

Talk with Explosive Researcher The TNT Man Dr Raj Boopathy



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For college students, the fall marks the beginning of four months of classwork, jobs and extracurricular activities. For nature lovers, the fall is the beautiful time when leaves turn from green to rustic orange and brown. For athletes, the fall means packed football games and cool breezes in which to practice. But for some folks who live near fields, the fall is associated with the smoky smell of burning sugarcane. Maybe not for long though. Dr. Ramaraj Boopathy, distinguished service professor of biological sciences, is studying ways to help sugarcane farmers eliminate the practice of sugarcane burning. Boopathy has received funding from the Governor's Energy Initiative to develop ways to produce fuel grade ethanol from sugarcane waste, such as sugarcane leaf litter and bagasse.

In addition to teaching and research, Boopathy reviews research proposals for the National Science Foundation, U.S. Department of Defense and U.S. Department of Energy. He also edits the International Journal of Biodeterioration and Biodegradation and was selected as a 2006 Fulbright Senior Scholar to visit Indonesia. Before coming to Nicholls in 1999, Boopathy worked as a scientist at Argonne National Laboratory, a U.S. Department of Energy laboratory managed by the University of Chicago. There he studied the bacterial degradation of trinitrotoluene, otherwise known as TNT.

courtesy: Nicholls state University's website

Dr Ramaraj Boopathy is a scientist with diversified interest but having a common goal i.e. Environment cleanup. He made his research outstanding by daring to challenge the nature in his favour. Like the microbial degradation of TNT or even converting it to vinegar are few facts among his long research interest list.

The excerpts of talk with Dr Boopathy we are giving here, was done in ICETB 2014, JNU.

Sir, the first thing I like to ask is your Personal background, early education and Motivation to pursue research career.

Answer: I was born in Sobanapuram, a small village in Trichy District in Tamil Nadu. I went to village school, then earned

HIS MAJOR AREAS OF RESEARCH INTERESTS

Biodegradation of hazardous chemicals.

Antibiotic resistant bacteria and Antibiotic resistance genes in the aquatic ecosystem.

Isolation and identification of novel bacteria.

Anaerobic degradation of explosive chemicals with particular reference to sulfate reducing bacteria.

Design and development of biological reactor systems.

Microbial immobilization of heavy metals and radionuclides. Alcohol production from agricultural residues.

Water quality in the wetlands.

Alternative to sugarcane burning,

Biological control of termites.

Organic ways to control land loss and coastal restoration.

my BSc, Zoology from the University of Madras, MSc in Environmental Biology from Tamil Nadu Agricultural University in Coimbatore, and Ph.D, Environmental Biology from University of Madras in 1986. In the same year I received Leverhulme Commonwealth Fellowship to do Post-doctoral research in University of Strathclyde in Glasgow, UK. In 1987, I got a job as a visiting scientist in the Italian National Lab for Nuclear and Alternate Energy (ENEA) in Bologna, Italy. I moved to USA in 1988 to the University of Missouri, then to University of Iowa, and to University of Notre Dam as a Post-doc from 1988-1992. I got a job as a scientist in US department of Energy Lab called Argonne National Lab near Chicago. I did research on Bioremediation of Explosives contaminated soil from 1993- 1999. I moved to my current job in 1999.

I was always intrigued by science and scientists and new discoveries. Through basic and applied science, the society benefits. One example is the discovery of radiowave (basic research) to radio (applied research) and recently the cell phone and Internet. So I was motivated to contribute to the society and I want to improve the quality of environment through my research.

Sir, what is your research title? What questions are you trying to answer in your work? What is the role of technology in your job?

Answer: I teach Microbiology and Environmental Biotechnology classes and I conduct research in the following areas: Biological Treatment of Wastewater, Bioremediation of

Professional Experience

January 2013 – Present: John Brady Endowed Professor in Biological Sciences, Department of Biological Sciences, Nicholls State University, Thibodaux. Teaching, Research, and Service to the University and Community.

August 2012 – Present: Alcee Fortier Distinguished Service Professor, Department of Biological Sciences, Nicholls State University, Thibodaux. Teaching, Research, and Service to the University and Community.

August 2004 – Present: Distinguished Service Professor, Department of Biological Sciences, Nicholls State University, Thibodaux. Teaching, Research, and Service to the University and Community.

August 2003- Present: Jerry Ledet Foundation Endowed Professor in Environmental Biology, Nicholls State University, Thibodaux. Conduct research in Environmental Biology and teach environmental biology related courses.

August 2005 –Present: Professor, Department of Biological Sciences, Nicholls State University, Thibodaux, Teaching Senior and Graduate level courses, Research work on Bioremediation of Hazardous chemicals and Anaerobic Microbiology.

August 2003 –August 2005: Associate Professor, Department of Biological Sciences, Nicholls State University, Thibodaux, Teaching Senior and Graduate level courses, Research work on Bioremediation of Hazardous chemicals and Anaerobic Microbiology.

August 2002 – August 2007: Graduate Program Coordinator for the Masters Program in Marine and Environmental Biology, Nicholls State University, Thibodaux. Coordinate the new MS program in the biology department and teach graduate level courses.

Jan. 1999 – August 2003: Assistant Professor, Department of Biological Sciences, Nicholls State University, Thibodaux, Teaching Senior and Graduate level courses, Research work on Bioremediation of Hazardous chemicals and Anaerobic Microbiology.

Jan. 1993 - Dec. 1998: Scientist, Advanced Environmental Studies, Environmental Research Division, Argonne National Laboratory. Research work on bacterial degradation of trinitrotoluene (TNT); operation of lab scale and field scale soil slurry reactors to study bioremediation of TNT, Petroleum Hydrocarbon, and Chlorinated solvents contaminated soil. Managed a microbiology laboratory for various other environmental research projects. Assisted in various full-scale bioremediation projects.

CV of Prof Boopathy

Jan. 1991 - Dec. 1992: Postdoctoral Research Associate, Dept. of Biological Sciences, University of Notre Dame, Notre Dame, IN. Research work on bacterial degradation of trinitrotoluene (TNT); microbial interaction with environment; bioremediation and anaerobic digestion of industrial wastes. Supervised graduate students in their thesis work.

Sept. 1989 - Jan. 1991: Postdoctoral Research Associate, Dept. of Microbiology, University of Iowa, Iowa City, IA. Research work on 1. Biocorrosion of metals by methanogenic bacteria; 2. Anaerobic degradation of furfural and furfuryl alcohol by sulfate reducing bacteria; 3. Isolation of novel anaerobic bacteria for the degradation of organotin compounds; and 4. Isolation of marine methanogens.

Sept. 1988 - Aug. 1989: Postdoctoral Fellow, Dept. of Agricultural Engineering, University of Missouri, Columbia, MO. Research work on anaerobic digestion of swine manure using modified anaerobic baffled reactor.

Oct. 1987 - Sept. 1988: Visiting Scientist, Italian Commission for Nuclear and Alternate Energy Sources (ENEA), Bologna, Italy. Research and development work on anaerobic digestion of agricultural and industrial wastewater; identification of bacteria responsible for the degradation of molasses wastewater; granulation process of biomass inside the anaerobic digester.

Oct. 1986 - Aug. 1987: Leverhulme Commonwealth Visiting Fellow, Dept. of Chemical and Process Engineering, University of Strathclyde, Glasgow, UK. Postdoctoral research work on anaerobic digestion of distillery waste using anaerobic baffled reactor. Also supervised graduate students in their thesis work.

May 1985 - Oct. 1986: Technical Officer, Center for Environmental Studies, Anna University, Madras, India. Teaching and research. Also did information collection and retrieval work in the field of ecotoxicology, biodegradation of wastes, environmental impact assessment and environmental system analysis.

April 1982 - May 1985: Research Fellow, National Environmental Engineering Research Institute (NEERI), CSIR Complex, Madras, India. Research and development work in biodegradation of wastes and ecotoxicology. Air quality survey, analysis of NO_x and SO_x in industrial sites and automobile emissions. Also did chemical and bacteriological analyses of water and wastewater.

Explosives and Petroleum contaminated soil and water, Biofuel, and survey of antibiotic resistance genes and antibiotic resistant bacteria in the environment.

All these research work are related to improve the quality of environment. Technology plays a significant role in cleaning up contaminated environment and preventing pollution.

Sir, what are the milestones of your research?

Answer: My research developed methods to clean up explosives-contaminated soil. Cleaned two army ammunition sites that are contaminated with explosives in Illinois and Iowa states in the US.

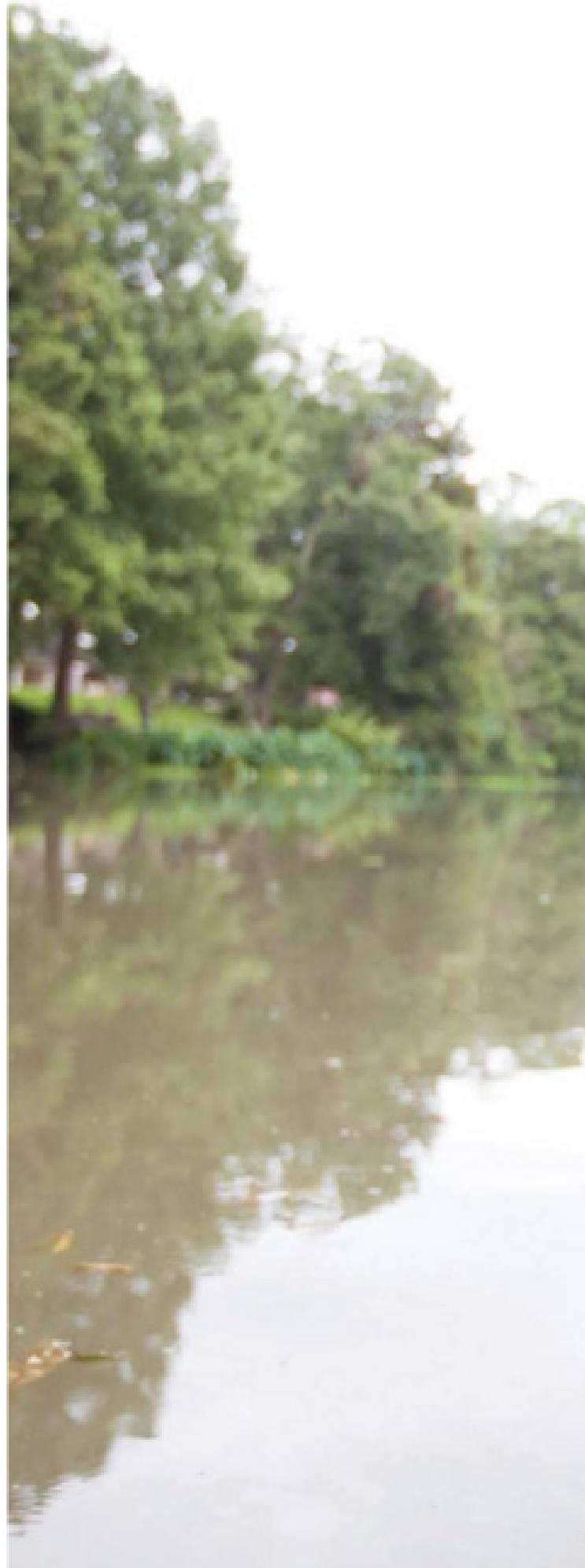
Also developed method to treat nitrogen rich wastewater in the shrimp aquaculture production facilities. Demonstrated the use of sequencing batch reactor (SBR) to remove excess nitrogen from the wastewater and reuse the water for shrimp production.

Sir, though your CV tells us how frequently you are obtaining grants and special grants but as a question to our audience I would like to ask, “what are the biggest funding agencies you are getting funds from”?

Answer: I have obtained various research grants from the US department of Energy, US department of defense, and the National Institute of Health to carry out my research.

Question a metabolic pathway and he will make it

Dr Boopathy discovered a way to convert TNT into vinegar and landed his “first real job” with the department of Energy in Chicago. In time, the lack of job security associated with governmental policy changes every two years led the biologists to seek a stable, permanent faculty position in higher education.





Recognitions and Awards to Dr Raj

In Teaching

- Received Presidential Award for Teaching Excellence in 2008.
- Received Nicholls Apple Award four times (2002, 2005, 2008, 2012, and 2014).
- Received Commendation Letters of Appreciation every semester from Vice President of Student Affairs as a result of graduating seniors' testimonials.
- Received Nicholls Academic Council Salute – 2003.
- Received \$ 500,000 training grants from LA BoR to mentor and train undergraduate students in research.
- Received \$ 80,000 Graduate Fellow grant from LA BoR to support graduate students as Research Assistant (RA) and this grant supported 6 MS students.
- Received Enhancement grant worth \$ 1.2 million to purchase research equipment.
- Visiting Faculty at the University of Notre Dame.
- Supervised 15 Graduate students.
- Trained 116 undergraduate students in Research.
- Mentored 17 Honors Students in their Honors Thesis Research.
- Mentored 15 graduate students in their Thesis Research and 10 of them graduated.

In Research

- Fellow of International Union of Pure and Applied Chemistry (IUPAC).
- Fellow of International Forum on Bioprocessing (IFBioP).
- Visiting Faculty at Argonne National Laboratory.
- Received Research grants worth \$ 10.7 million.
- Received US-European Union Transatlantic Biotechnology Fellowship -2007-2008, Bologna, Italy.
- Served on the National Science Foundation (NSF), Department of Energy, Environmental Protection Agency, and Department of Defense Review Panels for Research proposal.
- Published 129 research papers in International Journals.
- Published 12 book chapters.
- Wrote three Government reports for the Department of Defense.
- Editor of International Journal of Biodeterioration & Biodegradation.
- Associate Editor of the Journal, Bioresource Technology.
- Member of the Editorial Board of Journal of Soil and Sediment Contamination.
- Member of the Editorial Board of Renewable Bioresources.
- Member of the Editorial Board of Journal of Waste Management.
- Member of the Editorial Board of Journal of Water Sustainability.

- Presented 297 papers in various conferences of which 70 are invited talks.
- Delivered 30 invited seminars at various universities.
- Received Fulbright Scholarship – 2007 – Visited Indonesia.
- Hosted a Fulbright Scholar from Indonesia in my lab – 2011-2012.
- Served as a Ph.D Thesis Examiner for many International Universities.
- Received UK government Leverhulme Commonwealth Fellowship.

In Service

- Received Marie Fletcher Distinguished Service Award – 2012.
- Received Distinguished Service Professorship – 2004.
- Received Alcee Fortier Distinguished Service Professorship - 2012.
- Reviewed Research grants for EPA, NSF, DOD, DOE, USDA, EPA, DOT, Army Corps of Engineers, and Private Foundations.
- Reviewed Research Grants for Various International Government Agencies including Sweden, Norway, Switzerland, S. Africa, India, and Indonesia.
- Reviewed manuscripts for more than 32 International Journals.
- International Advisory Board Member for Biotechnology Conference, Food Bioprocessing Conference, and Environmental Science and Education Conference.
- Advisory Board Member of Benet Johnston Science Foundation, Gulf of Mexico Mercury Toxicity Task Force, US Marine Shrimp Farming Program, and Clean Power Energy Research Consortium.
- Member of the following University Committees: Tenure and Promotion Appeals Committee, Graduate Council, Research Week Committee, Policy for Graduate Faculty Criteria Sub-Committee, Distinguished Service Professor Selection Committee, Presidential Award Teaching for Excellence Selection Committee, and Search Committee for Library Director.
- Chair of the following Committees: Department Equipment and Computer Committee and three new faculty-hiring committees.
- Member of the following Department Committees: Strategic Planning Committee, Research Committee, Graduate Committee, Database Committee, and Member of several new faculty hiring committees.
- Visited following countries for Professional Services: France, England, Scotland, Portugal, Italy, Denmark, Greece, Austria, Australia, Mexico, Canada, Brazil, Costa Rica, India, Indonesia, S. Korea, China, Hong Kong, Malaysia, Singapore, USA, and Taiwan.

Sir, What aspects of your work do you think could be described as Indian science?

Answer: All of my research are applicable to Indian context as there are lots pollution and wastewater problems in India.

Sir, How do you think scientific research, which contains a lot of technical language and data, can be more accessible to the general public of India?

Answer: Scientific results can be disseminated to wider public by using simple language through publication such as yours. In the US, the publication like American Scientist simply does this.

Sir, What do you enjoy most about being a scientist?

Answer: Discovery of new methods, challenges in developing new methods, and imparting the knowledge to my students, and improving the environmental quality.

Sir, can you tell us about future goals of your lab?

Answer: I am currently focusing on the presence of antibiotic resistant bacteria and antibiotic resistance genes in local waterways including sewage treatment plant and drinking water treatment plant. This research is important as the antibiotic resistance is spreading rapidly. Most of the focus is in healthcare industry and I am looking at the environmental level whether the possibility exists for spread of antibiotic resistance through the use of water.

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