2. Several chemical methods are also applied for purification of the arsenic-contaminated water. Arsenic is present in the soluble state in the form of sodium, potassium and ammonium salts. The chemical method for separation of arsenic involves oxidation of arsenites present, preferably by chlorine water. The insoluble arsenates are then filtered. The filtrate is used for drinking purpose on a small scale.

3. A mechanism for the mobilization of arsenic in groundwater has been designed by D. Chatterjee and his group (Department of Chemistry, University of Kalyani, Kalyani). Arsenic is mobilized under reducing conditions from the adsorbing sites of the secondary phases of iron, aluminium, manganese oxides and hydroxides.

Mobilization depends on the redox geochemistry of arsenic that plays a vital role in the release and subsequent transport of arsenic in groundwater. Mitigation includes alternative source for safe drinking water supply[1]. Lowering of the ingested inorganic arsenic level and introduction of newer treatment options (implementation of laterite, the natural material) to ensure safe water supply (arsenic free and/or low arsenic within permissible limit) are the urgent needs to safeguard against mass arsenic poisoning and internal arsenic-related health problems.

4. Removal of arsenic (III and V) during biological iron oxidation has been investigated at the Laboratory of General and Inorganic Chemical Technology, Department of Chemistry, Aristotle University, Thessaloniki, Greece. Results showed that both inorganic forms of arsenic could be efficiently treated, for the concentration range of interest in drinking water (50–200 µg/l). In addition, the oxidation of trivalent arsenic was found to be catalysed by bacteria, leading to enhanced overall arsenic removal, because arsenic in the form of arsenites cannot be efficiently absorbed onto iron oxides. This method is a cost-competitive technology, which can find application in treatment of groundwaters with elevated concentrations of iron and arsenic[2].

5. Madhushanta De (Department of Genetics, Vivekananda Institute of Medical Sciences, Kolkata) and her group has been searching for natural remedies to counter the ravages of chronic arsenic poisoning for the past few years. She has found black tea useful for this purpose[3], as tea contains polyphenols that can scavenge free radicals. Extracts of green and two varieties of black tea as well as their principal polyphenols, (–)-epigallocatechingallate and theaflavin, efficiently counteracted the cytotoxic effects of arsenic compounds. She suggests those who have been consuming arsenic-contaminated water for more than 10 years, to take at least three cups of black tea every day.

6. In a search to find inexpensive treatments for arsenic poisoning, Khuda-Bukhsh *et al.*[4] have found the homoeopathic remedy Arsenicum Album to be effective. According to the them, 'this potentiated drug not only has the ability to help remove arsenic from the body, but also in microdoses appear to have the ability to detoxify the ill effects produced by arsenic in mice'. They have noted[4] that Arsenicum Album reduces liver damage caused by arsenic poisoning.

7. In another work[5], in collaboration with Kalyani University, WB, a team of researchers at the University of Manchester report mechanisms responsible for raising arsenic levels in water across South and Southeast Asia. Farhan Islam has shown, using microcosm experiments and DNA data, that the processes responsible for groundwaters acquiring arsenic from their host sediments are mediated by a special group of bacteria that live in the aquifer sediments. According to Islam, 'we now have a much better idea of how arsenic is released into the drinking water in aquifers in the region. It is hoped that the results will help to arrive at ways to remedy the water, leading to a healthier supply of water for thousands of people'.

1. Bhattacharyya, R., Chatterjee, D., Nath, B., Jana, J., Jacks, G. and Vahter, M., *Mol. Cell. Biochem.*, 2003, **253**, 347–355.
2. Katsoyiannis, I. A. and Zouboulis, A. I., *Water Res.*, 2004, **38**, 17–26.
3. Sinha, D., Roy, M., Dey, S., Siddiqi, M. and Bhattacharya, R. K., *Asian Pac. J. Cancer Prev.*, 2003, **4**, 233–237.
4. Mallick, P., Chakrabarti Mallick, J., Guha, B. and Khuda-Bukhsh, A. R., *BMC Complem. Alternat. Med.*, 2003, **3**, 7.
5. Islam, F. S., Gault, A. G., Boothman, C., Polya, D. A., Charnock, J. M., Chatterjee, D. and Lloyd, J. R., *Nature*, 2004, **430**, 68–71.

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Antarctica and Arctic: India's contribution

As the Indian team of scientists left for Antarctic from Goa in December 2004 for the 24th Expedition, it is of interest to trace the origins and perspectives of polar research. Although the presence of land near the southern pole was predicted in the 3rd century BC by the Greek, the reports of Captain James Cook (UK, 1773) about his trips on crossing the Antarctic Circle and seeing the existence of wildlife led one to believe the presence of land. Even so, the existence of a southern polar continent was not proven until the 19th century. Much of the early ventures of the Antarctic land/waters that were undertaken were for sealing and whaling activities. The presence of a peninsular region was realized accidentally when ships got wrecked in adverse weather conditions. The UK, France, Norway, Sweden, Belgium, Germany, Russia and the USA are some of the countries to have started expeditions during the 19th and early 20th centuries. Most of the work was done using timber-hulled sailing ships that lacked the structural strength, power and sophisticated navigation aids of modern era.

The first recorded ongoing settlement on Antarctica was in 1903 when the Scottish National expedition established a building on Laurie Island. The station was handed over to Argentina the following year and was later named 'Orcadas'. It is the longest continuously operating station in Antarctica. The International Geophysical Year (1957), proved to be a landmark in the history of Antarctic expeditions. After that, permanently staffed stations were established at many points around the continent. Most national Antarctic programmes continue using vessels as the principal means of transporting supplies and personnel. Air transport is also used by many operators for inter and intra-continental movement of personnel and supplies.

1 December 2004 was the 45th anniversary of the signing of the Antarctic Treaty and India has been part of this treaty for the past 21 years (since 19 August 1983). The first Indian Wintering was conducted in the permanent station 'Dakshin Gangotri' built in 1983 on the Prince Astrid ice shelf. Following this, India was admitted as member of the Scientific Committee on Antarctic Research (SCAR) in 1984 and a member of Convention for the Conservation of Antarctic Marine Living Resour-

ces (CCAMLR) in 1986. After the first station Dakshin Gangotri was submerged in polar ice, India built its second permanent indigenous station 'Maitri' in 1988–89 in the Schirmacher Oasis of the Central Dronning Maudland.

The Council of Managers of National Antarctic Programs (COMNAP) was established in 1988 to bring together those managers of national agencies responsible for the conduct of Antarctic operations in support of science. The council comprises representatives from 29 countries encompassing the Americas, Africa, Asia, Europe and Oceania, and India is one amongst the 29 countries.

India started a polar research laboratory, National Centre for Antarctic and Ocean Research (NCAOR), in Goa in 1997. The Indian Antarctic programme (IAP), a mandate of the Department of Ocean Development (DOD), is executed through NCAOR. It is designated as the nodal agency for coordinating and executing the IAP and conducting in-house research and development activities in specific areas of polar science. The centre is situated at windswept hills amidst a picturesque background overlooking the Arabian sea right at the headland to the Murmagao port. The research and development activities of this centre involve climate modelling, sea–ice–ocean–atmosphere coupling, polar remote sensing, Antarctic/Himalayan paleoclimate and Southern ocean oceanography. It is also working continuously on development of a complete database inventory as a part of the National Antarctic Data Centre including a polar museum.

The scientific programmes of the Antarctic missions are multi-institutional and multi-disciplinary in nature with a broad thematic focus on the following topical areas:

- Ice–ocean interaction and the global processes.
- Paleoenvironment and paleoclimatic studies.
- Geological evolution of earth and Gondwanaland reconstruction.
- Antarctic ecosystems, biodiversity and environment physiology.
- Solar terrestrial processes and their coupling.
- Medical physiology, adaptation techniques and human psychology.
- Environment impact assessment and monitoring.
- Enabling low temperature technology development.
- Studies on earthquakes.

The previous Indian expeditions to Antarctica have resulted in a large volume of research work and data collection on various areas. The members of various expeditions after returning to their respective laboratories in India have carried out further research to unravel some interesting results. Much of this work has been reported in various leading journals including *Current Science*[1–5]. The IAP has been constantly evolving to address issues of global concern with particular emphasis on areas that have direct relevance to the country such as: (i) Data generation in the field of meteorology and atmospheric sciences aimed at understanding the complex phenomenon controlling the monsoons and the weather patterns over the Indian Ocean; (ii) Studies on human physiology aimed to appreciate adaptation capabilities of human beings in cold and harsh conditions as in the frontier regions of the country; (iii) Application of low temperature engineering in developing innovative technologies and long distance communication for life-support systems in the Himalayas; (iv) Studies on geological sciences designed to acquire information on geo-resource distribution in context with the super-continent Gondwanaland of which India and Antarctica were once part of; (v) Exploration and survey of biopotentials and microbes and the techno-economical feasibilities for sustained exploitation of living resources in the southern oceans; (vi) Understanding the solar-terrestrial coupling phenomenon and its effect on satellite applications and human beings.

In India about 70 institutes are involved in these ventures. Indian contribution in the area of microbiology has been quite significant. Out of about 120 new microbes discovered by the all-nation Antarctic investigations, 20 have been contributed by Indian efforts. The NCAOR has an active role in analytical investigation of ice core brought from Antarctica carrying out both palaeoclimatic as well as prediction of future climate.

The 24th Indian expedition team is headed by R. Asthana, Geological Survey of India, Faridabad. There are 51 members in this year's Indian expedition team along with three people who are helicopter crew. This year's team consists of three Malaysian scientists also and the team has plans for some innovative experiments in microbiology. The team consists of two medical professionals who will be taking care of the team at Antarctica.

The expeditions normally start in December (the summer season at Antarctica). The team for these expeditions is selected after a long and thorough scrutiny starting every year in March. After the first level of screening, the selected people go for about two week training in camps in Auli (near Kedarnath). A medical screening follows this training. The final team gets additional training before it departs for Antarctica from the NCAOR. Defense Electronics Applications Laboratory (DEAL), Dehradun is involved in telecommunication through satellite with the station Maitri and has a major role to play in data transport. An annual report published by the DOD (Government of India, DOD, 2003–04) provides more information about the recent activities by Indians in Antarctica (http://dod.nic.in/ayr03-04/ann2003-04.pdf).

An additional station, third, for India would be coming up in Antartica in future. Only 2% of the area in Antarctica is ice-free and is ideal for the new station location. A team of Indian scientists from Geological Survey of India has carried out the initial survey for the location for the station and has recommended a site. This site is at the Larsemann Hill with latitude ~70° South and longitude 76° East. The new station is expected to be two days away by ship from Maitri.

Following the initiatives taken for South pole research, India also has plans for extending research to Arctic. A comparison of the data acquired from southern hemisphere will be made with those obtained from Arctic. Especially with the International polar year approaching (2007–2008), intense activity in polar research is expected over the next few years.

1. Sinha, R., Chatterjee, A., Panda, A. K. and Mitra, A., *Curr. Sci.*, 1999, **76**, 680–683.
2. Sinha, R., Navada, S. V., Chatterjee, A., Kumar, S., Mitra, A. and Nair, A. R., *Curr. Sci.*, 2000, **78**, 992–995.
3. Baruah, S. and Mohan, I., *Curr. Sci.*, 2001, **81**, 883–885.
4. Gadhavi, H. and Jayaraman, A., *Curr. Sci.*, 2004, **86**, 296–304.
5. Sharma, C., Bera, S. K. and Upreti, D. K., *Curr. Sci.*, 2002, **82**, 88–91.

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