

ICGEB

Annual Report 2019

SCIENCE

— Research highlights

PROGRAMMES

— Fellowships

Meetings

Grants

Technology Transfer

FINANCE

— Financial Report

PROJECTS

— Research Projects

OUTREACH

— Scientific events



ICGEB

International Centre for Genetic
Engineering and Biotechnology

ICGEB

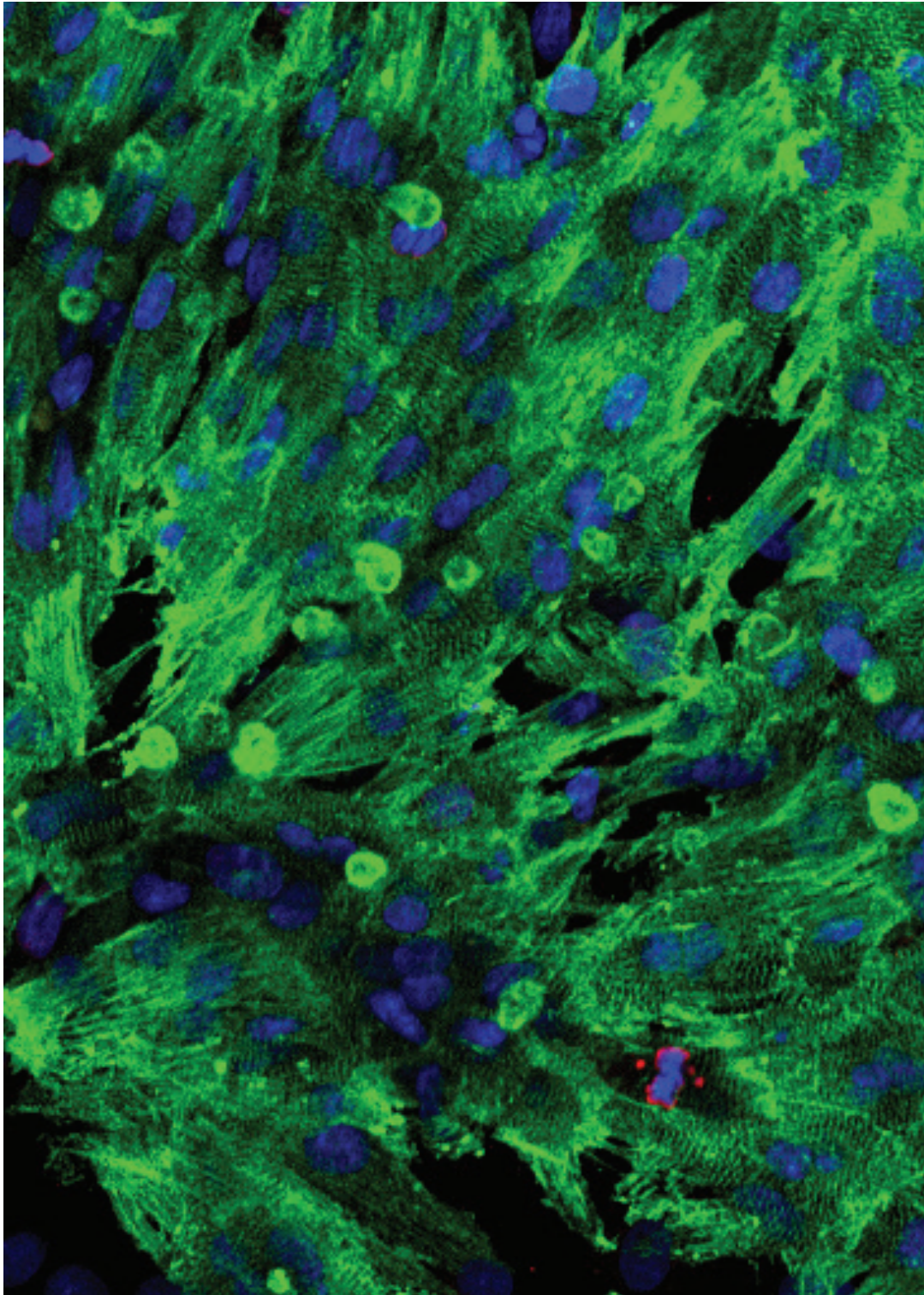
International Centre for Genetic Engineering and Biotechnology

An Intergovernmental Organisation for research, training, and technology transfer in the Life Sciences to promote sustainable global development

Annual Report 2019



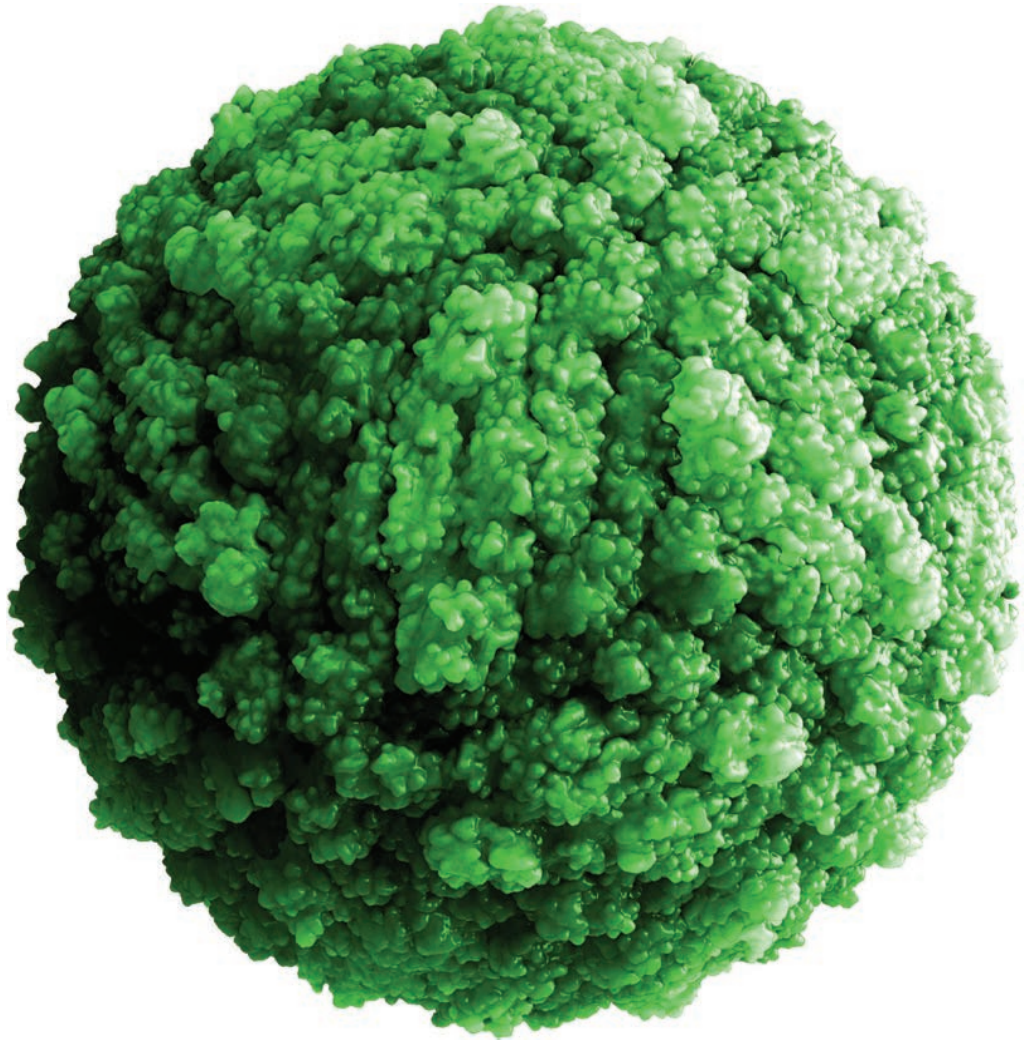
Science for Development



A primary culture of cardiac cells (green), in which the nucleus of those that are proliferating is labeled in red. Picture by Serena Zacchigna, Group Leader, Cardiovascular Biology lab, Trieste, ITALY

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Zika virus

MESSAGE FROM THE DIRECTOR-GENERAL



I am honoured to present the ICGEB Annual Report for 2019; a year, which, I believe, has marked the coming of age of the ICGEB. I took up the challenges as Director-General of the Organisation in July, and the commitment of the Host Governments of Italy, India and South Africa have been unflagging as we forge ahead to consolidate our actions championing science for global sustainable development.

Our scientific publications and collaborations reflect the continued pursuit of top-class basic research, through which solutions to many of humanity's major problems can be addressed. Our actions align Biotechnology for a Sustainable Future with the UN Sustainable Development Goals (SDGs), as we tackle problems related to health, food security, climate change and the environment. Our infrastructure and innovative programmes are far-reaching and provide world-class education, capacity enhancement, technology transfer and the promotion of international scientific collaboration and diplomacy.

Last December, no one thought that Covid19 would be a major global crisis. By late January, however, the picture was changing and ICGEB scientists had the foresight to recognise the danger looming and began to prepare for research on coronaviruses. Whilst research labs all over the world have been in lockdown, ICGEB research activities on Covid19 have remained active. During this time, our most pressing and immediate challenge was to support our 66 Member States with real practical assistance on diagnosis, surveillance and in the search for novel antiviral treatments. The coming months will see more effort placed on research and development for combatting the virus and in building capacity in our Member States so that they can develop their own infrastructure and expertise for dealing both with Covid19 and any future epidemics.

I personally thank all of our Member States for their continuing wonderful support and encouragement and also extend a truly heartfelt thank you to all of the organisations and partners with whom we are working to realise our common, noble goals. In this time of global crisis, Science provides a beacon of hope. I wish you all well. "Andrà tutto bene".

A handwritten signature in blue ink, appearing to read 'L. A. Banks', written in a cursive style.

Lawrence Banks, PhD
Director-General

April 2020

THE YEAR IN PICTURES

2019

ZIMBABWE



Zimbabwe becomes an ICGEB Full Member State in January 2019

MOLDOVA



Republic of Moldova becomes 65th Member State of the ICGEB

INDIA



On 1 July 2019 Dr. Lawrence Banks becomes the new ICGEB Director-General

ITALY



Dr. F. Benvenuti, Cellular Immunology Group Leader and her team receive five-year funding from the Italian Association for Research on Cancer AIRC

ITALY



Prof. M. Giacca and Ms. Mmamoloko Kubayi-Ngubane, Minister of Science and Technology during the signing ceremony for the Host Agreement between the Department of Science and Technology, Government of South Africa and the ICGEB

ETHIOPIA



Ethiopia becomes an ICGEB Member State in May 2019

SOUTH AFRICA



In July 2019, the Host Agreement with the Government of South Africa was signed

Jan
2019

Jan
2019

Mar
2019

Mar
2019

Jun
2019

Jul
2019

Jul
2019

UN - GENEVA



Dr. Alessandro Marcello, Molecular Virology Group Leader attended the Biological Weapons Convention Meeting of Experts MX4 in Geneva, SWITZERLAND

Aug 2019

SOUTH AFRICA



The ICGEB Director-General, Dr. Lawrence Banks, attended the BIOAfrica Convention in Durban, SOUTH AFRICA

Aug 2019

KENYA



Dr. Lawrence Banks in Kenya for ICGB Awareness Workshop during National Science Week, KENYA

INDIA



Dr. Sneha Lata Singla-Pareek, Plant Stress Biology Lab, and Dr. Pawan Malhotra, Malaria Biology, ICGB New Delhi, India were elected Fellows of the Indian National Science Academy (INSA)

Aug 2019

ROMANIA



Dr. Lawrence Banks visited Romania to consolidate strategies for future collaboration. Hosted by Carmen Socaciu, Member of the ICGB Council of Scientific Advisers, of the University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, ROMANIA

Sep 2019

INDIA



Dr. Dhiraj Kumar, ICGB New Delhi, has received the 2019 Shanti Swarup Bhatnagar award for Medical Science

Oct 2019

ITALY



Min. Fabrizio Nicoletti, Principal Director, Innovation and Research, Italian Ministry of Foreign Affairs and International Cooperation (MAECI), Rome, Italy, visited the ICGB Headquarters in Trieste, ITALY

Oct 2019

JORDAN



Dr. Lawrence Banks, ICGB Director-General and Dr. Vittorio Venturi, Scientific Coordinator were in Jordan to conduct an Awareness Workshop and to cement relations with the University of Jordan

Oct 2019

SOUTH AFRICA



South African Minister of Higher Education, Science and Innovation H.E. Dr. Nzimande met with Ms. Marianna Maculan, Chief External Relations and Ms. M. Luisa Fichera, Chief Legal and Administration in Rome, ITALY

Oct 2019

Nov 2019

STORY

The ICGEB was established as a special project of UNIDO in 1983, and is now the world's leading intergovernmental Organisation for **research, training and technology transfer** in the field of Life Sciences and Biotechnology.

It is unique in combining scientific research with capacity enhancement, thereby promoting **sustainable global development**.

With Headquarters in Trieste, Italy, and **47 laboratories** across three continents, the ICGEB forms an interactive network of internationally recognised scientists.

The first Director of the Centre (1987-1989) was Irwin Gunsalus, USA, followed by Arturo

Falaschi, Italy (Director-General from 1989-2004). Succeeded by Francisco E. Baralle, Argentina (2004-2014), and Mauro Giacca, Italy (2014-2019), Lawrence Banks, UK, became the 5th serving Director-General on 1 July 2019.

The ICGEB pursues the promotion of health and well-being, quality education, access to affordable and sustainable energy, innovation and Global Partnerships. Across all of its actions it supports gender parity, youth, and Least Developed Countries for global and regional development.



ITALY



INDIA

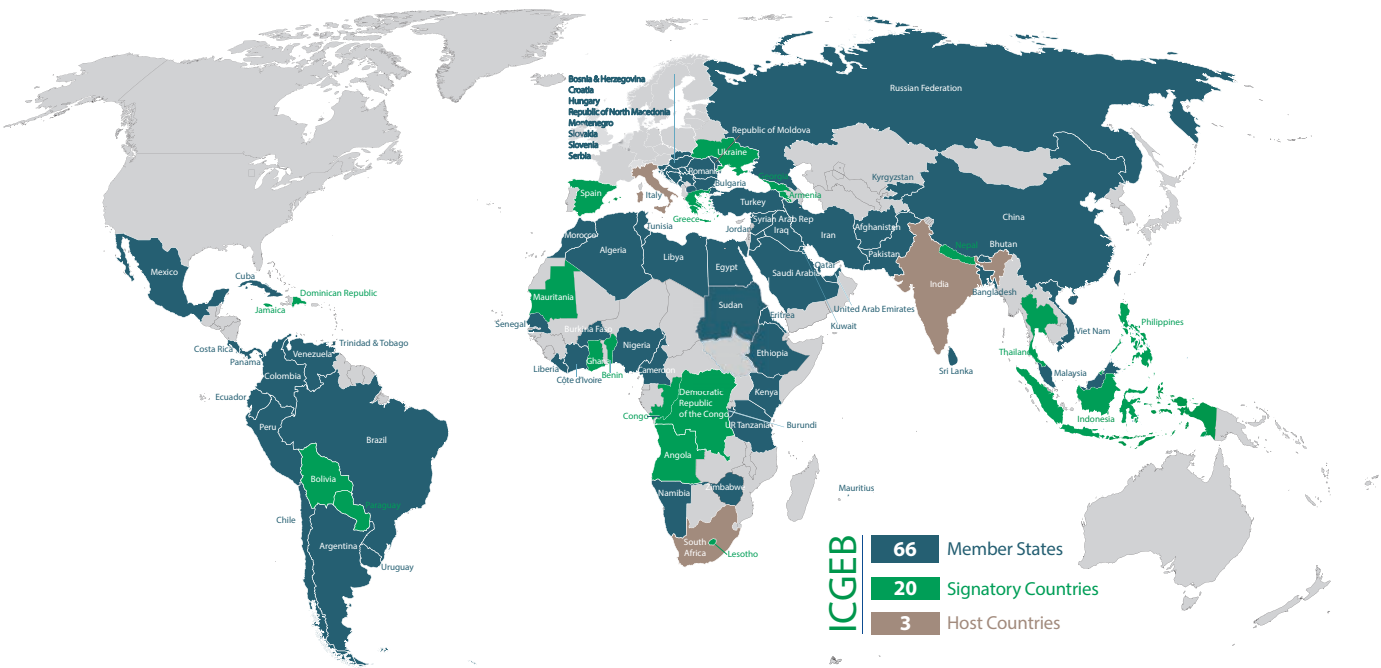


SOUTH AFRICA

ACTIVITIES

The Organisation offers a unique technological and educational platform to promote scientific learning and innovation, helping its Member States progress towards the achievement of the 2030 Agenda on Sustainable Development. The ICGEB's activities aim to reap the benefits

that modern biotechnology can provide in solving major problems affecting health, nutrition, agriculture, food security and industrial development. Its main instrument of actions are:



- **Cutting-edge scientific research** in its laboratories in Trieste, New Delhi and Cape Town
- Advanced education supported by long- and short-term **fellowships** for PhD students and post-docs
- Organisation of international **Meetings, Courses and Workshops**
- Award of competitive **research grants** for scientists in Member Countries, including Early Career Return Grants
- **Technology transfer to industry** for the

production of biotherapeutics, diagnostics and agricultural products

- Access to **state-of-the-art facilities**
- Provision of technical assistance and **advisory services** to Member States
- Access to a worldwide **network of biotechnology experts**
- Provision of instruments to achieve the 2030 Agenda on **Sustainable Development Goals**

GOVERNANCE

The Organisation is governed by the **Board of Governors**, which is composed of a representative from each of its Member States and which meets once a year. The current President of the Board is Mr. Victor Smirnov, Russia, and the Vice-President is Prof. Cristina Guerra Giraldez, Peru. In addition, a **Council of**

Scientific Advisers, comprising fifteen eminent scientists including Nobel Laureates, sustains and monitors the ICGEB scientific activities and makes recommendations to the Board.

CURRENT MEMBERS OF THE CSA

Roger N. Beachy, USA
 Zodwa Dlamini, SOUTH AFRICA
 Marco Foiani, ITALY
 Mariano Garcia-Blanco, USA
 Li Jin, CHINA

Alexis Kalergis, CHILE
 Jorge Kalil, BRAZIL
 Alexander A. Makarov, RUSSIA
 Rafael Rivera Bustamante, MEXICO
 * Richard J. Roberts, USA

Mohammed Sebahia, ALGERIA
 Carmen Socaciu, ROMANIA
 Ramesh V. Sonti, INDIA
 Inder Verma, USA
 Khatijah Yusoff, MALAYSIA

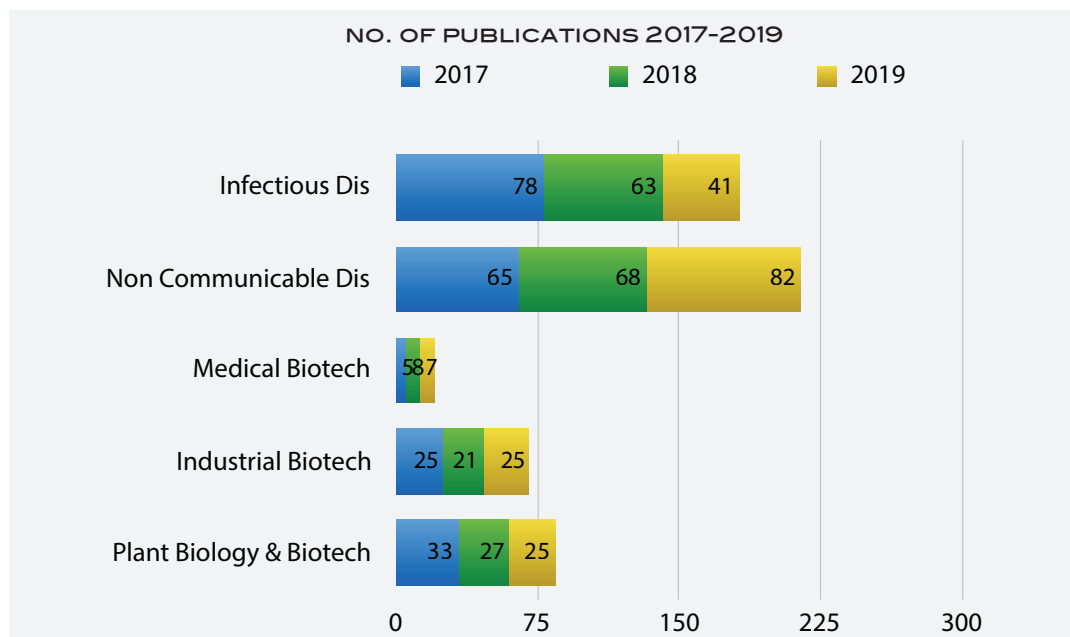
(*Nobel Laureate)

Housing state-of-the-art laboratories where advanced research in Life Sciences is performed makes ICGEB unique amongst Intergovernmental Organisations. These laboratories offer a scientific environment of top international standard for both basic and applied research. Cutting-edge instrumentation, specialised facilities and advanced services are available to the ICGEB investigators.

In 2019, over **600 scientists** representing more than 47 nationalities were on board in the ICGEB laboratories, undertaking research across five macro-areas (Infectious Diseases, Non-Communicable Diseases, Medical Biotechnology, Industrial Biotechnology, and Plant Biology and Biotechnology). In Trieste, **18 Research Groups**, comprising over 170 researchers have been active in various fields of biomedical research, including projects on cardiovascular, neurodegenerative and infectious diseases, as well as in immunology and human genetics. In New Delhi, studies performed by over 360 researchers in **26 Research Groups** have focused their attention on the development of diagnostic and vaccine candidates for Malaria and Dengue, and advanced research in plant biotechnology and biofuels. In Cape Town, **3 Research Groups**, comprising approximately 40 researchers have investigated parasitic diseases and the genetics of cancer development in Africa.

The success of these investigations can also be measured from a series of bibliographic parameters, including the number of publications in top international scientific journals, such as Nature, Cell, Nature Medicine, Nature Reviews Cancer, Nature Reviews Molecular Cell Biology, Cell Stem Cells, Nature Structural and Molecular Biology, and Journal of Experimental Medicine, among others.

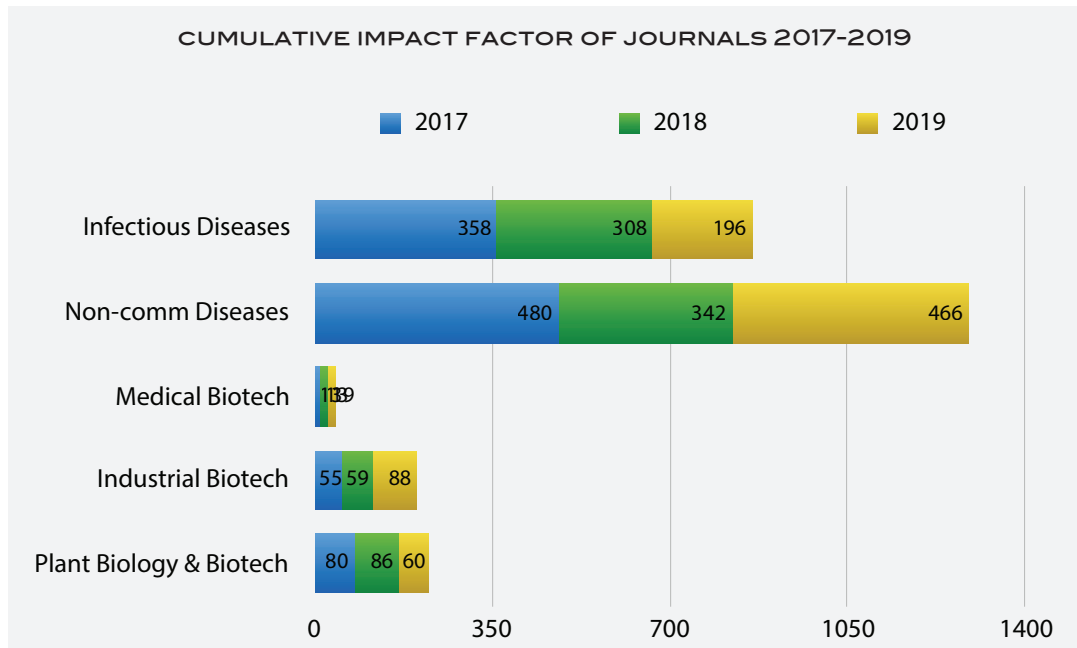
FIGURE 1



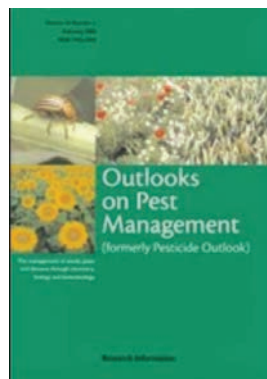
Total number of scientific publications in 2017-2019 divided according to the five macro-areas of research

In 2019, research carried out in the laboratories has generated 180 publications in peer-reviewed international journals. The number of publications and Impact Factor in each of the five macro-areas of activity are shown in Figure 1 and Figure 2.

FIGURE 2



Total Impact Factor of scientific publications in 2019 divided according to the five macro-areas of research



Recent ICGEB publications featured on Journal covers.

Macro Areas of RESEARCH

INFECTIOUS DISEASES

Virology
Parasitic Diseases

NON-COMMUNICABLE DISEASES

Cardiovascular Disorders
Immunology
Molecular Genetics
Neurobiology
Cancer

MEDICAL BIOTECHNOLOGY

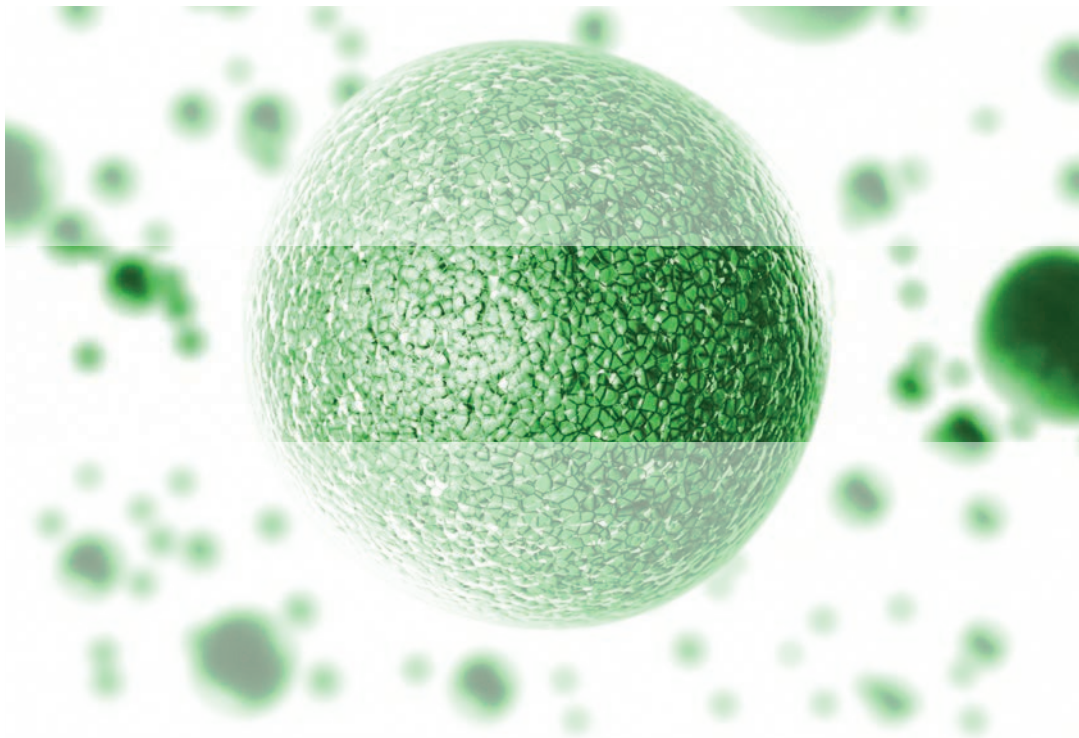
Biotherapeutic products
Translational Health

INDUSTRIAL BIOTECHNOLOGY

Biofuels and Industrial Biotechnology

PLANT BIOLOGY AND BIOTECHNOLOGY

Crop Improvement
Biotic and Abiotic Stress



1. INFECTIOUS DISEASES

Many countries in Asia, Africa and Latin America continue to suffer high levels of death and disease caused by infectious agents. The application of modern molecular biology to study human viral and parasitic diseases now offers unprecedented possibilities for developing more accessible diagnostics and novel strategies for effective treatment and prevention. Several Groups in Trieste (TS), New Delhi (ND) and Cape Town (CT) are actively engaged in these areas of research.

VIROLOGY

Alessandro Marcello (TS)

Sujatha Sunil (ND)

Anmole Chandele (ND)

Oscar Burrone (TS)



The Molecular Virology (Marcello) and the Vector Borne Disease Group (Sunil) investigate the molecular characteristics of different arboviruses, including Dengue, Chikungunya, Zika and Tick-Borne encephalitis Viruses. They are involved in the development of novel antiviral strategies and diagnostic tools for efficacious deployment in resource limited settings and in point of care formats. ICGEB Delhi (Chandele) runs a joint program with the Emory University, Atlanta, USA to understand human immunity to infectious disease for improving vaccine design.

Highlights in 2019

The Molecular Virology Group in Trieste made important advances in our understanding of the innate cellular response to Flavivirus infection (Carletti, Zakaria et al Nature Comm 2019). These results have important implications for our understanding of viral pathogenesis and to develop novel antiviral drugs. The Vector Borne Diseases Group in Delhi identified a mosquito microRNA that regulates Chikungunya replication (Dubey et al PLOS NTD 2019) while the ICGEB Emory Vaccine Program Group investigated the immunological correlates of Dengue infected patients in India (Gunisetty et al Int J Infect Dis 2019).

PARASITIC DISEASES

Frank Brombacher (CT)

Pawan Malhotra (ND)

Asif Mohammed (ND)

Renu Tuteja (ND)

Dinkar Sahal (ND)

Amit Sharma (ND)

Neel Sarovar Bhavesh (ND)



Several research Groups investigate the molecular and immunological correlates of parasitic infection. In Cape Town, the Cytokines and Disease Group (Brombacher) aims at elucidating the fundamental immunological mechanisms underlying human diseases, such as tuberculosis, African trypanosomiasis, leishmaniasis and helminthic infections (including bilharzia), in addition to chronic diseases like allergic asthma and colitis. In New Delhi, five Groups investigate the malaria parasite. The Malaria Biology (Malhotra) and the Parasite Cell Biology (Mohammed) Groups search for proteins encoded by the malaria parasite that could become targets for the development of innovative antimalarial drugs or become vaccine candidates. The Parasite Biology Group (Tuteja) studies the plasmodium proteins involved in the maintenance of parasite genomic integrity, while the Malaria Drug Discovery Group (Sahal) investigates the antimalarial properties of molecules isolated from marine organisms, medicinal plants, cyanobacteria and endophytic fungi from India and other sources in Africa and Asia. The Structural Parasitology Group (Sharma) uses a structural approach aiming to define the principles governing the biological functions of key malaria proteins, particularly focusing on the protein translational machinery of the parasite. The Transcriptional Regulation Group (Bhavesh) has a broad interest in elucidating the molecular interactions between protein and RNA, which it addresses by a combination of NMR spectroscopy and crystallography.

Highlights in 2019

The Cytokines and Disease Group in Cape Town has major advances in our understanding of how the immune response affects inflammation following helminth infection, and has defined a specific role for interleukin-4Ra in a specific subset of T cells, as being essential for controlling the immune response and minimising the disease pathology (Abdel Aziz et al., 2018, PLoS Biol., 16, e2005850). The Group also published an important review on the potential novel use of statins, normally used to treat cardiovascular disease, which can potentially be repurposed as adjuncts to treat a variety of infectious diseases (Parihar et al., 2019, Nat. Rev. Immunol., 19, 104–117). The Malaria Biology and Parasite Cell Biology Groups in New Delhi have made important advances in understanding novel protein complexes on the malaria parasite surface which play a key role in the invasion of red blood cells (Infect Immun., 88(2), thereby opening novel ways of potentially blocking parasite infection. Based upon their discovery of coalesced pathways of haemoglobin degradation and

hemozoin formation (Chugh et al., 2013, *Proc Natl Acad Sci*;110(14):5392-7), the Group have developed highly potent novel parasitocidal compounds with high potential to be developed as new antimalarials (PCT Int. Appl. (2019), WO 2019202609 A1 20191024; Indian Pat. Appl. (2019), IN 201811014401 A 20191018.; Rana et al., 2020, *Bioorg Med Chem.*;28(1):115155). Studies from the Structural Parasitology Group in New Delhi identified novel hit compounds targeting parasite tRNA synthetases. (Chhibber-Goel, J., and Sharma A. *Proteins.* 2019; 87(9):730-737; Baragaña B. et al., *Proc Natl Acad Sci* 2019;116(14):7015-7020; Mishra e al., *Acta Crystallogr.* 2019; 75(Pt 11):714-724).

2. NON-COMMUNICABLE DISEASES

There is a growing interest in the ICGB Member States for research into non-communicable disorders. Understanding the causes of human disease at the genetic and molecular level now allows the development of innovative therapies or preventive measures in fields of enormous importance for public health, such as cardiovascular disorders, cancer and neurodegeneration. Multiple Groups in Trieste, New Delhi and Cape Town are active in these areas.

CARDIOVASCULAR DISORDERS

Mauro Giacca (TS)
Serena Zacchigna (TS)
Francesco Loffredo (TS)



Two Groups in Trieste operate in the field of cardiovascular disease. The Molecular Medicine Group (Giacca) aims to identify proteins and microRNAs controlling cardiac protection and regeneration that might be exploited for the therapy of heart diseases, The Molecular Cardiology Unit (Loffredo) in the same Group specifically investigates pathways that regulate cardiac ageing. The Cardiovascular Biology Group (Zacchigna) aims to characterise the mechanisms that hamper the formation of new blood vessels in the heart after myocardial infarction and to develop innovative strategies to revascularise ischaemic tissues.

Highlights in 2019

Two fascinating studies involving these Groups in Trieste characterised the potential of microRNAs to promote cardiac regeneration after myocardial infarction in large animals and provided evidence for the repurposing of the anti-psychotic drug Haloperidol for the treatment of fibrotic diseases (Gabisonia et al., 2019, *Nature*, 7756, 418; Rehman et al. 2019, *JCI Insight*, 4, 8).

IMMUNOLOGY

Dinakar Salunke (ND)
Federica Benvenuti (TS)
Dhiraj Kumar (ND)
Ved Prakash Dwivedi (ND)



The immunology cluster at ICGB comprises two Groups in New Delhi (Structural Immunology - Salunke; Cellular Immunology - Kumar) and one Group in Trieste (Cellular Immunology - Trieste) with complementary interests in the molecular and cellular mechanisms of the immune response to pathogens and cancer. The Benvenuti Group has developed preclinical models of lung cancer and multi parametric flow cytometry to dissect the immune cell composition and function in lung tumors to understand tumor-driven immune suppression. The Structural Immunology Group has a long-standing interest in structural aspects of antibody-antigen recognition and has discovered key principles of molecular mimicry and evolution of the antibody responses to maintain self/non-self discrimination. The Kumar Group has a strong background in Mycobacterium host pathogen interaction and investigates changes in intracellular trafficking and gene expression in infected macrophages.

Highlights in 2019

Recent discoveries from the Structural Immunology group have shed light on the mechanism of loss of efficacy of vaccines against influenza virus (Vashisht et al, *Mol Imm*, 2019). A recent study from the Cellular Immunology Group in Delhi developed powerful tools to decipher transcriptional changes in Mycobacterium infected macrophages (Kalam H et al, *IUBMB Life*, 2018). The Cellular Immunology Group in Trieste is soon to publish the results of a four-year project on antigen presentation in lung tumors (Caronni et al, in revision).

MOLECULAR GENETICS

Marco Baralle (TS)
Andrés Muro (TS)
Franco Pagani (TS)



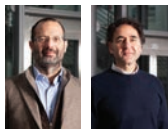
In Trieste, the RNA Biology Group (Baralle) has a long-standing interest in elucidating the molecular mechanisms that control the processing of human genes, and their relevance for human disease. In particular, it focuses on the splicing machinery and is addressing the epigenetic mechanisms that control cellular levels of RNA binding proteins. The Mouse Molecular Genetics Group (Muro) focuses on the study of molecular mechanisms of metabolic genetic diseases, and the development of therapeutic approaches for their cure, ranging from pharmacological therapies to gene therapy and gene editing, using transgenic and engineered mouse models of the human syndromes. The Human Molecular Genetics Group (Pagani) explores a novel RNA based strategy to correct splicing defects associated with haemophilias, cystic fibrosis, familial dysautonomia and spinal muscular atrophy. For these conditions, gene therapy using AAV vectors is offering new therapeutic opportunities.

Highlights in 2019

The Mouse Molecular Genetics Group reported a major advance in the development of genome editing strategies using *Crispr/Cas9* technology for treating monogenic diseases of the liver during the neonatal period, such as the *Crigler-Najjar Syndrome* (De Caneva et al, 2019, *JCI Insight*). This study provides a proof of concept for the potential application of the approach to other liver diseases. A major advance in the treatment of spinal muscular atrophy, a rare and devastating disease, was recently reported by the Human Molecular Genetics Group, based on the delivery of U1 snRNA molecules by adeno-associated virus (Donadon et al, 2019, *NAR*). Studies are ongoing, aiming to transfer this technology to the clinic (Donadon et al, 2018, *Hum. Mol. Genet.*, 27, 2466). This proof-of-principle study opens the way for studies aiming to transfer these technologies to the clinic.

NEUROBIOLOGY

Emanuele Buratti (TS)
Fabian Feiguin (TS)



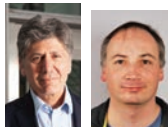
In Trieste the Molecular Pathology Group (Buratti) investigates aberrant pre-mRNA processing defects that lead to neurodegeneration. In particular, it studies the biological properties of TDP43, a nuclear factor involved in Amyotrophic Lateral Sclerosis (ALS) and Frontotemporal Lobar Degeneration (FTLD). The Neurobiology Group (Feiguin) uses the fruitfly, *Drosophila melanogaster*, as a model organism that has remarkable genetic conservation with humans, to study some of the most common neurological disorders, including Alzheimer's and motor neuron diseases.

Highlights in 2019

In 2019 several exciting discoveries were been obtained in ALS and FTLD pathologies. The Molecular Pathology and Neurobiology labs are collaborating on a project funded by the Italian ALS Association (ArisLA) on the identification of cellular transcripts whose expression is affected by changes in TDP-43 expression, but also by other RNA binding proteins that can rescue or worsen TDP-43 toxicity in flies (Appocher et al., 2017, *NAR*, 45:8026-8045). Knock-outs were constructed of these toxicity modifier factors in neuronal cell lines and transcriptomic approaches (RNAseq) identified key transcripts that are currently being validated. The Molecular Pathology lab has, for the first time, shown that phosphorylation of TDP-43 S375 residue can disrupt its intermolecular interactions (Newell et al., 2018, *Brain Pathol.* 29:397-413). A phospho-specific antibody was developed and observed to differentially stain pathological TDP-43 aggregates in the brain of FTLD patients. This result supports recent evidence pointing to the existence in patients of different morphological aggregates whose pathogenicity and importance for disease are still unknown. In 2019 the Molecular Pathology Group commenced investigation of a novel RNA binding protein, *RGNEF*, which has been hypothesized to represent a novel ALS gene. This research is being performed with several Canadian/American Groups and is supported by the Temerty Foundation (Canada).

CANCER

Lawrence Banks (TS)
Luiz Zerbini (CT)
Dimitar Efremov (TS)
Mike Myers (TS)
Arockiasamy Arulandu (ND)



Three Groups in Trieste, one in Cape Town, and one in New Delhi investigate the genetic and molecular mechanisms of cancer development. In Cape Town, the Cancer Genomics Group (Zerbini) develops novel therapeutics targeting various cellular proteins that are deregulated in cancer. The Protein Networks Group in Trieste (Myers) uses high-throughput mass spectrometry to perform proteomics studies to understand how protein complexes regulate normal and cancer cell behaviour, particularly in the process of protein modification. The Molecular Hematology Group in Trieste (Efremov) is interested in deciphering the intracellular signaling pathways that control the proliferation, differentiation and survival of normal and malignant B-lymphocytes. A particular focus is the study, in both patients' cells and animal models, of the mechanisms leading to the development of chronic lymphocytic leukemia (CLL). The Membrane Protein Biology Group in Delhi (Arulandu) strives to uncover the molecular mechanisms underlying the function of membrane proteins, focusing on chloride intracellular channels as potential novel anti-cancer targets. The Tumour Virology Group in Trieste (Banks) investigates the mechanisms by which Human Papillomaviruses (HPVs) infect cells and ultimately cause cervical cancer.

Highlights in 2019

The Hematology Group in Trieste made major advances in understanding the development of Diffuse Large B Cell Lymphomas (DLBCL) (Sasi et al., 2019 *Leukemia* 33; 2416-2428). In this study they found that 50% of DLBCLs have downregulated *SHP1*, which results in the constitutive activation of the B cell receptor pathway. This activation results in the resistance of these tumors to the chemotherapeutic agent venetoclax. Importantly, the Group demonstrated that targeting the activated BCR pathway with other inhibitors sensitizes these tumors to venetoclax. The Tumour Virology Laboratory identified how blocking

phosphorylation of the Human Papillomavirus (HPV) E7 oncoprotein offers an exciting prospect for novel forms of therapeutic intervention in cervical cancer and other HPV associated malignancies. (Basukala et al., 2019 PLoS Path). Inhibiting phosphorylation of E7 reduces cell proliferation and, most importantly, blocks invasive potential, suggesting that therapies targeting the kinase which phosphorylates E7 would reduce tumour invasion. The Cancer Genomics Group have explored the involvement and relevance of Axl in cancer in order to test its efficacy as a therapeutic target. The Group identified one compound (Paccez JP et al., Oncogenesis 8:14, 2019) having effects in tumor cell proliferation with no effect in normal cells with specificity for the Axl protein. This compound revealed to be safe and showed a synergistic effect with chemotherapeutic agents that current employed in the clinic and represents a new entry point for treatment.

3. MEDICAL BIOTECHNOLOGY

Applied research and product development in the field of biotechnology is central to the core mission of the ICGEB. This is in parallel with the growing international perception that biotechnology can offer practical and sustainable solutions for the diagnosis and treatment of human disease. Two Groups, (Trieste and New Delhi) have multiple interests in the biomedical field and are developing their research in close collaboration with industries in the ICGEB Member States.

BIOTHERAPEUTIC PRODUCTS

Nataša Skoko (TS)



The Biotechnology Development Unit (BDU) in Trieste (Skoko) focuses on the development of technologies for the production of biopharmaceuticals using three main expression systems: bacteria, yeast and mammalian cells. Techniques include the most comprehensive range of activities in bioprocessing such as upstream-downstream operations and quality control analysis following European Pharmacopoeia monographs. The BDU collaborates with pharmaceutical industries to transfer know-how to increase their capacity and reduce cost in ICGEB Member States.

Highlights in 2019

The BDU personnel have provided multiple training and technology transfers for the production of insulin and growth hormone to industry. The Unit is currently working on the development of production and quality control tests for the biosimilar Trastuzumab and has made a significant advance in identifying the miRNAs capable of enhancing production of biopharmaceuticals in CHO cells. The Unit has been working on a detailed project design of a new infrastructure dedicated to R&D bioprocesses in line with the principles of Good Laboratory/Good Manufacturing Practices. Such scientific support represents a significant incentive for the development of biosimilars both locally and internationally.

TRANSLATIONAL HEALTH

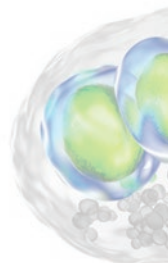
Navin Khanna (ND)
Ranjan Nanda (ND)



Understanding tuberculosis pathophysiology at case presentation and its alteration during therapeutic interventions is the key research target of the Translational Health Group (Nanda) in New Delhi. The team generates baseline data on microbiome dysbiosis, host genetics that might influence tuberculosis susceptibility or drug response and also elucidate pathogen diversity to discover new molecular targets for drug discovery. The Khanna Group continues investigations into Dengue, a mosquito-borne viral disease that is rapidly spreading globally, and is prevalent in more than 100 countries, with over 1 million new infections each day. Dengue infections result in massive economic losses, strained health services, morbidity and mortality, especially among children. The Dengue menace warrants an urgent need for a safe, affordable and efficacious vaccine, an antiviral, and point-of-care diagnostics.

Highlights in 2019

The Dengue vaccine technology developed by Dr. Khanna's team was licensed to Sun Pharma in 2016. Process scale-up has been conducted in the Sun Pharma affiliated Biotech company in Germany in 2019, and has been brought back to India for in-house development under the National Biopharma Mission, Government of India. A GMP facility of Sun Pharma is being established in Bangalore and efforts are being made to reach Phase 1 efficacy trials. The co-development of the world's first Botanical drug with Sun Pharma for the treatment of Dengue infection has entered Phase 1 clinical trial. Upon approval by the Indian drug controller, during the next Dengue season, up to 300 patients will be recruited and treatment will commence. The Nanda Group and clinical collaborators has identified a set of 192 host sputum proteins in tuberculosis patients, out of which a signature of 5 proteins could differentiate cases from non tuberculosis controls with an accuracy of 0.75 (Biswal et al., 2019, Sci Rep. 31;9(1):1036). Most importantly, a shift in vitamin D binding protein: DBP-antimicrobial peptide (AMP) axis in the lungs of tuberculosis patients favoring pathogen survival, is reported, which opens up avenues to find the contribution of DBP genetic polymorphisms to population level tuberculosis susceptibility.



4. INDUSTRIAL BIOTECHNOLOGY

The use of genetic engineering and other modern biological technologies has enormous potential for the production of clean and renewable energy from biological sources. Devising cost-effective processes to produce second-generation biofuels using microalgae, and the identification of novel enzymes effective against the cellulosic biomass are two examples of how energy can be extracted from biological sources. Biotechnology also offers a concrete promise for the development of more effective, sustainable agriculture in the ICGEB Member States.

BIOFUELS AND INDUSTRIAL BIOTECHNOLOGY

Syed Shams Yazdani (ND)

Naseem Gaur (ND)

Pavan Jutur (ND)

Shireesh Srivastava (ND)

Shashi Kumar Rhode (ND)

Dinesh Gupta (ND)

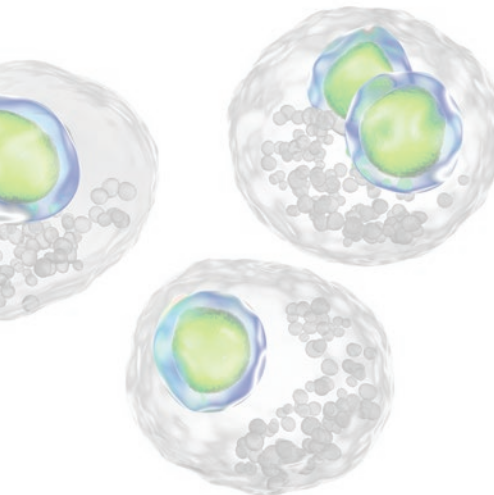
Giuliano Degrassi (Buenos Aires)



Six Groups at ICGB New Delhi develop technologies for the production of clean energy from biological sources. The goal of the Microbial Engineering Group (Yazdani) is to develop cost effective processes to produce second generation biofuels; the Group isolates novel enzymes (cellulases, xylanases) with higher specificity towards cellulosic biomass, and engineers fungi and bacteria with these enzymes that are capable of producing biofuels from this energy source. Current projects in the Yeast Biofuel Group (Gaur) aim to develop a cost effective lignocellulosic material based technology for fuels and chemical production. The Group is also developing robust microbial strains for the production of ethanol, fatty acid ethyl ester, xylitol, xylo-oligosaccharide and TAG from molasses and lignocellulosic biomass. The Group is focusing on scale-up studies for industrial use and advanced fuel and chemical production. Microalgae are the research focus of the Omics of Algae Group (Jutur), which studies the production of algal oils that serve as material for conversion to biofuels. The Group aims to reconstruct the metabolic pathways involved in the biosynthesis of triacylglycerols, essential for rendering algae-derived biofuels economically competitive. The Systems Biology for Biofuels Group (Srivastava) develops quantitative, genome-scale metabolic models of bacteria that could lead to increased biofuel production, and investigates marine cyanobacteria as factories to produce biofuel candidate molecules. The Metabolic Engineering Group (Kumar) develops various projects of industrial interest, working on a sustainable algal biofuels programme using synthetic biology and genome editing tools, and reducing carbon foot printing via engineering of carbon Concentration mechanism in marine algae. The Group is also working on artemisinin enhancement in *Artemisia annua* via chloroplast engineering and application of synthetic biology to produce artemisinin in edible plants for coherent malaria treatment (as reported in Mol Plant 2016). These activities are complemented by the Translational Bioinformatics Group (Gupta), which provides computational biology and artificial intelligence tools for the analysis of complex biological data, drug design and comparative genomics. The Industrial Biotechnology Group (Degrassi), located at the ICGB Outstation in Buenos Aires, Argentina, focuses on the development of biotechnological products and processes to be used in agriculture and industry. Current projects are specifically focused on the study of endophytic bacteria that have beneficial effects for crops.

Highlights in 2019

In a very extensive study involving *MetaExoProteomic* and *MetaTranscriptomic* approaches, the Microbial Engineering Group mined the complete repertoires of cellulases and xylanases present in the symbionts of rice yellow stem borer (Singh et al., *Biotechnol Biofuels*. 2019;12:265). The Group studied the critical features of a gut bacterium, *Paenibacillus polymyxa* that aided its survival in the gut of termite (Pasari et al., *Sci Rep*. 2019;9(1):6091). CRISPR/Cas9-mediated marker-free engineering of *Escherichia coli* was performed for *n*-butanol production from C5/C6 sugars (Abdelaal et al., *Ind Microbiol Biotechnol*. 2019;46(7):965-975). The Yeast Biofuel Group developed CRISPR/Cas9 based microbial modification tools for scarless genome engineering to produce fuels and chemicals (Kumari et al., 2019, *Methods Mol Biol*. 1995:161-171), and identified a robust yeast strain producing higher ethanol at 40°C (Pandey, A. K et al., 2019, *Biotechnol Biofuels*; 12:40). The Metabolic Engineering Group (Kumar), has shown that the co-culture of alga with endophytic fungus enhanced the algal biomass from 471.6 to 704 mg/L, and fatty acid methyl ester (FAME) dramatically (Bhatnagar et al., *Biotechnol Biofuels*, 2019; 12:176). Their cost effective algal harvesting technology reported reuse of culture medium without pH neutralization (Augustine et al., *Algal Research*, 2019; 39: 101437). They performed Life cycle assessment of *Chlorella* species producing biodiesel and remediating wastewater (Nawkarkar et al., *J Biosci*, 2019, 44:89). The Omics of Algae Group was involved in developing a new method for investigating the modulation of metabolites under high light in mixotrophic alga *Asteracys* sp. using a metabolic approach in collaboration with the Institute of Chemical Technology (ICT), Mumbai (Agarwal et al., 2019, *Algal Res*. 43,





101646). They also captured the metabolomic changes in oleaginous trebouxioiphycean alga *Parachlorella kessleri* when subjected to nutrient deprivation for enhanced biofuel production (Shaikh et al., 2019, *Biotechnol. Biofuels* 12, 182). The Systems Biology for Biofuels Group has identified a native marine cyanobacterium with fast growth, high amounts of glycogen and other attractive properties that can be developed for feedstock applications (Metabolites, In Press), and genetic engineering of another marine cyanobacterium to increase its growth and glycogen levels (*Biotechnol. Biofuels* 2020 <https://doi.org/10.1186/s13068-020-1656-8>). The Group published a genome-scale metabolic model (GSMM) of a methanotroph (PeerJ 2019 <https://peerj.com/articles/6685/>). This work was among the top 5 most-viewed articles in the *Synthetic Biology Journal*. The Group has also created a GSMM of the native marine cyanobacterium, which was used to identify the genetic engineering targets to produce several compounds of interest (Metabolites, In Press).

5. PLANT BIOLOGY AND BIOTECHNOLOGY

The demand for more effective and sustainable agriculture, able to cope with the exponential increase in the human population and the constraints imposed by current climate change, is growing in the ICGEB community. Genetic engineering of plants, development of eco-friendly biofertilisers, and other agricultural biotechnologies, together with molecular studies on the resistance of plants to biotic and abiotic stress, are among the most characteristic activities of the ICGEB New Delhi Component and the Bacteriology Group in Trieste (Venturi).

CROP IMPROVEMENT

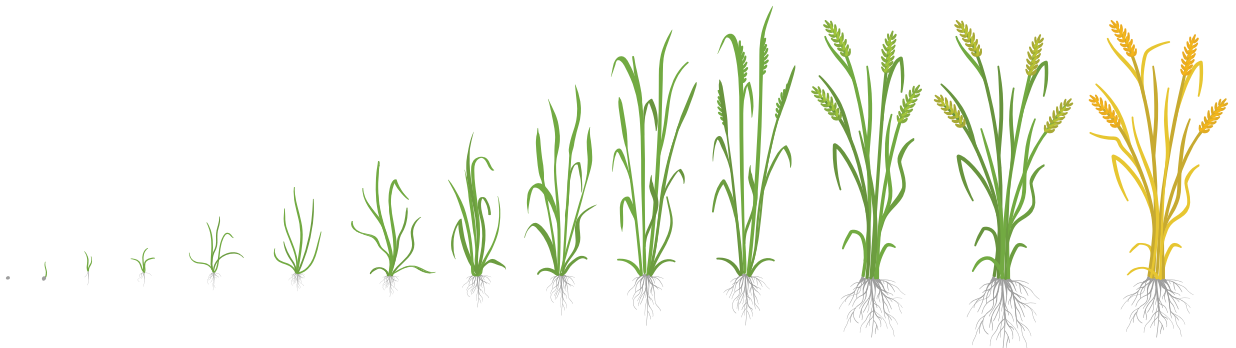
M.K. Reddy (ND)
Tanushri Kaul (ND)
S. Leelavathi (ND)
Vittorio Venturi (TS)



Three Research Groups in Delhi perform plant research to devise ways to improve food production and nutritional yield. The Crop Improvement Group (Reddy) modifies rice plants using CRISPR/Cas9 technology, improving rice agronomic traits such as the number of tillers and spikes. The Nutritional Improvement of Crops Group (Kaul) also uses state of the art CRISPR/Cas9 technology to: (i) improve the nutritional value of cereals, legumes and tomatoes; (ii) design non-selective herbicide-resistant rice plants for weed control, and (iii) identify genetic solutions to avoid premature ripening of fruits post-harvest. The Plant Transformation Group (Leelavathi) focuses on using chloroplast engineering tools for genetic improvement of rice and cotton. The Bacteriology Group in Trieste (Venturi) focuses on interkingdom and interspecies signaling between plants and plant-associated bacteria, as well as the composition and role of the microbiome in plant health.

Highlights in 2019

The Crop and Nutritional Improvement Groups in New Delhi are making very good progress in CRISPR/Cas9 technology of target loci for the generation of herbicide tolerant and nutritionally improved crops (*Front Plant Sci* 25:10,37, 2019; *Front Plant Sci* 10:1-17, 2019). Single-use herbicides often lead to the development of resistance within weed populations, and developing crops that are resistant to multiple herbicides offers huge advantages to farmers in weed management. The Bacteriology Group in Trieste has performed several rice microbiome studies in relation to bacterial diseases, has characterised beneficial plant-endophytic relationships (*Mol Plant Microbe Interact* 33 :349-363, 2020) and is collaborating with several private companies for the development of microbial inoculants.



BIOTIC AND ABIOTIC STRESS

Suresh Nair (ND)

Neeti Sanan-Mishra (ND)

Sneh Lata Singla-Pareek (ND)

Dennis Obonyo Ndolo (CT)



Three Groups in New Delhi are working to understand and improve adaptation of crop plants towards biotic and abiotic stresses for sustainable production of food grains. The Plant Insect Interaction Group (Nair) studies the interaction of the rice plant with its major insect pests with regard to the Asian rice gall midge and the Brown Planthopper, responsible for considerable yield loss in Asia and Africa. The Plant RNAi Biology Group (Sanan-Mishra) is interested in identifying the miRNA circuits regulating plant development and yield with respect to challenges imposed by increasing soil salinity, high temperature and virus infection. The Plant Stress Biology Group (Singla-Pareek) is involved in manipulating genes identified by the Group towards developing solutions to increase plant yield, which can also be sustained under conditions of water deficit (drought) and salinity. The Biopesticides Group (Ndolo) supports the discovery, development, formulation, commercialisation and use of biopesticides. This is achieved through a programmatic approach, which involves strategic engagement with relevant stakeholders to address the challenges confronting research and development of biopesticide products.

Highlights 2019

The Groups investigating plant response to biotic and abiotic stresses continued to make outstanding headway during 2019. The Plant RNAi Biology Group made an important discovery identifying the rice miRNA regulatory circuits and the associated pathways that are regulated in response to salinity and high temperature stress (Goel et al., 2019, *Funct. Integr. Genomics*, 19, 867). This study revealed the involvement of common miRNA regulatory nodes in response to two different abiotic stresses, thereby broadening our understanding of the mechanisms by which plants cope with extreme environmental cues. The Plant Stress Biology Group has identified several target genes in rice, which may be significant in closing the yield gap developed due to environmental changes (Nutan et al., 2019, *J. Exp. Bot.*). In a case study with the fall armyworm (*Spodoptera frugiperda*), the Biopesticides Group identified various research gaps which, if addressed, could significantly enhance the potential for utilisation of biopesticides for control of this invasive pest (Ndolo et al., 2019, *Outlooks Pest Manag.* 30,6).

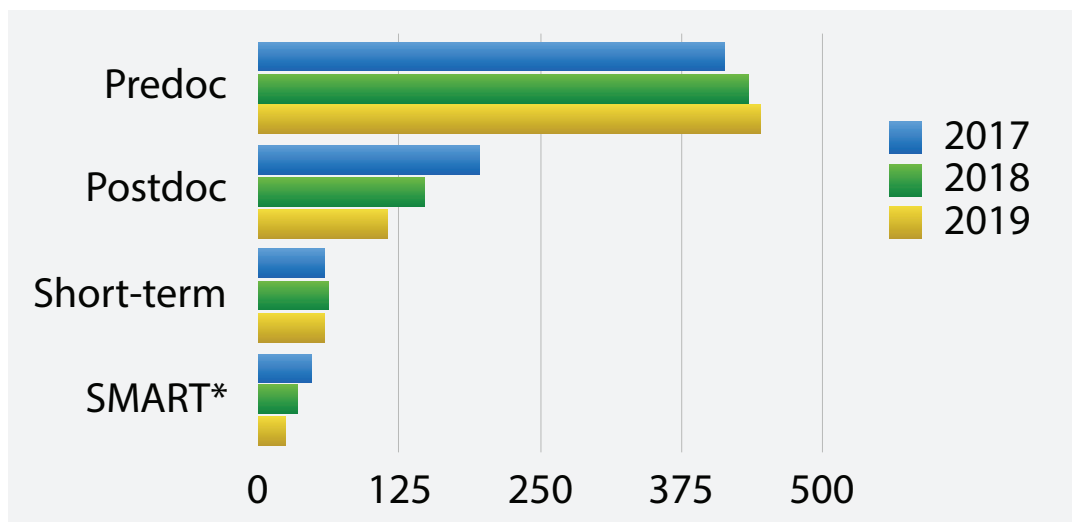


Each year, the ICGEB awards a number of Fellowships to young scientists from Member States to undertake research in its laboratories. These Fellowships are provided to pursue studies culminating in the award of a PhD degree (**Predoc**), to pursue research at the postdoctoral level (**Postdoc**), or to perform short periods of research (**Short-term Fellowships**).

The programme is named in memory of Prof. **Arturo Falaschi**, the mind and driving force of the Centre at its inception. During the period 2010-2019, the ICGEB has funded a total of 21,696.92 Fellowship/months. In 2019, 40 Arturo Falaschi Fellowships and 30 Fellowships on External funds were awarded to promising young scientists who were nationals of ICGEB Member States. Figure 3 shows the distribution of the Fellowships awarded and the type of support provided.

For PhD studies, the ICGEB in Trieste collaborates with top universities such as the International

FIGURE 3



Number of Fellowship/months funded per year in the period 2017-2019

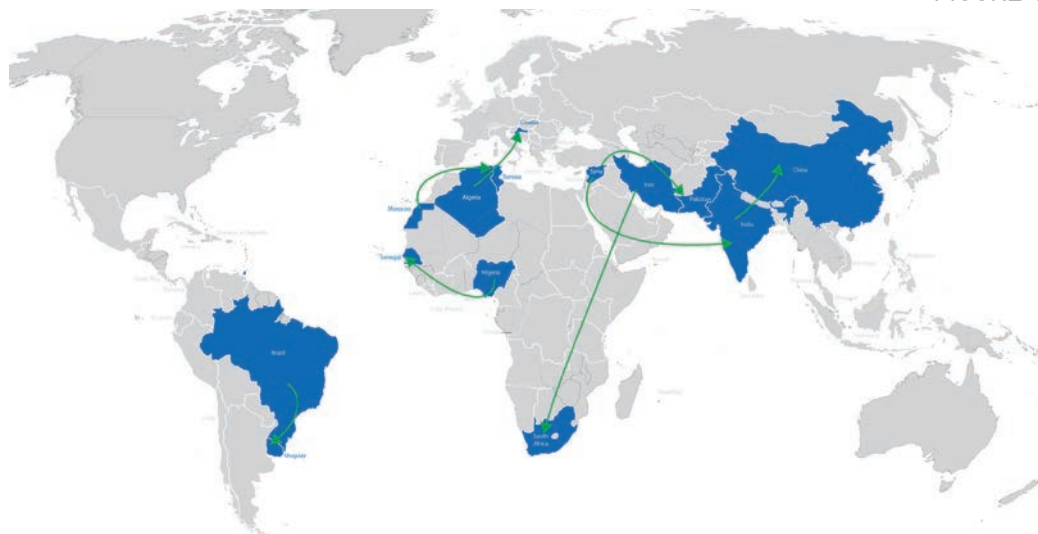
School for Advanced Studies (SISSA) in Trieste, the University of Trento, University of Ferrara and the Open University UK. In New Delhi and Cape Town, the PhD Courses are conducted in collaboration with the Jawaharlal Nehru University and the University of Cape Town, respectively.

During 2019, a total of 243 Fellows performed research in the ICGEB laboratories. Of these, 88 were funded under the Arturo Falaschi Fellowship Programme and an additional 155 were funded on External grants for specific projects run by the ICGEB laboratories.

ICGEB is committed to attaining and promoting gender equality in all its activities, and this is exemplified in the Fellowship Programme: in 2019, of 243 Fellows in the three Components, 59% were women.

The ICGEB SMART Fellowships Programme (Scientific Mobility for Advanced Research Training) has been running for 6 years, to promote the mobility of researchers between ICGEB Member States as a way of fostering South-South cooperation. This programme has been particularly popular

FIGURE 4



Map showing South-South mobility of SMART Fellowships awarded and ongoing in 2019

and, from feedback received from the fellows and the host supervisors, shows it has proven to be extremely useful and beneficial for both parties. In 2019 six new SMART fellowships were awarded: 3 at the PhD level and 3 at the Postdoc level, specifically, from Brazil to Uruguay, from Algeria to Croatia, from Syria to Pakistan, from India to China, from Syria to India and from Morocco to Tunisia. Of these four were women and 2 men (Figure 4).

Laboratories at ICGEB Trieste, ITALY



TABLE 1

Countries of origin and No. of Fellows at the ICGEB laboratories in 2019	
Africa (19+10*)	Burkina Faso (1*), Burundi (1), Cameroon (2), Kenya (3), Morocco (1), Nigeria (10), South Africa (9*), Tanzania (1), Zimbabwe (1)
North Africa (6)	Egypt (6)
Asia (19+119*)	Bangladesh (5), China (1), India (8+119*), Malaysia (2), Nepal (1), Pakistan (1), Viet Nam (1)
South America (11+2*)	Argentina (2+2*), Brazil (4), Chile (1), Peru (2), Uruguay (1), Venezuela (1)
Central America & Caribbean (3)	Cuba (2), Mexico (1)
Europe (27+24*)	Bulgaria (1+1*), Croatia (2+1*), Germany (1*), Italy (18+18*), Poland (1+2*), Serbia (1+1*), Slovenia (4)
Middle East (3)	Iran (1), Syria (1), Turkey (1)

In 2019, 243 Fellows were on board at the ICGEB Components (those on External Funds are indicated by an asterisk*)

MEETINGS AND COURSES

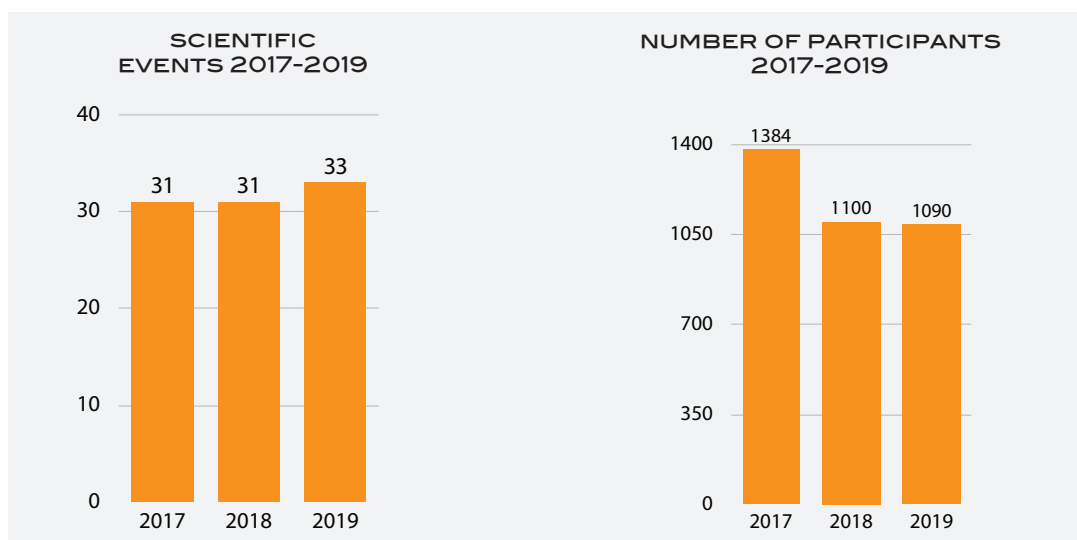
2019

Every year the Centre funds and organises **over 30 scientific events** on cutting-edge topics in the field of Life Sciences, to facilitate interaction between internationally renowned scientists and young researchers from Member States. The Programme offers **6 possibilities** for ICGEB support for scientific events: 1) Meetings held in ICGEB and co-organised by one or more ICGEB scientists; 2) Workshops co-sponsored by local organising institutes in any of the Member States or at ICGEB; 3) Courses, providing theoretical and/or practical training, in any of the Member States or at ICGEB; 4) the “Future of Science” programme that supports scientific events on current, hot scientific topics, with open communication to media and the public, and 5) Seeds for Science: small meetings aimed at building networks for future research collaborations and 6) Sponsorship provided to international scientific events relevant to the ICGEB mandate.

Over the last three years, the ICGEB has organised or sponsored a total of **95 scientific events** with the participation of over 3,500 researchers. In 2019, the ICGEB Meetings & Courses Programme included the organisation of 33 ICGEB scientific events and participation by **over 1,000 international scientists**, approximately 400 of whom received financial support from the ICGEB (Figure 5).

Meetings and Courses Highlights

- Participation of early career scientists from Bangladesh, Egypt, India, Jordan, Nigeria, Pakistan and Turkey at the Conference organised by an ICGEB Alumnus at NYU Abu Dhabi, UAE thanks to ICGEB grant award
- The 2nd edition of the course on UltraSound imaging in cardiac and vascular medicine in Trieste, while the 4th ICGEB FluoMicro Course was jointly organised at ICGEB New Delhi by Trieste and Delhi scientists; and a new course on Flow Cytometry was implemented at Headquarters in Trieste, Italy
- All courses continued to offer a strong practical component thanks to the collaboration of different external companies, which provided instruments and technical experts in support of a very intensive programme of activities
- ICGEB-IMBT Workshop in Hanoi, Vietnam with the contribution of the Italian Ministry for Foreign Affairs in the framework of the “Progetti Grande Rilevanza” Italy-Vietnam. Attended by scientists from many countries of the

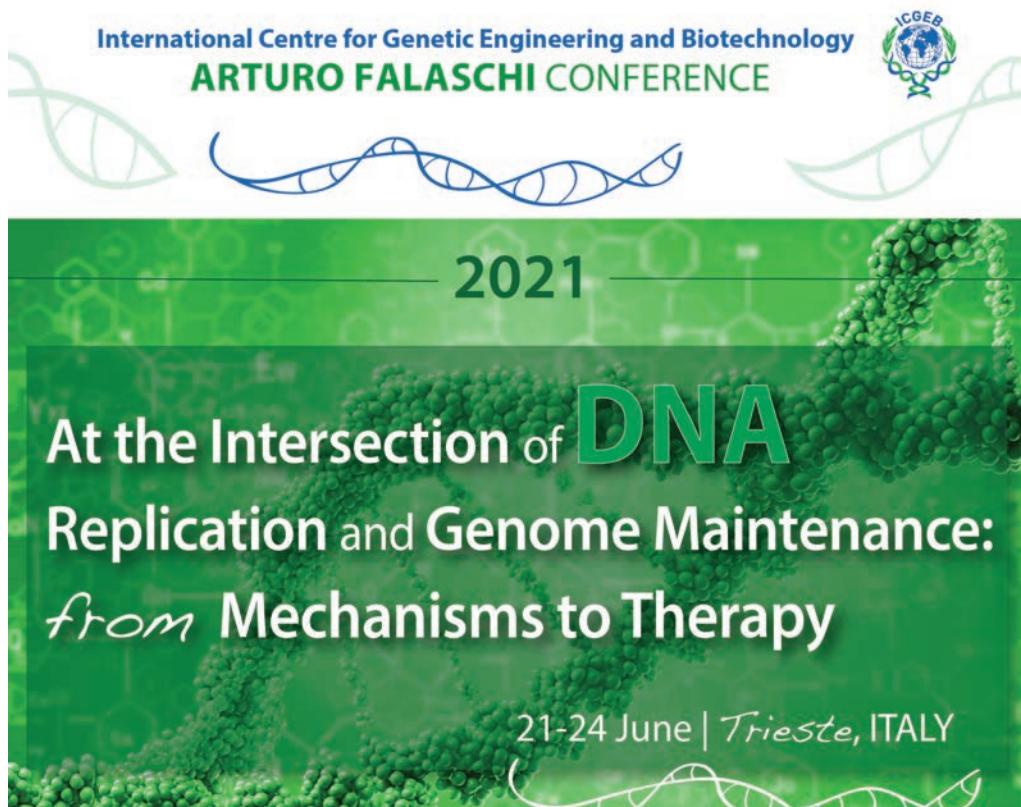


Number of Meetings and Courses 2017-2019 and number of participants per year

FIGURE 5

region, it generated new opportunities for networking and collaboration.

- A specific ICGEB Session on “Management of oral mucositis in oncological patients” within the Regional Education Meeting on Supportive Care in Cancer Patients in Belgrade, Serbia. In addition to direct financial support and ICGEB expertise, the session offered an opportunity to share the experience of the project LaserNET, led by ICGEB.
- ICGEB Keynote Lecture delivered by Nobel Laureate Eris Wieschaus at the LASDB Meeting held in Buenos Aires, also attended by 22 students and young scientists from Latin America through ICGEB support
- The ICGEB-TRAIN Workshop on High Content Imaging and Data Science for Virtual Screening and Drug Discovery in Bled, Slovenia proved to be a wonderful opportunity for the TRAIN partners to be exposed to excellent science and start new collaborations. The Workshop was co-funded by Cooperation Programme INTERREG VA Italia-Slovenia 2014-2020 project TRAIN - Big data and disease models: a cross-border platform for validated biotech industry kits
- The 50th Anniversary of the DNATV Meeting was celebrated in Trieste in July, through the organisation of an Arturo Falaschi Conference.
- On the occasion of the Editorial Board meeting of The FEBS Journal, which comprises scientific leaders spanning a wide range of topics and disciplines within the Life Sciences, an ICGEB-FEBS Journal Symposium was organised at Headquarters with the aim to provide a general overview that may be of value to Ph.D students and early career researchers seeking guidance for future research directions and priorities.
- The Workshop on Genome Editing Applications and Beyond, jointly organised by the ICGEB and the JRC in Trieste in November intended to provide a learning platform and a forum for discussion on genome editing and related technologies, with particular focus on scientific and regulatory considerations. The event provided consultancy on the regulatory, ethical and societal challenges driven by the technology and its applications; as well as guidance to scientists working in their Member States by providing practical skills and appropriate contacts to facilitate the access to this technology.



The poster features a green background with a DNA double helix and a molecular structure. At the top, it reads "International Centre for Genetic Engineering and Biotechnology" in blue and "ARTURO FALASCHI CONFERENCE" in green. The ICGEB logo is on the right. The year "2021" is centered. The main title is "At the Intersection of DNA Replication and Genome Maintenance: from Mechanisms to Therapy". The dates and location are "21-24 June | Trieste, ITALY".

International Centre for Genetic Engineering and Biotechnology
ARTURO FALASCHI CONFERENCE

2021

At the Intersection of **DNA**
Replication and Genome Maintenance:
from Mechanisms to Therapy

21-24 June | Trieste, ITALY

Originally scheduled to take place in 2020, the 6th Edition of the Arturo Falaschi Conference on DNA Replication will be taking place in June 2021

RESEARCH GRANTS

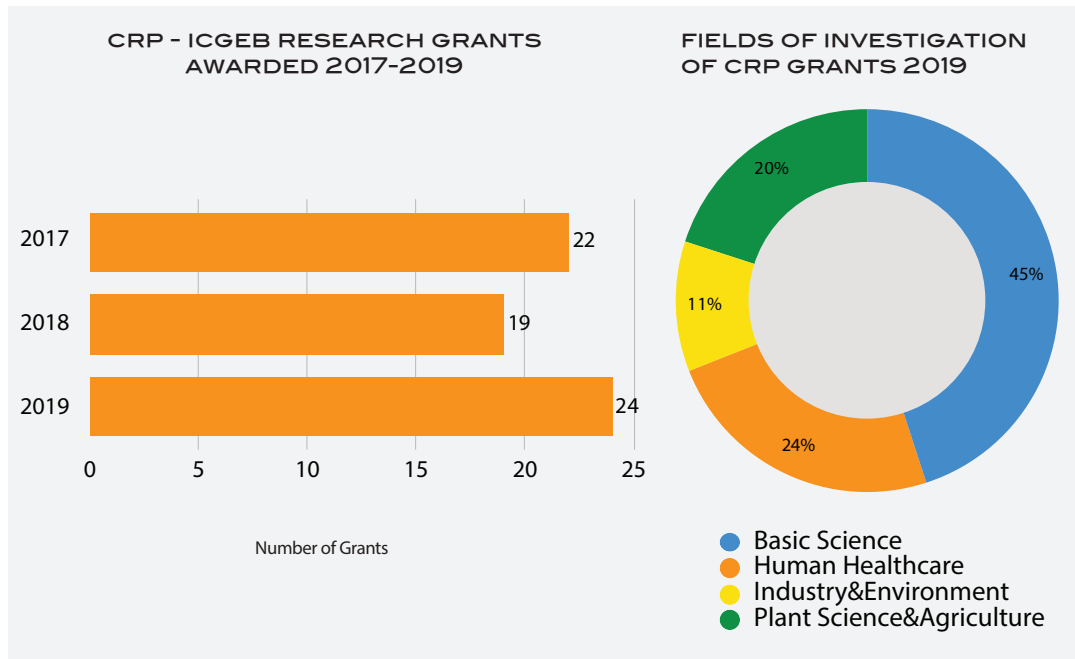
2019

Funding opportunities for Member State laboratories are made available through the ICGEB Research Grants - **Collaborative Research Programme (CRP)**, a dedicated source of funding aimed at **financing projects** addressing original scientific problems of particular relevance for the host country but which are also of regional importance. Established in 1988, the programme aims to stimulate collaborative research in Member States with the ICGEB laboratories, to promote **training of young scientists** and to facilitate the creation of appropriate research facilities. The programme provides support for research projects in basic science, human healthcare, industrial and agricultural biotechnology and bioenergy. To date, 549 projects have been funded for a global financial commitment of over €22 million. Figure 6 reports the number of grants awarded since 2017 and their fields of investigation.

The selection procedure for the funding of Research Grants, as with all ICGEB Programmes, involves a transparent process of peer-review. Liaison Officers in Member States make a preliminary selection of a maximum of three standard grants, plus two Early Career Return Grants, on the basis of merit and potential interest to the country. These applications are first reviewed by triage by a Committee of investigators from the three ICGEB Components; those passing the selection

In 2019, ICGEB made big efforts to implement and develop the awareness workshop in our Member States (Jordan, Kenya, Kuwait, Montenegro, Romania, Sri Lanka, and Vietnam) providing information and advice to young students on how to apply for different ICGEB activities (Grants, Fellowships, Meetings and Courses). Thanks to our Appointed Governors and Scientific Liaison Officers in the hosting country for the support.

FIGURE 6

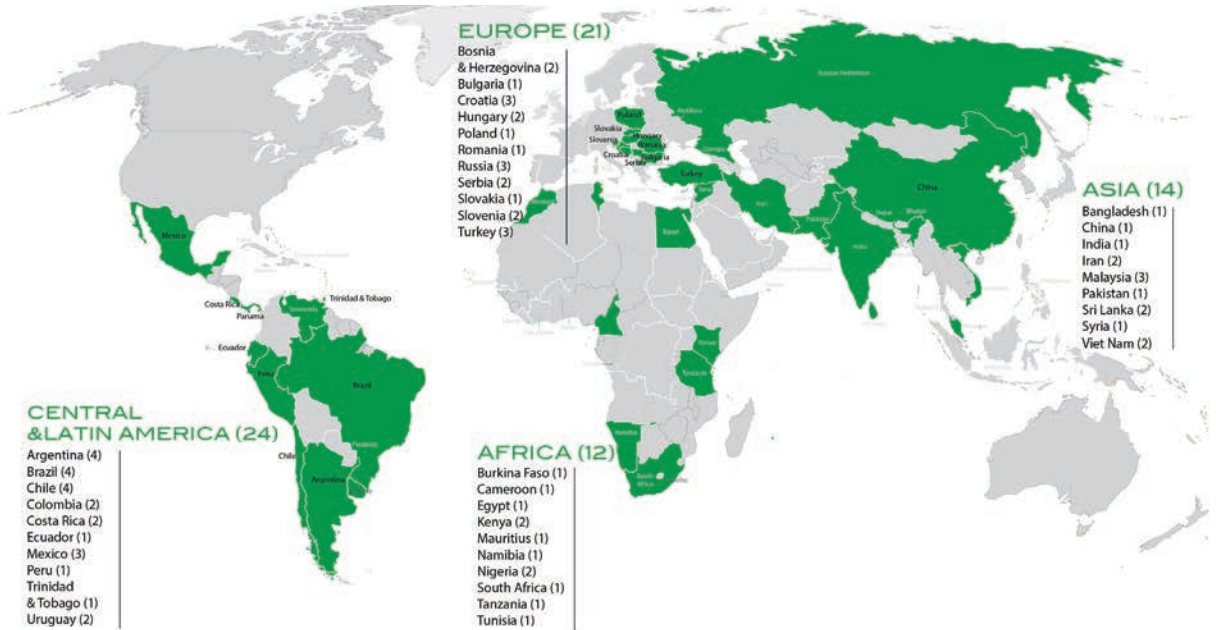


Number of CRP - Research Grants awarded 2017-2019 and fields of investigation

are sent out for peer-review by international experts in the specific field of the application.

In 2019, a total of 512 grant applications were submitted to the national Liaison Officers, of which 172 were forwarded to the ICGEB for consideration. From these, 108 passed to the second round of international peer-review, resulting in funding being awarded to 24 projects. A total of 71 CRP Research Grant-funded projects were ongoing in ICGEB Member States in 2019 (Figure 7).

FIGURE 7
Countries with ongoing Projects funded by the CRP - Research Grant Programme (71 projects in 39 countries)



ICGEB BUILDING CAREERS



PhD student in the Dr. V. Venturi lab in Trieste, 2006-10, **Dr. Zulma Rocio Suarez-Moreno** published 4 first, and 2 co-author papers in high-impact journals on quorum sensing signals and bacterial plant disease during this time. Following postdoc studies at the University of Medicine and Dentistry at New Jersey, she returned to Colombia as Research Associate at the Biotech Institute, Universidad Nacional in collaboration with Biocultivos S.A. In 2014 she joined Universidad de La Sabana as Assistant Professor and moved to a Biotech Company. At present she is Director of R&D at Empresa Colombiana de Productos Veterinarios VECOL S.A., Bogota.

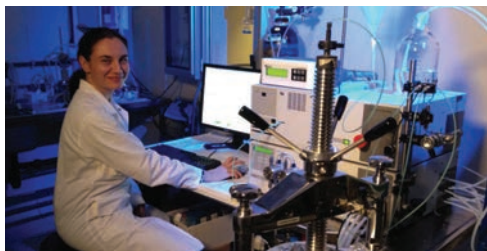
"ICGEB had an enormous impact on my career; it provided an international environment rich in experimental skills and ideas, training in leadership and diplomacy of science through life testimonials of young scientists and experienced researchers. My collaborations have developed through the ICGEB network, following the rules of respect and excellence learned in Trieste."



Dr. Bamidelesoji (Soji) Oderinde from the WHO Polio reference Laboratory in Maiduguri, Nigeria visited the Molecular Virology lab for three months as Short-term fellow. Senior lecturer at the local University in Maiduguri, Dr. Oderinde is collaborating with Prof. Marycelin Baba, Department of Medical Laboratory Science, Maiduguri, to expand the activities of the laboratory towards arboviral infections that are not, at present, diagnosed. In fact, feverish patients are often given antimalarials or antibiotics without proper testing resulting in ineffective treatments and wasted resources. Through the collaboration with Dr. A. Marcello and the Molecular Virology lab in Trieste, testing for arboviruses has been set up, and thanks to a CRP Grant the Nigerian team was able to acquire necessary instrumentation and diagnostic kits, including some serology tests produced at ICGEB.

Transferring technology to industry in Member States is one of the statutory goals of the ICGEB. In 2019, the Biotechnology Development Unit (BDU) finalised 2 agreements for the transfer of know-how in the technologies developed by the Centre. One involved technologies for the production of insulin and long-lasting insulins with an industrial partner based in Bangladesh, another related to the technology for the production of growth hormone has been signed with a company based in Moldova. During the year, the BDU also hosted scientists from a company based in Italy, in the **Region FVG**, to perform a period of training. At the time of writing, new Technology Transfer (TT) and collaborations are being explored with partners based in **India, Cuba and South Africa**.

The pillar of a successful TT is the training of scientific and research personnel. Training is provided in dedicated non-GMP facilities, which have been specifically developed for this purpose and are continually upgraded. Training is conducted by dedicated scientific experts skilled in developing high quality biosimilar active pharmaceutical products (API), verified for quality



Dr. Skoko heads the Biotechnology Development Unit and Biosimilars Technology Transfer at ICGEB

following internationally recognised scientific guidelines such as the European Pharmacopoeia Monographs. In addition, Dr. Natasa Skoko, Head of the BDU, is extremely active in promoting the R&D activities in the field of biosimilars and participated in the BioAfrica Convention in Durban (where she also carried out a workshop on Biosimilars); in the Ambrosetti Summit “Southern Africa Europe CEO Dialogue”, and in the Round Table “Africa’s Good Health” held on occasion of the Diplomacy Festival, in Rome.

R&D collaborations with industry

During 2019, the **Mouse Molecular Genetics Lab** continued research collaboration with a US based company to develop a novel AAV gene therapy for Ornithine Transcarbamylase Deficiency (OTC).

The **Bacteriology Lab** collaborates with companies to identify a set of bacterial endophytes that can work as plant fertilisers or growth promoters. In the context of an Interreg Italy-Slovenia Project, the laboratory has identified bacteria that help control one of the major diseases affecting grape cultivations.

The **Industrial Biotechnology Lab**, Buenos Aires, is active in research on plant bacterial endophytes and has entered into 2 new agreements with companies active in this field, one in **Serbia** and one in **Italy**.

The **Cytokines and Disease Lab** in Cape Town is completing collaboration with a leading pharma company on a project aimed at the assessment of anti-fibrotic candidate compounds during chronic murine schistosomiasis induced by *Schistosoma mansoni*, the leading cause of schistosomiasis, which is classified as a neglected tropical disease.

The **Metabolic Engineering Lab** in New Delhi signed an agreement with a leading global steel company, aimed at bioremediation of wastewaters using ICGEB in-house technology to develop genetically modified algae that will sequester more carbon and produce biofuel. This collaboration

aims to reduce carbon emission in cleaning waste water from steel manufacturing.

In New Delhi, the work led by the **Translational Health Lab** in collaboration with Sun Pharmaceuticals has progressed for the co-development of the world's first Botanical Drug for the treatment of **Dengue infection**. In December 2019, the Phase 1 clinical trial was initiated to identify the maximum dose that is safe in humans. Upon approval of the drug for human use by the Indian drug controller, up to 300 Dengue patients will be recruited and the treatment of patients will commence during the next Dengue season. Results on both safety and efficacy trials are expected in two years.

The SunPharma licensed Dengue vaccine technology has been scaled-up in the SunPharma affiliated Biotech company in Germany, and has been brought back to India for in-house development under the under the Government-led National Biopharma Mission, Government of India. Currently, the downstream process for vaccine development is being set up in the country. A GMP facility of SunPharma is being established in Bangalore and efforts are underway to get to Phase 1 trials.



TECHNOLOGY TRANSFER HIGHLIGHT

The **Mouse Molecular Genetics Lab** has developed data for the first ever gene therapy clinical trial for Crigler Najjar Syndrome. Within this trial, supported by an EC funded project, the first 3 patients have been treated. For its world renowned expertise in Crigler Najjar, the lab has been contacted by another US Company and will start a collaboration in 2020.



The greenhouse at ICGEB New Delhi, India

OTHER INSTITUTIONAL ACTIVITIES

2019

The ICGEB cooperates with Member States and non-member States and a number of other partners operating within the **United Nations System**, other International Organizations, Foundations, academia, research and funding institutions, and the private sector to promote sustainable development through scientific research, training and technology transfer.



Left: OWSD visit in Trieste, Italy



Right (from R-L): Dr. V. Venturi and Ms. M. Maculan together with Ambassador Charles Murigande, Rwanda, and Prof. Murenzi, Director of TWAS, at ICGEB Headquarters

With regards to partnership with Multilateral Organizations, ICGEB has improved its engagement with the UN System, by participating and contributing to the debate on Science and Development in the context of the **UN Agenda 2030**. In particular, ICGEB is cooperating within the auspices of the Technology Facilitation Mechanism (TFM), based on a multi-stakeholder collaboration between Member States, civil society, private sector, scientific community, United Nations entities, and other stakeholders. The TFM is composed of the United Nations Interagency Task Team on Science, Technology and Innovation (STI) for the SDGs, which ICGEB joined in 2018, and the collaborative Multi-Stakeholder Forum on STI. This partnership ensures that the ICGEB promotes coordination, coherence, and cooperation with the UN System on STI-related matters, increasing synergy and efficiency, in particular to enhance capacity-building initiatives. In this context ICGEB has joined the Gender and STI Group and is appreciated for the initiatives that it has taken forward to advance the participation and advancement of women scientists throughout its constituency.

Further, ICGEB is developing a framework of cooperation with the United Nations Office of South-South Cooperation (UNOSSC), aimed at strengthening each other's added value in promoting scientific cooperation between countries in the Global South. In addition, the ICGEB actively joined the discussion on the promotion of the peaceful development and use of biotechnology, and delivered the keynote address at the Global Forum on Scientific Advances important to the Biological Weapons Convention (BWC), held at the margins at the Meeting of the States Parties to the BWC in the United Nations in Geneva. ICGEB research on infectious diseases and capacity building in member countries in diagnostics and surveillance (e.g. the development of point of care devices for the detection of pathogens, considered as a first line containment for epidemic threats) are of interest to the States Parties to the Convention.



Ms. M. Maculan at the Festival della Diplomazia in Rome

ICGEB was fully involved in the narrative on science diplomacy and how the intrinsic soft power of science can be instrumental to peace and wellbeing. It presented, amongst others, in several panels of "**Festival della Diplomazia**", promoted by the Italian **Ministry of Foreign Affairs** and in the Workshop on Political Diplomacy for Scientists organized by IAP-TWAS-OPCW.



Women in Science at ICGEB

ICGEB consolidated its partnership with the Organization for **Women in Science** for the Developing World (OWSD), a Programme of UNESCO. ICGEB hosted the visit of the new cohort of **OWSD** Early Career Fellows and facilitated part of the Early Career Fellowship Regional Workshop in Dar es Salaam, focusing on the role of Technology Transfer offices, the management of IPRs and on opportunities for Research Funding.

ICGEB is continuing the valuable cooperation with the Istituto Italo Latino Americano (IILA) and in 2019 a joint project for extramural programs for Latin American Countries was jointly prepared. Moreover, new partnerships are developing with the **Human Technopole**, and the International Vaccine Institute.

ICGEB presented in the **BRICS** STI Framework Programme (BRICS STI FP), which aims to support excellent research on priority areas that can best be addressed by a multinational approach. BRICS cooperation is aimed at complementing and strengthening existing bilateral and multilateral relations among member countries. Biotechnology and Biomedicine, including Human Health and Neurosciences is one of such priority areas of cooperation, and falls within the ICGEB mandate. With laboratories in India and South Africa, the establishment of the **In-China Fellowship Programme** and **Regional Research Center at China Medical City in Taizhou**, and having strong ties with Russia and Brazil, the ICGEB is in the best position to strengthen existing bilateral relations within its multilateral umbrella, by offering technical advice and expertise in defining priority areas for development and cooperation, and ultimately for coordinating a joint project application.



In-China Fellowships cal 2020

During 2019, several non-Member countries were approached with the aim of eliciting the interest of Governments and the respective scientific communities, in the activities implemented by the ICGEB, with a view to their becoming potential new members of the Organisation.

Operating in the sensitive area of genetic manipulation, the ICGEB has a natural interest in the field of **bioethics**. The Centre is one of the founding members of the United Nations Inter-Agency Committee on Bioethics (**UNIACB**), established in 2003 and approved by the Secretary General of the United Nations. Among the areas covered, epidemics, genetic and prenatal testing, big data, aging, and genome editing are of particular interest for ICGEB. In 2019, the ICGEB organised and hosted a Webinar on Genome Editing and Artificial Intelligence. ICGEB is also continuing to lead the project for the consensus document on the scientific, juridical and ethical impact of novel technologies based on precise gene editing (in particular, the CRISPR/Cas9-based technology) on medical and agricultural applications and on society at large.

New Delhi, India

Trieste, Italy

ICGEB organises every year the **In-House Symposium** in Delhi (October) and the **ICGEB Annual Symposium** in Trieste (June). This event brings together Scientists from the 3 Components, showing synergy between laboratories and research.



The Centre represents a scientific reference point for Parties that have ratified the Convention on Biological Diversity (CBD) and, in particular, the regulatory issues arising from products of emerging biotechnologies.



Wendy Craig
(TS)

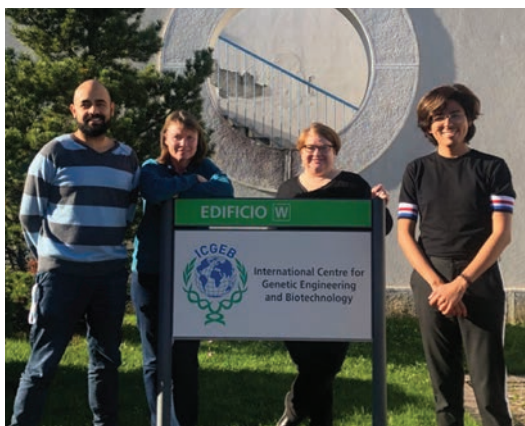
The Regulatory Science Group (formerly the Biosafety Group), led by Wendy Craig, is financially sustained through contributions from: the Bill&Melinda Gates Foundation for a project in sub-Saharan Africa; the Secretariat of the CBD to provide training to key regions of the developing world, and; a Global Environment Facility and United Nations Environment (UNEP-GEF)-funded project for Panama. Activities focus on providing direct support in the establishment and enhancement of national biosafety regulatory frameworks and administrative and technical offices, through the drafting of legislation, regulations and guidance documents, and providing in-country training in the execution of essential procedures. Complementing this work is the adoption of specially created online eLearning biosafety modules (<https://showcase-icgeb.elearning.it/index.html>) by African regulatory offices/National Competent Authorities (NCAs) to become autonomous in addressing their staff training needs.

Highlights in 2019

Donors and collaborators have recognised that activities of the Group continue to enhance the technical expertise of regulatory officers and experts in the developing world, with the mentored training fora and eLearning portfolio drawing particular attention. The emergence of new biotechnologies, especially gene drives, genome editing and RNAi technologies, that result in a broader range of applications and which, by extension, help governments meet a broader range of policy goals, has also resulted in increased requests for support.

The Group is therefore expanding the type of assistance it provides, for example, to include the exploration and refinement of the regulatory arenas that derived products will fall under, and to develop specific risk assessment approaches. These activities have underpinned the need for the Group to extend its mandate beyond conventional genetically modified organisms, and which is now reflected in the recent Group name change.

The Regulatory Science Group in Trieste, ITALY



OUR PARTNERS

2019

The ICGEB works actively to partner with other Organisations and academic institutions to fulfil its mission to advance progress towards the attainment of the sustainable development agenda through the development of biotechnology.



OUTREACH

2019

The ICGEB Communications and Outreach Office works to promote the **visibility** of the Organisation and align its strategy and structure with a recognisable brand. It operates on **multiple platforms**, including the Website, digital, social and other **media**, event promotion and **publications**, and compiles the analytical data of the Centre, the Governance documents, as well as online content and public information.

The new ICGEB Website was re-designed and launched in early 2019 and remains a major public information tool, attracting, on average, half a million views each month. The site includes a portal for on-line registration for participation in Meetings and Courses, and for applications for Fellowship Programmes. It is undergoing further development to include a donation structure, an **Alumni portal**, and sections dedicated to South-South and Women in Science activities.

This year the **ICGEB electronic Newsletter** was also launched across our network of 30,000 subscribers. The eNews includes science highlights, calls for applications, vacancies, testimonials and features on our Member States. The first 3 issues focused on the ICGEB Host Countries, and included articles written by the ICGEB Governor for Italy and the Secretary of DBT, Government of India.

The ICGEB is active on **five social media platforms**: Facebook, Twitter, Instagram, Linked-In and YouTube.



17,500 Followers (+ 20% a year)
most popular among the
25-34 age-group



7500 Followers
100,000 impressions a month



>1250 followers
>500 posts



Over 6500 followers
up one third since 2019
(+30% a year)
ICGEB Alumni Group
with over 400 members



1.33k subscribers
80,000 access a year
640 movies-55 topics
Health & Medicine and Science
Top views in USA (> 50%), Italy, India, UK
Germany, Japan, Australia and Canada



100k Viewers
640 movies
55 topics
Life Science



Ms. Suzanne Kerbavcic (R) ICGEB Head of Communications & Outreach meeting OWSD Postdocs from Latin America, at APANAC Panama National Congress of Science and Technology

The activities of the office increase engagement in science, build our network and **improve relations with media** and with other scientific and academic institutions and agencies. It promotes visibility and recognition of the ICGEB as a coherent, dynamic and relevant Organisation. It produces in-house publications to showcase our activities, facilities, projects and operations, in line with the **Sustainable Development Goals**.



Our team prepares proposals for **fundraising initiatives** and public engagement, and runs Open Days, school visits and programmes for school children. Researchers and students are encouraged to attend training workshops in best practices in science communication, and to participate in Science Fairs. Manu Prakash, the founder of **Foldscope** visited Cape Town in March 2020, requesting ICGEB Cape Town to

participate in a Foldscope Workshop, highlighting the impact that the South African Component has made in this area. ICGEB Cape Town is also organising the first international edition of ICGEB’s communication model “**Science & the City**”, a public conference series with an international panel, entitled: “Biosimilars: the benefit for Africa”, to be held during the EU-funded **STARBIOS2** Workshop “The African and European experiences in Responsible Research and Open Science in Health & Biosciences”.

Multimedia and knowledge transfer activities include **webinars, live streaming** and **podcasts**, which now number **over 640 movies**, covering more than **55 topics** in the Life Sciences, available in open source across three platforms and reaching a world-wide audience of 100k viewers each year.

The ICGEB Outreach office runs the **International Seminar Programme** in Trieste, with, on average, 45 speakers each year. To date, well over 700 invited speakers, who are eminent, international scientific experts in their fields, have participated in the programme. Seminars are also regularly hosted at ICGEB New Delhi and in Cape Town and podcast facilities are also being implemented in these Components.

To promote advocacy and fundraising, the office is working to consolidate the **ICGEB Alumni Association** and strengthen its ties with the 400 alumni active in all fields of science around the globe.



ICGEB Trieste

Dr. Om Basukala, Tumour Virology Lab, one of the students who successfully defended his PhD with the Open University in 2019.



ICGEB Cape Town

At **South Africa National Science Week**, presenting science-based activities during the country-wide celebration of science, and drawing huge crowds at **Foldscope** workshop events, which have since burgeoned into a programme with local high schools.



ICGEB New Delhi

Gained considerable scientific recognition, with Dr. **Navin Khanna**, Translational Health Lab, receiving the “**Padma Shri Award**” for distinguished service.

The Financial Statements of the ICGB are prepared in accordance with International Public Sector Accounting Standards (IPSAS). The overall ICGB budget is composed of the unrestricted **contributions from Member States** (representing the Core Budget of the Organisation) and of **External Funds**, consisting of grants and other forms of contributions from third parties for the execution of specific research projects or activities. For the period 2017-2019, the External Auditor of the Centre is the President of the Corte dei Conti (Court of Auditors) of the Republic of Italy. The Board of Governors approves the budget of the Centre at its annual session.

REVENUES

Member States participate in the financing of the Centre through **annual assessed contributions**, which are calculated as a proportion of each individual State's contribution to the regular budget of the United Nations. In addition to their mandatory contributions, the **Governments of Italy, India and South Africa** provide funding through voluntary contributions. These cover all costs of the respective Components and, in the case of the Government of Italy, also part of the costs for the extramural Programmes of the Centre (Fellowships, Meetings and Courses and CRP-ICGB Research Grants).

Table 3 reports the foreseen revenue of ICGB for financial year 2019.

TABLE 3

Revenues (in Euro)		2019	
Contribution of the Italian Government		10,170,000	
Contribution of the Indian Government		4,002,673	
Contribution of the South African Government		2,455,219	
Total Host Governments		16,627,892	
Member States' Assessed Contributions		1,000,000	
Other Revenues		632,000	
Total Core Revenues			18,259,892
External Funds		6,378,462	
Total External Funds			6,378,462
Overall Total			24,638,354

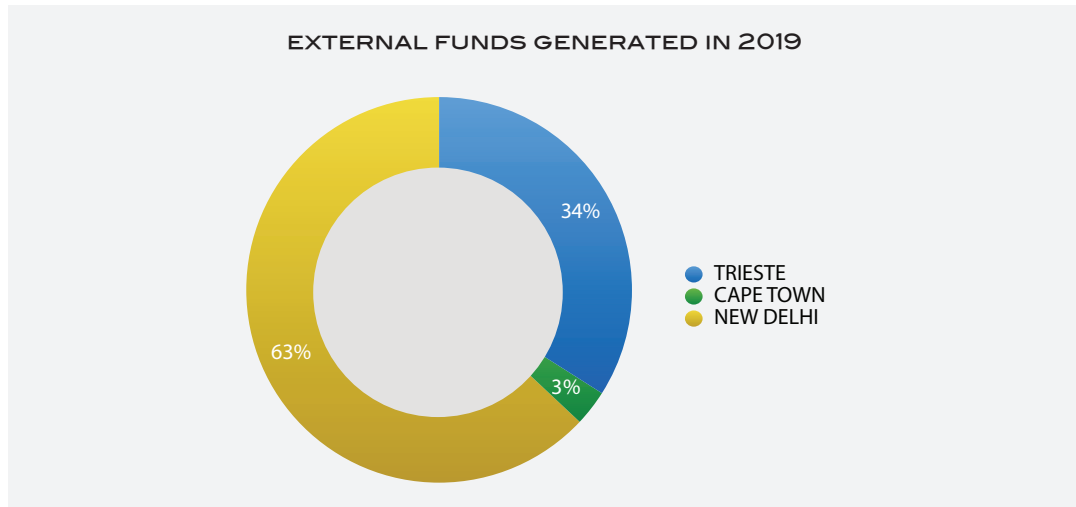
*Subject to the approval of the Financial statement by the External Auditors



Revenues are also generated through External Funds. The main sources of these funds are grants awarded to the ICGEB researchers by national and international donors for specific research or capacity building projects, and agreements with industries for technology transfer.

Figure 8 reports the amount of Revenues from External Funds generated by the ICGEB in 2019. During the last year, externally generated revenues amounted to €6,378,462, of which €2,146,624 were awarded through research project grants or technology transfer to the ICGEB laboratories in Trieste, €4,008,090 to the ICGEB laboratories in New Delhi, and €223,748 to the ICGEB laboratories in Cape Town.

FIGURE 8



External Funds generated by the ICGEB. The pie chart shows the distribution among the three Components

The Centre continues to attract the interest of development partners as well as industry.

During the period 2017-2019, the ICGEB received grants from several donors: (Regione Autonoma Friuli Venezia Giulia (Italy), Horizon 2020, National Research Foundation (SA), Global Innovation Technology Fund (Japan), Muscular Dystrophy Association (USA), Acid Maltase Deficiency Association (USA), AFM Telethon (France), Beneficentia Stiftung (Liechtenstein), Wellcome Trust Alliance (India), Indian Council of Agricultural research (India), Biotechnology Industry Research Assistance Council (India), Sun Pharmaceuticals (India), Merck (Switzerland), Vitalia (Italy), Department of Biotechnology of India, Department of Science and Technology of India, among others.

25th Session of the ICGEB Board of Governors, Trieste, Italy



EXPENDITURES

The overall budget implemented in 2019 amounted to € 17,439,631 million. In detail, Trieste implemented 94.03%, New Delhi 86.16% and Cape Town, 46.48% of their annual budget, respectively (Table 4). Approximately 49% of the Core Budget covers salaries of **Principal Investigators, Administration** and **Experts** in the three Components, who direct research of the Components' laboratories, take responsibility for the training of ICGEB Fellows, and coordinate

EXPENDITURE* (ON CORE FUNDS)

TABLE 4

Description	2019 Expenditure (in Euro)
Personnel	8,459,332
Professional Staff	2,630,676
General Staff and National Officers	5,276,107
Experts and Consultants	552,549
Governance	272,611
Governance & ICGEB Bodies	272,611
Extramural Activities	2,247,924
Fellowships	1,134,929
Meetings and Courses	333,495
CRP- ICGEB Research Grants	779,500
Running of the Laboratories	3,360,260
Consumables	1,429,099
Equipment	1,501,314
Library	138,005
Travel	291,839
Premises and Utilities	2,671,989
Premises and Utilities	2,671,989
Sundries and Hospitality	427,518
Sundries and Hospitality	427,518
Total Core	17,439,631

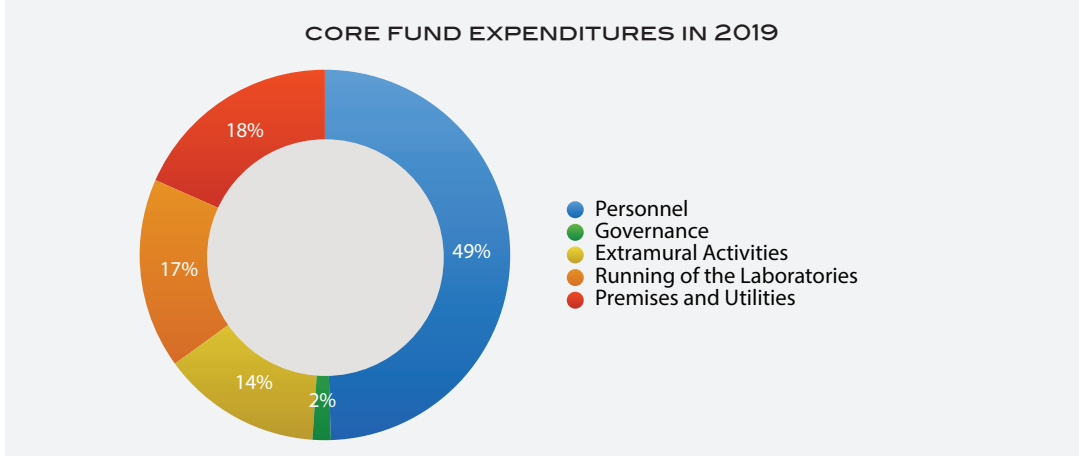
*The amounts in this table are rounded to the nearest euro. Totals may not add up owing to rounding



the ICGEB extramural activities. ICGEB Principal Investigators and Experts are also instrumental in obtaining External Funds. Extramural activities in Member States for CRP-ICGEB Research Grants, Fellowships, and Meetings and Courses collectively amount to approximately €2.3 million of the Core Budget (Figure 9).

2019 Core Fund Expenditures by category

FIGURE 9



PROJECTS

2019

The ICGEB research groups participate in many calls for research proposals in topics relevant to their research expertise, supported by a vast array of donors: from governmental institutions to private companies, from charities to donations. Here is a cross section of grants from 50,000 Euro onwards in progress during 2019 in the ICGEB labs:

Regione Autonoma Friuli Venezia Giulia

POR-FESR 2014-2020

Partners: G. Degrassi, Industrial Biotechnology ICGEB Trieste, Biogas Progetti srl.

Title: Enzymes and innovative industrial processes for the production of biogas

Duration: 2018-2019



MAECI

Exec. Prog. Scientific & Technological Cooperation - Italy & Vietnam

Partners: V. Venturi, Bacteriology ICGEB Trieste, IMBT, Vietnam National University Hanoi (VNUH)

Title: The role of microbiome in rice plant health

Duration: 2017-2019



Farnesina
Ministero degli Affari Esteri
e della Cooperazione Internazionale



MAECI

Exec. Prog. Scientific & Technological Cooperation - Italy & Argentina

Partners: O. Burrone, Mol. Immunology ICGEB Trieste, Inst. Biotechnology, National Institute of Agricultural Technology (INTA)

Title: Experimental vaccines using baculovirus as antigen vectors for the control of emerging virus in South America characterising immunol. mechanisms

Duration: 2017-2019



Farnesina
Ministero degli Affari Esteri
e della Cooperazione Internazionale



Regione Autonoma Friuli Venezia Giulia

L.R. 17/2014

Partners: M. Giacca Mol. Medicine ICGEB Trieste, Azienda Sanitaria Universitaria Integrata di Trieste ASUITS (Struttura Complessa di Cardiologia)

Title: Cardiomiciti da cellule staminali per una cardiologia personalizzata –CardioStem

Duration: 2019-2021



REGIONE AUTONOMA
FRIULI VENEZIA GIULIA

Regione Autonoma Friuli Venezia Giulia

L.R. 19/2000

Partners: S. Zacchigna Cardiovascular Biol. ICGEB Trieste, Clinical Centre of Serbia, Inst. Oncology & Radioth. of Serbia, Univ. Children Hosp. of Serbia, Univ. Trieste, Pediatric Hosp. Burlo Garofolo, Trieste

Title: LaserNET-Strengthening laser therapy as treatment of oral mucositis, stomatitis, dermatitis ...

Duration: 2018-2020



REGIONE AUTONOMA
FRIULI VENEZIA GIULIA



REGIONE AUTONOMA
FRIULI VENEZIA GIULIA

Regione Autonoma Friuli Venezia Giulia

L.R. 45/2017

Partner: N. Skoko Biotechnology Development ICGEB Trieste

Title: Biosimilars: Contribution to setting up the laboratory dedicated to research and quality certification of processes and biosimilar pharmaceuticals

Duration: 2017-2020

PROJECTS

2019

Regione Autonoma Friuli Venezia Giulia INTERREG Italia – Slovenia 2014-2020

Partners: S. Zacchigna Cardiovascular Biol. ICGEB Trieste, Jozef Stefan Int. Postgraduate School, Technology Park Ljubljana, Slovenia, Biovalley Investments SpA, Experteam srl

Title: TRAIN Big data and models of diseases: cross border platform of validated kits for biotech industry

Duration: 2017-2020



Regione Autonoma Friuli Venezia Giulia INTERREG Italia – Slovenia 2014-2020

Partners: V. Venturi Bacteriology ICGEB Trieste, AREA Science Park, Primo Principio Soc. Coop., Primorska Gospodarska Zbornica, Univ. na Primorskem, Vinakoper d.o.o, Consorzio Tutela Vini Collio

Title: SUSGRAPE promoting sustainable viticulture through ICT within ITA-SLO cross-border areas

Duration: 2017-2020



Regione Autonoma Friuli Venezia Giulia L.R. 17/2014

Partners: S. Zacchigna Cardiovascular Biol. ICGEB Trieste, University of Trieste (Dipartimento di Scienze Mediche e Chirurgiche e della Salute)

Title: ComUnicaRe per crescere In SALute -Curiosa

Duration: 2019-2022



Regione Autonoma Friuli Venezia Giulia INTERREG Italia – Slovenia 2014-2020

Partner: A. Marcello Mol. Virology ICGEB Trieste, Valdoltra Orthopedic Hospital (Ankaran, Slovenia), University of Ljubljana, Faculty of Chemistry and Chemical Technology, Dott. Dino Paladin, Jafral

Title: Diagnosi di infezioni protesiche in ortopedia con metodi innovative basati sull'uso di batteriofagi -IMBI

Duration: 2019-2021



AIRC

AIRC Investigator Grant 2016

Partner: L. Banks Tumour Virology ICGEB Trieste

Title: Characterisation of the High Risk Human Papillomavirus E6 Oncoproteins

Duration: 2017-2019



AIRC

AIRC Investigator Grant 2018

Partner: F. Benvenuti Cellular Immunology ICGEB Trieste,

Title: Does lung tumour development suppress the presentation of neo-epitopes by type 1 dendritic cells?

Duration: 2018-2022



PROJECTS

2019

EU Horizon 2020

Partners: L. Zerbini Cancer Genomics ICGEB Cape Town, 12 partners in Brazil, Bulgaria, Denmark, Germany, Italy, Poland, Slovenia, South Africa, Sweden, UK and USA

Title: STARBIOS2 Structural Transformation to Attain Responsible BIOSciences

Duration: 2016-2019



UNEP Latin America and the Caribbean Office

Partners: W. Craig Regulatory Science ICGEB Trieste

Title: Assist the government of Panama to create a legal framework that will implement the provisions of the Cartagena Protocol on Biosafety

Duration: 2019-2020



AIRC Investigator Grant 2019

Partner: L. Banks Tumour Virology ICGEB Trieste

Title: Characterisation of the functions of the Human Papillomavirus E6 and E7 oncoproteins

Duration: 2019-2024



Fondazione CRTrieste CARDIOGEN

Partners: M. Giacca Mol. Medicine ICGEB Trieste, Azienda Sanitaria Universitaria Integrata di Trieste ASUITS (Struttura Complessa di Cardiologia)

Title: Progetto per il consolidamento di una piattaforma di Medicina di Precisione in Cardiologia

Duration: 2017-2022



Fondazione Telethon

Partners: F. Pagani Human Molecular Genetics ICGEB Trieste

Title: Development of exon specific U1 snRNA-based therapy for familial Dysautonomia

Duration: 2018-2021



Fondazione CRTrieste

Partners: S. Zacchigna Cardiovascular Biology ICGEB Trieste, University of Trieste

Title: "MicroRNA per la terapia della fibrosi polmonare idiopatica"

Duration: 2017-2020



PROJECTS

2019

Western Ontario University

Partners: E. Buratti Mol. Pathology ICGEB Trieste
Title: Full length RGNEF and/or “RGNEF leucine –rich domani” as a therapeutic target in ALS
Duration: 2019-2022



Muscular Dystrophy Association

Partners: F. Pagani Human Molecular Genetics ICGEB Trieste
Title: Exon Specific U1 snRNA as a therapeutic approach for spinal muscular atrophy
Duration: 2016-2019



Foundation Leducq Transatlantic Networks of Excellence in Cardiovascular Research Program

Partners: M. Giacca Mol. Medicine ICGEB Trieste, Univ. Washington, Hubrecht Institute, Univ. Med. Centre Goettingen, Univ. Texas
Title: Programming the failing heart to a regenerative state
Duration: 2016-2020



Acid Maltase Deficiency Association - AMDA

Partners: E. Buratti Mol. Pathology ICGEB Trieste, Azienda Sanitaria Universitaria Integrata di Udine ASUIUD (University Hospital “Santa Maria della Misericordia”)
Title: Pre-clinical validation of FDA approved molecules able to rescue GAA pre-mRNAs splicing of c.-32-13T>G mutants as therapeutic agents for late-onset Pompe Disease
Duration: 2019-2022



Centro Cardiologico Monzino Subcontract for ERA-CVD Joint Translational Call 2016 on Cardiovascular Diseases

Partner: M. Giacca Molecular Medicine ICGEB Trieste
Title: Cardiomyocyte - non myocyte interplay as a novel platform for mechanistic insights and therapeutics approaches in ACM heart failure
Duration: 2017-2020



Beneficentia STIFTUNG

Partner: E. Buratti Molecular Pathology ICGEB Trieste
Title: Identifying early gene expression changes in peripheral mononuclear cells (PBMC) from early-stage Parkinson patients and Parkinson with dementia
Duration: 2019



PROJECTS

2019

Bill&MelindaGates Foundation

Partners: W. Craig Biosafety ICGEB Trieste
Title: Assist the development of effective safety and regulatory systems for the products of modern biotechnology in six Sub-Saharan African countries
Duration: 2012-2020

Genethon

Subcontract of a H2020 financed project
Partners: A. Muro Mouse Mol. Genetics ICGEB Trieste, Genethon
Title: CureCN
Duration: 2018-2022

BILL & MELINDA
GATES *foundation*



Regione Autonoma Friuli Venezia Giulia POR-FESR 2014-2020

Partners: A. Marcello Molecular Virology ICGEB Trieste, Alifax Research, Laboratori Riuniti
Title: "Point-of-care per la rivelazione simultanea dei virus Zika, Dengue e Chikungunya"
Duration: 2018-2020

National Research Foundation South Africa/SWISS Joint Research Cooperation Programme

Partners: L. Zerbini Cancer Genomics ICGEB Cape Town, Univ. Bern, Inst. Oncology Research, Bellinzona
Title: Epigenetic cross-talks and novel therapeutic strategies to prevent disease progression in ERG fusion positive prostate cancer
Duration: 2017-2020



Wellcome Trust Alliance

Partners: D. Kumar Cellular Immunology ICGEB New Delhi
Title: Regulation of host splicing machinery by factors from mycobacterium tuberculosis and its impact on host innate defense mechanism
Duration: 2018-2022

National Eye Institute of the National Institutes of Health

Partner: F. Pagani Human Molecular Genetics ICGEB Trieste, Massachusetts General Hospital
Title: A novel exon-specific U1 snRNA strategy to correct splicing in Familial Dysautonomia
Duration: 2018-2022

wellcome trust



PROJECTS

2019

Indian Council of Agricultural Research

Partners: MK. Reddy Crop Improvement ICGEB New Delhi, IARI

Title: Genetic improvement of rice for yield, NUE, WUE, abiotic and biotic stress tolerance through RNA guided genome editing (CRISPR-Cas9/Cpf1)

Duration: 2018/2021



Department of Science and Technology (DST)

Partners: A. Sharma Structural Parasitology ICGEB New Delhi

Title: Biomolecular characterisation of Malaria parasite drug target dihydropteroate synthase

Duration: 2018-2021



Biotechnology Industry Research Assistance Council (BIRAC)

Partner: V. S. Chauhan ICGEB New Delhi, Syngene International Ltd

Title: A Phase I, clinical trial to assess the safety and immunogenicity of *P. falciparum* vaccines

Duration: 2018-2020



Biotechnology Industry Research Assistance Council (BIRAC)

Partner: R. Nanda Translational Health ICGEB New Delhi, Manipur Univ., Jawaharlal Nehru Inst. Medical Sciences, Naga Hospital Authority, Agartala Gov. Med. College

Title: Evolution and transmission of drug resistant tuberculosis in Agartala, Kohima and Imphal population

Duration: 2018-2021



Department of Biotechnology
Government of India

Department of Biotechnology

Partners: V.S. Chauhan Malaria Biology ICGEB New Delhi

Title: Translational research and clinical development of malaria vaccine candidates

Duration: 2019-2023



Department of Biotechnology
Government of India

Department of Biotechnology

Partner: S. Yazdani Microbial Engineering ICGEB New Delhi India

Title: Development of paenibacillus polymyxa as a platform for production of branched chain alcohols

Duration: 2019-2022



Department of Biotechnology
Government of India

PROJECTS

2019

Department of Biotechnology (DBT)

Partners: S. Kumar Metabolic Engineering ICGEB New Delhi, Jamia Hamdard

Title: Chloroplast metabolic engineering of *Artemisia annua* for enhancing artemisinin biosynthesis

Duration: 2018-2021



सत्यमेव जयते

Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partners: S. Kumar Metabolic Engineering ICGEB New Delhi

Title: Synthetic biology approach for producing artemisinin in edible plant and effective Malaria treatment by oral delivery of plant cells

Duration: 2018-2021



सत्यमेव जयते

Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partners: S. Yazdani Microbial Engineering ICGEB New Delhi, University of York (UK), University of Leon (Spain), Jesmond Engineering Ltd (UK)

Title: Reducing industrial waste from sugar cane processing in India

Duration: 2018-2021



सत्यमेव जयते

Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partners: N. Sarovar Bhavesh Transcriptional Regulation ICGEB New Delhi

Title: Functional delineation of viral encoded RNAi suppressor on plant miRNA pathways

Duration: 2018-2021



सत्यमेव जयते

Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partner: D. Kumar Cellular Immunology ICGEB New Delhi, National Inst. Biomed. Genomics, Foundation Neglected Disease Res., Mizoram University, Dpt. Health & Family Welfare

Title: Genomics-driven dissection of susceptibility and drug resistance to pulmonary tuberculosis, with a geographical focus on NER

Duration: 2018-2021



सत्यमेव जयते

Department of Biotechnology
Government of India

Department of Biotechnology

Partners: P. Jutur Omics of Algae ICGEB New Delhi

Title: Demonstration of algal chassis for the photo autotrophic production of isoprenoids

Duration: 2019-2022



सत्यमेव जयते

Department of Biotechnology
Government of India

PROJECTS

2019

Indian Council of Agricultural Research

Partners: T. Kaul, Nutritional Improvement of Crops, ICGEB New Delhi

Title: Re-designing rice crops for improved grain micronutrient quality using CRISPR-Cas9/Cpf1 genome editing

Duration: 2019-2021



Indian Council of Medical Research

Department of Biotechnology

Partner: S. Sunil Vector Borne Diseases ICGEB New Delhi India

Title: Development of a chikungunya candidate vaccine in vesicular stomatitis virus (VSV) gene delivery platform

Duration: 2019-2022



Department of Biotechnology
Government of India

Department of Biotechnology

Partners: A. Mohammed Parasite Cell Biology ICGEB New Delhi

Title: Comprehensive omics studies to understand the biology of drug resistant mycobacterium tuberculosis clinical isolates from Arunachal Pradesh

Duration: 2019-2022



Department of Biotechnology
Government of India

Department of Biotechnology

Partners: A. Chandele EMORY- ICGEB Vaccine Program ICGEB New Delhi

Title: Human B Cell responses and receptor repertoire in dengue patients from India

Duration: 2019-2021

भारत सरकार DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVERNMENT OF INDIA



Department of Science and Technology (DST)

Partner: A. Sharma Structural Parasitology ICGEB New Delhi

Title: Hit to lead development of potent anti-parasitic natural product scaffolds

Duration: 2019-2023

भारत सरकार DEPARTMENT OF SCIENCE & TECHNOLOGY
GOVERNMENT OF INDIA



Indo-French Centre for the Promotion of Advanced Research

Partner: A. Mohammed Parasite Cell Biology ICGEB New Delhi

Title: Membrane biogenesis in Apicomplexa parasites: trafficking and recycling lipid sources for membrane remodelling as drug targets against malaria and toxoplasmosis

Duration: 2019-2023



IFCPAR/CEFIPRA Indo-French
Centre for the Promotion of
Advanced Research

PROJECTS

2019

Biotechnology Industry Research Assistance Council

Partners: A. Chande EMORY- ICGEB Vaccine Program ICGEB New Delhi

Title: Translational Research Consortia for establishing platform technologies to support prophylactic and therapeutic strategies for Dengue discovery to proof of concept

Duration: 2019-2023



Biotechnology Industry Research Assistance Council

Biotechnology Industry Research Assistance Council

Partners: S. Sunil Vector Borne Diseases ICGEB New Delhi

Title: Translational research consortia TRC for Chikungunya virus

Duration: 2019-2024



Biotechnology Industry Research Assistance Council

Department of Biotechnology (DBT)

Partners: A. Arulandu Membrane Protein Biology ICGEB New Delhi

Title: Structure determination and targeting of ubiquitously expressed membrane integrated form of chloride intracellular channels (CLICs) for discovery of small molecular anti-cancer therapeutics

Duration: 2019-2023



Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partners: D. Salunke Structural Immunology ICGEB New Delhi

Title: Targeting drug resistance in tuberculosis and malaria

Duration: 2019-2023



Department of Biotechnology
Government of India

Department of Biotechnology (DBT)

Partner: S. Yazdani Microbial Engineering ICGEB New Delhi

Title: Indian Marine cyanobacterial host for production of drop-in fuels

Duration: 2019-2022



Department of Biotechnology
Government of India

TATA STEEL LIMITED

Partner: S. Kumar Metabolic Engineering ICGEB New Delhi

Title: Carbonaceous gas to fuel by genetically engineered organisms

Duration: 2019-2022



PROJECTS

2019

Merck Global Health Institute

Partners: F. Brombacher Cytokines & Disease Group
ICGEB Cape Town

Title: Effect of Repeated Chemotherapy with Praziquantel on resistance to reinfection and protection against pathology during murine schistosomiasis: Mechanistic studies

Duration: 2017-2020

Department of Science and Technology

Partners: A. Sharma Structural Parasitology ICGEB
New Delhi

Title: Bio molecular characterization of a malaria parasite drug substrate dihydropteroate synthase (DHPS)

Duration: 2019-2023



Laboratories at ICGEB Cape Town, South Africa

INSTITUTIONAL

Founded	1983
Fully operational	1987
Components	3
Full Member States	66
Additional Signatory Countries	20

PERSONNEL

Total Personnel	701
Scientific Personnel	572

RESEARCH

Research Groups	47
Active Research Grants	139 (6.37 Million Euro)
Publications since 1988	>2900
Publications in 2019	180

FELLOWSHIPS

Fellowships awarded since 1988	1580
Fellows on board 2019	243
PhD students on board 2019	229

MEETINGS & COURSES

Meetings and Courses since 1988	596
Meetings and Courses in 2019	33

GRANTS

CRP-Research Grants since 1988	549
CRP-Research Grants 2019 awarded	24
Countries with ongoing CRP Grants	39

OUTREACH

Podcasts	640
iTunes and YouTube Downloads	>100,000/year
Social Media	



THE MEMBER STATES

2019

AFRICA

Algeria
Burkina Faso
Burundi
Cameroon
Côte d'Ivoire
Egypt
Eritrea
Ethiopia
Kenya
Liberia
Libya
Mauritius
Morocco
Namibia
Nigeria
Senegal
South Africa
Sudan
Tunisia
United Republic of Tanzania
Zimbabwe

EUROPE

Bosnia & Herzegovina
Bulgaria
Croatia
Hungary
Italy
Montenegro
North Macedonia
(*Republic of*)
Romania
Russian Federation
Serbia
Slovakia
Slovenia

MIDDLE EAST

Iran (*Islamic Republic of*)
Iraq
Jordan
Kuwait
Qatar
Saudi Arabia
Syrian Arab Republic
Turkey
United Arab Emirates

ASIA

Afghanistan
Bangladesh
Bhutan
China
India
Kyrgyzstan
Malaysia
Pakistan
Sri Lanka
Viet Nam

CENTRAL AMERICA & CARIBBEAN

Costa Rica
Cuba
Mexico
Panama
Trinidad & Tobago

SOUTH AMERICA

Argentina
Brazil
Chile
Colombia
Ecuador
Peru
Uruguay
Venezuela
(*Bolivarian Republic of*)

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