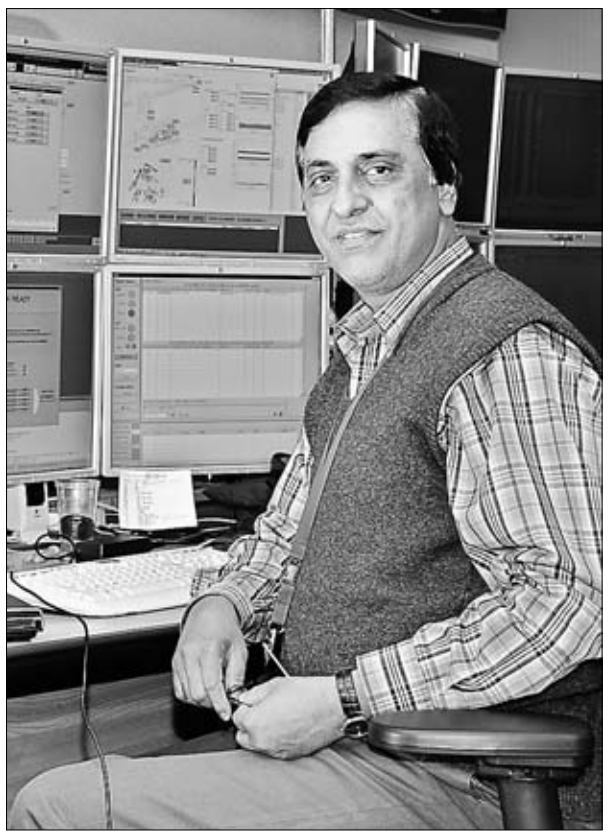
# Orissa's Geneva connection



Mahapatra in the CERN control room

## Durga Prasad Mahapatra, who has been working on the LHC for a decade, says there's a long way to go for the atom smasher

**DEBABRATA MOHANTY**

PROFESSOR Durga Prasad Mahapatra, a particle physicist at the Institute of Physics, Bhubaneswar, was awed when he first stepped into the CERN facility in Geneva in 1994. Only the best particle physicists survive at CERN, says Mahapatra, who was there again last month, from March 5 to March 28, a couple of days before the Large Hadron Collider reached a proton collision energy peak of 7 TeV on March 30. Over the last decade, 57-year-old Mahapatra and his team of Ph. D students and senior scientists from IoP have worked on the Photon Multiplicity Detector, one of the many detectors that are part of the LHC. Ajay Das, who is doing a Ph. D under Mahapatra, is now at CERN, representing IoP.

**"Real success will come when two lead nuclei, far heavier than the current single proton particles we are colliding, smash into each other"**

"At the CERN control room located above the collider, where data cables connect the numerous detectors to computers, you have to work nonstop. You can't even go out for food—there's coffee next door, which you have to drink with your eyes glued to the screens. There is no room for anybody who is not consumed by a desire to reinvent physics," says Mahapatra. About eight Indian scientists from different universities work with the ALICE and CMS projects at CERN at any given point of time.

The collider will operate round the clock for the next one-and-a-half years, with hundreds of proton collisions taking place every second. But not all the data can be recorded, Mahapatra says, as the computer servers installed for the purpose can keep records of only a fraction of the collisions.

The success of March 30 notwithstanding, Mahapatra says it is too early to rejoice. "Real success will come when two lead nuclei, far heavier than the current single proton particle that we are colliding, smash into each other at 14 TeV energy. Then we can have a 'big bang' that would last about two microsecond," he says.

Apart from the work at CERN, Mahapatra is also involved in the STAR (Solenoid Tracker) detector at the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Lab in New York's Long Island. The STAR detector, weighing 1,200 tonnes, specialises in tracking the thousands of particles produced by ion collisions at RHIC. The collider smashes together gold ions travelling at nearly the speed of light. The result of the collisions is a tiny region of space so hot—four trillion degrees Celsius—that protons and neutrons melt into a plasma of their constituent quarks and gluons. Before the LHC was built, the RHIC was the biggest ion collider in the world.

PHOTOS: VISHAL SRIVASTAVA


# All for a good crop

## The Central Institute for Subtropical Horticulture in Lucknow arguably has the largest collection of mango varieties from across the country and abroad, and is adding more

**SURBHI KHYATI**

FOR the last four months, mango has been the buzz word at the Central Institute for Subtropical Horticulture (CISH), Lucknow. March saw the end of hectic pesticide and insecticide spraying in the 70-80 hectares of the mango orchards maintained by the institute. Field technicians are preparing for irrigation in April and scientists are hoping for a good crop.

Sprawled over 132.5 hectares near Kakori village in Uttar Pradesh, CISH claims to have the largest collection of mango varieties in the world. Name a variety, and you will find a row of its cultivars in CISH fields. The institute has a field gene collection of 732 varieties of mango, collected over a period of 40 years from India and abroad—there are 17 of the best varieties from across the world. "This is the largest collection of mango germplasms (genetic material) in the world. And more varieties are being added," says Dr H. Ravishankar, director of the institute.

Established in 1972 as the Central Mango Research Station, the institute is a pioneer in technologies for enhancing production of the most relished fruit in the country. Apart from mango, the institute is involved in research on subtropical fruits like guava, *amla* and *bael* while also focusing on what they call "underutilised fruit" like *jamun*, papaya and *litchi*. The institute, which also maintains a bank of 100 guava germplasms, recently developed a hybrid wilt-resistant variety of the fruit.


(Clockwise from top) The institute; the collection of mango varieties includes 17 of the best from abroad; insecticides are sprayed at the mango orchard; CISH also has 100 guava varieties

"Mangoes are highly adaptable fruits—they change their characteristics according to climatic conditions, which is why India is home to so many varieties. While in the rest of the country the fruit is harvested around June, in the Kanyakumari region the trees bear fruit in October-November. We are trying to assess the characteristics of the plants there to enhance the productive season of mangoes across the country," says Ravishankar. "Mango is propagated through seed germination, because of which some varieties may be lost—this is where the germplasm bank becomes important. Each variety has some special characteristics, which can be exploited for hybridisation experiments in order to get better crops. *Elaichi*, for example, is an indigenous variety of mango which is found to be free from flowering malfunctioning—where the clustering of the flowers prevents the blooms from developing into fruits—and this quality can be exploited to get better hybrid varieties."

The institute is DNA fingerprinting the various varieties of mangoes found in the country, with the aim of securing intellectual property rights over commercially important varieties. A fingerprint collection of over 150 important varieties from north and east India has already been done by CISH, while varieties from the south and the west are being fingerprinted by the Indian Institute of Horticulture Research, Bangalore, says Ramesh Chandra, principal scientist at CISH.

According to the scientists, scarcity of water and the steadily reducing size of fruits are major problems. For effective water management, CISH is advocating methods like basin irrigation or drip irrigation, which saves 40 to 60 per cent water. Having found that the soil in their mango plantation area is lacking in micronutrients like zinc, manganese, boron and iron, CISH has adopted the 'fertigation' method, in which fertiliser solution is delivered to the plants through drip irrigation.

CISH has also pioneered a plantation method called ultra high density meadow orchard plantation of guava, which is proving to be popular with farmers in Maharashtra and Andhra Pradesh. The method allows plantation of 5,000 plants per hectare instead of the traditional number of 277 and produces 50 tonnes of fruit per hectare as against 10-15 tonnes in traditional plantations. The height of the plants is maintained at 1.5-2 metres and with pruning and cutting thrice a year, they yield three harvests of guava in a year.

CISH has recently come up with a seedless variety of *jamun*, which is undergoing evaluation. The institute is also working on the isolation of an anti-diabetic compound from the fruit. Around 35 varieties of papaya are also being screened at the centre to help cultivate the plant widely in the subtropical regions.

The institute has also adopted one village each from the mango and guava belts of the state. Farmers in these villages are trained to use technologies developed in the institute and get assistance from the scientists in managing their crop as well as post-harvest advice.

# Two wheel drive

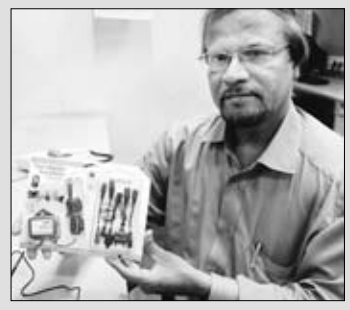
## Jagdish Limaje has developed a device for charging mobile phones while riding a two-wheeler

**ROHAN SWAMY**

THE little black unit looks like a pedometer. It's a simple mobile phone charger, the brainchild of design engineer Jagdish Limaje. "The whole idea was conceptualised when I saw that sales and marketing personnel used mobile phones the most and they constantly required to charge the battery. Since most of them spend a good part of the day roaming the city on two-wheelers, without a way of charging their phones while on the move, this got me thinking—the end product was this mobile charger for two-wheelers," he says.

The device, which costs Rs 110 for the basic charger, and Rs 150 with multiple pin connectors, was launched three weeks ago. "The charger comprises a one-and-a-half-ft-long cable that is connected to the vehicle's battery on one side and to the mobile phone on the other. It basically scales down the 12 V current of the battery to the requisite 5.5 V needed for charging the mobile," Limaje explains.

The design of the Amitech mobile charger, which was finalised about two months back, was created after a couple of trials and errors, Limaje says. "A unique feature of the charger is that it doesn't



drain the battery of the vehicle to which it is connected. This is because it will only charge once the ignition key is switched on," he adds. The charger, wrapped in an epoxy resin base, is waterproof.

The product is manufactured at the Amitech factory in Warje, Pune, where each component is tested before assembly. "My sons helped design the charger. We make about 150 units a day," Limaje says.

Limaje, who was a design engineer with Philips, started JD Designs in the 1990s—the company makes products with interesting design, such as a pen wherein you can fill *rangoli* powder. Amitech began a year ago. Limaje says he hopes to design a cost-effective charger for bicyclists. "We are working on using the cycle dynamo and a rechargeable cell to generate the necessary output for charging," he says.

# From byproducts of bio-diesel, a new, low-cost bio-plastic

## The Central Salt and Marine Chemicals Research Institute in Bhavnagar, Gujarat, has come up with a waste-free way of making biodegradable polymers from byproducts of bio-diesel

**ADAM HALLIDAY**

INDUSTRY has long been wary of mass-producing biodegradable plastics, not only because of deficient technology, but also because of the high costs usually associated with them.

But a CSIR-funded institute in Bhavnagar, Gujarat, might just have the solution with its breakthrough discovery last week—a process by which biodegradable polymers can be developed at almost zero cost using byproducts of jatropha-based bio-diesel.

Many institutions have developed biodegradable plastics using crude glycerol, a byproduct of bio-diesel, but the process has been extremely sophisticated and expensive. "We are not the first people to make bio-diesel from crude glycerol. But we wanted to find a smarter way," said Pushpito K. Ghosh, director of the Central Salt & Marine Chemicals Research Institute (CSMCRI).

CSMCRI owes its biodegradable polymer to a project that started 12 years ago, when it started conducting research on the practicality of cultivating jatropha on wasteland 12 years ago.

"The challenge," said Ghosh, "was, can we really grow jatropha on marginal land?" By 2004, the answer started to sound like yes. The institute developed a machine to separate the shell of the jatropha fruit from the seed—the main source of oil. It also developed another machine to convert the empty shells into a fuel that could be used instead of coal in a *chulha*. As for the seed, it was crushed in a mechanical oil expeller, resulting in two by-products: a liquid layer of crude glycerol and another layer of crude bio-diesel.


Mishra and her team; Ghosh (right) says the jatropha bio-diesel was adjudged the best bio-fuel by an EU study

In August 2005, scientists from the institute rode three bio-diesel-powered Mercedes Benz cars to the highest motorable road in the world, the Khardunga Pass in Leh. The bio-diesel they used also turned out to be the best bio-fuel for a car's engine—a European Union-commissioned study adjudged it the best for overall engine performance in 2006.

The institute applied for a US patent for its process, which was granted in February 2010. The scientists, however, continued to experiment with one of the byproducts—crude glycerol. This is what led to the present breakthrough.

The team's experiments led them to discover and isolate a microbe from seawater from the Gujarat coast. The microorganism was allowed to grow on crude glycerol and de-oiled cake, using it as an inexpensive carbon and nitrogen source for biodegradable polymer (*polyhydroxyalkanoate*-PHA) accumulating bacteria.

"Jatropha bio-diesel byproducts reduced the cost of raw material and increased marine bacterial cell density with PHA accumulation of 75-80 per cent cell dry weight of bacteria and 20 per cent carbon conversion efficiency," Sandhya Mishra, one of the scientists involved, said in an email. "Thus, jatropha bio-diesel byproducts are potentially viable as a source for commercial, large-scale production of PHA."

"The entire reaction period between the bio-diesel byproducts is usually 48 to 96 hours," Ghosh said. The remaining solution that is excluded from the reaction is, in fact, a good nutrient for jatropha plantations, making the entire process virtually waste-less.

Further testing showed that when the polymer was buried in the soil for six months, it dissolved completely.

"We have conducted the experiments up to the gram scale level," Mishra said, "and we are now looking towards scaling up for commercial production at the kilogram level."