

Feature

Health

A new class of molecules called biosensors are making their debut for clinical and industrial use. These exploit nature's unique biological recognition systems to serve as analytical sensing devices.

Molecular recognition systems form an integral part of all living systems, being an absolute prerequisite for the extraordinary specificity and selectivity of molecular interactions that are characteristic of all biological systems.

Understanding molecular recognition can lead to important medical and industrial applications. Some of the feasible uses include drug design, modification of neutral enzymes to perform specific functions and the building of catalytic machinery for chemical and biochemical processes.

In the past few years, scientist have begun to utilize these molecular recognition systems to synthesise biosensors for use in human and veterinary health care, environmental monitoring and food, fermentation and chemical industries.

They are now in wide demand for rapid clinical tests for glucose and urea levels, testing animals for disorders and diseases, measurement of toxic chemicals released by industries and in brewing and baking industries.

The complex molecular recognition systems are constantly operating in the human body. For example, all biochemical reactions that are fundamental to life processes depend on enzymes' ability to recognise specific substrates to catalyse these reactions.

Antibodies recognise and combine with specific antigen proteins on invading organisms' surfaces to control diseases and offer resistance.

Special receptors called

Biosensors : Molecules Recognise Molecules

By T.V. Padma

chemoreceptors present in the tongue and nasal lining being with specific molecular in food and scents to impart a sense of taste and smell.

This complex molecular recognition system helps the various enzymes, receptors and antigens bind with only one specific type of molecular or substrate and not with any other chemically or structurally similar analogue.

The recognition triggers a chain of chemical reactions that are essential for life processes. As both the substrates and the end products are ionic or neutral, they can be measured using ion sensors or gas sensors.

For example, if the biological interaction results in a change in pH, uptake of release of gases, ions, heat or electrons, or disturbance in some optical parameter, the biological signal may be converted into an electrical signal prior to being multiplied, digitised and output in the digitised format.

A biosensor is essentially an analytical device that converts the concentration of the biological component into an electrical signal through a transducer which is in intimate contact with or integrated to the biological sample.

Biosensors are already evolving into miniaturised, disposable, solid-state devices with the theoretical capacity to obviate the need for traditional external instrumentation.

Physical changes such as

production of heat, light and sound can be detected directly using thermistors, photon counters or piezoelectrically.

It can be immobilised in three main ways — chemical binding, physical retention and forming thin films — depending on its type.

The biological component can be chemically bound to a carrier or through cross-linking. Alternatively it may be physically entrapped in the matrix in the form of beads or fibres or simply encapsulated in it.

The thin film technique is relatively new where the biological component is adsorbed onto a single layer of an amorphous compound and later transferred to a solid support.

Usually enzymes are chemically bound to carriers or cross-linked, while whole cells and cell organelles are physically entrapped in membranes or polymeric matrices.

Enzyme-based biosensors in the form of enzyme electrodes find both clinical and industrial applications. A number of enzyme electrodes have been prepared for ascorbic acid oxidase, alcohol dehydrogenase, glucose oxidase, lactate oxidase and lactate dehydrogenase.

Scientists at the Tata Institute of Fundamental Research (TIFR), Bombay, have prepared a glucose sensor using the enzyme glucose oxidase which was immobilised with bovine serum albumin (BSA) with glu-

taraldehyde as the cross-linking agent. The enzyme electrode was prepared using platinum strip which was uniformly coated with a mixture of enzyme solution, BSA and glutaraldehyde.

The TIFR scientists also prepared a glucose oxidase biosensor by physically entrapping the enzyme in polyurethane polymers and coating a platinum strip with the two.

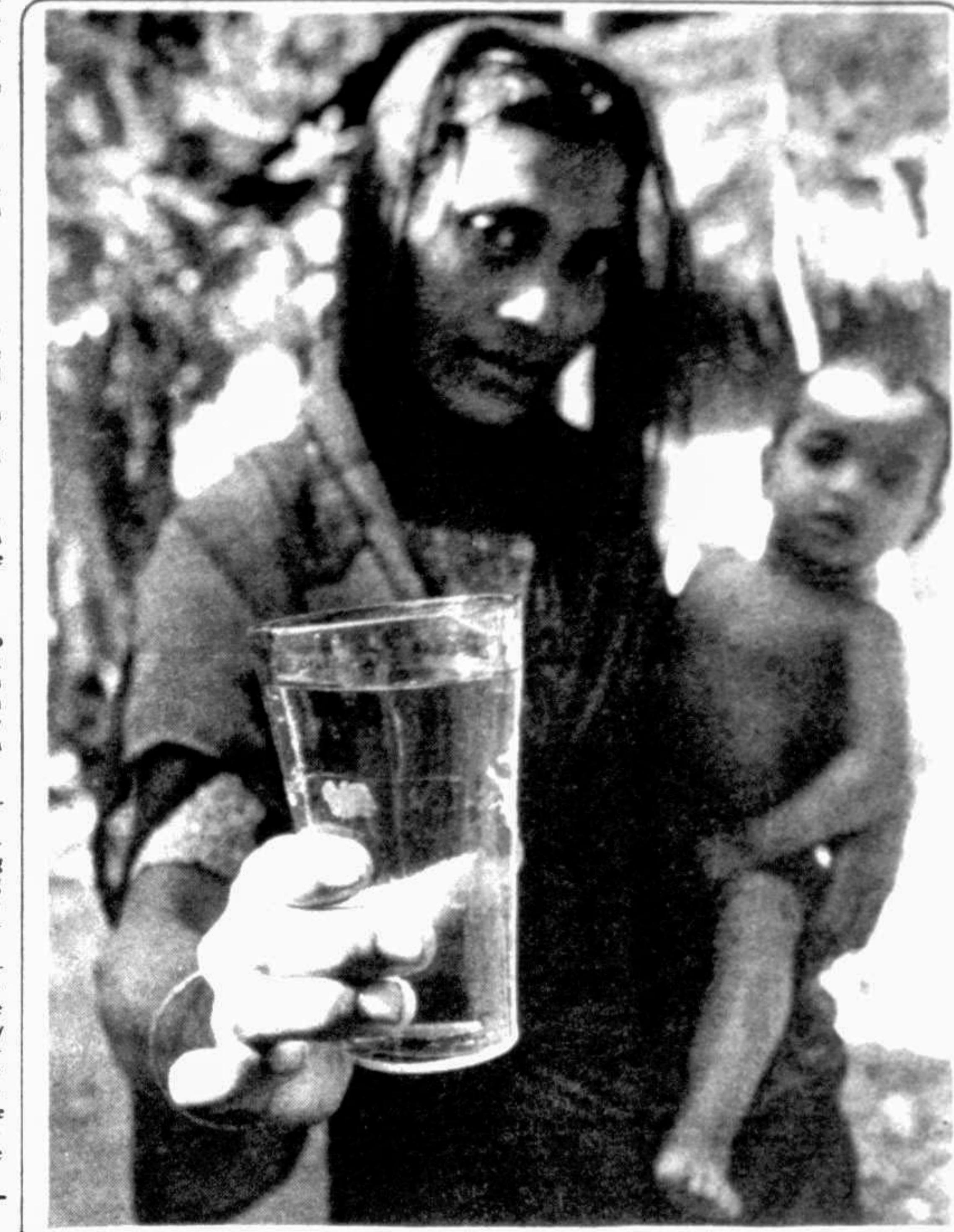
Scientists in Britain have developed biosensors that can give a warning within a few seconds of the presence in the atmosphere of enzymes used in washing powders.

Biological washing powders contain proteases, protein-disolving enzymes, which affect the skin and lungs of workers in washing powder production plants. Skin rashes and allergies, and serious lung diseases are common in factories where they are made while housewives using them experience minor irritations.

The biosensor is proving to be a sensitive detector that picks up traces of the enzymes before their levels are high enough to represent any threat, and which gives a warning in a few seconds.

The two biosensors developed at the Teesside Polytechnic and Sunderland Polytechnic in England act as watchdog alarm systems for washing powder proteases and in the future for biological active substances.

Although the potential applications of biosensors are burgeoning, yet there are formidable obstacles in the way for immediate commercialisation of this technology. These include making the sensitive electronic components passive to the rigours of aqueous solutions and the liability of the biologically active sites. — PTI.



Drinking water should be boiled and then cooled off; and whenever boiling is not possible water for drinking should be stored in a covered container and left standing in sunlight for two days before use.

Simple Preventions for Better Health

by Sabah Chowdhury

IT is not essential that one spend millions to obtain better health for the general people. Sometimes by simply maintaining better hygienic conditions one can improve the general health of the people. This will prevent spending for the cure of the disease as prevention is better than cure and more economical and a variety of diseases like diarrhoea, dysentery, hepatitis etc. can easily be averted.

The foremost hygienic factor which can help is cleanliness. Keeping one's body clean keeps diseases away. Washing one's hand keeping them clean prevents those diseases which can enter the body through food. It is very important to wash one's hand thoroughly after defecating before handling food, and after cleaning the bottoms of a baby or child who has just defecated. One has to be especially careful with children as they often put their hands into their mouths. So it is important that we wash a child's hands particularly before meals.

Doctors know that active gastritis is caused by helicobacter. It leads, in a small proportion of people, to so-called atrophic gastritis, in which secreting glands in the stomach wall die off, causing a drop in production of acid. This allows bacteria which are not usually found in the stomach to flourish. The researchers believe that certain of these organisms convert nitrates into nitrites, which can cause cancer. If bacteria damage the layers of mucus which protects the stomach lining, it may make it easier for all manner of cancer-causing substances to enter into the stomach.

So *H. pylori* may be involved in causing more diseases than anyone suspected. It's bad news for those who think stress causes ulcers; you might catch one.

— By arrangement with New Scientist.

Face also should be washed at least once every day. This helps prevent eye infections. Having regular baths is essential for general cleanliness as these prevent skin infection. Soap is a helpful factor in keeping clean, but it is not available then only water should suffice.

Next is the use of clean or safe water for the purpose of drinking and cooking. In rural area people generally use water from ponds, streams, wells, tanks etc. should only be had after boiling it and then cooling it. It is more essential in the case of babies and young children, as they have less physical resistance.

If boiling is not possible drinking water should be stored in a closed or covered container of clear plastic or glass and left standing in sunlight, for two days before use.

Few simple precautions mentioned above can prevent diseases, and in some cases even save life.

(Source: Facts for life: produced by UNICEF, WHO and UNESCO).

Nepal Oral Cancer Incidence Growing

While textbooks are not available in villages, shops have plenty of Cokes, Pepsis and other softdrinks, by Jan Sharma

ORAL health tops the list of health problems in Nepal, the Nepal Oral Health Society (NOHS) has warned.

Incidence of oral cancer is growing rapidly, and so are dental decay and gum diseases in Nepal, mainly among smokers and those with the habit of chewing beetle nuts (pan) and tobacco.

It is now well established that the cause of dental decay is the sugar in the diet. The traditional Nepali diet rich in carbohydrates is being supplemented by high sugar diet.

Sugar consumption has increased to 56,000 tons annually. Few realise that a high diet causes obesity, heart disease, diabetes and tooth decay.

The traditional low-sugar diet is being supplemented in Nepal by Western style processed and high sugar content food and snacks," says Sturat G. Little, an American involved in promoting oral health in Nepal.

Such programs should be aimed at small groups, rural areas where there are plenty of Cokes, Pepsis and other softdrinks which are highly sweet. This is leading to rapid increase in dental decay on top of an alarmingly high rate of gum diseases and cancer of the mouth," he says.

areas that have oral health problems," says Dr. Manik Ratna Bajracharya, the NOHS chairman. Free clinics have been opened in places like Doti in remote west Nepal and Sankhu village near the Kathmandu valley, bringing the number of such oral clinics in the kingdom to 20.

Dr. Bajracharya says demands for free oral health clinics have been received from numerous villages. "It is frankly impossible to cope with the growing demands and the amount of work involved," he admits.

Part of the problem is that Nepal has not yet evolved an oral health strategy in keeping with the needs of the population. "Until such a strategy is developed, nothing of lasting significance can be expected to occur," says Mr. Little.

In order to begin work on such a strategy, the first step is for a national oral health survey. This is more important in view of the scanty oral health data available at present.

Most of the services now given by dentists in Nepal are those ordinary paramedics could do even better, observers say. It costs a poor country like Nepal US\$10,000 to train a dentist in Britain.

Health Briefs

ONCE-A-WEEK PILL

Once-a-week oral contraceptive pill developed by the Central Drug Research Institute (CDRI) in Lucknow has gotten the approval of the Indian Drug Controller for marketing. According to CDRI, which has been working on the drug for about two decades, it is a non-hormonal drug, the first of its kind in the world.

The pill, called centechrom, will be manufactured by the state-owned Hindustan Latex Limited which now makes condoms. It will be in market in three months and will have a tremendous export potential, says CDRI.

CDRI, which carried out a two-year clinical trial on 125 women, said the drug was safe and non-toxic. It is said to be devoid of all the side effects typical of hormonal pills now in use. Out of the 125 women only three became pregnant, which the health ministry says is acceptable enough for the pill's introduction into the family planning programme.

According to CDRI, the pill is to be taken twice a week for first three months and once a week thereafter. It also works post-coitally if taken within 24 hours. It has been declared safe for lactating mothers and women of any age in their reproductive life.

A spokesman of the Indian Council of Medical Research said the pill's mechanism of action is not fully understood. It has weak anti-estrogen and anti-progesterone properties and is believed to stop pregnancy by preventing implantation of the embryo.

RASAGOLLA FROM SOYA MILK

The much relished "rasagollas" which are normally prepared from cow's milk can now be prepared from soya milk, much in vogue now-a-days as a cheap and protein-rich food.

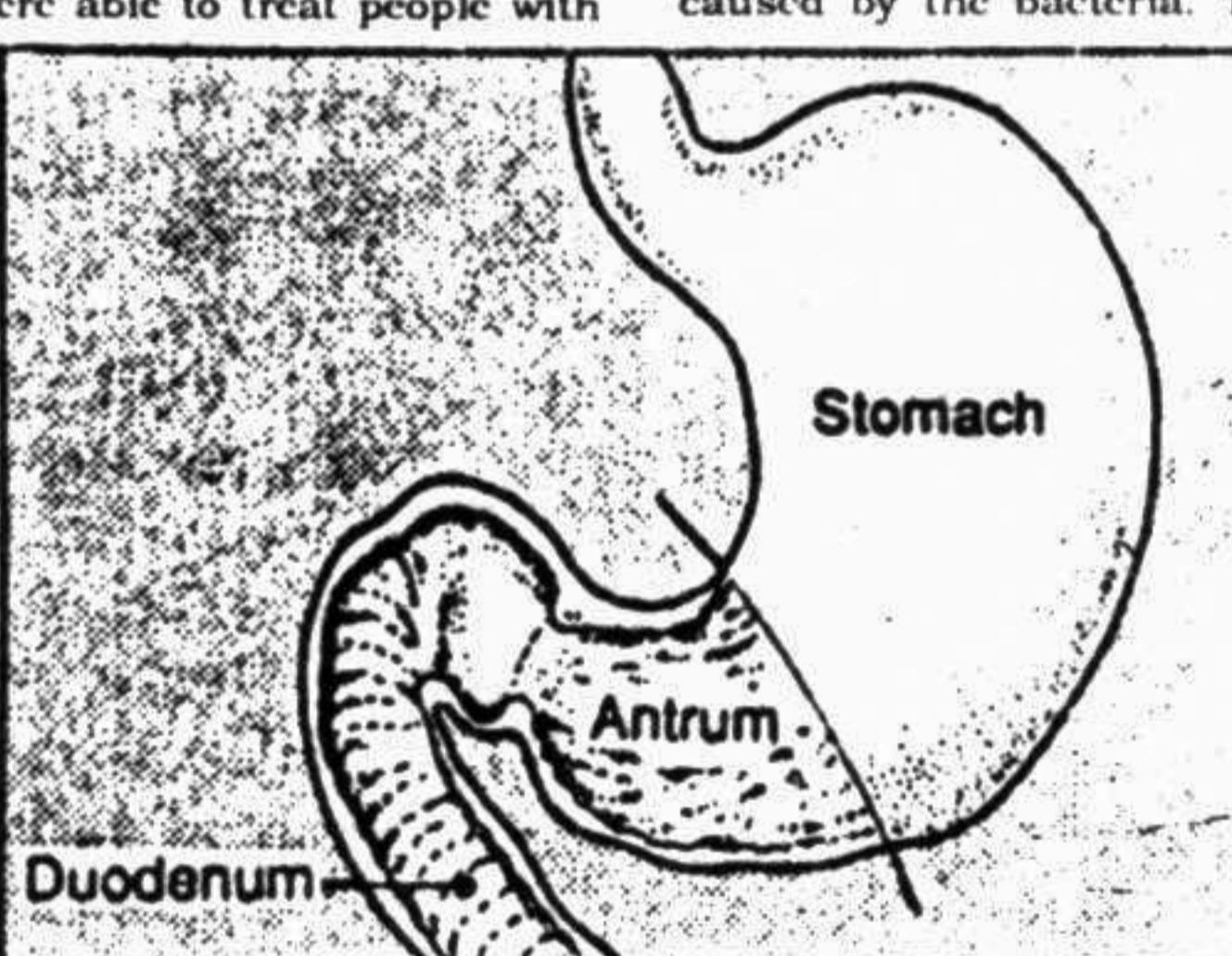
A new technology developed by the Bidhan Chandra Krishi Viswavidyalaya, West Bengal, uses 2 per cent calcium lactate as a coagulant at about 85 degrees Celsius to give a soya-rasagolla that looks very much like those made from cow's milk.

It has not been possible so far to standardise methods for making rasagollas from soybean milk, low-cost and excellent source of protein and fat, or from buffalo milk.

The Bidhan Chandra Krishi Viswavidyalaya scientists cooked small balls made from soyabean (channa) in boiling 50-55 per cent sugar syrup for about 15 minutes and stored them in the syrup at room temperature overnight.

According to the researchers, soy-rasagollas have certain advantages over those prepared from cow's milk. They show more elasticity and sponginess and have more fat and protein.

Any increase in the temperature of coagulation leads to a decrease in protein and fat content.



H. pylori by giving them a cocktail of antibiotics and a bismuth compound. This eradicated the bacteria. The bacterium can survive in the stomach despite the fact that the stomach's acidity kills all but the toughest micro-organisms. It neutralises the stomach's acid by converting urea in gastric juice into alkaline ammonia.

Researchers have found that if *H. pylori* is put in a solution with a pH of 3, it dies, but if urea is added the bacterium thrives. This means that the urea is essential to the bacterium.

The researchers found that without the bacterium, the stomach released less gastrin following meals and became less acidic. Earlier clinical trials showed that people given a short-term treatment that killed *H. pylori* remained free

found that the children's brothers and sisters were far more likely to harbour the bacterium than other children chosen at random. So, too, were the children's mothers — though not their fathers — interestingly. According to Dr. Drumm, the clustering of infection within families suggests that the bacteria spread from one person to another.

Researchers are also focusing on the possibility that *H. pylori* is a cause of stomach cancer. Scientists from the

Imperial Cancer Research Fund's Cancer Epidemiology Unit in Oxford have compared levels of gastric cancer with the prevalence of *H. pylori* infection in different parts of China. They find that areas with high levels of the disease tend also to have high levels of the bacterium.

The Oxford epidemiologists say that many factors over several decades affect the development of stomach tumours, and *H. pylori* may be one of them. They have studied people from Caerphilly, in South Wales, a town which has a high rate of gastric cancer. It also has high levels of *H. pylori*. The team found that about half of the elderly population harboured the bacterium, the great majority without ill effect. But there is a possible role for *H. pylori* in causing the cancer, the researchers say.

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AIDS victims have been infected.

Virtually no hospital in the country observes basic safety precautions when dealing with AIDS patients, it was noted at the seminar. As a result, medical staff have been unwittingly exposed to the virus.

Also, Indian women involved in health care often function in low-status jobs as nurses, maids and cleaners who have little or no say on the matter of safety precaution. This increases their vulnerability to infection.

It was revealed that 90 per cent of efforts and the budget for AIDS management in India have been directed toward blood testing for the virus.

Dr. Mane and Dr. Ravikant Kamath who heads the Department of Human Development, Bombay University, suggested that AIDS awareness programs for Indian women be conducted in regional languages, if possible in dialects, taking into account the cultural cues of the group targeted.

Such programs should be aimed at small groups, rural areas where there are plenty of Cokes, Pepsis and other softdrinks which are highly sweet. This is leading to rapid increase in dental decay on top of an alarmingly high rate of gum diseases and cancer of the mouth," he says.

While primary 'grade textbooks are not available in villages, shops there have plenty of Cokes, Pepsis and other softdrinks, by

Jan Sharma

of the Women's Studies Unit of TISS. She revealed that these women are required to give blood samples, but they are never informed of the purpose for such, much less of survey results or even the result of the test.

Social worker Rukmani Bansode who works with Bom-

bay prostitutes said there is fear among the women that AIDS management efforts are aimed at protecting not them but their clients.

IHO Vice President Dr. Vijay Thakur noted that AIDS awareness exhibitions in red-light areas have dampened business, depriving the women—especially those with children — of support of income. He said the AIDS awareness programs do not offer prostitutes an alternative means of livelihood, and no study has been made of the extent to which the children of

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It is not only the trekking