



BRICS Young Scientist Forum

Bangalore Conclave 2016

25 Sep—01 Oct

Highlights, Outcomes & Recommendations

Computational Intelligence, Energy Solutions & Affordable Healthcare



Department of Science & Technology
Government of India, New Delhi

National Institute of Advanced Studies (NIAS)
Indian Institute of Science Campus, Bengaluru





BRICS-STI Coordinating Ministries

Brazil

Ministry of Science, Technology and Innovation (Contact Person: Mr. Danilo Zimbres, Senior International Advisor to the Minister, Ministry of Science, Technology and Innovation)

Russia

Department of Science and Technology (Contact Person: Dr. Andrey Polyakov, Deputy Director of the Department, Ministry of Education and Science of the Russian Federation)

India

Department of Science and Technology (Contact Person: Ms. Sadhana Relia, Adviser/Scientist G and Head, International Multilateral & Regional Cooperation Division)

China

Ministry of Science and Technology (Contact Person: Ms. Wang Rongfang, Coordinator, Division of International Organizations & Conferences, Ministry of Science and Technology)

South Africa

Department of Science & Technology (Contact Person: Dr. Neville Arendse, Chief Director Overseas Bilateral Cooperation, Department of Science & Technology)

Bangalore Conclave 2016

Steering Group

Prof Baldev Raj, Director, NIAS
(Chairperson)

Prof DD Sarma, IISc, Bengaluru

Prof SS Hasan, Former Director, IIA,
Bengaluru

Dr Sadhana Relia, DST, New Delhi

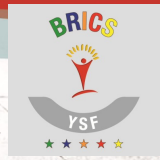
Dr RK Sharma, DST, New Delhi

Dr Shubra Priyadarshini, Nature India,
Gurgaon

Prof Sundar Sarukkai, NIAS, Bengaluru

Prof Anindya Sinha, NIAS, Bengaluru

Prof D Suba Chandran, NIAS, Bengaluru



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Speakers: A Profile





BRICS Young Scientist Forum

The core strength of BRICS is its unique and diverse young population that is complemented by the surging scientific and technological prowess in the world. Recognizing this huge opportunities before the youth, BRICS leaders at the Seventh BRICS Summit in Ufa, Russia (2015) endorsed India's proposal to create the BRICS Young Scientist Forum with India as the coordinating country.

In line with the above, India hosted the BRICS Young Scientist Conclave in September 2016, as an integral part of the BRICS Young Scientist Forum initiative. The initiative was approved by the Second BRICS Science, Technology and Innovation Ministerial Meeting at Brasilia in March 18, 2015 on the principles of co-ownership and co-investment by the BRICS countries.

BRICS Young Scientist Conclave

26-30 September, Bengaluru

The National Institute of Advanced Studies (NIAS) and the Department of Science & Technology (DST) of the Government of India recently hosted the BRICS Young Scientist Conclave in Bangalore. This Conclave aimed to bring together some of the brightest young minds from the BRICS countries on a single platform, allowing intense scientific exploration, technological innovations and avenues for transformative changes to the most pressing problems of the society.

The Conclave became a platform to harness solutions/ideas on country-specific problems and common challenges faced by BRICS nations. Three subjects were chosen to be the main themes for the Conclave: Computational Intelligence, Energy Solutions and Affordable Healthcare.

One of the primary objectives of the Conclave was to forge a 'BRICS Scientific Identity' through the establishment of a Pan BRICS network of young talents. This Forum is likely pave the way for creation of a strong future generation of BRICS S&T leadership that can accelerate change. The report titled *BRICS Science and Technology Enterprise*, release during the Conclave, aims at the above.

The Conclave looked into the issues of Science through a larger perspective; it would include science, technology, social sciences, humanities and will also look at the social impact and its contribution to development.

The Conclave also witnessed the young participants coming together to prepare an action plan through a set of recommendations.



Bangalore Conclave Steering Group

Under the chairmanship of Prof Baldev Raj, Director, National Institute of Advanced Studies, a Steering Group was constituted to plan, schedule and execute the entire Bangalore Conclave.

The Steering Group met multiple times during 2016 to chart the path for the Conclave. The National Institute of Advanced Studies (NIAS) acted as the Secretariat for the Conclave. Through the NIAS, the Steering Group successfully selected the applications from young scientists to participate in the Conclave. It also assembled together an expert group with leading scholars to prepare a document titled *BRICS Science and Technology Enterprise*.

Members of the Steering Group



Prof Baldev Raj
Director, NIAS
Chairperson



Prof DD Sarma
IISc, Bengaluru



Prof DD Sarma
IISc, Bengaluru



Dr Sadhana Relia
DST, New Delhi



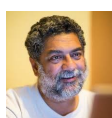
Dr RK Sharma
DST, New Delhi



Dr Shubra Priyadarshini,
Nature India, Gurgaon



Prof Sundar Sarukkai
NIAS, Bengaluru



Prof Anindya Sinha
NIAS, Bengaluru



Prof D. Suba Chandran
NIAS, Bengaluru



Bangalore Conclave 2016

25 Sep—01 Oct

25 September 2016

Session-I

Welcome

Welcome Address:

Prof Baldev Raj

Director, National Institute
of Advanced Studies
(NIAS), Bengaluru

Special Address:

**Interdisciplinary Science
for Society and Humanity**

Dr K Kasturirangan

*Emeritus Professor and
former Director NIAS;
Chairman, Karnataka
Knowledge Commission;
and former Chairman,
Indian Space Research
Organisation (ISRO)*



26 September 2016

Session-II

Introductions



Initial remarks by Prof Baldev Raj

**Special Address: Global Partnerships in
Scientific Research**

Prof VS Ramamurthy

*Professor Emeritus NIAS & Former Secretary,
Department of Science & Technology,
Government of India.*

Session-III

**Panel Discussion: Affordable Health Care
Making Healthcare Affordable: Corporate
Social Responsibility**

Mr Dipak Marwah,

Executive Director of Strategic Initiatives,



Samhita

Traditional Science and Indigenous Knowledge

Dr Darshan Shankar,
Vice Chancellor of Trans
Disciplinary University,
Bengaluru

Special inputs:

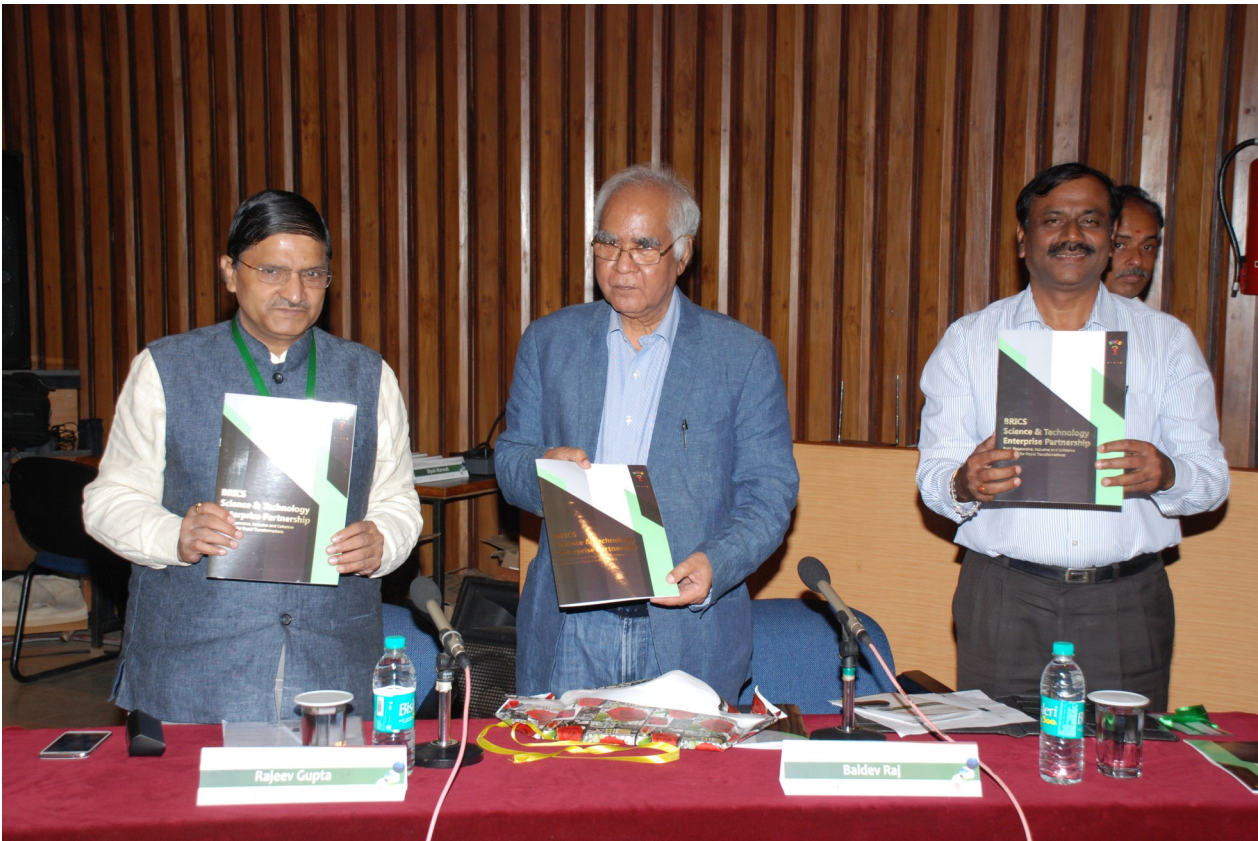
Prof Yahya Choonara,
University of Witwatersrand,
South Africa &
Prof Lian-Wen Qi,
China Pharmaceutical
University, Nanjing, China



Session-IV

BRICS Policy Reflections on Youth

An interaction with **Mr Rajeev Gupta**, Secretary, Department of Youth Affairs, Government of India



Mr Rajeev Gupta releasing the BRICS Science and Technology Enterprise Partnership document



Session-V

Ideas Hunt-I (Led by Participants)

Preventive and Personalized Healthcare in BRICS countries: Need for Cost-effective Diagnostics/ Therapeutics

Swadha Anand

Tata Consultancy Services, Pune, India



Noninvasive Analysis of Metabolomics-based Markers in Plasma for Diagnosis and Progression of Coronary Artery Disease

Lian-Wen Qi

Professor, China Pharmaceutical University, Nanjing, China



The Fourth State of Matter (Plasma) in the field of Medicine and Agriculture

Akshay Vaid

Institute for Plasma Research, Gandhinagar, India

Creation of Triticum aestivum L. resistant to a Complex of Abiotic Effects by means of a Genetic Engineering

Timoshenko Anastasia & Spechenkova Nadezda

Koltzov Institute of Developmental Biology, RAS, Russia



The Use of Liquid Biopsy in Breast Cancer

Somsubhra Nath

Saroj Gupta Cancer Centre and Research Institute, Kolkata, India

Immunohealorate: A Bio-engineered Immune Boosting and Wound healing Chocolate Formulation for Child Care and Wound Care

SP Bhuvaneshwaran

Indian Institute of Technology, Kharagpur, India



Target Specific Molecular Recognition Markers as Prediagnostic Kit

Nazia Tarannum

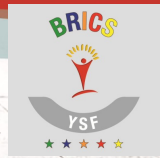
Assistant Professor, CCS University, Meerut, India

Exploring Lab-on-a-CD Device for the Investigation of Hematological Disorders.

Shantimoy Kar

Senior Research Fellow, IIT, Kharagpur





27 September 2016

Session-VI

Panel Discussion: Computational Intelligence

Multiobjective Optimization and Clustering

Dr Sanghamitra Bandyopadhyaya,
Director, ISI, Kolkata

Simulations for Knowledge-based Discovery of Materials for Energy and Environment

Dr Umesh Waghmare,
Jawaharlal Nehru Centre for
Advanced Scientific Research,
Bengaluru



Special inputs:

Prof. Fulufhelo Nelwamondo,
Council for Scientific and Industrial Research (CSIR), South Africa &

Mr. Nishant Kumar Agrawal, Scientist, TCS, Mumbai



Session-VII

Special Address: Energy Foresights, Security and Sustainability

Prof Baldev Raj

Session-VIII

Panel Discussion: Energy Solutions

Global Renewables Development: Opportunities and Challenges

Dr Molefi Motuku, Deputy CEO, Research and Development of the Council for Scientific and Industrial Research (CSIR), South Africa

Thermoelectric Waste Heat to Electricity

Generation

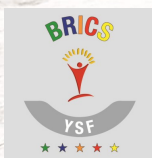
Dr Kanishka Biswas, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

Special inputs

Prof Li Yangyang
Deputy Director, China Coal Research Institute,
Beijing &

Mr Dronov Alexey,
National Research University of Electronics
Technology, Russia





Session-IX
Ideas Hunt-II

**Explore Secrets in Combustion and Pursue Controllable Design/
Utilization of Fuels**

Dr. Yuyang Li,
Associate Professor, Shanghai Jiao Tong University, Shanghai, China

Lithium-Ion Battery Materials for Energy Storage

Regina Rapela Maphanga,
Senior Researcher, University of Limpopo
South Africa



Fuel Cell Technology in Transportation and other Applications

Kui Jiao, Professor,
Tianjin University, China

Multi-purpose Highly-efficient Microturbine

Gornovskii Artem & Kosach Lev,
Moscow State University of Mechanical Engineering, Russia

Hydrothermal Processing: Key to Sustainable Energy

Anu Dhar,
Senior Engineer, Process, Reliance Industries Limited, Mumbai, India



Energy Solutions

Weiwei LUO
Yunnan Academy of Scientific and Technical Information, Kuming, China

System to Minimise Electricity Usage during peak times

Sphumelele Ndlovu,
PhD Candidate, Hartebeeshoek Radio Astronomy Observatory
(HARTRAO), South Africa



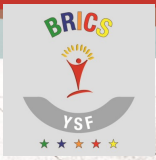
**Distributed Renewable Energy Solutions: Applications in Telecom
Towers and Rural Areas**

Prabal Goyal,
Energy Engineer, IIT New Delhi & Ecole Polytechnique, Panchkula, India

**The Functional Nanomaterials for Energy Generation, Conversion and
Storage Portable Devices**

Dronov Alexey,
National Research University of Electronics Technology, Russia





Session-X
S&T & Diplomacy
Special Address: Collaborating for the Future

Amb Shyam Saran
Former Secretary, Ministry of External Affairs, India

Special Address: S&T and Diplomacy: Some Perspectives

Dr Bhaskar Balakrishnan
Former Indian Ambassador, Ministry of External Affairs, India





28 September 2016

Session-XI

Special Address: Machine Learning in Cancer Biology

Dr M Vidyasagar (through Skype)

Department of Bioengineering, University of Texas, Dallas, USA

0945-1100 hrs: Session-XII

Special Address

Additive Manufacturing of Materials: A New Paradigm

Prof Bikramjit Basu

Materials Research Centre, Indian Institute of Science, Bengaluru

Doing More with Less: Pan-BRICS Scientists Opportunity

Mr K Venkataramanan

Former MD & CEO, Larsen & Toubro (L&T)

Session-XIII

Ideas Hunt-III

Nanoscale energy transport in advanced energy storage

Zheng Bo

Professor, Zhejiang University, China

Routes of Clean energy and environment protection in China after COP21 Paris and G20 2016

Li Yangyang

Deputy Director, China Coal Research Institute, Beijing, China

Humanoid robots for use full application in nuclear energy sector

Y V Nagaraja Bhat

Scientific Officer, Indira Gandhi Centre for Atomic Research, India

From Big Text to Big Knowledge

Partha Talukdar

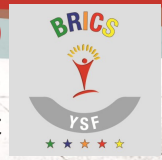
IISc, Bangalore, India

High Performance Computing and Big Data Analytics for solving Computational Challenges across Many Domains

Nishant Kumar Agrawal & Sarmimala Saikia

Tata Consultancy Services, India





A New Type of Urban Transport

Yamaev Renat
OAO "Moslift", Russia

Machine Intelligence Framework for Human Action Recognition in Infrared Imagery: Towards smarter and safer homes and cities

Aparna Akula
CSIR-Central Scientific Instruments Organisation,
Chandigarh, India



Cosmic Ray Modulation: A Multidisciplinary, Ab initio Approach

Nicholas Eugene Engelbrecht
Center for Space Research, North-West University, South Africa

Session-XIV

Workshop: BRICS STI Enterprise

Led by Dr P Goswami

Director, National Institute of Science, Technology and Development Studies (NISTADS), New Delhi

1530-1600 hrs: Tea



Session-XV

Young Indian Trailblazers

Space Technology and its Usage: The Next Giant Leap for Private Enterprise?

Mr Rahul Narayan

Founder, Team Indus, Bengaluru

Musical Ambassador for Change

Mr Ricky Kej

Grammy Winning Composer & Conservationist

Rich in Ideas, but Making Films in Poverty

Mr Pawan Kumar

Film Director, Bengaluru





Session-XVII: Valedictory

Special Address: BRICS Policy Reflections

Prof Ashutosh Sharma

Secretary, Department of Science and Technology, Government of India, New Delhi



Special Address: A Scientific Identity for BRICS

Prof. K VijayRaghavan

Secretary, Department of Biotechnology, Government of India, New Delhi

Valedictory Address

Dr VK Saraswat

Member, NITI Aayog, Government of India, New Delhi



Session-XVIII

Group Presentations

Computational Intelligence, Energy Solutions and Affordable Healthcare Led by Participants



Bangalore Conclave 2016 Major Recommendations

The Conclave participants, as a part of their interactions were divided into groups. The groups deliberated on the subjects and came up with the following recommendations/inputs for the BRICS Scientist Forum.

Computational Intelligence

Computational Intelligence (CI) holds the potential to provide breakthrough solutions to many applications of critical importance to the BRICS countries. In all such applications, there is a repeated need to perform analytics over large-scale, heterogeneous, and multi-modal data. For example, an effective pandemic containment system needs to track and contain a pandemic by integrating human travel and mobility logs, information from social networks, gene sequencing data, and demographic data, among others.



Since many of these datasets are sensitive in nature, the system also needs to be privacy-aware. Moreover, the system needs to continuously learn and improve over time. Such a system may also be used for disaster alert and response, drug discovery, smart material synthesis, efficient grid management, and many more.

While BRICS countries are rich in traditional knowledge, such valuable knowledge is often fragmented and scattered across numerous sources, thereby reducing overall utility. The continuous learning system proposed above may be used to automatically create a unified repository of traditional knowledge from all BRICS countries and make it widely available.

Development of solutions using computational intelligence will require access to large data and computing capabilities. This calls for greater resource sharing among BRICS countries. In order to foster collaboration among scientists from BRICS countries, there should be frequent and focused workshops, especially in an emerging areas such as Computational Intelligence.

Energy Solutions

Energy (more specifically electrical power) can be broadly divided into four categories



1. Generation
2. Distribution and Storage
3. Consumption
4. Policies

There are several problems which plague these four sub-domains of Energy and focused efforts are required to come up with real life solutions. These solutions have to incubate from the labs/universities but should be implemented by the government/regulatory bodies with the support from industry.

The following three projects (non-exhaustive list) were proposed by the BRICS YSF Energy Group as collaborative projects

1. Optimization of electric power load profiles in BRICS countries

Some of the BRICS nations such as India, South Africa and China are suffering from irregular power supply and power outages due to gaps in power generation and consumption. The problem worsens in peak hours when supply shortage causes the blackout in certain areas especially in rural part of the countries. This causes a distress situation in the inhabitants of the residents and slows down the growth of such regions.

The proposed project is to encourage the power usage among the inhabitants of the country at different times to distribute the peak consumption pattern across the geography and sectors. This project would redistribute the peak load in different times of the day to reduce the load on grid. The project consists of the following phases to address the problem:

- a. Collect data points to understand the peak consumption patterns of selected high demand areas of the country
- b. Estimating the contribution of various sectors like industry, offices/service sectors, domestic and household etc. towards the consumption of electricity during peak hours
- c. Develop a virtual electricity consumption environment in the cities during different time of the day/night by mathematical/computational model
- d. Optimize the consumption pattern by distributing the demand in different parts of the day
- e. Implement the staggered distribution by encouraging the flexi pricing/cheaper tariffs

and linking the consumption units with the time of day

2. Gap analysis on country electricity generation and applicability of distributed renewable energy generation in localized areas

Currently, the power generation in BRICS countries is mainly centralized where big (~1 GW) power plants (coal/gas fired) supply the electricity to the end users through grids. However, still there are local communities or rural areas where the grid connection is intermittent or the grid does not exist. Further, the development and installation of small distributed energy solutions in such areas is increasing due to the reduction in price of the solutions and increasing incentives from government. Each of the individual BRICS countries have developed their own indigenous micro-grid/off-grid/distributed energy solutions (conventional and non-conventional energy technologies) and these solutions can be potentially used in other BRICS countries who face similar problems.



The projects aims at doing a GAP analysis on each of the BRICS country's electricity generation and checking the applicability distributed renewable energy generation in localized areas. This analysis would also help to develop solutions to increase the penetration of micro-grid/off-grid/distributed energy solutions in rural areas and therefore contribute towards the national goals.

3. Development of Hydrothermal Processing to recover Energy-Water-Fertilizer from Wet Biomass

The total combined Municipal Solid Waste (MSW) for all BRICS nations is close to 1 million tons per day. All the 5 countries are struggling to overcome the ever rising volume of waste. The biggest problem with current technologies is to be able to work upon the bio or a specific section of waste while the available waste have mixed components of all sorts. Hydrothermal Processing is an emerging technology which can treat all the organic waste right from kitchen waste (fruit and vegetable waste with more than 80% moisture content) to waste that is plastic, paper or polymeric in nature and is relatively dry or even metals which can act as catalysts at operating conditions. Such a flexibility makes it universal and independent of geography. In this technology the unsegregated waste is cooked at high temperature and pressure, close to critical point of water. The proposed technology works upon the principal that water (moisture content) present in waste changes its properties at critical conditions and can dissolve organic matter facilitating the various kinds of reactions for breaking the

polymers to monomers and converting them to new components similar to crude oil. Based on its merits, the proposed technology has the potential to treat variety of waste from wet industrial waste to municipal sludge and is considered baseline technology for sludge by Department of Energy, USA. In this process, clean potable water and micronutrients like N,P,K etc. are also recovered.

Affordable Healthcare

Role of BRICS nations in healthcare

Despite significant differences in geographic locations and living culture of BRICS nations, they face similar health issues. Although, the fast socio-economic growth in BRICS nations has led to improvement in life expectancy, it has resulted in inequitable distribution of resources leading to differential access to healthcare services and increasing health costs. Further, changes in lifestyle have shown considerable increase in prevalence of non-communicable diseases (NCDs).

These NCDs like diabetes, obesity, cardiovascular ailments and cancer have led to ~28 million deaths in developing countries itself according to WHO statistics [1,2,3]. This growing incidence of NCDs leads to a high financial burden on these countries proving to be a hindrance in economic development. Contrary to the “prosperity diseases” in urban strata, a considerable fraction of rural population suffers from malnutrition especially in children less than 5 years of age. The dearth of proper sanitation facilities and paucity of nutritious food in villages is a major cause of infant and maternal mortality. The rural population in India and South Africa possess the highest numbers of undernourished children in the world according to UNICEF survey [4]. Brazil has recently made significant developments in improving malnutrition in children [5] and can potentially provide useful insights into the various healthcare strategies that can be adopted in order to enhance treatment of malnutrition. In spite of these deleterious consequences, these chronic diseases attracted less attention as compared to other infectious diseases.



Another set of diseases are caused by infection with bacteria, viruses, fungi etc. Antibiotics have significantly contributed to increase in average life span especially in areas with poor sanitation. The development of resistance in microbes against these antimicrobials leads to loss of drug efficacy and immediate measures need to be undertaken for prevention. There is a dire



need for implementations to increase access, awareness and monitoring health and sanitation in rural areas. In addition, an appropriate usage of antibiotics should be encouraged in terms of use in agriculture as well as while prescribing it to treat infections. There is an urgent need to discover new antimicrobial compounds with different chemical structures and mechanisms of action to combat resistance. Recent studies have shown that plant products often

used in our traditional medicines can be used to handle resistance and for quorum sensing inhibition. An understanding of defense mechanisms in plants by utilizing our traditional knowledge of these herbal medications could provide significant clinical applications. This information can be used to initiate further research across BRICS countries to design novel antimicrobials.

The differences in the lifestyle and environmental conditions of BRICS countries emphasize the need for studying these populations separately to identify unifying as well as differential medical themes to provide efficient healthcare regimes. Further, it is imperative to find health solutions for early diagnosis of these at a stage when it might be reversible by treatment preventing loss of life quality as well as a high health cost burden. Several technological advances in last decade have opened opportunities for different fields of research to design such non-invasive and cost effective diagnostic strategies in order to sustain them from becoming chronic. Coordination between research groups across BRICS countries with complementary skills can help to accelerate development and standardization of these novel treatment methods. These collaborations can help in understanding the efficacy of these treatments across populations in order to provide a global solution.

Thematic areas: Providing healthcare

Under the theme of collaborative efforts for affordable healthcare among BRICS countries, we have divided our aims in two categories as follows:

1. Early Diagnostics

An early diagnosis of different diseases might help to reduce the overall burden of cost of treatment required during later stages of the disease. Further pro-active and personalized medication is the need of the hour in order to prevent diseased condition. Thus, the criticality of development of these treatments suggests a need for sustainable and logistic strategy for advancement of research collaboration across these nations towards a common goal. Development of potential biomarkers for early detection as well as progression of non-communicable diseases using non/minimally invasive biomaterials (blood/fecal samples) as mentioned below:



(a) Microbiome-based markers
Known facts and proof of concept

- Microbes contribute around 90% of cells in humans called our 'human microbiome' and their symbiotic role in maintaining human health has been established [6,7].

- Traditional culture based microbiology techniques cannot be utilized to identify these unculturable organisms.

- Culture independent methods like metagenomics

- allow their characterization and understanding their functional potential.
- Dysbiosis of human microbiome has been associated with several diseased conditions [8].
- Constitution of human microbiome changes with dietary patterns, environmental conditions as well as genetics of an individual [9,10].
- Proposed Research for diagnostics and therapeutics across all BRICS countries
- Samples from different geographies should be analyzed to account for differences in microbiome due to changes in lifestyle and dietary patterns. (Personalized medication)
- Samples required for these studies are either non- or minimally-invasive including fecal material, saliva, sputum, blood or skin swabs etc.
- Reduction in cost of sequencing and in silico analysis to identify microbial changes.
- Identification of microbes that can act as early stage diagnostic biomarkers for a disease [11,12].
- Diagnostic kit based on biomarker detection.

(b) Secretome (proteins and metabolites) –based markers

- Blood samples from patients affected with non-communicable diseases, like heart diseases and cancer among BRICS countries
- Examine secretory pool of metabolites and proteins in samples.
- Finding biomarkers for these diseases using these metabolites and proteins
- Affordable diagnostic kit for specific biomarker detection using immunoassay and/or molecular imprinting technology (as demonstrated at BRICS YSF, 2016)

2. Therapeutics

In therapeutics, we have categorized our aims in the following parts:

(a) Disease-specific probiotics

- Cocktails of beneficial symbiotic bacteria act as probiotics leading to improvement in gut health [13].

- Commercially available probiotics are for general gut health and there is a need to develop disease specific probiotics.
- These probiotics can be used as a preventive healthcare regime, which can be used for microbiome management at various stages of life.
- Pro-active healthcare can help curtail costs of treatment incurred for curing these ailments in later stages.

Why build a BRICS microbiome consortium?

- Initiatives like Metahit (<http://www.metahit.eu/>) and Human Microbiome project cater mostly to western populations [14,15].
- Different dietary/lifestyle patterns necessitate development of a BRICS microbiome consortium.
- The cost effectiveness as well as pro-active nature of microbiome based diagnostics and therapeutics make it a potential candidate for revolutionizing future medicine. Apart from bacterial community, understanding the viral composition (using viromics) and gene expression (through metatranscriptomics) in the dysbiotic gut samples might require fruitful collaborations across countries.

(b) Fastening wound healing

Using a novel technology (plasma-jet technology as demonstrated at BRICS YSF, 2016), fast and cheap effort in wound healing will be tested as a therapeutic.

(c) Targeting disease-inducers by genetic engineering

Gene silencing technology (siRNA cassettes as demonstrated at BRICS YSF, 2016) will be adopted to minimize disease-inducers and check its effect on disease prevention.

(d) Exploring traditional medicines

BRICS nations like India and China are a rich repertoire of traditional medicines. We will adopt the following strategies to explore this repertoire among BRICS countries:

- Cataloging traditional medicines available at BRICS countries and creating a database with their constituents and potential uses.
- Investigating the applicability and functionality of a prospective traditional medicine among BRICS countries
- Several traditional medicinal plant products are known to act as inhibitors of resistance mechanisms to antibiotics e.g. efflux pumps, lactamases etc. These products will be explored and used in combination with antibiotics



in order to delay onset of antibiotic resistance.

- Antimicrobial potential of several plant products and their minimum inhibitory concentrations would be explored to understand their efficacy as alternative therapy.

(e) Healthcare awareness and rural coverage

We aim to spread healthcare awareness among BRICS communities, giving a special emphasis on including rural areas under this programme. We plan to adopt the following strategies towards this aim:

- Submitting a funding proposal to hire healthcare workers to develop a team
- Training the hired workers to run healthcare awareness programmes in different localities, covering rural parts.
- Setting up healthcare camp for localities, providing basic health check-up (blood pressure and sugar monitoring, general eye check-up etc.) along with informing the locals about healthcare parameters

(f) Health and sanitation

We aim to reach communities, including rural belts to educate locals about importance of sanitation. Toward that, our aims are as follows:

- Informing the locals about basic parameters of sanitation and their importance in the above-mentioned healthcare camps
- Reaching school students by setting up special classes to educate them about requirements and basic parameters of general healthcare and sanitation

Microbiome markers to reduce infant mortality by handling malnutrition

- Disturbances in gut microbial community show association with malnourishment status of a child [16,17].
- Therapeutic supplements like Ready To Use Therapeutic food and probiotics approved by WHO has also shown an increase in beneficial gut bacteria in their intestinal tract [18].



Bacteria obtained as biomarkers of malnourishment specifically from population within a particular country can help to design personalized and more efficient medications to alleviate the symptoms of malnourishment. Further, these probiotics will be affordable for rural population and lead to significant enhancement in life quality of young children.

References

- [1] Burki, T.K. BRICS nations tackle non-communicable diseases. *Lancet Oncol.* 2012 May;13(5):451
- [2] World Health Organization, Diabetes country profiles 2016 <http://www.who.int/diabetes/country-profiles/en/>
- [3] World Health Organization, Report on Non communicable diseases, 2015 <http://www.who.int/mediacentre/factsheets/fs355/en/>
- [4] UNICEF malnutrition data latest report <http://data.unicef.org/nutrition/malnutrition.html>
- [5] WHO Global nutrition report 2016 <http://www.ifpri.org/cdmref/p15738coll2/id/130354/filename/130565.pdf>
- [6] Marchesi JR. et al. The gut microbiota and host health: a new clinical frontier, *Gut.* 2016; 65(2):330-339.
- [7] Carding S. et al. Dysbiosis of the gut microbiota in disease. *Microb Ecol Health Dis.* 2015; 26:26191
- [8] Shreiner AB, Kao JY, Young VB. The gut microbiome in health and in disease. *Curr Opin Gastroen.* 2015; 31(1):69-75.
- [9] Yatsunenکو et al. Human gut microbiome viewed across age and geography. *Nature.* 2012; 9; 486 (7402):222-227.
- [10] Patrice D. Cani and Amandine Everard. Talking microbes: When gut bacteria interact with diet and host organs. *Mol. Nutr. Food Res.* 2016; 60: 58–66.
- [11] Yassour M. et al Sub-clinical detection of gut microbial biomarkers of obesity and type 2 diabetes. *Genome Med.* 2016 Feb 17;8(1):17.
- [12] Zeller G et al. Potential of fecal microbiota for early-stage detection of colorectal cancer. *Mol Syst Biol.* 2014 Nov 28;10:766.
- [13] Sanders ME, Guarner F, Guerrant R, et al. An update on the use and investigation of probiotics in health and disease. *Gut.* 2013; 62(5):787-796.
- [14] A framework for human microbiome research. Human Microbiome Project Consortium, *Nature.* 2012; 486; 215-221.
- [15] Structure, function and diversity of the healthy human microbiome. Human Microbiome Project Consortium, *Nature.* 2012; 486: 207–214.
- [16] Ghosh et al. Gut microbiomes of Indian children of varying nutritional status. *PLoS One.* 2014; 24 9(4):e95547.
- [17] Gupta et al. Metagenome of the gut of a malnourished child. *Gut Pathog.* 2011; 3 :7.
- [18] Smith MI et al. Gut microbiomes of Malawian twin pairs discordant for kwashiorkor. *Science.* 2013; 339(6119):548-554.





BRICS Science & Technology Enterprise Partnership

Bold, Responsive, Inclusive and Cohesive Solutions for Rapid Transformations

As a part of the research activities, the Conclave also witnessed the preparation and release of a document titled BRICS Science and Technology Enterprise Partnership.

BRICS-STEP at a Glance (Extracts from the Report)

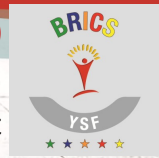
BRICS has been quite successful in enhancing scientific collaborations among the member nations, as evidenced by scientometric analysis. However, there is potential in BRICS to provide a platform for shaping the economic, social, and political contours for a better world, accelerating transformation through Bold, Responsive, Inclusive and Cohesive Solutions. In spite of their

inevitable development path dependencies, the commonalities of concerns and aspirations far outweigh differences: harnessing potential synergies, BRICS can address current regional and global concerns.

The proposed BRICS S&T Enterprise Partnership (BRICS-STEP) will engage BRICS scientists in an enterprise mode that would be driven by the S&T challenges, thus creating a new identity for the BRICS. The BRICS-STEP programmes will be sustained based on compelling commonalities where synergistic partnership can significantly add value to national aspirations and provide global leadership. BRICS-STEP will complement traditional discipline-driven collaboration with product-oriented programmes in priority and challenging areas, through sustained, critical effort and delivery mechanisms aimed at high impact.

For implementation, BRICS-STEP should be created with an action-oriented structure. The management structure of BRICS-STEP should be designed to allow integration of thoughts and inputs from all the three tiers: policy makers, experts and young scientists, who should be involved in the industry from the inception. These inputs will be used to design and drive the BRICS-STEP implementation, like choices and prioritization of projects. A project team will be created for each identified project through pooling of required resources from the participating members, ensuring end-to-end product and utilization. The entire process can be overseen by the BRICS-STEP council.

With the strong and growing evidence of scientific collaboration among its scientists and enthusiastic and energetic AND support of young researchers, BRICS can realize its potential with bold, responsive, inclusive and cohesive initiatives through an S&T Enterprise Partnership (STEP). In the process, BRICS can develop new ways to relate to the world, creating a model for other societies.



The report includes the following:

Foreword: Ashutosh Sharma, Secretary, DST

Executive Summary: P Goswami and Baldev Raj

Prologue: BRICS and World Order: P Goswami and Baldev Raj

BRICS: Emerging Reality: Shadhana Relia, A Kumar, Kasturi Mandal, Suba Chandran

BRICS: Common Aspirations, Common Challenges: P Goswami and Baldev Raj

Brave New World: Sociocultural and Philosophical Dimensions of BRICS-STEP: Shundar Sarukkai and Anindiya sinha

BRICS-STEP: Characterization and Structure: Kasturi Mandal and P Goswami

BRICS-STEP: An Operational Model: S P Bhuvaneshwaran, S Bhattacharya, T Jamal, S Pohit, Kasturi Mandal and P Goswami

BRICS-STEP: Strategy & Positioning: S Pohit, Kasturi Mandal and P Goswami

BRICS-STEP: Young Speak on Collaborative Research

Computational Intelligence-Nishant Agrawal, Sarmimala Saikia, J Chintalapati, S Mohanty, Y Suman

Energy-Madhulika Bhati, S Arunachalam, Anu Dhar, Bhuvaneshwaran Subramanian, Nagaraj Bhat , Kanishka Biswas, S Pohit, Sujoy K Guha

Health: Swadha Anand, Nazia Tarannum, S Ray and Akshay Vaid

BRICS-STEP: IPR Policy and Financial System: S Bhattacharya and P Goswami

BRICS –STEP: Building on Experiences and Competencies: N Kumar, S Bhattacharya, T. A. Abhinandan, S Arunachalam, M Bhati, AK Das

Second Month(h-index) Analyses: Kasturi Mandala and P Goswami

Patent landscaping of energy, Healthcare and Computational Intelligence Sectors in BRICS: H Purushotham, S Majumdar

Epilogue/Outlook: P Goswami and Baldev Raj

Women Scientists in STEM An interaction with the NIAS Education Programme

The Education Program at the National Institute of Advanced Studies (NIAS) invited the Women Scientists from the BRICS countries taking part in the Conclave for an interaction to explore the canvas of the experiences and concerns of Women Scientists in STEM.



The Women Scientists discussed the following questions during the interaction:

- What networking opportunities/constraints do women scientists experience?
- What recommendations do the

Scientists have to improve opportunities for networking and mentoring?

- What cross-country observations are there in terms of the experiences of women in STEM?



Visit to JSW Steel Plant, Vijaypur

The Young scientists from the BRICS countries also visited the modern steel plant in Vijaypur. Mr Sajjan Jindal, the Chairman and the Managing Director of the JSW through video message invited the participants and gave a brief on the history of JSW steel plant, current performance and future aims. The senior management of the JSW then had a detailed interaction with the participants on various issues—focussing global economy, environmental implications, maintenance of global standards etc.

After the interactions with the senior executives, the participants were divided into two groups and taken a complete tour of the steel plant.



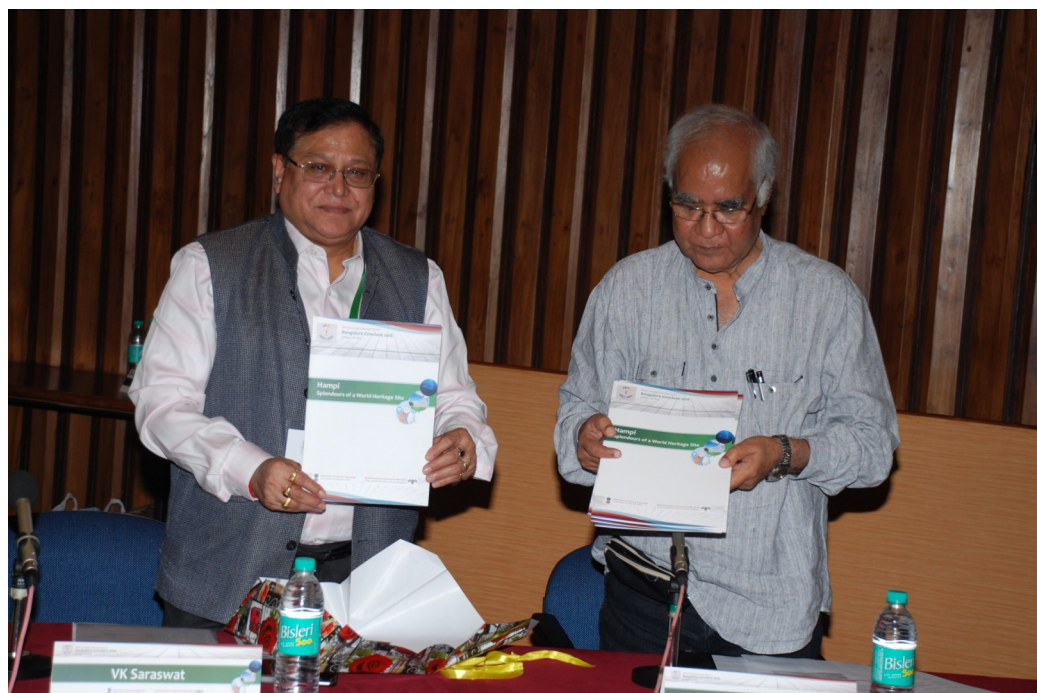
Hampi: Splendours of a World Heritage Site

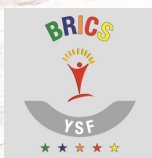
The National Institute of Advanced Studies also prepared a document on the world heritage site near Bangalore—Hampi.

The scientists attending the Conclave were taken to the site; according to the report, “The Deccan plateau (where Hampi is located) was also home to some of the earliest technological innovations including production of very high quality steel and alloys. Many pioneering technological and artistic contributions in early India came from innovative artisans, craftsmen, artists and thinkers who came from many diverse castes and communities. These practices contributed to a flourishing trade and led to vibrant economic exchange between

India and Arabic countries as well as those in Asia. It is within this larger world of philosophical, scientific and political excellence that one can imagine the world of Hampi in its heyday.”

Dr VK Saraswat released the report.



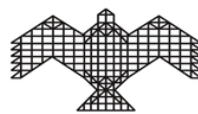


Department of Science and Technology

India is one of the top-ranking countries in the field of basic research. Indian Science has come to be regarded as one of the most powerful instruments of growth and development, especially in the emerging scenario and competitive economy. The Department of Science & Technology plays a pivotal role in promotion of science & technology in the country.

The department has wide ranging activities ranging from promoting high end basic research and development of cutting edge technologies on one hand to service the technological requirements of the common man through development of appropriate skills and technologies on the other. DST accordingly (a) Develops S&T policies, (b) Strengthens human resources and institutional capacities, (c) Enables development & deployment of technologies, (d) Creates opportunities for societal interventions through S & T & (e) Establishes and engages in mechanisms of international science, technology and innovation cooperation, partnerships & alliances at bilateral, regional and multilateral levels. These approaches that reflect its mission ensure a holistic systemic influence, immediate, medium and long term relevance/ gains. It enables cross cutting impacts across sectors to sustain growth/ development and synergies to optimize on time, human, institutional and financial resources.

The DST establishes strategically important systems / mechanisms to stimulate and foster excellence and leadership in scientific research and development.



National Institute of Advanced Studies (NIAS)

National Institute of Advanced Studies (NIAS) was conceived and founded in 1988 by the late Mr. JRD Tata, who sought to create an institution to conduct advanced multidisciplinary research. Housed in a picturesque green campus in Bangalore the Institute serves as a forum to bring together individuals from diverse intellectual backgrounds. They include administrators and managers from industry and government, leaders in public affairs, eminent individuals in different walks of life, and the academicians in the natural and life sciences, humanities, and social sciences.

NIAS has an active programme of public lectures, regional, national and international conferences, symposia and seminars organized independently or jointly with other institutions that focus on topical areas of research and public concern. NIAS aims to integrate the findings of scholarship in the natural and social sciences as well as technology, the humanities and arts through multi-disciplinary research on the complex issues that face Indian and global society, and to assist in the creation of new leadership with broad horizons in all sectors of society by disseminating the conclusions of such research through appropriate publications and courses as well as through dialogues with leaders and the public.

