Purnima and Mrs Dirac continued till the death of Paul Dirac in 1984.

Chapter 6 'A critical observer and translator' shows some interesting features of Purnima's character as an independent thinker. She had the opportunity of seeing from close quarters the inner structures of University of Calcutta, Bose Institute, Central Glass and Ceramic Research Institute, Visva-Bharati and Geological Survey of India. She was emphatic in her views about Indian science, children's education and social hindrances as follows:

1. 'Science is not developing in India due to lack of research facilities. Even if instruments are there, scientists are reluctant to share them with their colleagues. There is a lack of cooperation within the community.
2. She opined that scientists do not protest against the poor working conditions and people in power are not interested in the scientists' work.
3. The tradition of recruitment of talented scientists from an all India base has completely broken down in favour of recruiting only Bengalis.
4. Instead of the young and enthusiastic, old scientists who have stopped research work are promoted based on their seniority instead of their scientific achievements.
5. Purnima observed that bureaucrats dominate the scientific laboratories.
6. After independence funds were not an issue but there were no good scientists in the well-equipped laboratories.
7. Our education system is not progressive. Even in the innovative field of science, our emphasis is on cramming. We do not encourage our children to ask questions.
8. She suggested that students from middle and upper middle classes should compulsorily work with farmers and workers. In order to make scientific planning realistic, persons from the working class should be appointed.
9. In order to impart science education to all strata, S. N. Bose and others thought of teaching science in Bengali.'

In chapter 7 'Conclusions', the authors dilate further on Purnima's qualities of head and heart and pay her glowing tributes in the following words:

1. 'Purnima's writings show that she had a bleeding heart for the down trodden. Though she came from a well-to-do family, she was always in favour of workers and farmers. This part of her life seems to have been influenced by her father, who was President of Labour Party of India (1934).
2. Purnima's scientific work as well as her ventures into different fields, particularly music, and her criticism of the existing scientific policies leave no doubt that she was an independent and analytical woman'.

Purnima Sinha was a versatile writer in Bengali. She translated Maxim D. F. Kamenetskii's book *Unravelling DNA* and Erwin Schrödinger's – *Mind and Matter* into Bengali under the title *Mon O Jodobostu*. She was a loyal student and like a daughter to S. N. Bose. She wrote two biographies of her mentor: *Amar Katha* and *Bijnan Sadhanar Dharay Satyendranath Bose*.

In my view, the authors deserve all praise for their labour of love in digging up archival material running up to ten pages of bibliography about this unique multi-talented lady, who created history by fabricating her own equipment to carry out research investigations into an hitherto unexplored field in India. Purnima was the first woman Ph D student of Calcutta university supervised by S. N. Bose. Despite many handicaps, her achievements both in Arts and Science are remarkable.

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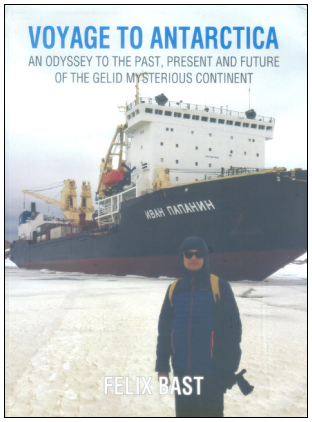

Voyage to Antarctica: An Odyssey to the Past, Present and Future of the Gelid Mysterious Continent. Felix Bast. Vigyan Prasar, Department of Science & Technology, A-50, Industrial Area, Sector-62, Noida 201 309. 2019. xii + 172 pages. Price: Rs 300.

This book by Felix Bast is originally a diary and a travelogue. The author was on a short Antarctic summer trip and has tried to share his polar experiences. It is really admirable that a first-time-visitor to Antarctica was fired with the enthusiasm to chronicle his impressions! Even in his first exposure to Antarctica, the author appreciates the Indian Antarctic programme establishing great facilities in the remotest place on the earth, '…indubitably a remarkable achievement'. He recognizes that the pre-expedition training and interactions at Auli-India were useful preparations, '…the Antarctic veterans… the interactions I had with them were simply the best part of the whole acclimatization program'. He also rightly points out that 'Climate change denialism is indeed a form of pseudoscience…'.

However, the book is full of major factual errors; reflecting on author's limited polar experience and inadequate Antarctic knowledge. The book should contain facts and not vague assumptions.

Since its first expedition in 1981, Indian Scientific Expedition to Antarctica (ISEA) was initially managed by the Department of Ocean Development (DOD) and now by NCPOR under the aegis of the Ministry of Earth Sciences (MoES). ISEA was never 'managed by the Indian Navy', as mentioned by the author (p. 91).

Geology, glaciology, paleoclimatology have always been integral aspects of ISEA. The author wrongly mentions that

'India initiated Ice Coring recently (in 2016)' (p. 133). The first Ice Core Drilling by Indian scientists was done in 1992 and India has a functional Ice Core Lab at NCPOR-Goa, since 2005.

The author writes elaborately that 'a key area entirely missing from ISEA is Seismology' (p. 160). However, NGRI has a Seismological Observatory at Maitri Station since 1996; which has been contributing to Global Seismographic Network (GSN).

Since the signing of Antarctic Treaty in 1959, Antarctica is only for scientific and peaceful research; and that has also been the main objective of ISEA since 1981, which has focused on varied branches of scientific research. The author is wrong in saying 'the prime goal of ISEA was krill fishing and then oil-gas-exploration' (p. 90); it conveys a totally false picture.

The author criticizes that 'wintering is not justified… no scientific work… scientific output perhaps nil… scrap wintering component' (pp. 157, 163). First, there is a huge scientific output from wintering work: GSI (bathymetric GPR-profiling and ice core drilling), IIG (geomagnetic fluctuations), NGRI (seismic events), IMD (ozone profiling and yearly-met-data), and NPL (ionospheric variations). A special publication of *Geological Society, London* includes 'Bathymetry of Schirmacher Lakes' based on GPR profiling of frozen lakes, a work done by Indian scientists during peak Antarctic winters. Secondly, India retains its Voting Rights in the Antarctic Treaty System (ATS) by maintaining the wintering component; year-round presence in Antarctica and publication of that scientific work are the two prerequisites for the rights of any nation in the Treaty. The author is obviously ignorant of these crucial aspects.

The author blames that 'DG station sank in ice due to poor structural design' (p. 91). He does not know that all stations built on shelf-ice have a limited life; any heated polar station invariably sinks inside the surrounding cold ice. Even the most famous Antarctic shelf-ice station, Halley of UK, has sunk in ice five times between 1956 and 2013; requiring constant rebuilding of newer stations above the old sunken stations. The present UK shelf-ice station is known as Halley-VI.

The author writes, 'There are four books till date written by previous ISEA members' (p. 155). However, Antarctic beauty and polar challenges have inspired many expeditioners before him! More than 12 well-known books have been published by ISEA members in English, Hindi and many regional languages. Some of these books have been awarded by the Govt of India and the State Governments. A large number of articles have also been serialized in many magazines and newspapers.

The author writes that GSI has '…not a single peer-reviewed journal paper' and 'ISEA has less than 10 with Citation-50' (p. 157); which is blatantly false. GSI has 39 International papers, with 4 papers in the highly rated *Nature Geoscience*, and ISEA has more than 450 national–international journal publications, well documented in their Antarctic bibliography.

The author suggests for saving money, the ship should start from Kanyakumari, '…departing from Kanyakumari or the nearest port (Kochi for instance) makes more sense to me' (p. 164). India launched its expedition ships from Goa between 1981 and 1998, due to available support structures of docking for large ships, customs, cargo-containers, cranes, repackaging facilities, trained manpower, office and lab space. Since lots of overseas cargo is ordered every year; and since voyage-time from Cape Town to Antarctica is just 10 days, compared to 25 days from Goa; therefore financial experts have minutely calculated comparative cost-savings and time-savings. Thus from 1999, India is launching its expedition ships from Cape Town or from Goa, as required by cargo for that particular year. The author is talking ignorantly about a subject, which financial and logistic wizards have already analysed for years.

The author complains about 'expired food items in stations; even rice–wheat–lentils expired' (p. 136). The ship drops supplies for the full year; so by the time the next ship arrives, it is already one-year-old; this is a standard practice in Antarctic stations of all countries. However, the shelf-life of food increases drastically in the utterly dry and cold Antarctic climate. Dry rations like rice and wheat will remain undamaged even after a century! Expeditioners have used decades old food in emergencies, without any illness. When Felix Bast himself had posted his query of 'any expired food in other polar stations' on the Net (ref: *Facebook*, 'I've been to Antarctica'), he had received a flood of responses from Antarctic veterans of many nations; they enlightened him about safely using Antarctic foods 10 to 40 years old! Some old-timers had even discussed eating 80 years old food, without any health problems.

In addition to the above major errors, the book is full of many other mistakes; all of which cannot be discussed in a short book-review. His assertions are wrong about 'minimum Antarctic temperature of –102°C' (p. 70), actually it is –89.2°C recorded in Soviet Station Vostok in July 1983; about 'meaning of Maitri is Earth in Hindi' (p. 91), actually it means friendship; about 'ten members of TechBean winter over in Bharati… causing huge expenses' (p. 100), actually trained TechBean station maintenance team is variable during short polar summer and then up to 4 technicians stay in winters, as per their annual maintenance-contract; about 'instead of helicopters, use small boats between ship and Bharati Station and dock at a makeshift dingy' (p. 121), actually it would be extremely risky in the unpredictable Antarctic Ocean, putting lives and cargo in peril; and it will also be very time-consuming, all expeditions race against time, making optimal use of limited good weather days.

Some of his suggestions, like 'stop buffet system and give rationed fixed meals in plates to everyone' (p. 163) are ridiculous and laughable! The physical exertions of desktop scientists sitting inside heated labs vs the exposure of field parties and logistic personnel to extreme cold and icy winds of Antarctica, can never be compared. Thus, the appetites and food requirements of all expeditioners differ vastly.

As a conclusion, the author has nicely described the personal experiences of his

Adélie Penguin in an island.

first Antarctic expedition. He has tried to vividly express the beauty of Antarctic Ocean and the sea-life, the vastness of the Antarctic Ice sheet, the hazards of unpredictable Antarctic weather, and the challenges of working in Antarctic cold and winds. He had a unique opportunity to participate in a national Antarctic expedition for a brief period of 3–4 austral summer months. It is commendable that he tried to record the thrill of working in Antarctica and to share this excitement with the readers! The story-line in his book would have been more lucid and coherent if he had focused on these aspects. However, his limited polar experience has resulted in spreading a lot of misinformation and factual errors. He should have double-checked the facts from authentic sources before publishing the book. A young aspiring reader would get a misguided distorted picture about Antarctica and Indian expeditions from his inaccurate views.

Finally, on the back-cover of the book, the author makes an enormously tall claim, '…the book… would arguably serve as the most authentic popular science book on Antarctica worldwide yet'. The polar veterans of many nations, having decades of Antarctic working experience, absorbing multiple polar winters and summers, and thus having read and written amazing books on Antarctica, would only smile – 'not only ignorance, but arrogant ignorance indeed!'

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