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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-3852

DATE: January 14, 1991

SUBJECT: Report of Foreign Travel of Prem C. Srivastava, Nuclear Medicine Group,
Health and Safety Research Division

TO: Alvin W. Trivelpiece

FROM: Prem C. Srivastava

The traveler visited several Indian institutions in cooperation with the Council of Scientific and Industrial Research of India in an effort to coordinate research in the field of chemotherapeutic agents and radiopharmaceuticals. This trip was the result of a Distinguished Scientist Award made to the traveler from the United Nations Development Program.

SITES

VISITED:

11/26-27/90 12/27/90	United Nations Development Office and Council of Scientific and Industrial Research Office, New Delhi, India	Dr. P. N. Bhattacharya Dr. P. N. Pathak
11/28/90- 12/11/90 12/22/90- 12/26/90	Central Drug Research Institute, Lucknow, India	Dr. D. S. Bhakuni Dr. B. N. Dhawan Dr. C. M. Gupta Dr. R. Pratap Dr. R. C. Srimal
12/12/90- 12/18/90	Indian Institute of Chemical Biology, Calcutta, India Indo-American Society of Nuclear Medicine, Calcutta, India Variable Energy Cyclotron Center, Calcutta, India	Dr. S. B. Mahato Mr. P. Sur Dr. V. Sinha
12/19-21/90	Board of Radiation and Isotope Technology, Bhabha Atomic Research Center, Bombay, India	Mr. C. N. Desai

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12/24/90

Sanjay Gandhi Post Graduate
Institute of Medical Sciences,
Lucknow, India

Dr. B. K. Das

ABSTRACT: The traveler received a United Nations Development Program (UNDP) Award for Distinguished Scientists to visit Indian Research Institutions including Central Drug Research Institute (CDRI), Lucknow, the host institution, in cooperation with the Council of Scientific and Industrial Research (CSIR) of India. At CDRI, the traveler had meetings to discuss progress and future directions of on-going collaborative research work on nucleosides and had the opportunity to initiate new projects with the divisions of pharmacology, biopolymers, and membrane biology. As a part of this program, the traveler also visited Sanjay Gandhi Post Graduate Institute (SGPI) of Medical Sciences, Lucknow; Board of Radiation and Isotope Technology (BRIT) and Bhabha Atomic Research Center (BARC), Bombay; Variable Energy Cyclotron Center (VECC) and Indian Institute of Chemical Biology, Calcutta. He also attended the Indo-American Society of Nuclear Medicine Meeting held in Calcutta. The traveler delivered five seminars describing various aspects of radiopharmaceutical development at the Oak Ridge National Laboratory (ORNL) and discussed the opportunities for exchange visits to ORNL by Indian scientists.

UNITED NATIONS DEVELOPMENT PROGRAM (UNDP) AWARD FOR DISTINGUISHED SCIENTISTS

Since the 1950's, the United States, Canada, Germany, and Australia have attracted nearly 450,000 highly skilled Indian professionals to work in the areas of sophisticated technology, advanced science, and other areas of industrial development. The United Nations agencies now realize that these highly trained and experienced people could be of great help to the country of their origin. The UNDP was therefore initiated in 1977, whereby distinguished scientists and engineers with expertise in a defined field are invited to undertake short-term assignments in their home countries. The experts (consultants) are expected to provide input in specific areas of national priorities to strengthen the research and development efforts of the country. The program, first started in Turkey in 1977, now includes 30 developing countries. It is estimated that out of the 450,000 Indian professionals only 18,000 are highly qualified and experienced enough to meet the requirements of the UNDP Distinguished Scientist Program. The Council of Scientific and Industrial Research (CSIR) is the implementing agency for the program on behalf of the government of India.

**CENTRAL DRUG RESEARCH INSTITUTE (CDRI)
LUCKNOW, INDIA**

The traveler visited CDRI, the host institution, at the invitation of Dr. B. N. Dhawan, the director of CDRI, and several other senior scientists with whom the traveler has ongoing collaboration. This national laboratory, under CSIR, is a multidisciplinary research center specializing in biological sciences including biochemistry, biopolymers, medicinal chemistry, membrane biology, and pharmacology. The research and development program of CDRI is organized into 16 research divisions involving both basic and applied research.

New drug development is a major thrust of CDRI research programs. Since its establishment in 1951 as the largest drug research institute in Southeast Asia, CDRI has already released five of its pharmaceutical products in the market for use as drugs. The search for a new drug starts with the generation of a biologically active compound obtained either by chemical synthesis or by isolation from natural sources. About 600 newly synthesized compounds, extracts of 200 plants, and 50 marine flora/fauna are screened every year using about 90 *in vitro/in vivo* tests. Compounds chosen for development as drugs through detailed chemical and biological studies are further investigated for process development, quality control, toxicity testing, and pharmacokinetics. Clinical trials of promising compounds are undertaken in collaboration with the State Medical and Health Directorate and various medical institutions after clearance for clinical trials.

Basic research at CDRI forms an integral component of each project area and is oriented to provide leads for development of new drugs and vaccines and to generate new knowledge. Areas studied include parasitic function, synthesis of novel immunomodulators, ligand-receptor interactions, and adrenergic mechanisms in cardiovascular and nervous systems, etc.

At the request of Drs. R.C. Srimal and B. N. Dhawan, the traveler presented a seminar entitled "Site-specific Sustained Delivery of Drugs to the Brain." The traveler had developed some unique agents at the Oak Ridge National Laboratory (ORNL) and had patented a technology for transport of drugs and radiopharmaceuticals to the brain. Dr. K.B. Mathur, Head, Division of Biopolymers, and his associates have developed some polypeptides for treatment of Parkinsonism. These CDRI investigators discussed the possibility of collaboration with the traveler to study the transport of polypeptides utilizing ORNL technology.

The traveler has extensive experience in the field of nucleosides and has on-going collaboration with the senior investigators (Drs. R. Pratap and D.S. Bhakuni) at the Medicinal Chemistry Division of CDRI. The traveler currently has 10 new nucleosides undergoing biological screening at CDRI. Dr. Bhakuni, a Director's-grade scientist, retired December 31, 1990. He is now Scientist Emeritus at CDRI, and our collaboration with his group and Dr. R. Pratap will continue. The traveler delivered a seminar on "Hypoxia as Target for Nucleosides In Diagnosis and Therapy of Cancer" at the Medicinal Chemistry Division.

**VISIT TO SANJAY GANDHI POST GRADUATE
INSTITUTE (SGPI) OF MEDICAL SCIENCES
LUCKNOW, INDIA**

While in Lucknow, the traveler visited SGPI at the invitation of Professor B. K. Das, Head, Department of Nuclear Medicine, SGPI, and presented a seminar entitled "A Decade of Radiopharmaceutical Development at ORNL."

Located in the outskirts of Lucknow, SGPI was established in 1988 by the State of Uttar Pradesh, India. The main hospital at SGPI has 600 beds, 12 well-equipped specialty operating rooms, a 30-bed intensive care unit, and a 16-bed dialysis unit. The Institute provides extensive investigative facilities. The Department of Nuclear Medicine at SGPI has been designed to cater to the needs of the "super specialties" planned for the Institute. A SPECT gamma camera system with rings of stationary detectors called HEADTOME will enable study of localized cerebral blood flow abnormalities as well as regional metabolic function. A large-view gamma camera with whole-body and SPECT capabilities will cater to the needs of organ imaging and cancer management. Another gamma camera is exclusively devoted to functional imaging of organs including renal transplants. In the near future, SGPI's Nuclear Medicine Department plans to interface a central computer network for exchange of data with similar departments in Europe and the United States. Collaboration with this well-equipped department will be especially useful for clinical investigation of radiopharmaceuticals developed at ORNL.

**ATTENDANCE AT THE INDO-AMERICAN SOCIETY OF NUCLEAR MEDICINE
CALCUTTA, INDIA**

The traveler attended the Indo-American Society of Nuclear Medicine and the XXII Annual Conference of the Society of Nuclear Medicine, held in Calcutta, India, from December 13-16, 1990. The meeting was inaugurated by Mr. P. Sur, Health Minister of West Bengal. In his opening statement Mr. Sur remarked, "...modern medical and high technology facilities were basically elitist and thus did not benefit the common people...." The Minister said that specialization in medicine had increased the cost of medication beyond the reach of the common man. Mr. Sur, who referred to the role of physics and nuclear science in the development of medical science, felt that these achievements ought to be used for prevention of ailments and provide better community health by ensuring that the sophisticated health care facilities were affordable by the public. He regretted that despite the spectacular developments in medical science and the opening up of new vistas, a high rate of infant mortality persisted in India and fatal ailments like cancer could not be wiped out.

**INDIAN INSTITUTE OF CHEMICAL BIOLOGY
CALCUTTA, INDIA**

The traveler also visited the Indian Institute of Chemical Biology at the invitation of Dr. S. B. Mahato. Dr. Mahato had expressed his interest in some berberine analogues prepared by the traveler at ORNL several years ago. Dr. Mahato has research interest in the field of molecular biology and biotechnology applied to the study of parasites, including chemotherapy of leishmaniasis.

**VARIABLE ENERGY CYCLOTRON CENTER (VECC)
CALCUTTA, INDIA**

The traveler was invited by Dr. B. Sinha to visit VECC, where he delivered a seminar entitled "Study of Tissues by Twinkling Molecules." The center was established by the government of India to produce and supply radioisotopes to the medical community in the eastern part of India.

**BOARD OF RADIATION AND ISOTOPE TECHNOLOGY (BRIT)
BHABHA ATOMIC RESEARCH CENTER (BARC)
BOMBAY, INDIA**

The traveler was invited to this institution by Mr. C. N. Desai, Senior Executive of BRIT, to tour the facilities and present a seminar entitled "Radiopharmaceutical Development at ORNL." This seminar was well publicized/attended and included an interesting question-answer session. The traveler spent two days at BRIT and had the opportunity to meet several of their scientists and visit the Isotope Division, Radiation Technology Division, Radiopharmaceuticals Division, and the Labeled Compounds Section.

The Atomic Energy Center was established in January 1954 and was renamed the Bhabha Atomic Research Center in 1967 to perpetuate the memory of the father of atomic energy in India, Dr. Homi J. Bhabha. Today this facility is one of the largest and best equipped research centers in the world. Over a period of fifteen years it has developed strong research groups with a wide range of modern facilities in a number of disciplines and programs such as reactor development, reactor engineering, heavy water, radioisotopes, radiation medicine, radioactive waste management, health physics, and radiological protection.

Formerly the Isotope Group of BARC, BRIT is engaged in the production and supply of various radioisotopes for use in medicine, industry, agriculture, and research. The research reactors, Cirus (40 MW) and Dhruva (100 MW), provide the irradiation facilities for production of radioisotopes. The Radiopharmaceuticals Division of BARC produces and supplies a wide range of radiopharmaceuticals to over 120 hospitals and medical institutions enabling over 500,000 patient investigations to be carried out annually in India. Radiopharmaceuticals from BARC are also exported to several other countries, including western countries such as Australia, Denmark, and France.

The BRIT scientists have expressed interest in the use of the maleimide kit for protein labeling under a collaborative arrangement. The maleimide technology developed at ORNL by the traveler won a 1990 R&D100 award.

SUMMARY AND CONCLUSIONS

The traveler, under a UNDP Award, had the opportunity to visit several Indian research institutions, present seminars on several topics on radiopharmaceutical development at ORNL, interact with the scientists, and make collaborative arrangements. The UNDP award, in recognition of the traveler's experience and expertise, also provided the traveler with the opportunity to expand his role in the area of nuclear medicine and radiopharmaceutical development. The collaborative arrangements that were established will continue to benefit the ORNL Nuclear Medicine Research Program which is supported by the Department of Energy. The visit was also helpful for exchange of ideas and evaluation of programs among ORNL, CDRI, and BARC. Several graduate students and scientists showed keen interest in pursuing postdoctoral or short-term sabbatical work with the traveler at ORNL.

APPENDIX

Itinerary

1990

- 11/24-11/26 Travel from Oak Ridge, Tennessee, to New Delhi, India
- 11/26-11/27 United Nations Development Program (UNDP) and Council of Scientific and Industrial Research (CSIR) Offices.
- 11/28-12/11 UNDP Distinguished Scientist Assignment, Central Drug Research Institute, Lucknow, India
- 12/12-12/18 Indian Institute of Chemical Biology, Indo-American Society of Nuclear Medicine and Variable Energy Cyclotron Center, Calcutta, India
- 12/19-12/21 Bhabha Atomic Research Center and Board of Radiation Isotope Technology, Bombay, India
- 12/22-12/26 Central Drug Research Institute and Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India
- 12/27 Visit UNDP Office, New Delhi, India
- 12/28-12/29 Travel from New Delhi, India, to Oak Ridge, Tennessee

PERSONS CONTACTED

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