clear axes: shoulder-to-tip (proximal-distal), thumb-to-little finger (anterior-posterior), and wrist-to-palm (dorsal-ventral). The arrangement of bones confirms this and reveals a similar pattern in birds as well, whose limbs appear to differ drastically from humans for instance.

Among the more impressive pieces of synthesis in modern developmental biology is the realisation that limb development depends on similar genes. This, in turn, implies that deep down, the mechanisms of limb development must be the same in all vertebrates. If true, it means the basic principles of limb development have remained the same right from the beginning of the evolution in vertebrates. A recent report by B Christen and J M W Slack of the University of Bath, UK, contradicts all this and points out that amphibians use a different sort of genetic logic to form limbs (*Nature*, Vol 395, No 2134). More specifically, the genetic circuitry responsible for limb development along the dorsal-ventral axis differs between amphibians and mammals.

The current belief regarding limb development is that it depends on a combination of growth and patterning, with the latter depending crucially on special

groups of cells, known as signalling centres. These signalling centres release diffusible small molecules that 'tell' various genes located in other cells what to do. In the mouse, it is known that a special group of cells located in the extreme ventral region (ventral epidermis) make a gene transcription factor called *En-1*, and wherever *En-1* is present, represses two signalling molecules called *wnt-7A* and *Rfng*. As a result, the two signalling molecules are made only in the dorsal region where *En-1* is absent. *wnt-7A* and *Rfng*, in turn, positively regulate the functioning of other molecules that lead to the formation of dorsal structures.

Christen and Slack examined the expression of the gene *En-1*, *wnt-7A* and *Rfng* in the developing limb of the South African clawed toad *Xenopus*. To their surprise, only *En-1* was expressed where it was expected to be, in the ventral epidermis. The activity of the other genes, far from being localised, showed a more or less uniform expression pattern throughout the limb bud.

Other experiments showed that there appeared to be no such anomaly when genes that regulated the proximal-distal and anterior-posterior patterns were monitored. It appears, then, that these two aspects of limb determination have been conserved ever since amphibians (the earliest four-limbed creatures) first made an appearance on earth. But at some later stage, mammals would seem to have modified the logic used by their amphibian ancestors in deciding on how to pattern the limb along the dorsal-ventral axis. ■

Frog rock: geneticists have found why and how organisms develop their limbs



Two words that have helped **build** one of
the **world's** most **efficient** cement companies.

“ I can ”

At Ambuja, we follow a unique homegrown philosophy that gives people the authority to set their own targets and the freedom to achieve them: *I can*. This simple belief is at the heart of everything our people do. And it's the reason why we're ranked as one of the world's most efficient cement companies. | **GUJARAT AMBUJA CEMENTS LTD.**

Kiss the virtual bride

Computers and virtual reality were a huge hit in video game arcades and air force training when gamers and trainee fighter pilots went inside virtual simulators flying virtual fighters and battling virtual enemies. Now the same aerospace simulation technology is being adapted to plan weddings in Japan. NEC, Japan's electronics behemoth, says its Virtual Wedding system uses graphics processing and a high-resolution display to create every little detail from a virtual reception hall to a virtual wedding cake. If the commercial trials are a success, the company plans to combine this with software that will even superimpose the faces of the happy couple on a virtual bride and groom.

Leather protein

Researchers in the US have used a washing powder ingredient to turn waste leather into a high-value protein used in the manufacture of adhesives and packaging films. Agricultural Research Service scientists used alkaline protease to break leather shavings into low value protein hydrolysate that can be used in fertilisers. By modifying the process the researchers found they could produce a high-value grade of gelatine protein equal in quality to commercially-produced gelatine. The protein is ideal for making adhesives, industrial packaging films and encapsulating agents for agricultural chemicals, they said. The tanning industry only converts 50 per cent of cattle hides into leather. The missing half is shaved off to give leather a uniform thickness. Each year, about 60,000 tonnes of these waste shavings are dumped in landfill sites. The US agriculture secretary Dan Glickman, announcing the research recently, said, "This is an innovative process that puts to good use a waste product that is currently hauled off to landfills at a price." The discovery, which has already been patented, would prove extremely beneficial for both the environment and economy, Glickman said.

INDUSTRY & TECHNOLOGY

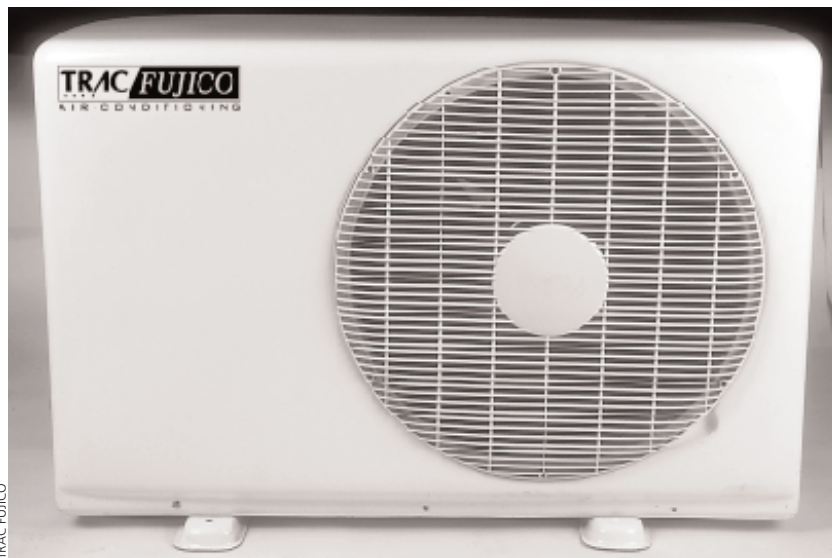
Eco-cool

An Indian firm introduces eco-friendly air conditioners and takes a step towards a future free from ozone holes

N RAGHAVAN BANGALORE

BANGALORE-BASED Trac Fujico Air Systems Ltd has become the country's first indigenous manufacturer to develop and introduce air conditioners (ACs) that do not use HCFC (hydrochlorofluorocarbon). HCFC, used widely as a refrigerant, is a potential environmental hazard as it contributes to the depletion of the ozone layer.

refrigerators, ACs and all other cooling devices used CFCs as their primary cooling agent. Though the ban made these machines obsolete in the West, many of them are still functional in the developing countries. One good sign came earlier this year, when scientists declared that CFC-usage had indeed gone down over the last 10 years. The threat to the ozone layer, however, is far from over. Seeking alternatives to CFCs, industries



Giving the ozone layer a breathing space: TracFujico's eco-friendly AC

Ozone depletion was one of the primary environmental concerns of the last decade when, alarmed by a rapidly-growing hole in the Earth's ozone layer, nations pledged to cut down their use of ozone-depleting chemicals. The ozone layer is critical for our survival, as it absorbs most of the harmful radiation from the Sun. In 1987, through the Montreal Protocol, most developed countries banned the production and use of chlorofluorocarbons (CFCs) and halons, the main chemical agents behind the gaping hole in our ozone layer. Certain industries were affected initially, such as the aerosol and refrigeration sectors since these made extensive use of CFCs. Prior to the Montreal Protocol, household and industrial

switched to other chemicals, one of which was HCFC. As the name suggests, it is not very different from their CFCs. Apart from posing a significant threat to the ozone layer, it also contributes to global warming. So thus began another movement, and this one tried to curb the new ozone threat — HCFCs.

Recently, some US firms took up the challenge to produce CFC and HCFC-free fridges and used air as the cooling agent. Close on the heels of their achievement comes the news of this Indian innovation. It seems that a world free of any threats to the ozone layer is fast becoming a reality.

The new-age ACs developed by Trac Fujico, in technical collaboration with the Hong Kong-based Fujico, works on

R-407-C, a hydrofluorocarbon (HFC) which is also an ozone-friendly chemical. The Trac Fujico ACS use scroll compressors — a new generation compressor with very few moving parts — unlike the conventional ACS that use reciprocating compressors. Apart from a different compressor, these ACS also use polyol-ester oil and outscore all currently-available ACS when it comes to energy efficiency, lower vibration and noise levels, and reliability. Anil Dev, president of Trac Fujico Air Systems Ltd, claims that their ACS, though 15-20 per cent more expensive than conventional systems, are so energy-efficient that a user can recover their cost scan within two years.

The company also upgrades existing air conditioning systems to new eco-friendly levels. They claim that these new ACS are compatible with all HFC-based systems. The company has already found takers for its new range, says Dev. "Six per cent of all orders booked are for our HCFC-free systems and we are targeting 10 per cent of sales in 1999-2000," he says. Current customers for HCFC-free systems include a multinational software company and a hotel. The company began commercial production of the ACS in June 1996. Since then Trac Fujico has claimed to have achieved impressive annual turnover figures. ■

'Small' achievements

The world's fastest piece of machinery is also the smallest

TAKE big, complex machines and make them small. That, in a nutshell, is the essence of nanotechnology. But not just small, so very small that nanoengineers need powerful microscopes to even see them. And since the mid 1980s, nanotechnologists have periodically astonished us with micrometer-sized turbines, gears and other pieces of machinery.

But now, they have stumbled across something that has made them proud as never before. US researchers have spun a tiny device at phenomenally high speeds. Researchers at Sandia National Laboratories in New Mexico, USA, were simply trying to show the size of a

microscopic gear wheel when they discovered that the ultra-low friction component — part of the world's smallest combination lock — can spin at an jaw-dropping 350,000 revolutions per minute (rpm).

To demonstrate the size of their "nanolock" — a device that might one day keep hackers out of computer networks — the researchers placed a spider mite on top of a 0.3 millimetre diameter gear wheel. "It looked like an elephant in comparison," observed Larry Dalton, engineering manager at Sandia. Out of sheer curiosity they decided to spin the wheel with an electrostatic motor. They just wanted to see how fast it could go. While doing so, they gave the poor mite the most giddy ride of its life.

At 2,000 rpm the researchers let the somewhat disoriented mite off, and at 350,000 rpm they realised they were on to something fast. They calculated that if they designed a gear specifically for speed, they could go as high as 10 million rpm, which could make such devices ideal for use as high-speed switches in optical computers (*New Scientist*, Vol 160, No 2149).

In the macro world, the best machine tools can achieve speeds of up to 20,000 rpm — any faster and friction becomes insurmountable. However, in the microscopic world, friction and inertia are less of a problem as decreased masses are involved, says a Sandia researcher,

Stealth flier

Aeroplane passengers may no longer have to yell at each other to be heard. Ultra Electronics of Cambridge, UK, has designed a passenger seat that halves the perceived ambient noise inside most aircraft cabins.

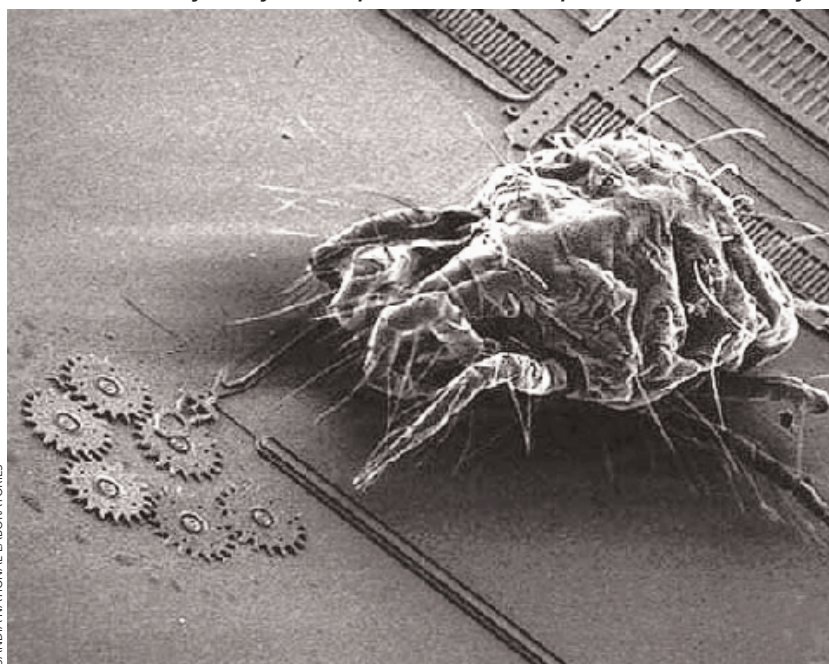
The trick is done through a sound-cancelling device built into the headrests. A microphone samples sound around the head of the passenger with frequencies up to one kilohertz, including the roar of the engines, the hum of the air conditioners and the 'whoosh' of air along the fuselage.

A signal with the same frequency and amplitude as the incoming noise — but with the opposite phase — is then fed to the speakers. The destructive interference between this signal and cabin noise reduces the racket by up to 10 decibels.

"It's perceived by the passenger as less than half of the original din," says Lawrence Earl, spokesperson for Ultra.

adding that the mites often try to pick the gears up and move them about — these devices could force us to revise our concept of a "computer bug". ■

It's fast and it's tiny: a tiny mite inspects an even tinier piece of nano machinery



SANDIA NATIONAL LABORATORIES

Rain is decentralised.
So is the demand for water.
Why can't we decentralise supply?



...With the water crisis worsening
by the day, can we allow
the crisis to grow further?

It's time we
harked back
to our native
wisdom...

Come, join us at the
**2nd National Conference on
Traditional Water Harvesting Systems**

Kindly note the change in dates

October 3 - 5, 1998

India International Centre, New Delhi

Organised by Centre for Science and Environment, New Delhi

The purpose of the TWHS conference is to:

- strengthen TWHS where they are still in vogue;
- revive TWHS where they have fallen in disuse;
- make TWHS a thrust area of national water policy;
- discuss water harvesting in urban context; and
- take a global overview of rainwater harvesting.

Register before July 15, 1998.

Write to Shyam Pandharipande at CSE for registration and more information.

To present a paper, please send us the title and the abstract.



Centre for Science and Environment

41, Tughlakabad Institutional Area, New Delhi - 110 062 Fax: 91-11-6985879 / 6980870

Website: www.oneworld.org/cse Email: shyam%csesdalt.ernet.in

Banking on carbon

World Bank's proposed role in the global carbon market is good news for the US, but it may spell doom for developing countries

NIKHAT JAMAL QAIYUM

IN A crowded corner of the busy corridors at the venue for round four of the climate negotiations in Buenos Aires, a ballot box was being crammed with votes. This was an 'election' of a novel type. Participants attending the conference, NGOs and negotiators alike, were asked to cast their verdict on the fossil fuel projects funded by the World Bank.

Ninety-three per cent of the voters disapproved of the bank playing a key role in jump starting the global carbon market while spending billions of dollars on fossil fuel development projects. The World Bank, on its part, was making an all out effort to keep its proposal on a Prototype Carbon Fund (PCF) for carbon trading a hush-hush affair. It is known that, so far, the PCF has secured advance commitments of at least US \$130 million from 13 companies and five countries. The bank, however, has refused to provide any other information about the PCF.

But, the bank's strategy has been made public in a detailed report prepared by the Washington-based Institute for Policy Studies (IPS), after a five-year assessment of the WB's role in fuelling climate change. The report shows that:

- The WB has spent 25 times more on fossil fuel projects than on renewable energy since the 1992 Earth Summit;
- In the next 20 to 50 years, WB-financed projects will add carbon emissions to the atmosphere equivalent to 1.3 times the amount emitted by countries worldwide;
- Less than 10 per cent of all World Bank projects are being calculated for their impact on the climate;
- Nine out of 10 WB fossil fuel projects benefit transnational projects based in the wealthy G-7 countries, many of whom are members of a US-based lobbying group, the Global Climate Coalition, that actively opposes any action on climate change.

Criticism of the bank's performance on the environmental front has been growing over the last few years. The organisation, whose prime role is to tackle poverty and promote sustainable development, has

shown that it is not interested in doing either or in promoting a less carbon-intensive future.

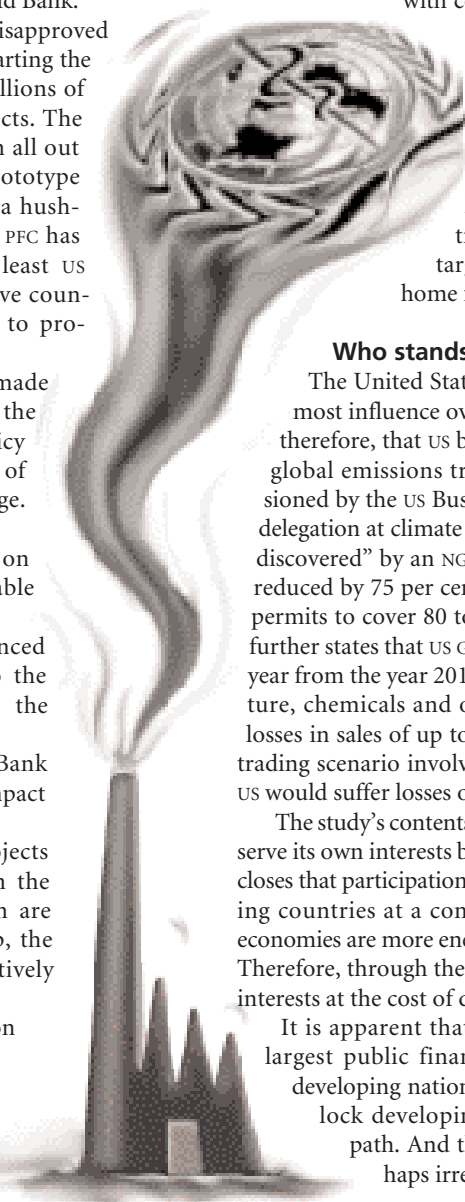
At the COP-3 held in Kyoto in December 1997, emission reduction targets were set for 38 industrialised nations (Annex-1) which is to be met by 2008-2012. At that time, the WB unveiled its proposal for setting up a PCF. The idea was "to pool funds from governments and companies in countries with commitments and invest them in emission reductions in economies in transition and developing countries." It is estimated that such trading could generate profits for the bank to the tune of US \$100 million on a trading volume of up to US \$2 billion by 2005. More importantly, it will help industrialised countries meet emissions targets without taking any action on the home front.

Who stands to gain?

The United States, as WB's largest contributor, has the most influence over the bank's policies. It is no surprise, therefore, that US businesses would profit the most under global emissions trading. A preliminary study commissioned by the US Business Round Table and faxed to the US delegation at climate talks in Buenos Aires was "accidentally discovered" by an NGO. The study states that costs could be reduced by 75 per cent or more if the US is able to purchase permits to cover 80 to 90 per cent of its reduction target. It further states that US GDP losses would exceed US \$60 billion a year from the year 2010 under any other scenario. US agriculture, chemicals and other energy intensive industries risk losses in sales of up to five to 10 per cent in 2010. Even in a trading scenario involving other industrialised countries, the US would suffer losses of two to four per cent.

The study's contents expose the United States' intent to preserve its own interests by pushing for emissions trading. It discloses that participation in global trading actually puts developing countries at a competitive disadvantage, because their economies are more energy-intensive than industrial countries. Therefore, through the PCF, the World Bank will only serve US interests at the cost of developing countries.

It is apparent that the bank has chosen to become the largest public financier of carbon-emitting projects in developing nations. The immediate consequence would lock developing countries into a fossil fuel energy path. And the ultimate consequence is rapid, perhaps irreversible, global climate change. ■



Counter Productive

The post-Pokhran sanctions on Indian scientific institutions by the West could be a blessing in disguise for the country and its scientists



SHOBIT MAHAJAN

ONE of the reactions to the nuclear explosions at Pokhran has been the imposition of sanctions by the United States on various Indian institutions. These include all research institutes funded by the Department of Atomic Energy like the Tata

Institute of Fundamental Research (TIFR) in Mumbai and the Institute of Physics in Bhubhaneshwar and various other institutes and companies which ostensibly work on projects that could be used for helping India's nuclear programmes. There has been a lot of hue and cry about the effects of such sanctions on Indian science. Already, a letter has been circulated among the various universities and institutes pointing out the disastrous effects this would have on scientific progress in India.

What do the sanctions mean? Scientists working in targeted institutions cannot collaborate with any institution in the US now. They will, in all likelihood, be denied visas for visits or conferences to the US. Equipment cannot be bought for laboratories from US companies. Are all these necessarily calamitous for Indian science?

What constitutes Indian science?

Before we can answer such a question, we need to ask ourselves what constitutes Indian science? Without going into debates about *swadeshi* vs international science, I think an operational definition could be that Indian science is what is done by scientists working in India. Though by no means a non-controversial definition, it is certainly the least value-loaded one. Once this is accepted, it follows that we need to look at the various dimensions of science as it is being practised in India.

With the second largest scientific human resources in the world, we certainly have an impressive scientific infrastructure. We have a large network of laboratories associated with atomic energy, space and defence. Besides, there are CSIR laboratories, regional research laboratories as well as the research institutes like TIFR and Indian Institute of Science, Bangalore. At the lowest level, we have some 225 universities. Of course, the scientific world is also divided into "haves" and "have nots". The budget for atomic energy, space and defence is presumably huge though the government rarely discloses the allocated amount. Research institutes, which are relatively few in number, get a disproportionately large percentage of the total amount of funds.

The universities, on the other hand, are constantly starved of funds for even basic facilities. So we have a scenario where a few research institutes are lavishly funded in terms of infrastructure as well as other scientific resources, while the univer-

sities by and large languish with a chronic shortage of money even for teaching, let alone research facilities. The state of libraries, classrooms and laboratories in most of the universities, including prestigious ones like Delhi University, has to be seen to be believed.

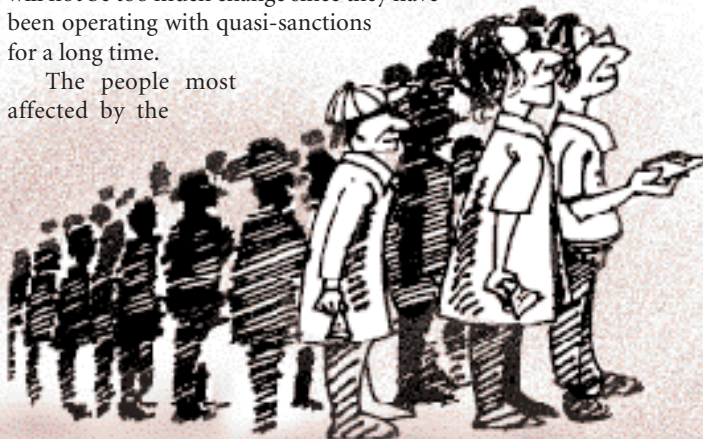
It is no one's contention that the research institutes are not doing good science. The point is that the whole idea of promoting a few islands of excellence while depriving many others is short sighted. If for nothing else, the science planners have to realise that science is ultimately done by human minds and if the nursery for scientific talent — the universities and colleges — are starved of funds, there will never be an overall promotion of science in the country. The result: a caste system within the scientific community.

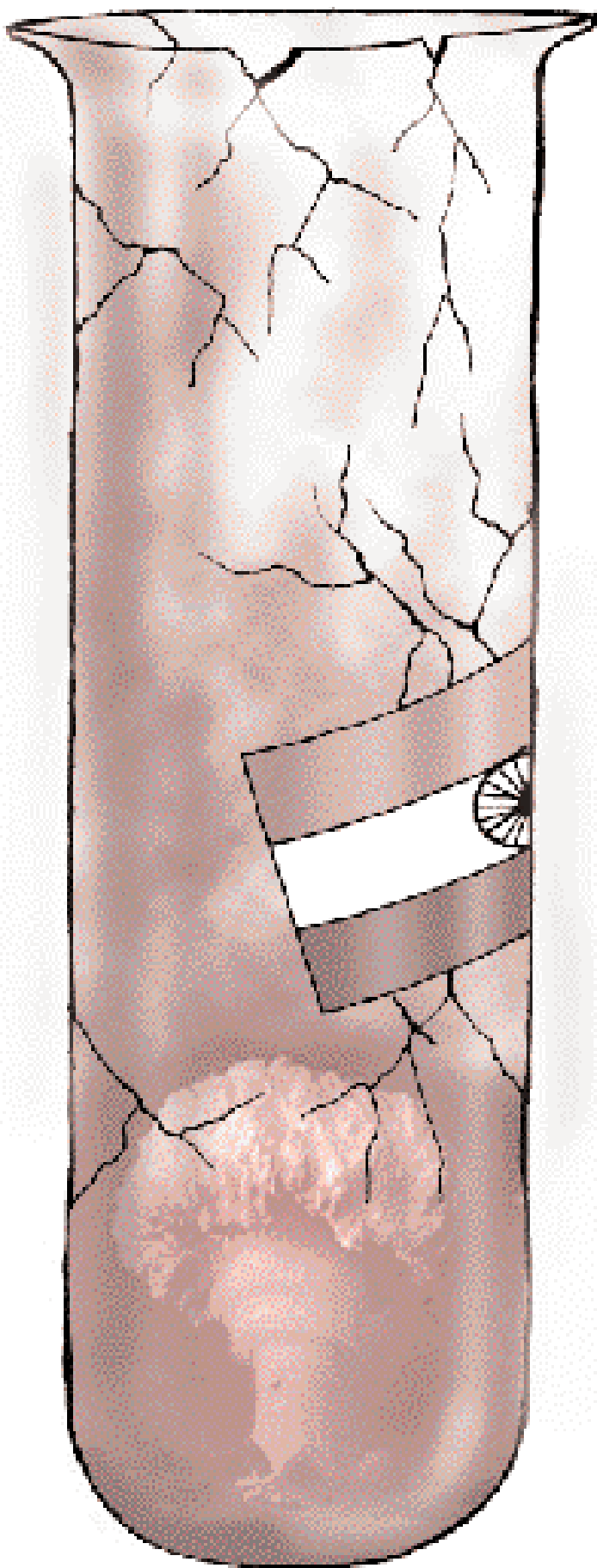
If you are one of the lucky ones working in the research institutes or the lavishly-funded labs, you have access to the latest equipment, journals and, of course, foreign trips. On the other hand, if you happen to be one among the vast majority who teach in the universities, you have to contend with libraries which have no funds for journals, labs which have no maintenance grants to repair equipment and, in some cases, classrooms with no lights. It is under these circumstances that the average scientist at a university works, for whom just routine duties are a chore, leave alone path-breaking research. Yet, they do their bit. Occasionally, one finds a paper written by some scientist teaching in some small town in international journals.

Sanctions: what do they entail?

The atomic energy, space and defence establishments have always been restricted in terms of their access to latest technology. Yes, there will be restrictions on their personnel travelling to the US for visits. The denial of visa to Professor R Chidambaram for attending the crystallographers conference is just one example. But other than that, there will not be too much change since they have been operating with quasi-sanctions for a long time.

The people most affected by the





sanctions will be the handful of scientists working in research institutes. Most of these people travel frequently to the West for purposes of academic visits and conferences. In some cases, there are active collaborations with institutes and laboratories in the West. These activities will definitely be curtailed.

As for their poor country cousins working in the universities, their horizon is limited to the next Indian Science Congress being held in Jaipur or Chennai. For them the sanctions have no meaning. Occasionally, some university department may face problems in importing some equipment, but this will be rare.

This whole debate about sanctions reminds one of the situation faced by the former Soviet Union and China in the last several decades. Scientists working in these countries had almost no access to information (in the pre-Internet days), exchange visits and certainly no equipment (including computers) from the West. This meant that they had to reinvent the wheel and look for alternatives in which this embargo had minimum effect. Yet, even in the face of this adversity, they came up with world class science. Be it space programme or invention of particle accelerator, the facilities created by them can claim to be among the best in the world while their researchers in many fields are world class.

Contrast this with the situation here. In 1911, Dutch scientist H K Onnes discovered superconductivity. To get to the low temperatures, he needed liquid helium which he made from the sands obtained from the Malabar coast of India. Ironically, even today we cannot build a liquid helium plant by ourselves. In all these years, can any one of our laboratories or institutes claim to have made any extraordinary contribution to science? We shall not even comment on these ivory towers doing relevant science, since even the basic design of a bullock cart wheel has not been improved in our country for the last millennia or so.

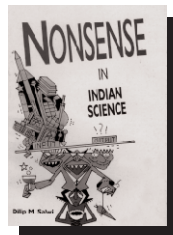
A positive outlook

There are many reasons why science in India is in such a bad state — centralisation of decision-making, excessive bureaucratisation, skewed priorities to name a few. But I think there is a important reason which contributes to the present state of Indian science: lack of self-confidence. A majority of our scientists work on research problems which have already been explored by their Western counterparts. Research agendas are decided by the dons working in Princeton and Berkeley. Rarely do we see a new field being explored by them or even any new fundamental idea being generated. It is then obvious that these people who tread the trails blazed by their brethren in the West, will also seek recognition by the West. This explains the visits and conferences to the West, of course at a cost of the exchequer. The efficacy of these visits in promoting good science in the country is certainly questionable.

The sanctions imposed by the West need to be seen in this perspective. It could, in fact, have a very positive impact on Indian science. May be our scientists will finally be forced to leave the apron strings of their Western counterparts. Who knows, in this process we may even see the blossoming of truly Indian science, one which is not only practised here but is born out of the minds of researchers who are intellectually free. ■

Shobit Mahajan is a professor at the department of physics and astrophysics, Delhi University

Senseless science



NONSENSE IN INDIAN SCIENCE • Dilip M Salwi •
Konark Publishers Pvt Ltd,
Delhi • Rs 125

MOHAMMED ZEYAU HAQUE

THE state of Indian science is a grand paradox. Ostensibly one of the largest scientific communities in the world, Indian scientists have failed to produce world class research. Science writer Dilip M Salwi apparently finds the situation amusing since he has written a “fun book” on the subject.

Nonsense in Indian Science is an interesting book to read but becomes gruesome to contemplate on the ironies. There are many people in the scientific establishment whom Salwi calls “genuine scientists” — people whose integrity, and even brightness, is not questionable. It is the system that has failed, sinking with it the best of talent.

The malaise is deep-rooted. Some of the most glaring failures are attributed to the scientific bureaucracy that stifles talent, enforces an order that encourages mediocrity and hinders creativity rather than helping it. There are too many rules, too much *babudom*, too many *gurus*. To highlight the contrast, Salwi quotes Thomas Alva Edison, the inventor of the light bulb: “There are no rules here. We are trying to accomplish something.”

About India’s burgeon-

ing gurudom, from *karmacola* to spiritually-guided levitation (which, in fact, is a form of frog-hopping), Salwi has this gem of an observation: “In the West, there are research *gurus*, who may or may not be Nobel Prize winners, but whose word matters in the world of science and technology. In India also, there are *gurus* but hardly a handful in research. There are *gurus* in plenty of a wide variety of other kinds. These *gurus* could be administrative officers, bureaucrats, politicians and even leaders of different religious sects. Much of the irrationality in Indian science can be traced to these *gurus* who are indirectly controlling its destiny.”

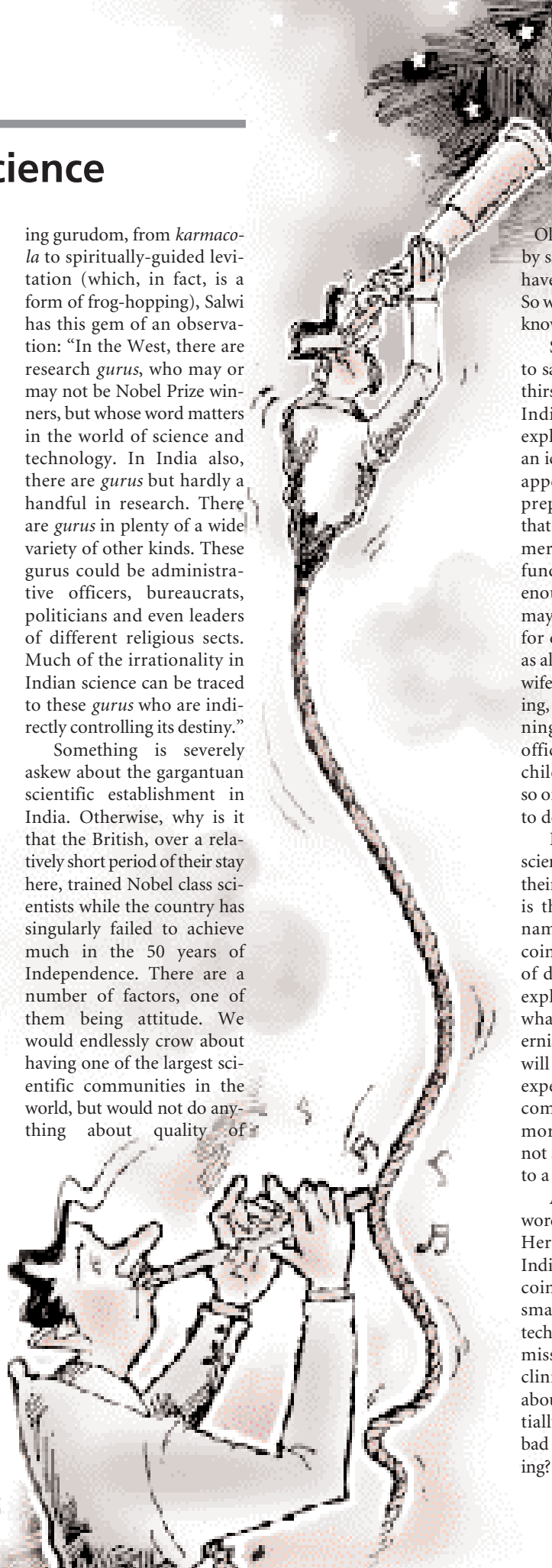
Something is severely askew about the gargantuan scientific establishment in India. Otherwise, why is it that the British, over a relatively short period of their stay here, trained Nobel class scientists while the country has singularly failed to achieve much in the 50 years of Independence. There are a number of factors, one of them being attitude. We would endlessly crow about having one of the largest scientific communities in the world, but would not do anything about quality of

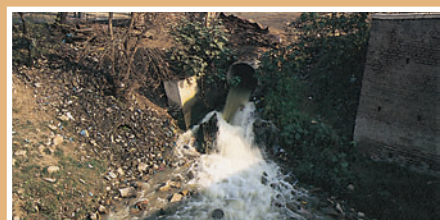
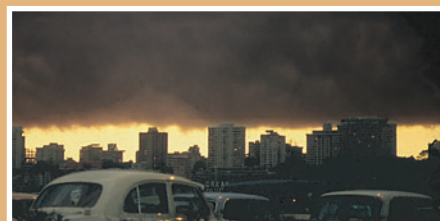
research. It is the same attitude, writes Salwi, that makes us rationalise the failure to get an Olympic gold in swimming by saying: “Well, we may not have won the Olympic gold. So what? A large number of us know how to swim.”

Salwi rakes enough muck to satisfy an average reader’s thirst for the shenanigans of Indian science. All that, he explains, is barely the tip of an iceberg, thus whetting the appetite further. He is not prepared to accept the idea that Indian science is lagging merely because of lack of funds. Even if we have enough funds, our scientists may not find enough energy for doing scientific research as all of it is drained in taking wife and children for an outing, making social calls, running around government offices, taking the wife and children to the doctor, and so on. “So where is the energy to do research?” he asks.

Ever wonder what our scientists have been doing in their laboratories? Well, here is the answer: “giving new names to old horses” and coining “big words” instead of doing “big deeds”. Salwi explains: “Ask a scientist what he would do to modernise his lab or institute. He will talk about having more expensive equipment, more computers, more space and more scientists. And also, not surprisingly, a new name to a lab or institute.”

And what about big words substituting big deeds? Here we go again: “More Indian scientists are adept at coining big words for their small deeds. For example, technology parks, technology missions, technology polyclinics, etc. They are talked about with a great gusto initially and then forgotten as bad dreams.” Is all this amusing? Or disgusting? ■





The **Audio Visual Unit** of the Centre for Science and Environment has:

- A photolibrary of over 40,000 transparencies/slides on environment and related issues in India and all over the world.
- A video library of more than 350 films. CSE is the video resource centre in India for the Television Trust for the Environment, UK and can distribute films for non-broadcast use.
- Environmental posters of global organisations for quick exhibitions.

You can buy slides/transparencies; buy/borrow films and refer to posters.

Our resources are at your disposal.

PRICES*

Digitised images	
High resolution (print quality)	Rs 1,500 per image
Low resolution (screen quality)	Rs 700 per image
Duplicate Slide	
Multiple use	Rs 2,500 per image
One time use	Rs 1,000 per image
One time use (for 10 or more)	Rs 700 per image
Prints	
Multiple use	Rs 1,000 per print
Onetime use	Rs 500 per print
Video	
Films	Rs 450-850 per film

*Discounts available for rural NGOs and Schools



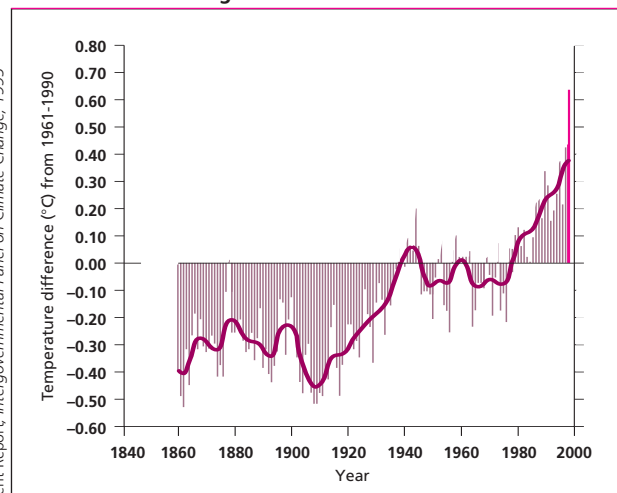
For more information contact: Coordinator, Audio Visual Unit
Centre for Science and Environment, 41, Tughlakabad Institutional Area, New Delhi-110062
Tel: 6981110, 6986399, 6983394 Fax: 91-11-6985879
Email: cse@sdalt.ernet.in Website: www.oneworld.org/cse

Going under

The Earth has warmed by about 0.5°C in the past 100 years. Evidence suggests that human activity has contributed to this change. Given current trends of increase in atmospheric concentrations of greenhouse gases, carbon dioxide in particular, it may warm by another 1°C to 3.5°C by 2080. The threat to the developing countries in the tropics and sub tropics is apparent: rising sea levels will displace tens of millions of people in small island states and the low-lying delta areas of Bangladesh, Egypt and China. Coastal wetlands are sensitive to climatic changes. Wetlands in the western coast of Central and North America may be lost.

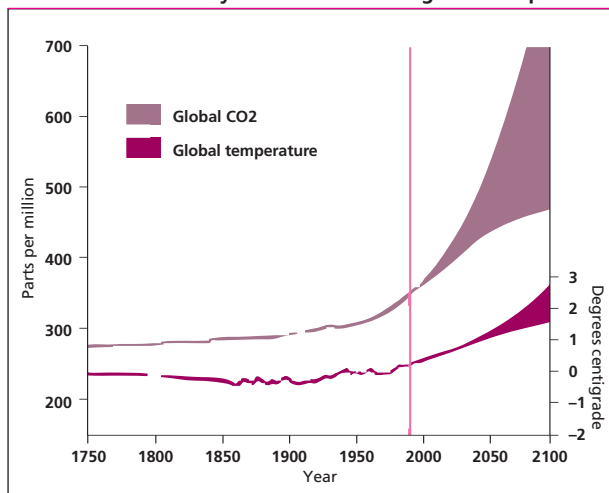
On a slow burner

Combined global land, air and sea surface temperatures from 1860 to August 1998 show a rise of 0.5°C



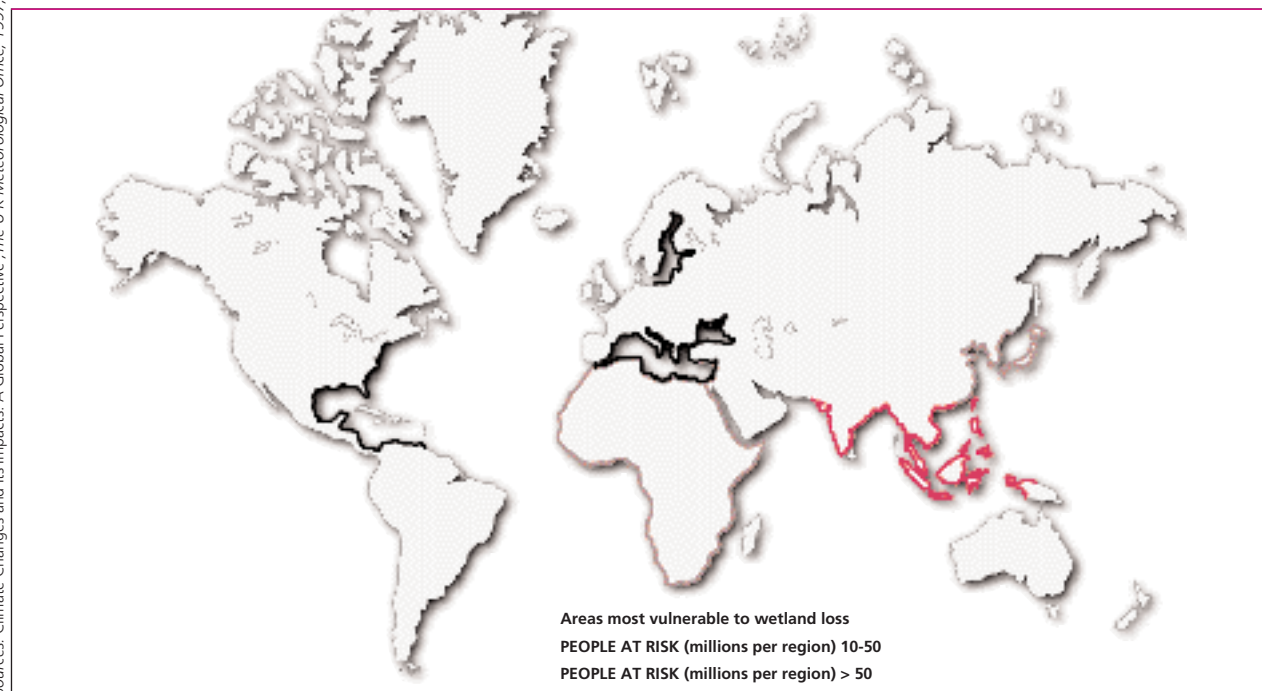
The human touch

The increase in atmospheric concentrations of carbon dioxide due to human activity and its relation to global temperature



The risks to people and the environment

Assuming 1990s level of flood protection, the risks due to a rise of 40 mm in the sea level by the 2080s



5 State of India's ENVIRONMENT A CITIZENS' REPORT

This book will be read by prominent

industry captains
corporate managers
policy makers
academicians
scientists
environmentalists
activists
politicians

Do you have anything to tell them ?

State of India's Environment: A book series people still talk about.

The First Citizens' Report (1982) was hailed by *Le Monde* of Paris, *The Economist* from London. New Scientist did a cover story on it. It was a pioneering work. It prompted similar reports from USA, Bhutan, Bangladesh, Indonesia and Nigeria.

The Second Citizens' Report (1984-85) impressed the then Prime Minister Rajiv Gandhi so much that he asked CSE to make a presentation on India's environment to the Union Council of Ministers and to all Parliamentary committees. *Business India* selected it as one of the ten most important books in 50 years of independent India.

The Third Citizens' Report (1991) subtitled *Floods, Floodplains and Environmental Myths* kicked up a furious debate on the role of deforestation in floods in the Indo-Gangetic Plains. It is one of the very few books on the changing ecology of the region.

The Fourth Citizens' Report (1997) subtitled *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems* was one of the greatest efforts to document India's traditional wisdom in water management. The book is still being talked about by the Indian media.

Now the *Fifth Citizens' Report* is in the pipeline, a 500-page book, with a print order of 10,000.

Your unique chance to reach out to a unique target group that matters. By placing an advertisement you also help us to keep the price low and reach out to a larger readership.

ADVERTISEMENT RATES

SIZE	COLOUR	BLACK & WHITE
Full page 24 cms x 18 cms	Rs 35,000.00 (US \$ 800)	Rs 20,000.00 (US \$ 550)
Half page (12 cms x 18 cms or 24 cms x 9 cms)	Rs 20,000.00 (US \$ 550)	Rs 12,000.00 (US \$ 300)

MECHANICAL DATA

PRINT AREA SIZE: Height: 24 cms Width: 18 cms

BLEED SIZE: Height: 28 cms Width: 21 cms

SCREEN RULING: 110 lpi.

For bleed please allow 8 mm on either side extra over bleed size for width and 3 mm extra side for height. The live matter should be within 1 cm from cut mark.

INPUT MATERIALS

COLOUR: Colour positives with progressive proof.

BLACK AND WHITE: Artwork, artpull, positive or text.

No block accepted.

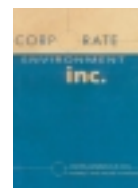
Last date for receipt of bookings — July 31, 1998

Last date for receipt of material — August 15, 1998

PAYMENT: The release order should be accompanied with cheque/demand draft in favour of Centre for Science and Environment payable at New Delhi.



Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi - 110 062
Ph: 91-11-698 3394, 698 6399, 698 1110
Email: cse@sdcernet.in Fax: 91-11-698 5879
Website: www.oneworld.org/cse



**A monthly
environmental
scrutiny of industries**

**For investors,
policy makers and NGOs
to intervene**

**For Industries and
Entrepreneurs to
stay ahead of their
competitors**

Bottomline

- A monthly compilation of news on industry's environmental track record.
- Indexed by companies and sorted by major industrial sectors.
- Analysed and compiled from over 80 leading newspapers and periodicals from across the world.

For more details contact:



Centre for Science and Environment

41, Tughlakabad Institutional Area, New Delhi - 110062 Ph.: 2995 6394 / 6399 / 6110
Fax: 91-11-2995 5879 Email: pub@cseindia.org
Website: www.cseindia.org

YES! I WANT TO SUBSCRIBE CORPORATE ENVIRONMENT INC.

	Annual Subscription	*Annual Subscription with half yearly database
INDIA (Rs)	2,800/-	3,800/-
REST OF THE WORLD (US \$)	250	285/-

* Special digital package available in database format on • Major Industrial Sectors • Companies / Firms • Place of Investment • Project Summary • Impact on Waterbodies • Industries & Litigation

Please find enclosed my annual subscription to 12 copies of **Corporate Environment Inc** ☐ For myself ☐ For my institution ☐ To gift a friend*

Name: Mr/Ms/Institution _____ Designation _____

Department _____ Institution _____ Area of Interest _____

Address: ☐ Office ☐ Residence _____ City: _____

State: _____ Country: _____ Pin Code

Phone: Off ☐ Res ☐ _____ Fax: _____ E-mail: _____

I wish to pay by ☐ Cash / MO ☐ Cheque/Demand draft (add Rs 15 for outstation/non-Delhi cheque) DD/Cheque No Dated _____ payable to

Centre for Science and Environment. Credit Card: ☐ Visa ☐ MasterCard ☐ Amex ☐ Diners Rs _____

Credit Card No Valid till Date of Birth _____ **Card Verification Value No

Date _____ Signature _____

For online subscription payment please login at website <http://csestore.cse.org.in> *For gift subscription add receiver's name & address on a separate sheet. **Last three digits on the reverse of credit card.

Please fill this form and mail or fax to: **Centre for Science and Environment**,
41, Tughlakabad Institutional Area, New Delhi-110062 Ph: 91-11-2995 5124 / 6394 Fax: 91-11-2995 5879 Email: pub@cseindia.org