

Global warming: nuclear power gaining acceptance

In most American universities, nuclear engineering courses are overbooked

NUCLEAR POWER may have a new dawn, though many wrote it off as a sunset industry. Recently, while speaking at a Pennsylvania nuclear power plant, President Bush focused most strongly on nuclear energy, calling it a source of power that is abundant, affordable, and safe (*Environment News Service*, May 25, 2006).

The US Energy Policy Act 2005 supports construction of new nuclear plants. It provides loan guarantees, production tax credits, and investment protection for delays beyond the builder's control to build new reactors.

How many, where, when

Wall Street appears to be interested in nuclear power. "It is no longer a matter of debate whether there will be new nuclear plants..." "...Now, the discussion has shifted to predictions of how many, where and when," Nuclear Energy Institute, a nuclear lobby group quotes from the March 13 Special Report of the Fitch Ratings Global Power Group.

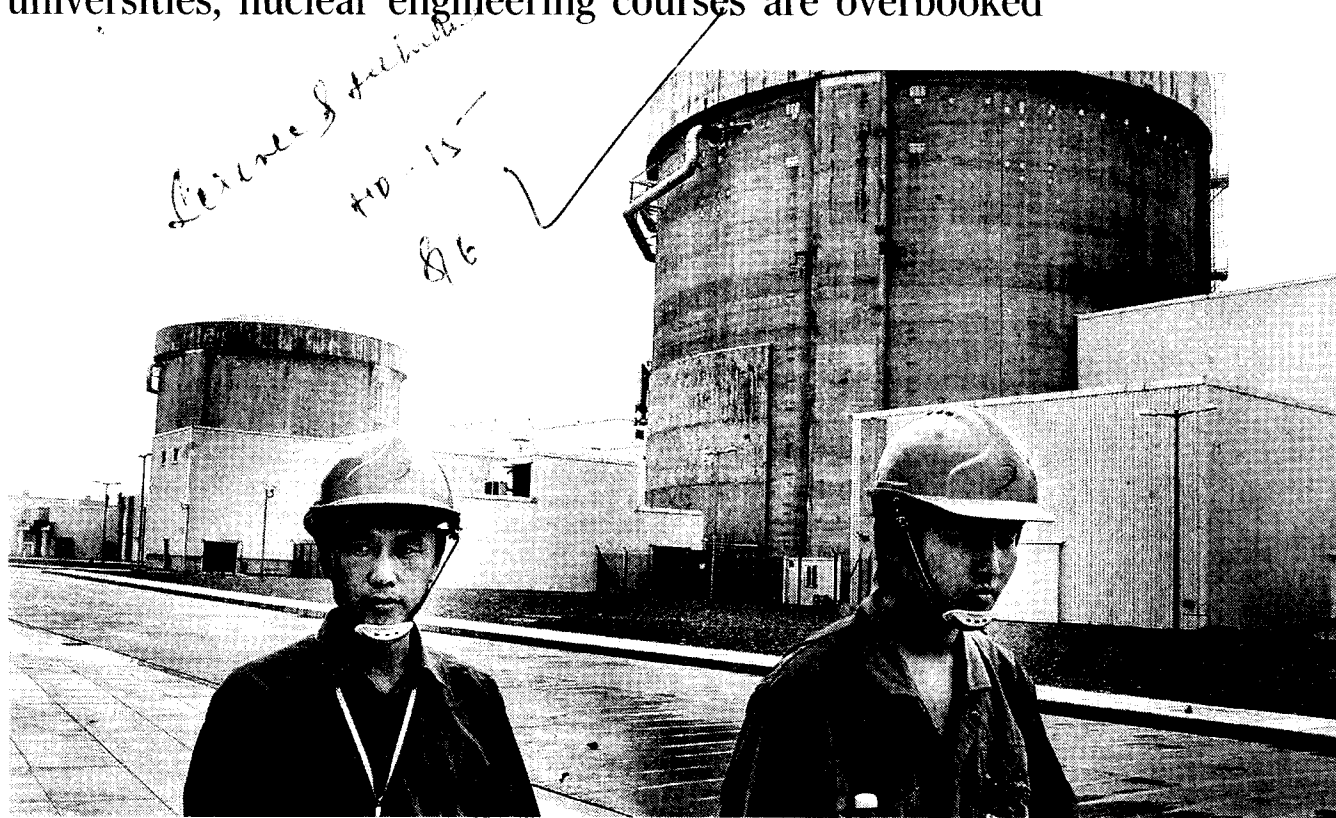
The *Christian Science Monitor* (CSM) reported that in most American universities, most nuclear engineering courses are overbooked. Every seat in the workshops for young professionals who believe in nuclear science and technology is filled.

Edward McGaffigan Jr., Commissioner, United States Nuclear Regulatory Commission (USNRC) says that NRC may recruit 350 persons per year for the next foreseeable future to cope up with a 'tsunami' of applications for new reactors!

Back on the agenda

On 16th May this year, British Prime Minister Tony Blair declared that the issue of new nuclear power generation was back on the agenda with a vengeance.

Canada, China, several European Union countries, India, Iran, Pakistan, Russia, and South Africa have schedules to build or refurbish about two dozen power plants during the



GOING GREEN: Canada, China, several European Union countries, India, Iran, Pakistan, Russia, and South Africa have schedules to build or refurbish about two dozen power plants during the next five years. Photo: AP

next five years. In the U.S. and the U.K., governmental preparations are under way that may lead to 15 new reactor orders by 2007 (*Physics Today*, February 2006).

Finland is constructing a new reactor. Western Europe is quietly backing away from planned nuclear phase-outs. France is moving in to construct a new 1,600 MWe Reactor.

Worldwide, nearly 80 per cent of the 441 commercial nuclear reactors currently in operation are more than 15 years old. New reactors will have to replace decommissioned ones to maintain nuclear power's position in the overall energy mix.

Nearer home

Nearer home, Unit 4 of the Tarapur Atomic Power Project, India's largest nuclear power reactor became commercial in December 2005. On May 20 this year, Unit 3 of TAPP went critical. In 2007, five units including

• **President Bush called nuclear energy a source of power that is abundant, affordable, and safe**

• **Sir David King, U.K. government's chief scientist, warned that global warming is more serious than terrorism**

the first unit (1,000 MWe) of the Kudankulam Power Project are scheduled to go commercial.

Benign view

Cracks are developing among environmentalists. They hate nuclear power but like renewables. Sun is not always reliable. Wind, often lazy and slow.

They are unreliable and add totally a small percentage. If we need power that is always available, we have to have it from coal or natural gas or nuclear.

Sir David King, U.K. government's chief scientist warned that global warming is more serious than terrorism. James Lovelock, a well-known Green guru concurred. "We have no time to

experiment with visionary energy sources; civilisation is in imminent danger and has to use nuclear – the one safe, available energy source – now or suffer the pain soon to be inflicted by our outraged planet" Lovelock wrote in *The Independent*. Greenpeace and Friends of the Earth, for whom opposition to nuclear power is an article of faith, rejected his claim. Late Hugh Montefiore, former Bishop of Birmingham, a trustee of Friends of the Earth, quit the agency to support nuclear power.

Greenpeace leader Patrick More and Christine Todd Whiteman, former Administrator, Environmental Protection Agency

and former Governor, New Jersey, set up the Clean and Safe Energy Coalition to promote nuclear power.

"The only technology ready to fill the gap and stop carbon dioxide loading is nuclear power," Stewart Brand, a founder of the *Whole Earth Catalogue* wrote in *Technology Review* (2005).

Wired Magazine noted that even the Union of Concerned Scientists, a well known anti nuclear agency has a growing pro-nuke faction.

Softening resistance

According to the magazine, much of the resistance of the Greens to nuclear power will soften if the industry dealt with issues such as proliferation, safety, waste management and the like.

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LUNAR MISSION ■ NASA chief Michael Griffin will be reaching Bangalore on May 8

ISRO-NASA Chandrayaan-1

payload pact on May 9

AMBABAKSHI
BANGALORE, MAY 2

TAKING the first few steps towards what could become a long-term relationship of cooperation, the Indian Space Research Organisation (ISRO) will sign a memorandum of understanding (MoU) on May 9 here with NASA on the US payload for Chandrayaan-1. Chandrayaan-1 is the first lunar mission of India to be completed in 2007-08.

NASA chief Michael Griffin will be visiting ISRO to sign the MoU, under which NASA will provide two payloads — Miniature Synthetic Aperture Radar and Moon Mineralogy Mapper operating in 0.7-3 micrometre band.

"The NASA chief will be arriving here on May 8 and we will sign the MoU the next day. We had invited many European and other countries to submit their proposals and we will be carrying the payloads for free," said ISRO spokesperson S Krishnamurthy.

The main scientific objective of the lunar mission is the physical and chemical mapping of the moon from 100-km lunar polar orbit. The PSLV will place the lunar spacecraft in a 240 km X 24000 km orbit and the spacecraft will use its own propulsion system for reaching the 100-km orbit around the moon. Besides the US, Chan-

drayaan-1 would have payloads from Bulgaria and European Space Agency (ESA).

The 500-kg satellite (liftoff weight 1304 kg) will have a host of Indian payloads, taking up chemical mapping of the entire lunar surface, besides helping to prepare a three-dimensional atlas of regions of scientific interest.

The Indian payloads that are proposed include a terrain mapping stereo camera having 5 m spatial resolution and 20 km swath (400-900nm band). This is accomplished by using three suitably displaced linear arrays in the focal plane of a single lens; a

hyper spectral wedge filter camera. The hyper spectral camera has 64 channels.

The other payloads to be included are a solar x-ray monitor and laser ranging instruments among other things. Also, a moon impact probe (MIP), which is conceived as a technology forerunner for future lunar landing mission, is also being incorporated.

The Rs 386-crore maiden planetary exploration project of India was approved by the Government in September 2003.

The data collected through the US, European and the Indian payloads will be shared among each other.

This is India's first unmanned moon mission and the orbiter is expected to last for two years.



05 MAY 2006

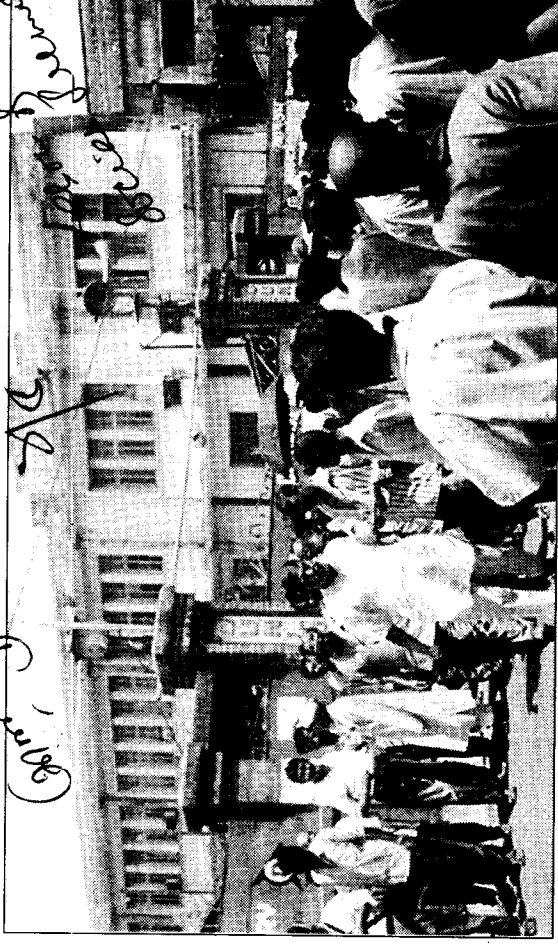
বেতনের হিসাব শর্ত মেনেই, দাবি পবন রুইয়ার

বকেয়ার কিস্তি ফিরিয়ে দিলেন ডানলপ-কর্মীরা

নিজস্ব সংবাদদাতা, কলকাতা ও চুঁচুড়া: সাহাগঞ্জ কারখানা খোলার শুরুতেই ডানলপ কর্তৃপক্ষের সঙ্গে সংঘাত বাধল কর্মীদের। বকেয়া বেতনের হিসাবকে কেন্দ্র করেই ওই সংঘাত। এর জেরে রবিবার বকেয়া বেতনের প্রথম কিস্তি গ্রহণ করতে অস্বীকার করলেন ডানলপ-কর্মীরা।

এ দিন ডানলপের প্রায় ৪,২০০ কর্মীর বকেয়া বেতনের প্রথম কিস্তি হিসাবে প্রত্যেককে সর্বোচ্চ ৫০০০ টাকা করে শেটনোর কথা ছিল। টাকার পরিমাণ চুক্তি অনুযায়ী নয়, তার থেকে কম, এই অভিযোগ তুলে রবিবার সকালে সিটু এবং আইএনটিইসি সংগঠনের সব শ্রমিক সাহাগঞ্জে ডানলপ কারখানার গেটে রীতিমতো মাইক বেঁধে বিক্ষোভ দেখালেন এবং কর্তৃপক্ষের দেওয়া টাকা ফিরিয়ে দিলেন। তবে কর্ণধার পবন রুইয়া জানান, তিনি ইউনিয়নের বক্তব্য লিখিত ভাবে জানতে চেয়েছেন। বিষয়টি আলোচনার মাধ্যমে মেটালো সম্ভব হবে বলে তিনি মনে করেন। সিটু সহ-সভাপতি অশোক পাল জানান, আগামী কাল মঙ্গলবার কর্তৃপক্ষের সঙ্গে আলোচনা হবে।

ইউনিয়নের ওই অভিযোগ



রবিবার সাহাগঞ্জে ডানলপ কারখানার গেটে বিক্ষোভরত শ্রমিকেরা। — তাপস ঘোষ

পুরোপুরি অস্বীকার করেছেন ডানলপের নতুন মালিক পবন রুইয়া। এই দিন তড়িৎঘড়ি সাংবাদিক বৈঠক ডেকে রুইয়া দাবি করেন, “গত ৯ এপ্রিল সাহাগঞ্জের কারখানা খোলা নিয়ে কর্তৃপক্ষ এবং ইউনিয়নের মধ্যে

যে-চুক্তি হয়েছে, আমরা তার শর্ত যথাযথ ভাবে মেনেই বকেয়া বেতনের হিসেব কষেছি। কর্মীদের টাকা নিতে অস্বীকার করার ঘটনা দুঃখজনক।”

রুইয়া জানান এর আগে দু’দফায় ডানলপ বন্ধ হয়ে ফের যুগেছিল। ওই শর্তেই সেটা ছিল। তিনি এও দাবি

করেন যে, হিসাব কষার সময় কর্মীদের ছুটির বিষয়টিও মাথায় রাখা হয়েছিল। বক্তৃৎপক্ষে বিরোধের মূল বিস্মৃতি হল, কর্মীদের মতে বেতন দিতে হবে মাসের ভিত্তিতে। সর্বোচ্চ ক্ষেত্রে এগারো মাসের বেতন। কর্তৃপক্ষের বক্তব্য, চুক্তি অনুযায়ী কে কত দিন কাজ করেছেন, তার উপর ভিত্তি করেই হিসাব করার কথা।

শ্রমিক নেতাদের অভিযোগ, কর্তৃপক্ষের সঙ্গে যখন চুক্তি হয়, তখন কথা হয়েছিল, তাতে তাঁদের সবেতন ছুটি থাকাকালীন টাকা কাটা হবে না। কিন্তু ছুটির টাকা কেটে নেওয়া হচ্ছে। অশোকবাবুর অভিযোগ, “কর্তৃপক্ষ এমন ভাবে হিসাব কষেছেন, যাতে কোনও কর্মীরই ৫,০০০ টাকা পাওনা না-হয়। কর্তৃপক্ষের হিসাবে কারচুপি আছে। আমরা তা মানছি না।” সিটু সম্পাদক দীপঙ্কর রায় বলেন, “টাকা না-নেওয়ার পরামর্শ দিয়েছি। আদায়ের জন্য যা করতে হয়, তা-ই করব।” আইএনটিইসি নেতা রঞ্জিত নিয়োগী বলেন, “রাজ্য সরকার এই পরিস্থিতির মোকাবিলায় এগিয়ে আসছে না কেন?” এ দিন সকাল থেকে দফায় দফায় বিক্ষোভ চলে। এক সময় পুলিশকেও ঘটনাস্থলে আসতে হয়।

6 MAY 2008

Ending child labour

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165

The International Labour Organisation's finding of a global decline in child labour between 2000 and 2004 suggests that the multiple strategies adopted over the past two decades to remove children from work are proving effective. But the report also highlights the huge challenge, especially in the agricultural sector that employs seven out of 10 children at work and in the arena of domestic work, that needs to be met. *The End of Child Labour: Within Reach 2006*, the second report of its kind, estimates that the world's 218 million working children (2004 figures) represent an 11 per cent drop from 2000. The 26 per cent decline in child workers engaged in hazardous occupations suggests that ending child labour in high-risk conditions is easier to achieve than the abolition of child labour under 'normal' conditions. The ILO points out that the Latin American and Caribbean countries have actually freed two-thirds of working children from economic activity. But despite a steady fall in fertility rates, Asia and the Pacific region are home to the largest number of child workers (122 million) in the 5-14 age group. Shockingly, half of them are engaged in hazardous work. The situation in Sub-Saharan Africa has been made worse by the high population growth, regional conflict, and the loss of large numbers of people in the active age groups to the HIV-AIDS pandemic. Underlying the overall improvement are the progress made in the spread of compulsory school education and a concerted attack on mass poverty in several developing countries. China leads the field. Its rapid progress in school education and lifting millions of people out of poverty is an inspiring example of high economic growth, successful reforms, and well-targeted social policies combining to effect a huge decline in the number of the world's child workers.

The growing involvement of trade unions has been a critical factor in the campaign against child labour in countries such as India, given the well-known fact that the practice of child labour has the effect of depressing adult wages and also has a detrimental impact on productivity. At the same time, there is an imperative need to speed up the adoption of international labour standards, which continue to be viewed with scepticism by policy-makers in several developing countries. In the case of India, the failure of successive governments to ratify the two international labour standards that pertain to the prescription of a minimum age for entry into employment and the abolition of the worst forms of child labour — two of the core ILO Conventions — reflects poorly on the state's commitment to abolish child labour, the Child Labour (Prohibition and Abolition) Act notwithstanding. Continuing to accept the excuse of 'harsh realities' and waiting for economic development to phase out child labour are also inimical to realising the constitutional guarantee of free and compulsory education for all children up to the age of 14.

16 MAY 2006

THE HUNDU

Chernobyl: 20 years later

The accident occurred when attempts to improve the reactor's safety were under way

ON APRIL 26, 1986, the worst nuclear accident in history occurred at the Chernobyl nuclear power station.

Exactly twenty years later, it is now time for calm contemplation. Ironically, the accident occurred when the engineers and technologists at the power station were carrying out an innovative experiment to design and develop a back up power supply to improve the safety of the reactor!

Design flaws combined with unpardonable operator errors and sloppy procedures caused the accident. In an interview given while attending a peer review meeting at the International Atomic Energy Agency at Vienna, Mr. Yuri Vishnevskiy, former Chairman of the Federal Nuclear and Radiation Safety Authority of Russia admitted that nobody could understand that such an accident could happen (*AERB Newsletter*, 1999).

After the accident

"Frankly speaking, there were some observations on the weaknesses of Chernobyl reactors. But nobody could foresee that the deficiencies could lead to such a reactor accident." "... Before the accident, the attitude of the management towards the nuclear power reactor was the same as towards a conventional power station; but after the accident...there was a clear change in the attitude. They started respecting the process of nuclear reactions".

Various agencies gave different reasons for the accident. Mr Vishnevskiy gave a not so publicised theory. "The Russian Academy of Earth Sciences published another reason.

According to them there was a localised earth quake close to Unit 4 and the bottom structure of the unit developed a crack," he clarified. A 600 page report titled 'Chernobyl's Legacy: Health, En-

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- With the exception of a few areas, radioactive contamination levels have fallen within safe levels

- The UN report labelled the mental health impact as the largest public health problem

vironmental and Socio-Economic Impacts' released on September 5, 2005 by the Chernobyl Forum which is made up of eight UN specialised agencies gave the most authentic information on the impact of the accident.

Many myths

As of mid 2005, fewer than 50 people died due to radiation exposure, almost all being highly exposed rescue workers. This included nine children who died of thyroid cancer out of about 4000 cases of thyroid cancer mainly in children and adolescents. Many myths prevailed (*The Hindu*, June 23, 2005).

The wave of thousands of cancers and deaths among the survivors reported by some agencies was found to be 'fiction.' The specialists did not find any evidence or likelihood of decreased fertility or congenital malformations among the population. (*The Hindu*, August 15, 2005).

Based on current knowledge, the international specialists made a statistical prediction that about 3,940 deaths due to radiation exposure in the 600,000 exposed persons (including 200,000 emergency workers, 116,000 evacuees and 250,000 residents of the most contaminated areas) could oc-



Science & Tech
10-16
2019

DANGEROUS DEGRADATION: The structural elements of the 'sarcophagus' hastily built around the stricken reactor have degraded. -AP

cur due to the accident over their life time.

This estimate relies on Linear Non Threshold hypothesis, which assumes that any dose, however small, can cause harm. This concept drew flak from The French Academy of Sciences.

Some 350,000 persons relocated from the affected areas suffered indescribable mental trauma.

Within safe levels

The UN report labelled the mental health impact as the largest public health problem. The report called for providing

accurate information on the persistence of radioactive contamination in some areas where the authorities must restrict harvesting of some wild products. With the exception of a few areas, radioactive contamination levels have fallen within safe levels.

The authorities forbid agricultural and industrial activities in some areas. This led to the creation of 'a unique sanctuary of biodiversity.'

The structural elements of the 'sarcophagus' hastily built around the stricken reactor have degraded, posing a risk of col-

lapse and release of contamination.

International funds to carry out rebuilding of the sarcophagus are being committed by various countries.

It is difficult to say that the world has recovered from the 'Chernobyl shock' and has started looking at nuclear power benignly twenty years after the accident.

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20 APR 2006

THE HINDU

Kalam for big push to nanotechnology

India could follow Singapore's 'Biopolis model'

Special Correspondent

NEW DELHI: President A.P.J. Abdul Kalam on Wednesday urged the Ministries of Human Resource Development and Science and Technology to launch a major drive to build up human resources in emerging fields such as nanotechnology, biotechnology and information technology.

The President was inaugurating a two-day Indo-U.S. conclave on nanotechnology here.

India could follow Singapore's "Biopolis model," witnessed by him during his recent visit there.

Under the model, a global search for talent would be made and the talent spotted would be provided with all amenities to qualify from a university of his or her choice. The candidates' entire study programme would be funded and they were mandated to return and work in Singapore in the field of life sciences for a minimum of six years.

Nurture young talent

"There is an important message here for all of us to nurture young talent for all scientific research work, particularly in na-

- **Increase human resources in emerging fields**

- **India lags behind in implementing research findings**

noscience and nanotechnology. With 540 million youth in India, we have to hone skills of youth at the graduate, post-graduate and Ph.D levels," Mr. Kalam said.

He rued that despite doing exceedingly well in the field of research in advanced topics right from the late 1950s, India lagged behind in implementing the research findings on a commercial level.

"This should not happen vis-à-vis areas like nanotechnology and convergence of nanotechnology with ICT and BT. Therefore, even while eminent scientists are focussing on basic research, simultaneously, Indian industries — small, big and medium — must work in tandem to commercialise nanotechnology," the President said.

Suggesting setting up special

funds by industries to commercialise products, Mr. Kalam called for creation of innovative managerial mechanisms to ensure that the funds were utilised speedily with commercial success in mind.

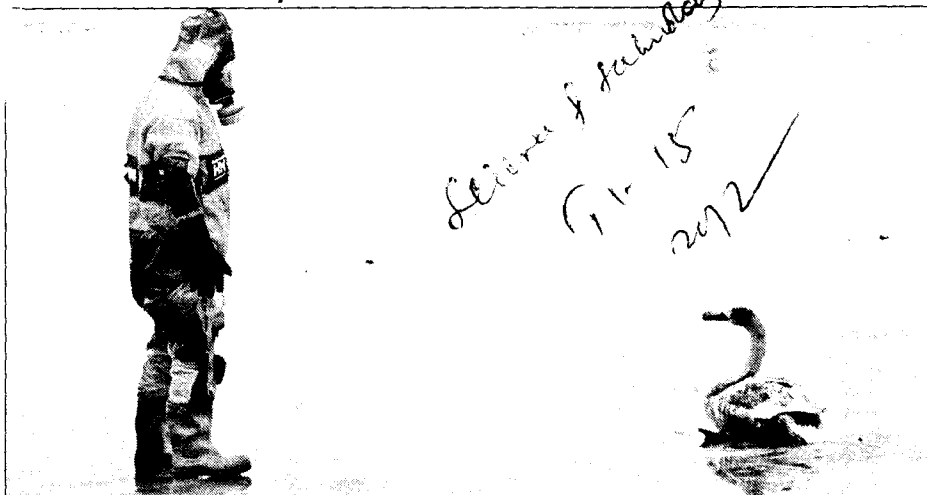
"I feel the Government can set apart sufficient funds on a non-lapsable basis for nanotechnology commercialisation."

India should strive to capture at least five per cent of the market share in the nanotechnology sector within a decade from now, using its core competence with international partnership. The country needs to launch vertical missions in nanotechnology under organisations such as the CII or NASSCOM, and with the public-private investment in at least 10 nanotechnology products in fields like water, energy, agriculture, healthcare, space, defence and ICT.

"Indian nanotechnology initiatives are maturing into marketable products for worldwide applications. Industries, both foreign and Indian, are evincing interest to commercialise our technologies," Mr. Kalam said.

Lethal flu strain spreads wings

France, Iran Confirm H5N1 Virus



DEVELOPMENTS AROUND THE WORLD

- Austria records two more cases of H5N1 bird flu near Vienna, bringing its number of cases to 7
- Indonesia confirms its 19th human death from the disease
- In Hong Kong, a dead magpie tests positive for the disease—the ninth infected bird to have been found in the territory in 3 weeks.
- Egyptian authorities cull 10,000 birds at a chicken farm near Cairo, a day after Egypt reported its first cases of H5N1

The deadly H5N1 strain of bird flu has continued to spread, with France and Iran becoming the latest countries to confirm the presence of the virus following tests carried out on dead birds.

France's first H5N1 case was confirmed following tests on a dead duck near Lyon. France's food safety agency, AFSSA, "confirmed the presence of a highly pathogenic H5N1 virus on a duck found dead on February 13 in the town of Joyeux," the ministry said in a statement Saturday night.

France, the EU's top poultry producer, is already on alert to try to ensure that bird flu does not spread from the wild to its 200,000 farms that raise 900 million birds each year. All fowl have been ordered indoors or vaccinated amid fears of an outbreak in France.

The ministry said the strain was "99%" identical to the virus that swept from Asia to Europe and Africa and raised fears of a worldwide flu pandemic if it mutates into a form easily transmitted between humans.

In line with new EU anti-bird flu measures adopted Friday by the European Commission, French officials set up a 3 km protection zone around the spot. Veterinarians were checking

poultry in the zone starting Friday, while the movement of live poultry to and from the area was banned and wild birds were being watched more closely, the ministry said. At a news conference in Paris on Saturday, Agriculture Minister Dominique Bussereau said that some 900,000 birds across France would be vaccinated.

Confirmation of the deadly disease in France brings to seven the number of European countries infected by the H5N1 strain over the past week.

Earlier this week, the EU approved a series of measures to try to halt the spread of the virus, including the automatic creation of protection and surveillance zones around outbreaks in wild birds. If the virus transfers from wild birds to poultry "buffer zones" that could cover an entire region could be established and the transport of poultry restricted within them.

In Iran, tests on more than 100 dead swans found in wetlands in the northern province of Gilan showed the presence of H5N1. Despite the outbreak, Iranian veterinary chief Hossein Hassani said there was "no concern" about humans contracting the disease. Agencies

Brush with bird flu

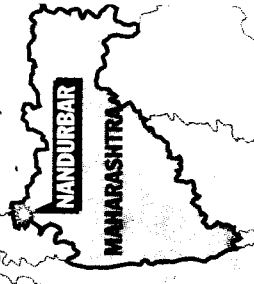
No human case so far

G.S. MUDUR

New Delhi, Feb. 18: The deadly avian influenza H5N1 virus has surfaced in India among poultry in a corner of northern Maharashtra, where it has killed over 30,000 chickens in the past 10 days, officials announced today.

The High Security Animal Disease Laboratory in Bhopal confirmed genetic

Gujarat
Madhya Pradesh



signatures of the virus in eight samples of dead poultry tissues it had received from Navapur in Nandurbar district near the Maharashtra-Gujarat border.

Animal husbandry and health officials have initiated a plan to contain the infection through the mass slaughter of more than 300,000 chickens in the infected zone and intensive surveillance to spot symp-

toms in humans. "There is no human case so far, and no cause for panic," health secretary Prasanna Hota said after a meeting in Delhi.

More than 200 veterinarians armed with protective gear and covered by antiviral medication will begin administering the mass death sentence to the chickens spread across 16 farms around Navapur, beginning Sunday morning, the Maharashtra state minister for animal husbandry, Anees Ahmed, told *The Telegraph*. "We expect the culling to be completed within 24 to 48 hours."

Doctors from Delhi and Pune have flown to Navapur to examine people who have come into contact with the infected poultry.

The doctors have examined some people who have had symptoms of cold and cough, but have not detected any case of pneumonia — one of the hallmarks of H5N1, Hota said. Twelve human samples have been sent for tests and four people are being kept under observation in Maharashtra.

Animal husbandry officials have designated a 3-km radius area as the "infected zone" and a 7-km radius area

ACTION PLAN

On confirmation of H5N1 diagnosis, what the government is expected to do:

- A 3-km radius area around infected sites to be designated infected zone
- A 10-km radius to be designated surveillance zone
- Absolute ban on movement of poultry and poultry products from infected zone
- Closure of poultry and egg markets in infected zone
- Local officials to destroy all diseased birds, and those in contact with the sick ones
- Dead birds to be burnt on fire and buried within infected zone

WHAT YOU SHOULD KNOW

- **Is there reason for panic?** No
- **Why is it so?** The virus has surfaced only in poultry in Nandurbar. There is no confirmed human case yet. The virus does not cross easily from birds to humans
- **But can't humans also be affected?** Yes, they can be. But human infection is a rare occurrence. The virus is transmitted through inhalation from bird droppings. No proof yet that it is transmitted through food
- **What are the symptoms in humans?** High fever, cough, breathlessness and pneumonia
- **Isn't there a vaccine?** No vaccine is ready yet for commercial production
- **What about medicines?** Two drugs oseltamivir (commercially known as Tamiflu) and zanamivir (commercially known as Relenza) can reduce the severity and duration of illness. The drugs may improve prospects of survival, if administered early, but clinical data are limited

CAN WE EAT POULTRY PRODUCTS?



- **Yes, you can, if you are not in the affected zone**
- **But cook thoroughly all poultry products, including eggs. Cook meat till it's no longer pink. Make sure the egg's yolk is not runny**
- **Boil chicken at least 10 minutes more than usual. Cook it on high flame**
- **Do not refrigerate raw chicken meat**
- **Avoid barbecues**
- **Don't buy birds that look sick**
- **Those preparing food should wash hands with soap and hot water**
- **Disinfect surfaces in contact with poultry products**

Delhi has a familiar disease

RASHEED KIDWAI

Bhopal, Feb. 18: Rapid dissemination of information — that's the cornerstone of the fight against any contagion, but not if Delhi can help it.

The High Security Animal Disease Laboratory in Bhopal, the only one in Asia equipped to deal with bird flu, developed cold feet for a few hours this evening after confirming that the deadly virus has arrived in India.

"Yes, it is bird flu," an official confirmed in the afternoon. Hours later, however, he was less sure: "It was a preliminary report and we need to confirm it."

The official had been taking calls from across the country. However, sources in Delhi said a few calls from the capital made the officials of the lab clam up.

The sources said some decision-makers in Delhi were upset with the laboratory for creating a "scare". They feared that businesses such as poultry, tourism and aviation would be hit and conveyed their displeasure to the lab.

By night, however, an official at the lab again confirmed that some samples had tested positive. "But there is no need to panic," he added.

chickens in the zone. The World Health Organization (WHO) has said that since 2003, H5N1 has been reported in 170 people and 92 have died, though the virus remains largely a bird disease.

Scientists fear that H5N1 may exchange genes with human viruses, gain the ability to move from person to per-

son through coughs and sneezes, and trigger a new influenza pandemic.

Most human cases of H5N1 so far have involved only people who have had long, close contact with live, diseased poultry.

Animal husbandry officials said the route of entry of H5N1 into Indian poultry is unclear.

beyond as a "surveillance zone". Every chicken in the infected zone will be killed. The veterinarians will either gas the chickens or decapitate them and then burn or bury them.

The surveillance zone around Navapur has 60 farms and one million chickens. The government has ordered 750,000 doses of vaccines for

showing the symptoms.

Bengal alert

The Bengal government has issued a state-wide alert, saying the local animal husbandry officer should be informed if any bird, domestic or wild, or livestock behaves abnormally or shows signs of sickness.

■ See Pages 3 and 4

Bird flu hits India

HD-1
1912

Science
2006

2 lakh poultry to be culled

Gargi Parsai

NEW DELHI: The dreaded pathogenic H5N1 bird flu has hit the country — about 50,000 birds are suspected to have been infected in the tribal Nandurbar district of Maharashtra. As a precaution, two lakh birds being reared in 16 commercial farms within 3 km radius of the affected area would be culled (killed), the Secretary, Animal Husbandry and Dairying, P.M.A. Hakeem, told *The Hindu*.

A red alert has been sounded in the adjoining Surat district in Gujarat, which has many commercial farms. India has about 490 million poultry of which 60 per cent is in the commercial sector. The rest is backyard poultry.

Cabinet Secretary B.K. Chaturvedi convened a late evening meeting of senior officials to assess the situation and activated an action plan to prevent the spread of the disease. A team of over 200 veterinary doctors and specialists has been rushed to Maharashtra. A five-member rapid response team from the National Institute of Communicable Diseases has also been despatched.

According to Mr. Hakeem there had been no case of human infection so far. A Central team comprising officials of the Health and Family Welfare Ministry and the Animal Husbandry Department has already been sent. The H5N2 vaccine for birds and 'tamiflu' tablets against human infection have been moved to the district. Mr. Hakeem too is rushing to Maharashtra to take stock of the situation.

He said the cause of the infection could not be immediately ascertained, although it was suspected to be from migratory birds. The affected districts are

• **H5N2 vaccine for birds and 'tamiflu' tablets for humans kept ready**

• **No case of human infection so far**

dotted with swamps and small water bodies. India has banned the import of poultry since February 2004 when bird flu first hit parts of Europe. Neighbouring Pakistan was affected then, though India remained safe.

Mr. Hakeem said initially Rankhet disease (manmodi) was suspected but the Regional Disease Diagnostic Laboratory at Bhopal, where samples of infected birds were sent two days ago, confirmed the pathogenic avian flu. As a precautionary measure the entire affected area would be cordoned off and ring vaccine administered to farms within three to 10 km radius in neighbouring districts. India had two months stocks of vaccine that was imported from Europe.

In this type of flu, the respiratory system of the poultry is infected killing them within hours. The flu has spread across Europe and parts of South-East Asia. Even humans have been infected in some parts of South-East Asia. India has tested 20,000 samples of birds since 2004 at its four laboratories in Pune, Bangalore, Kolkata and Jalandhar. This is the first time that the tests have been positive. However, experts say there is no cause for alarm. All precautions have been taken to check the spread of the disease. Chicken cooked at 60 degrees centigrade for over 15 minutes makes it safe.

The State Government has been advised to compensate the poultry farmers who suffer losses due to culling of birds.

10/10/2006
HACU

MONDAY, JANUARY 16, 2006

Learning from Turkey

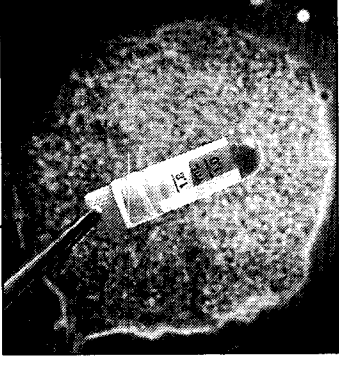
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The way the lethal H5N1 strain of bird flu has spread in Turkey, reaching as far west as Istanbul, has aroused great international concern. The first outbreak in that country was reported at a turkey farm in early October 2005. The Turkish Government promptly ordered a cull of all poultry in the village and, according to press reports, of street dogs too. The strategy appeared to work as the outbreak died out. Then suddenly in early January, in a different part of the country, a teenage boy, his two sisters, and brother were hospitalised and found to have the feared form of bird flu. Three of them died. Thereafter, reports began pouring in of outbreaks of avian influenza among domestic birds and, worse still, of more cases of human infection. In less than a week, 11 more people were confirmed with H5N1 infections. In East Asia, where H5N1 is entrenched in many countries, the general pattern has been for the virus to become rampant among poultry and then cause humans infection. International health officials now believe the disease has been spreading unnoticed for some time among domestic birds in Turkey. When the weather turned bitterly cold, villagers followed their customary practice of keeping their birds indoors and the close contact made it easier for the virus to infect humans.

It is quite possible the Turkish Government let its guard down rather precipitately after the first outbreak. It also appears that the less developed eastern region of the country, where outbreaks were first reported this year, had neither the knowledge nor the skills required to deal with the crisis. Even after the outbreaks became internationally known, the official machinery did not seem able to move swiftly enough to handle infected birds and carry out the culling. The United Nations Food and Agriculture Organisation has warned that H5N1 could become endemic in Turkey and also pose a serious risk to neighbouring countries. India and other developing countries can learn from Turkey's experience. The first priority should be preventing the virus from spreading and establishing itself in poultry. Prevention is not an easy task in a situation where large numbers of poor people keep a few chicken or ducks in their backyards. So people must be educated on how best to protect their birds, on ways to minimise the risk of themselves catching the infection, and on what to do if they notice illness in the birds. Equally important, the Government must have a drill in place to deal quickly with any outbreak. Efficient and fair procedures for compensating farmers when slaughter of their birds becomes inevitable for saving human lives must be an essential part of such advance planning. Bulgaria, which is currently free from H5N1 infection, has taken the commendable step of announcing it will pay twice the market price for birds that are culled. The old adage about a stitch in time has rarely applied to a situation better than it does today to countries vulnerable to avian influenza.

20 JAN 2006 THE HANCOCK

স্টেম-সেল সম্পর্কে বাকি দু-একটা কথা যা আমি জানি



৯ নভেম্বর (২০০৫) অধ্যাপক আনন্দলাল রায়ের সম্পাদকীয় প্রবন্ধ 'বিজ্ঞান চলুক, চলুক, চলুক বিতর্কও... থামুক বিজ্ঞান নিয়ে রাজনীতি' নিয়ে দু'চার কথা বলতে চাই!

১) শ্রীরায় স্টেম-সেল কী জানাতে লিখেছেন, 'এরা এক বিশেষ ধরনের কোষ যাদের নিজস্ব উৎপাদনের ক্ষমতা আছে।' আসলে যে কোনও কোষের দুটো বিশেষ গুণ থাকলে তাকে স্টেম-সেল বলা চলে। আর এই গুণগুলো হল: ক) তারা নিজেদেরকে অধিকৃত রেখে অধিকল একই ভাবে বহু সংখ্যক হতে পারবে, অর্থাৎ অসীম প্রজনন ও বৃদ্ধির ক্ষমতা। আর খ) অন্ততপক্ষে তারা অন্য ধরনের একটা কোষে রূপান্তরিত হতে পারবে। আর রূপান্তরিত হবার পর, তাদের প্রজনন ক্ষমতা সীমিত হবে। উদাহরণ দিলে বলা চলে, একটা স্টেম সেল থেকে উপযুক্ত ব্যবস্থায় কোটি কোটি স্টেম সেল পাওয়া সম্ভব। আবার স্টেম সেলকে রূপান্তর ঘটিয়ে ধরা যাক মায়ুকোষ বানানো হল। এই নতুন তৈরি মায়ুকোষগুলির বৃদ্ধি এবং প্রজনন সীমিত। ফলে, ওগুলোকে যেমন সংখ্যায় বাড়াবো সম্ভব নয় তেমনই একবার মায়ুকোষ হয়ে গেলে ওদেরকে আর অন্য কোনও কোষে (যেমন, রক্ত, চামড়া, চুল, মাংসপেশি বা অগ্নাশয় ইত্যাদি কোষে) রূপান্তর সম্ভব নয়। এ ছাড়াও এমন অনেক ক্যান্সার সেল লাইন আছে যাদের মধ্যে এই দুই গুণই লক্ষ করা যায়। তারা কিন্তু স্টেম সেল নয়। কারণ,

অন্যান্য অনেক ধরনের কোষে সব রূপান্তরিত হতে পারে। তা ছাড়াও, যেহেতু তাদের বৃদ্ধির ক্ষমতা বহুগুণ, তারা মস্তিষ্কে ডিউমার তৈরি করতে পারে। তাই এই রকম ক্ষয়রোগের ক্ষেত্রে বা করা যায় তা হল, অগ্নজাত স্টেম সেলগুলোকে টিস্যু কালচার স্ট্রেটে প্রথমে ডোপামিন-নিঃসরণকারী মায়ুকোষে অথবা নিউরোনাল প্রজেনিটর (বা নিউরোনাল স্টেম) সেলে রূপান্তরিত করা আর তার পর মস্তিষ্কে প্রতিস্থাপন করা। অন্য উপায় হল, সরাসরি নিউরোনাল প্রজেনিটর বা নিউরোনাল স্টেম সেলকে ডোপামিন নিঃসরণকারী কোষে রূপান্তর ঘটিয়ে তার ব্যবহার করা।

৪) ইনডিট্রো ফার্টিলাইজেশনে, প্রায় সব ক্ষেত্রেই একাধিক অণু তৈরি করা হয়, সব থেকে ভালটা বেছে নেওয়ার জন্যে। ফলে সব সময়ই অণু উদ্ধৃত থাকে। আর তার ব্যবহার করা যেতে পারে অগ্নজাত স্টেম সেল উৎপাদনের জন্যে।

৫) রাজনৈতিক ও ধর্মীয় প্রসঙ্গ, লেখক লিখেছেন 'বিজ্ঞানীর উত্তরে বলবেন, না, ই এস সেল শুধুমাত্র কোষ, যদিও এই কোষের অণু সৃষ্টি করার ক্ষমতা এক সময় ছিল।' অণু সৃষ্টি করার ক্ষমতা' কথাটির জায়গায় 'পূর্ণাঙ্গ শরীর সৃষ্টি করার ক্ষমতা' কথাটা বিক্রান্তি দূর করতে পারে। কেননা, ই এস সেলগুলো তো আসলে মৃত কোষ নয়, তারা জীবিত। আর ইসল্যামের মতোই, ইহুদি ধর্মেও গর্ভধানের চল্লিশ দিন পর্যন্ত অণুকে মানব সন্তান হিসেবে গণ্য করা হয়

না, তাই গবেষণায় ব্যবহার করার অসুবিধা নেই। বৌদ্ধ, হিন্দু বা সমতুল ধর্মে যেহেতু কর্ম ও জন্মান্তরবাদ মানা হয়, তাই স্টেম সেল ব্যাপারটা এঁদের চেয়ে জন্মান্তরের কর্মের পরিণতি রূপেই গণ্য হয়। বিশেষজ্ঞরা এই ধর্মের লোকজনদেরকে স্টেম সেল গবেষণার বিরোধী বলে মনে করেন না।

৬) চিকিৎসায় স্টেম সেলের সরাসরি এই রকম ব্যবহার ছাড়াও বিজ্ঞানের অন্যান্য ক্ষেত্রেও এই কোষ বিরাট কাজে আসতে পারে। যেমন, ডেভেলপমেন্টাল বায়োলজি, মলিকিউলার প্যাথোলজি কিংবা ড্রাগ টেস্টিং ইত্যাদি ক্ষেত্রেও সরাসরি স্টেম সেল ব্যবহার হচ্ছে।

৭) সবশেষে প্রসঙ্গক্রমে বলি যে, ভারতে তৈরি স্টেম সেলের যে দশটা লাইন, তার তিনটে (যেগুলো বাঙ্গালোরের ন্যাশনাল সেন্টার ফর বায়োলজিক্যাল সায়েন্সেস নামের প্রতিষ্ঠানে তৈরি) তো গবেষকদের কাছে এখনও পৌঁছয়নি। আদর্শে তা কখনও পাওয়া যাবে কি না তার কোনও নিশ্চয়তা নেই। মুম্বইয়ের একটি বিশেষ ব্যবসায়িক সংস্থার বাকি সাতটার কতগুলো পাওয়া যায় তা বলা মুশকিল। যুক্তরাষ্ট্রের ন্যাশনাল ইনস্টিটিউট অব হেলথ-এর নবতম তালিকাতে এই দশটা লাইনের কোনটাই পাওয়া যায় না বলে দেখানো হয়েছে। সুজয়কুমার খাড়া। স্টেম সেল গবেষক, রিজেনারেটিভ বায়োসায়েন্স সেন্টার, ইউনিভার্সিটি অব জর্জিয়া, আর্বেক্স, জর্জিয়া, মার্কিন যুক্তরাষ্ট্র

WHO probes rapid spread of bird flu among children in Turkey

Science & Tech

Geneva: World Health Organisation officials are trying to determine why the bird flu outbreak in Turkey has spread so quickly among humans, especially children. WHO spokeswoman Maria Cheng said the UN health agency believes 15 people have become infected with the disease in Turkey during the past week, almost all of them teenagers or younger.

"That's unprecedented," Cheng told The Associated Press on Tuesday. That is more than China (8) and Cambodia (4) combined, according to WHO figures. Indonesia has recorded 16 cases since last July. Turkey has almost as many as Thailand, which has counted 22 human cases since 2003, Cheng said. "I don't think there's something strange going on," Guenaël Rodier, who is heading the WHO team of experts in Turkey, told a telephone conference call. "I was querying

myself if we are dealing with a more efficient transmission from animals to humans," Rodier said. "It's an open question. I have no answer to that."

Rodier said it wasn't surprising that children appear to be coming down with the disease more than adults. It likely has to do with lower immunity as well as the likelihood that they come into closer contact with poultry in playing. "It's probably easier to catch a sick chicken than a healthy one," he said.

He said WHO and Unicef officials were thinking of ways to warn children more effectively of the need to keep their distance from poultry. "We may need to target messages to children in particular and probably to their mothers," said Rodier.

He said all indications are that the disease has spread from animals to humans and not person to person.

"There is no element to date that would support person-to-person transmission," Rodier said, but added it was probably too soon to determine what changes there had been in the pattern of the disease, in the pattern of transmission or of the virus itself.

"Much more work will be required," he said, but added, "It seems to be clear that we are dealing with a situation similar to what we have seen in Asia, which means in practice a number of small sites, family clusters of disease involving many children and always with documented or reported contact with infected birds, typically backyard poultry, particularly chickens which could be dead or sick."

He said WHO had no reason to place any restrictions on travel to Turkey. AP

12 JAN 2006

Dog clone saving grace in stem cell deceit

Korea Herald/ANN

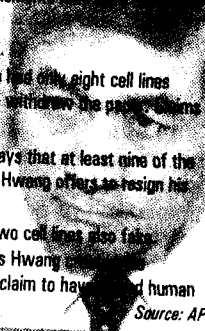
SEOUL, Jan. 10. — Scientist Dr Hwang Woo-suk and his team fabricated data for a 2004 stem-cell paper published in the US journal *Science*, said an investigation panel at his school. However, Dr Hwang's claim of having produced the world's first cloned dog is authentic, the Seoul National University panel said in its final report released yesterday.

The embattled scientist may face fraud charges given that his team received 62.3 billion won from the government between 1998 and 2005 for the research which has now been proven false, prosecution sources have said. His later *Science* paper published in 2005 which claimed to have developed custom-made stem cells was also proven as fake.

Dr Hwang is also accused of having told another lie that he had no knowledge of ova donations to his research by junior members of his team. A full report on the panel's probe will be

DIARY OF DISGRACE

- February 2004: Dr Hwang Woo-suk and colleagues announce they cloned a human embryo and extracted stem cells from it.
- May 2004: *Nature* reports two female scientists in Dr Hwang's lab donated eggs for research. Dr Hwang issues a denial.
- May 2005: Dr Hwang's lab reports creating 11 lines of human embryonic stem cells that are genetically matched to patients.
- August 2005: Dr Hwang's lab reports the first cloning of a dog.
- November 2006: Dr Gerald Schatten of the University of Pittsburgh pulls out of a partnership with Dr Hwang, citing questionable ethical practices in obtaining donor eggs.
- 24 November 2005: Dr Hwang apologises for lying about source of donor eggs.
- November 2005: Resigns as head of the World Stem Cell Hub.
- December 2005: Dr Schatten asks *Science* to remove his name from Dr Hwang's May 2005 report saying some elements were falsified.
- Dr Hwang's university launches a probe.
- 16 December 2005: Dr Hwang admits his lab had only eight cell lines when article was submitted. Asks *Science* to withdraw the paper claiming some stem cells were switched.
- 23 December 2005: Seoul National University says that at least nine of the 11 cell lines Dr Hwang reported were bogus. Dr Hwang offers to resign his professorship.
- 29 December 2005: University says remaining two cell lines also fake.
- 10 January 2006: Seoul National University says Hwang's world's first cloned dog, but faked the 2004 claim to have cloned human embryonic stem cells.



Source: AP

released tomorrow, which will define the roles co-authors of his 2004 and 2005 papers played in fabricating the studies.

The panel, consisting of six SNU faculty members and two outside experts, said Dr Hwang's team manipulated images and DNA

fingerprints published to support the 2004 paper.

The *Science* article claimed to have achieved the world's first in cloning a human embryonic stem cell line, bringing Dr Hwang to prominence. However, the panel has concluded the stem cell was developed not

by cloning, but by parthenogenesis — a process by which an egg develops on its own without fertilisation. The prosecution is set to launch a probe into Dr Hwang Woo-suk focusing on suspicion that he may have gained funding from the government under false pretenses and misappropriated the money and will also look into Dr Hwang's claim that his junior researchers interfered with his research.

The prosecution has already placed overseas travel bans on related professors and researchers who were involved in the stem cell research in order to question them. Those who are reportedly under the travel ban are Dr Hwang, researcher DR Kim Seon-jong, SNU's professor Dr Ahn Curie, MizMedi Hospital's chairman Dr Roh Sung-il and three other researchers. After Seoul National University announced its final report yesterday, the prosecution is able to begin its own investigation of Dr Hwang.

■ See editorial: Stem cell mystery, page 6

Stem cell mystery

1111 596 Science & Substrates
Science's cutting edge is its bleeding edge

Fundamental scientific research can involve pioneering researchers taking great and even wild risks with their lives and professional careers. The cutting edge of the frontiers of science (or for that matter any field of endeavour) is frequently its bleeding edge. Even critics of Seoul National University's 53-year-old professor of veterinary medicine Dr Hwang Woo-suk admit he has been at the cutting edge of research on stem cells and that he has cloned the world's first dog. In the last few months, he definitely has been at science's bleeding edge too. A country hungry for national heroes found one in him when he and his team claimed in the prestigious American journal *Science* in 2004 and 2005 that they had opened the possibility of patient-specific stem cell treatment in humans, whereby damaged body tissues could be repaired by new ones cloned specifically for an individual patient and which, therefore, would not be rejected by the patient's immune system.

Such treatment holds out hope for Alzheimer's, diabetes, and many other diseases. Dr Hwang was flooded with commercial offers to create a stem-cell bank that would be an international source for cell, tissue and organ repair. There has been deep discomfort in Western countries on Judaeo-Christian religious grounds with the idea of cloning human cells. Korea took the lead instead, and all Asia was proudly watching. Then in November 2005, Dr Hwang publicly admitted ethical breaches in using eggs of two junior scientists on his team, and further allegations arose that he had coerced one of these researchers to make the donation because she had accidentally destroyed a sample. On Monday Dr Hwang admitted to the newspaper *Kyeongin Ilbo* that DNA fingerprint traces of stem cells kept in their laboratory did not match those of cells featured in his team's article. He had raised similar doubts in late December in an interview with a Buddhist newspaper. Seoul National University has now found his published results to have been false, has alleged that he had falsified them and brought shame to the institution, and has promised "severe" penalties.

Dr Hwang has given no explanation for this situation except to protest his innocence and suggest that the stem cells described in his 2004 article had come to be swapped with other cells. There are rumours of professional jealousy and sabotage in the laboratory. South Korean prosecutors are due to investigate the whole matter including the question of whether Hwang misappropriated government funds — as well as Dr Hwang's own allegation that enemies within his own team maliciously switched some of his stem cell samples. He has claimed to have the technology to clone stem cells and has asked to be given an opportunity to reproduce his experiments. What is certain is that there is no evidence presently available that Dr Hwang's team in fact created the world's first cloned human embryo or extracted stem cells from it, or has the capability to produce even a single line of patient-specific stem cells. It all amounts to a deep and engaging scientific mystery about something important — so much more refreshing and significant than our current Indian mysteries of who tapped whose telephone or whether non-vegetarian remains have entered a vegetarian's bottle.

THE STATESMAN

11 JAN 2006

Turkey flu cases rise, WHO allays fears

Dogubayazit (Turkey), Jan. 9 (Reuters): Turkey reported a spike in suspected bird flu cases among people across the country today as fears grew that the deadly disease was sweeping westward towards mainland Europe.

The World Health Organisation (WHO) said victims appear to have contracted the virus directly from infected birds, allaying fears it was now passing dangerously from person to person.

The Turkish authorities reported 14 people have tested positive for the deadly bird flu virus, including three children from the same family in an impoverished region of eastern Turkey who died last week.

Bird flu is known to have killed 76 people since the latest outbreak emerged in late 2003. Human cases had been confined to east Asia until the virus was identified in Turkey last week.

China confirmed its eighth human infection from bird flu today, the latest victim a six-year-old boy from the central Hunan province who is being treated in hospital.

Indonesia said local tests showed a 39-year-old man had died from the virus earlier this month after contact with dead chickens. If confirmed, it would be the 12th death in Indonesia.

Worried Turks rushed to hospitals today for tests for the virus, which kills more than

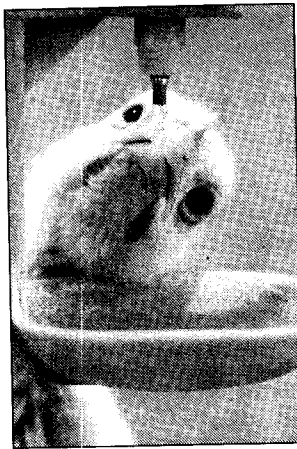
half of those it infects.

Thirteen children were among 23 people undergoing tests for bird flu in Istanbul, a teeming city of 12 million which is the country's commercial hub and the gateway to Europe from Asia.

Experts fear the deadly H5N1 strain will mutate just enough to allow it to pass easily from person to person. If it does so, it could cause a catastrophic pandemic, killing tens of millions of people, because humans lack immunity to it.

However, a WHO team visiting Dogubayazit, the home village of the dead children, said the evidence there pointed to infection from diseased chickens.

"At the moment there is no



A chicken drinks water at a farm in Damascus, Syria. (Reuters)

element in this village indicating human-to-human transmission. It's typically similar to what we have seen so far (in Asia)," Guenaël Rodier, heading the WHO's mission to Turkey and a specialist on communicable diseases, said.

The WHO has confirmed only four cases in Turkey, including two deaths. The WHO said other cases reported by Turkey have so far not been verified by laboratory tests.

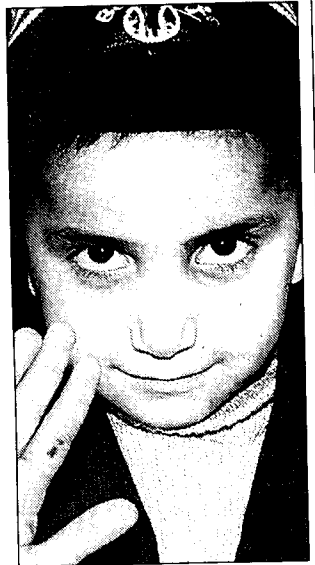
Investments and the economy could take a hit if tourism suffers as a result of health fears in Turkey, analysts say.

Russia told its citizens yesterday to avoid travelling to Turkey, a popular destination for Russians.

"It has the potential to become quite serious depending on how long it stretches out," said Sonal Desai, senior emerging market economist at Dresdner Kleinwort Wasserstein in Milan.

Turkey has said it is treating human cases drawn from three broad areas, including victims from around the capital Ankara, about 400 km east of Istanbul. The other victims are from the Black Sea area in the north and the east where the deaths were reported last week.

"The total number of cases in our country is 14 confirmed by laboratory tests, and out of those 14, three children have died," Turkey's health minister Recep Akdag told a news conference.



Hasan Ali Kocyigit, who has escaped infection from the H5N1 virus, waves after being discharged from a hospital in Van, Turkey, on Monday. Kocyigit's two sisters and a brother died of bird flu last week. (AFP)

Need for second green revolution, Manmohan tells scientists

Science & Technology

Address the needs of small and marginal farmers, Science Congress delegates told

P. Sunderarajan

HYDERABAD: Prime Minister Manmohan Singh on Tuesday called upon the scientific community to work towards bringing about a second green revolution that would have a special focus on dryland agriculture and address the needs of small and marginal farmers.

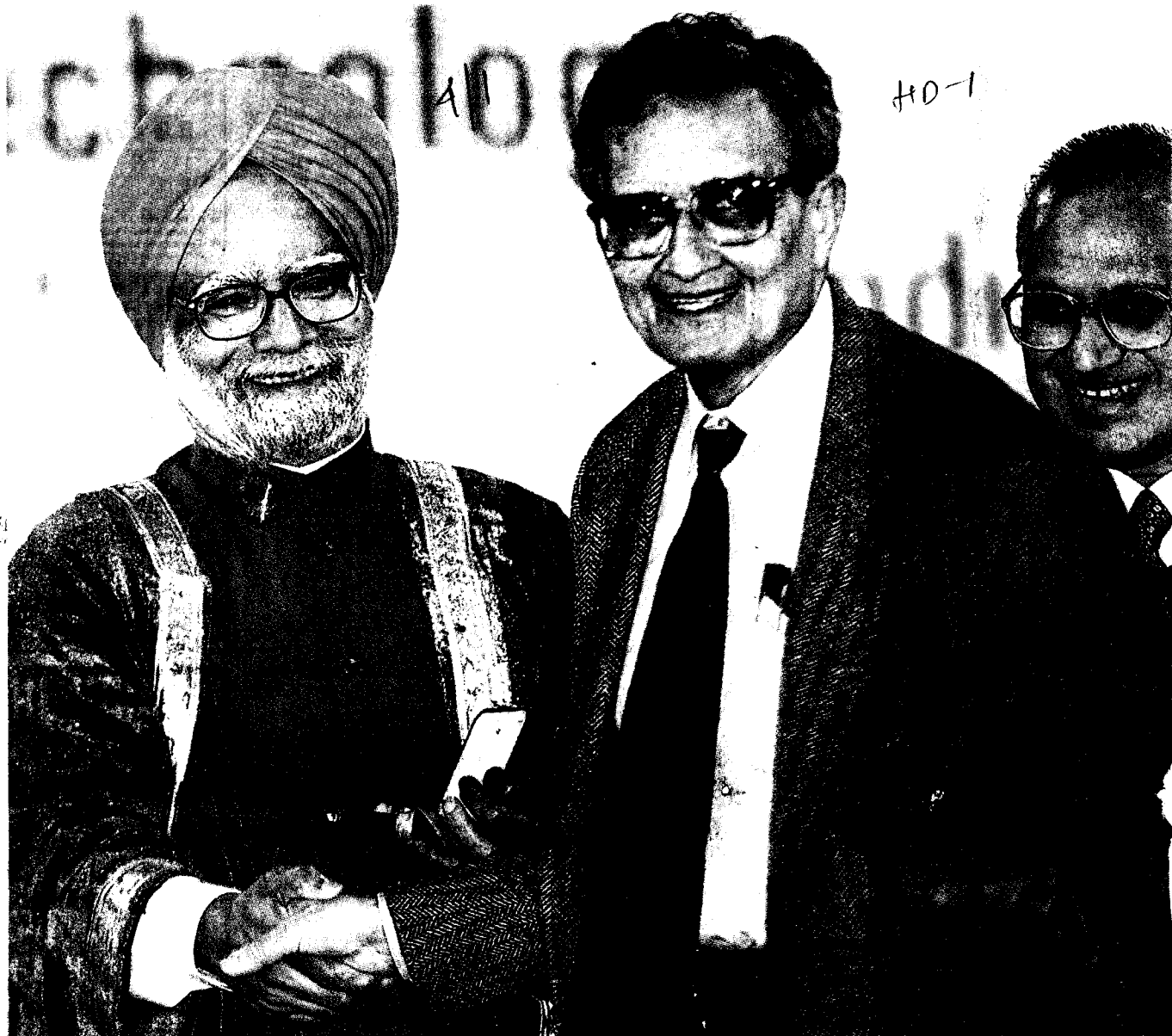
Inaugurating the 93rd session of the Indian Science Congress here, he said though the farmers have benefited much from the contributions of science and technology over the past three decades and more, a lot more remained to be done.

The technologies and strategies unleashed by the first green revolution seem to have run their course. There was, therefore, a need for a second green revolution. It should not be confined to food crops alone. It should also cover non-food crops, horticulture and new plant varieties.

The new technologies that the scientists develop should be economically affordable and relevant to small and marginal farmers. "Two criticisms of the first green revolution have been: one, that it did not benefit dryland agriculture, and two, that it was not scale neutral and had benefited large farms and big farmers only. While evidence showed that this was not always the case, we must ensure that the second green revolution technologies have a special focus on dryland agriculture and do benefit small and marginal farmers."

Rural distress

The Prime Minister also urged the scientific community to work towards developing technologies that were labour using and at the same time efficient in both farm and non-farm business, considering that even as the share of agriculture in national income was falling rapidly, the share of population dependent on agriculture is not declining as rapidly, leading to rural distress and enforced migration from rural to urban areas. The aim should be to develop technologies both in agriculture and rural manufacturing so that jobs could be created closer home for those who



HONOURED: Prime Minister Manmohan Singh presenting the 93rd Indian Science Congress General President's Science Excellence Award to Nobel laureate Amartya Sen in Hyderabad on Tuesday. — PHOTO: K. RAMESH BABU

live in villages.

In addition, he said, there was need for greater investment in skill development, modernisation of sectors such as handloom and handicraft industries and development of new functional townships away from cities, well equipped with basic infrastructure to attract new investments in the manufacturing and services sectors in rural areas. All this opened up opportunities for new technology developments. Agricultural universities must be intellectually alive to such

possibilities and develop courses and programmes to train people living in rural areas.

"My vision of rural India is of a modern agrarian, industrial and services economy co-existing side by side, where people can live in well-equipped villages and commute easily to work, be it on the farm or in the non-farm economy. There is much that modern science and technology can do to realise this vision," he said.

Quoting the late Prime Minister Indira Gandhi's speech at the

Indian Science Congress session in 1976, he said the strategy for rural India has to be one of improving the quality of life in villages, based on easily accessible and appropriate technologies so that people can continue to live where their forefathers have lived for generations and yet live comfortable and decent lives.

PM Singh also called for greater research on development of affordable and appropriate technologies for water resource management and energy production as water and energy, like

land, were scarce resources and science and technology could help on the supply side by increasing factor productivity and by developing technologies that conserve their utilisation. Assuring that the Central Government would encourage world class research in appropriate water and energy related technologies, he said, "I seek a more informed debate on utilisation of river waters in a manner that would be ecologically sustainable and economically affordable."