An Intergovernmental Organisation for research, training, and technology transfer in the Life Sciences to promote sustainable global development
Annual Report
2020

Science for Development
In vitro cultured mammary gland: generation of a mini-organ.
Picture by Elena Campaner, Cancer Cell Signalling lab, Trieste, ITALY
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Message from the Director-General

I am delighted and honoured to present the ICGEB Annual Report for 2020. This has been a truly remarkable year. The world has endured, and continues to face, enormous challenges resulting from the COVID-19 pandemic. However science is, as usual, coming to the rescue. Who would have thought that in less than a year vaccines would be rolled out across the world to combat a new infectious agent? At the same time, we are seeing massive improvements in patient survival with the development of innovative therapeutics. I am personally extremely proud of ICGEB’s achievements during the course of 2020. Thanks to a remarkable team, spanning all the ICGEB Components in Trieste, New Delhi and Cape Town, the scientific, administrative and institutional activities of ICGEB barely faltered, even during the worst periods of the health crisis. For this, I owe a massive thank you to every single person working within ICGEB, and to all of our wonderful Governors, Liaison Officers and members of the Council of Scientific Advisors, all of whom have worked tirelessly to ensure that ICGEB could continue to fulfil its mandate, despite all the obstacles.

Whilst the pandemic has brought huge challenges, it has also brought huge opportunities. We have all learnt how well the world is connected, even if we cannot travel. During this time, we have completed cooperation agreements with TWAS, UNOSCC, IILA and the UN Tech Bank, to name a few. Through these collaborative efforts we are expanding our footprint in some of the poorest countries in the world, directly providing capacity enhancement and assistance, both in the fight against SarsCoV-2, and also in the broader mission of ensuring that no country, or individual, is left behind. During this time, I have witnessed at first hand the difficulties and obstacles that scientists in many countries have encountered, both from COVID-19 and from economic and security-related issues. I am in awe of the commitment to science and the incredible levels of resilience and ingenuity that many of our colleagues have displayed over this time, and it makes me even more committed to ensuring that ICGEB continues to be at the forefront in bringing science and its benefits to all corners of the globe.

Lawrence Banks, PhD
Director-General

April 2021
Dr. M.K. Reddy, Group Leader, Crop Improvement lab, New Delhi, receives a grant from the Department of Biotechnology, Gov. of India to address rice blast disease, which causes serious damage to rice production worldwide.

ICGEB-Argentina Cooperation Agreement with MINCYT and INTI

Dr. Dhiraj Kumar, Group Leader, Cellular Immunology lab, New Delhi, publishes his latest study on overcoming major hurdles in tuberculosis control in Nature Communications.

Dr. L. Banks, ICGEB Director-General meets with the South African Minister of Higher Education, Science and Technology, Min. Bonginkosi Nzimande.

The ICGEB opens an online, Covid-19/SARS-CoV-2 Resource Platform to provide Resources, Tools and Know-how to fight the SARS-CoV-2 virus that causes Covid-19, free of charge, to its Member States.

ICGEB receives Real-time fluorescent RT-PCR kits for detecting COVID-19 and protective face masks in donation from its collaborating institutes in China.

ICGEB and Sun Pharma: Phase-II clinical trial on AQCH for treatment of COVID-19 patients.

SOUTH AFRICA

Antonella Cavallari, Secretary-General of IILA, meets with Dr. L. Banks, ICGEB Director-General to announce joint funding for ICGEB CRP COVID19-related research projects

LATIN AMERICA

MSC Cruises launches an innovative next-generation air sanitation system called “Safe Air”, in collaboration with the Molecular Virology lab, headed by Dr. A. Marcello

AFRICA

ICGEB starts a project on SARS-CoV-2 testing materials from New England BioLabs (NEB®), with support from the Bill & Melinda Gates Foundation

ITALY

Dr. F. Benvenuti, Group Leader, Cellular Immunology lab, Trieste, the journal Nature for the “Where I work” article series

INDIA

Indo-Italian Cooperation for COVID-19 webinar, Italian Ministry of Foreign Affairs, Italian Ambassador to India, Vincenzo de Luca, and Ambassador of India to Italy, Reenat Sandhu

LATIN AMERICA

Antonella Cavallari, Secretary-General of IILA, meets with Dr. L. Banks, ICGEB Director-General to announce joint funding for ICGEB CRP COVID19-related research projects

MOLDOVA

Dr. L. Banks attends the Jubilee Congress of the “Nicolae Testemitanu” State University of Medicine and Pharmacy, in Chisinau, Moldova, dedicated to the celebration of 75 years of activity

ANGOLA

Angola becomes 66th Member State of the ICGEB, the 22nd African Member

ICGEB Regional Research Centre unveiling at China Medical Expo

MSC Cruises launches an innovative next-generation air sanitation system called “Safe Air”, in collaboration with the Molecular Virology lab, headed by Dr. A. Marcello

ICGEB starts a project on SARS-CoV-2 testing materials from New England BioLabs (NEB®), with support from the Bill & Melinda Gates Foundation

Angola becomes 66th Member State of the ICGEB, the 22nd African Member
VISION
To be the world’s leading intergovernmental organisation for research, training, and technology transfer in the field of Life Sciences and Biotechnology

MISSION
To combine scientific research with capacity enhancement, thereby promoting sustainable global development
The ICGEB Strategic Plan 2020-2030 builds on the activities approved by the Board of Governors, and presents them in the context of the United Nations 2030 Agenda and the Sustainable Development Goals (SDGs). The Agenda envisions “a world of universal respect for human rights and human dignity, the rule of law, justice, equality and non-discrimination”, with a strong emphasis on the empowerment of women and of vulnerable groups.

The aim is to reconcile global economic progress with social justice and the conservation of natural resources. Developing countries, emerging economies, and industrialised nations must all do their part to ensure the success of the Agenda. The ICGEB Strategic Plan seeks to leverage the Centre's strengths to maximize the Organisation's contribution to the achievement of SDGs, in the spirit of openness and collaboration, as called for by the Economic and Social Council of the United Nations (ECOSOC), the General Assembly and the Secretary-General of the UN. The ultimate goal is to empower ICGEB Member States in the use of the latest scientific developments and help them apply modern biotechnology solutions to end disease and achieve food and energy security, while fostering the development of human capital through education, training and provision of equal opportunities for all.

The African Union’s Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) defines four mutually reinforcing pillars that are supported by the present strategy: building and/or upgrading research infrastructures; enhancing professional and technical competences; promoting entrepreneurship and innovation; and providing an enabling environment for STI development.

**UN GOALS INCLUDED IN THE ICGEB STRATEGIC PLAN FOR 2020-2030**

- **Zero hunger** - ICGEB focuses on plant biology and biotechnology, and aims to improve crop production and resistance to environmental stresses

- **Promote health and wellbeing for all** - is underpinned by ICGEB's research on parasitic and viral infectious diseases, and by research on non-communicable diseases, such as neurodegeneration, cancer and cardiovascular disorders

- **Quality education for all** - ICGEB programmes aim to develop skills and make higher education possible for individual scientists, their institutions and the scientific communities

- **Promote access to affordable and sustainable energy** - guides the work of scientists at the ICGEB in New Delhi

- **Promote innovation** - ICGEB aims to do this at the country level, through the empowerment of individual scientists and local pharmaceutical companies

- **Promote Global Partnership for the Goals** - ICGEB shares knowledge, expertise and technology through projects, and strategic partnerships that support countries’ efforts to achieve the SDGs and their own development priorities
The ICGEB is a unique intergovernmental organisation initially established as a special project of UNIDO. Autonomous since 1994, it runs 46 state-of-the-art laboratories, in Trieste, Italy, New Delhi, India and Cape Town, South Africa and forms an interactive network with over 65 Member States.

It plays a key role in Biotechnology worldwide for excellence in Research, Training and Technology Transfer to Industry to contribute in concrete terms to the achievement of sustainable global development and its operations are aligned to those of the United Nations System.
The ICGEB is dedicated to advanced research and training in molecular biology and biotechnology and advancing knowledge, applying the latest techniques in the fields of:

- biomedicine
- crop improvement
- environmental protection/remediation
- biopharmaceuticals, biopesticide and biofuel production
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 2020, 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 180 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 350 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, 4 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, Circulation Research, Nature Reviews Cancer, Nature Reviews Molecular Cell

![Figure 1](image-url)

**Figure 1**

<table>
<thead>
<tr>
<th>Research Area</th>
<th>No. of Publications 2018-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Diseases</td>
<td>63 41 67</td>
</tr>
<tr>
<td>Non Communicable Diseases</td>
<td>68 82 74</td>
</tr>
<tr>
<td>Medical Biotech</td>
<td>87 20</td>
</tr>
<tr>
<td>Industrial Biotech</td>
<td>21 25 48</td>
</tr>
<tr>
<td>Plant Biology &amp; Biotech</td>
<td>27 25 35</td>
</tr>
</tbody>
</table>

Total number of scientific publications in 2018-2020 divided according to the five macro-areas of research
Biology, Cell Stem Cells, Acta Neuropathologica, and Journal of Experimental Medicine, among others.

In 2020, research carried out in the laboratories has generated 244 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

Cumulative Impact Factor of Journals 2018-2020

<table>
<thead>
<tr>
<th>Macro-Area</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Diseases</td>
<td>308</td>
<td>196</td>
<td>270</td>
</tr>
<tr>
<td>Non-comm Diseases</td>
<td>342</td>
<td>466</td>
<td>417</td>
</tr>
<tr>
<td>Medical Biotech</td>
<td>13</td>
<td>19</td>
<td>45</td>
</tr>
<tr>
<td>Industrial Biotech</td>
<td>59</td>
<td>88</td>
<td>146</td>
</tr>
<tr>
<td>Plant Biology &amp; Biotech</td>
<td>86</td>
<td>60</td>
<td>149</td>
</tr>
</tbody>
</table>

Total Impact Factor of scientific publications in 2018-2020 divided according to the five macro-areas of research

ICGEB publications in peer-reviewed journals
The ICGEB Strategic Plan 2020-2030 Macro Areas

ICGEB Research Groups, expertise and facilities
# Macro Areas of Research

## Infectious Diseases
- Virology
- Parasitic Diseases

## Non-Communicable Diseases
- Cardiovascular Disorders
- Immunology
- Molecular Genetics
- Neurobiology
- Cancer

## Medical Biotechnology
- Biotherapeutic products
- Computational Biology
- 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.

The Molecular Virology Group (Marcello) in Trieste has continued its studies on the detection and molecular mechanisms of different arboviruses, but over the last year has been mainly involved in the response to the COVID-19 pandemic, providing support to the ICGEB Member Countries. Activities included the formulation of protocols for SARS-CoV-2 molecular and serological diagnostics, and the production of on-line tutorials and reagents to enable the development of low-cost in-house assays. SARS-CoV-2 viruses circulating in several countries have been sequenced for the first time, and the data have been made available to the scientific community. A pipeline for testing antivirals against SARS-CoV-2 has been set up, allowing the identification of novel drug candidates. The Vector Borne Disease Group (Sunil) in New Delhi investigates the molecular mechanisms of infection of different arboviruses in both the host and vector. During the COVID-19 pandemic, her group has set up antiviral assays for SARS-CoV-2 testing, as well as studying re-infections. The group of Chandele in New Delhi runs a joint program with the Emory Vaccine Center, Atlanta, USA to understand human immunity to infectious disease. The newly established Emerging Viruses Group (Schäfer) in Cape Town will focus on oncogenic viruses that are relevant in the Sub-Saharan African context. In response to the COVID-19 pandemic surge, diagnostic capacities have been developed to support the South African NHLS laboratories. Moreover, SARS-CoV2 pseudovirus neutralisation assays have been set up to test infected and vaccinated patient serum for neutralising antibody capacity towards the main circulating SARS-CoV2 lineages.

**Highlights in 2020**

The Molecular Virology Group in Trieste made advances in setting up a pipeline for full genome sequencing (Licastro et al J Virol 2020, Alm et Eurosurveillance 2020), and in the identification of antiviral compounds against SARS-CoV2 (Marcello et al Redox Biol 2020, Milani et al Antiviral Res. In press). They also made important steps in the development of diagnostics for Usutu virus, an emerging pathogen of the Flavivirus family (Caracciolo et al., PLoS Negl. Trop. Dis. 2020). The Vector Borne Diseases Group in New Delhi was among the first groups globally to examine reinfection of SARS-CoV-2 in patients (Shastri et al., SSRN, 2020). Further, the facility for SARS-CoV-2 antiviral testing has been assigned as one of the nodal centres for antiviral testing for the whole of India by the Department of Biotechnology and Indian Council of Medical Research. The ICGEB Emory Vaccine Program Group - while continuing to study human immunity to dengue and chikungunya virus - contributed extensively to understanding B cell responses to SARS-CoV-2 in recovered individuals from India (Nayak K, Virology in press). The lab was also successful in making human monoclonal antibodies specific to the receptor binding protein of SARS-CoV-2 that can be explored for improved diagnostics, as well as therapeutic and prophylactic regimes in the future. The Emerging Viruses Group in Cape Town, although the lab’s main focus has been on oncogenic viruses (particularly KSHV and HPV), has started new research activities in response to the global COVID-19 pandemic. In a recent study, plasma samples from Healthcare workers have been tested for SARS-CoV2 neutralising capacity using a SARS-CoV2 pseudovirus neutralisation assay. Moreover, several diagnostic pipelines have been established as surge testing capacities.

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.
PARASITIC DISEASES
Frank Brombacher (CT)
Pawan Malhotra (ND)
Asif Mohmmed (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 to elucidate the fundamental immunological mechanisms underlying such human diseases, as tuberculosis, African trypanosomiasis, leishmaniasis, helminthic infections (including bilharzia), and the role of neuroimmunology, in addition to chronic diseases like allergic asthma and colitis. In New Delhi, six Groups investigate the malaria parasite. The Malaria Biology (Malhotra) and the Parasite Cell Biology (Mohmmed) Groups functionally characterize 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 involved in post-transcription regulation of mRNA, which it addresses by a combination of NMR spectroscopy and crystallography.

Highlights in 2020
The Cytokines and Disease Group in Cape Town has contributed some major advances to our understanding of helminth infection, allergic responses and neuro-immunology of the immune responses affecting inflammation. In schistosomiasis they worked on antiparasitic drugs and preclinical models in humans (Nono et al, 2020, Sci Rep; Kamdem et al, 2020, Sci Rep). Indeed, worm infections can also impact on neuro-immunology (Brombacher et al, 2020, Brain Behav Immun S0989) and memory (Brombacher et al, 2020, Sci Rep). The Malaria Biology and Parasite Cell Biology Groups in New Delhi have made groundbreaking advances in understanding novel protein complexes on the malaria parasite surface and their post-translational modifications, which play key roles in the invasion of red blood cells (Ekka et al., mBio. 2020, 11(5):e00166-20; Chourasia et al., 2020 Infect Immun.; 88(2)), thereby opening novel ways of potentially blocking parasite infection. Studies from the Structural Parasitology Group in New Delhi made great progress in identifying novel compounds targeting the parasite tRNA synthetases, and determined the structural basis of their inhibitory activities (Sharma et al., Nat Commun. In press), again opening the way for the development of novel therapeutics.
### Immunology

The immunology cluster at ICGEB comprises three Groups in New Delhi (Structural Immunology - Salunke; Cellular Immunology - Kumar; Immunobiology - Dwivedi) and one Group in Trieste (Cellular Immunology - Benvenuti), with complementary interests in the molecular and cellular mechanisms of the immune response to pathogens and cancer. The Cellular Immunology Group (Zacchigna) focuses on the processes that occur during the initial phases of immune responses against pathogens, tumours and autoimmune responses. 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 2020

Recent discoveries from the Structural Immunology group have shed light on T cell receptor conformational changes and the structure of MP-4 from Mucuna pruriens (Jain A et al, 2020, Acta Crystallogr F Struct Biol Commun; Shikhi, M, 2020 BBRC). A major study from the Cellular Immunology Group in Delhi defined how Mycobacterium tuberculosis can survive in mesenchymal stem cells and thereby allow escape from anti-TB drugs. This has very important implications for future studies aimed at targeting these immune-privileged sites for improving therapy and prevention of tuberculosis (Jain N et al, 2020, Nat Comm). The Cellular Immunology Group in Trieste made an important contribution in unveiling the role of actin polymerization during cGAS-STING responses to self-DNA (Piperno et al, 2020, JCI Insight), thereby providing further insights into molecular basis of autoimmune disease in patients with Wiskott-Aldrich syndrome.
In Trieste, the RNA Biology Group (Baralle) performs research 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, using transgenic and engineered mouse models of the human syndromes, aiming to develop therapeutic approaches that could be translated to patients. The applied research ranges from pharmacological therapies to gene therapy and gene editing, using AAV vectors in combination with engineered nucleases. The Human Molecular Genetics Group (Pagani) is interested in translational approaches, using a novel RNA-based strategy to correct splicing defects associated with haemophilia, cystic fibrosis, familial dysautonomia and spinal muscular atrophy. This applied approach via gene therapy, using AAV vectors, is offering new therapeutic opportunities.

**Highlights in 2020**

The Mouse Molecular Genetics Group reported a potential AAV codon-optimised gene replacement vector therapy for ornithine transcarbamylase deficiency (De Sabbata et al., Mol Ther Methods Clin Dev 20:169-180, 2020), and demonstrated long-term safety and efficacy, thereby opening the way for future therapeutic applications. The Human Molecular Genetics Group has made enormous efforts in using exon specific U1 snRNAs to correct splicing defects. In a major study using this approach to develop novel therapies for cystic fibrosis, they identified the molecular basis underlying splicing defects in a range of cystic fibrosis associated mutations, and defined a common strategy for the rescue of these common exon-skipping mutations in the CFTR locus using modified U1 snRNAs (Donégà et al., Hum Mut 41:2143-2154, 2020).

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 TDP-43, 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 2020**

In 2020, several major advances were reported, with regards to the work on ALS and FTLD pathologies. The Molecular Pathology Group participated in a joint research project with a clinical research group in Rotterdam to identify, for the first time, the presence of TDP-43 somatic mutations in the brains of patients affected by Semantic Dementia (van Rooij et al., Brain. 2020 143(12):3827-3841), a late onset neurodegenerative disease with unknown aetiology. These mutations in TDP-43 resulted in aberrant splicing and altered subcellular localization, and indicate that these somatic variants in TDP-43 may contribute to the development of Semantic Dementia. The same group, also exploring TDP-43 function, made a ground-breaking observation in identifying specific changes in the phosphorylated form of the protein in FTLD, indicating possible avenues for therapeutic intervention (Neumann et al. Acta Neuropathol. 2020, 140(5): 645-658).

Several research groups in Trieste, in Cape Town, and 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. The Membrane Protein Biology Group in Delhi (Arulandu) investigates the molecular mechanisms underlying the function of membrane proteins, focusing on chloride intracellular channels as potential novel anti-cancer targets. The newly-established Cancer Cell Signalling Group (Del Sal) studies the tumour microenvironment in relation to physical and biochemical cues that result in signalling that determine cell fate. The Tumour Virology Group in Trieste (Banks) studies the mechanisms by which Human Papillomaviruses (HPVs) infect cells and cause cervical cancer.

**Highlights in 2020**

The Hematology Group in Trieste revealed a novel mechanism of action of a cytotoxic agent that had previously been proposed to function as a BCL-2 antagonist. This drug was shown to selectively kill chronic lymphocytic leukemia (CLL) and diffuse large B cell lymphoma cells by inhibiting the PI3K/AKT pathway and down regulating MCL-1 (Vervloesem et al., Cell Death Dis. 2020), and offers new routes for therapeutic intervention. In addition, the Hematology Group made a major contribution to our understanding of how B Cell Receptor signaling contributes to the regulation of cell proliferation in CLL, and defined how loss of negative regulators of cell proliferation, such as p53, further enhance tumour growth. Most importantly, the study also opens the way to the use of drug combination therapies for disease treatment (Chakraborty et...
al., Blood in press). The Cancer Genomics Group in Cape Town has discovered, in circulating plasma extracellular vesicles, a novel biomarker that is associated with aggressive prostate cancer. A study was published (Albino et al., Commun. Biol. In press), providing a comprehensive analysis of the consequences of the release of circulating plasma exosomes in cancer patients, demonstrating the important role of this phenomenon in tumour progression and recurrence.

### 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. Four Groups in 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.

**BIOENGINEERING**

**Navin Khanna (ND)**

The Computational Biology Group (Piazza) in Trieste was newly established in 2020. The focus will be on studying mechanisms of cancer via integrative analysis of large genomic datasets of biological and clinical data. Many collaborations have also been initiated with other ICGEB Groups to bring supporting computational biology approaches for the analysis of next-generation-sequencing data sets.

**BIOENGINEERING**

**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 elucidates 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, being now prevalent in more than 100 countries, with over 1 million new infections each day. Dengue infections result in massive economic loss, strained health services, morbidity and mortality, especially among children, and warrants global attention.

**BIOENGINEERING**

**Silvano Piazza (TS)**

The Biotechnology Development Unit (BDU) in Trieste (Skoko) focuses on the development of sustainable technologies for the production of biopharmaceuticals. The aim is to increase the capabilities of the pharmaceutical industries in the ICGEB Member States, by training bioprocessing professionals and transferring knowledge. Training programmes include the manipulation of recombinant cells, and downstream process and quality control procedures for 14 biologics, such as filgrastim, erythropoietin, growth hormone and insulins. The availability of such scientific support in the ICGEB represents a significant incentive for the development of biosimilars locally and internationally, and to accelerate the biopharma ecosystems in emerging markets.

**BIOENGINEERING**

**Nataša Skoko (TS)**

During 2020, in order to meet the growing demand for distance learning, the BDU designed online training modules that cover the entire production process from the cell to the purified product. This rich video-based platform can deliver training effectively everywhere, as an alternative to standard in-house training. The BDU signed several technical assistance agreements for the production of insulin, based on this video training. In the course of 2020, the ICGEB has been creating a new pharma-compliant facility for development of biosimilars. The BDU is now intensively developing the structure and documentation for a Good Manufacturing Practice (GMP)-certified Quality Control laboratory, including the successful implementation of an Electronic Lab Notebook for easy lab data management in a GLP/GMP-compliant manner. The new facility will help ICGEB to continue supporting the global harmonization of quality specifications for biologics. This expansion will also allow the development of similar antibody-based therapeutics. A key focus is the development of technologies for the production of the monoclonal antibodies trastuzumab and tocilizumab, for the treatment of breast cancer and arthritis, respectively. Furthermore, in response to the coronavirus pandemic, the BDU has prepared stably-transfected CHO cell lines for the production of the spike protein, as well as a SIR recombinant antibody for serology testing SARS-CoV-2.

**BIOENGINEERING**

**COMPUTATIONAL BIOLOGY**

**Navin Khanna (ND)**

**Ranjan Nanda (ND)**

**Silvano Piazza (TS)**

**Nataša Skoko (TS)**
4. INDUSTRIAL BIOTECHNOLOGY & RENEWABLE ENERGY

The use of genetic engineering and other modern biological technologies has enormous potential for the production of clean and renewable energy from biological sources. The identification of novel enzymes effective against the cellulosic biomass and devising cost-effective processes to produce third-generation biofuels using microalgae 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)

Five Groups at ICGEB 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; they isolate novel enzymes (cellulases, xylanases) with higher specificity towards cellulosic biomass, and engineer fungi and bacteria with enzymes that can produce biofuels from this energy source. The Group uses metabolic engineering and synthetic biology approaches to produce high density fuels and green chemicals. Current projects in the Yeast Biofuel Group (Gaur) aim to develop a cost-effective lignocellulosic material-based technology for fuels and chemical production. They are also developing robust yeast 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. Algal Biology is the focus of the Omics of Algae Group (Jutur), where research aims to understand the dynamics of microalgal systems through an integrative multi-omics approach with well-defined functional pathways that will elucidate an effective strategy for converting light/carbon source to biomass, biofuels and biorenewables (B3) for sustainable solutions. Findings will provide important breakthroughs on the essential metabolism in these microalgae, required for biotechnological improvement of next-generation biofuels/biorenewables. 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) has various projects of industrial interest, working on a sustainable algal biofuels programme using synthetic biology and genome-editing tools. They aim to reduce carbon footprint by introducing Carbon Concentration Mechanisms (CCM) into marine algae and knocking out genes that limit the carbon capture efficiency of photosynthetic organisms via RNAi/CRISPR-
The process to develop an alkane-producing algal system for “drop-in jetfuel” is also underway via synthetic biology. The Group also works on enhancing artemisinin biosynthesis in the Artemisia annua plant, via chloroplast engineering to produce a complete artemisinin drug in edible plants for coherent treatment of malaria.

**Highlights in 2020**

A major achievement of Yazdani’s Group has been the characterization of a novel Polysaccharide Monoxygenase of fungus and its overexpression with Cellobiohydrolase I to enhance the efficiency of the secreted cellulase enzyme (Ogunyewo et al., Appl. Environ. Microbiol. 2020; 86:23). The resultant enzyme preparation DICzyme-3 showed higher biomass hydrolysis potential, compared with the commercial enzyme, Ctech3, and is ready for the scale-up studies and commercialisation. The Metabolic Engineering Group enhanced artemisinin biosynthesis in Artemisia annua plant via chloroplast engineering, while the Omics of Algae Group was involved in understanding the molecular mechanisms of the CO2-driven carbon partitioning and metabolic regulation within oleaginous microalgae Microchloropsis gaditana (Kareya et al., 2020, Front. Plant Sci. 11: 981; Kareya et al., 2020, Mater. Sci. Energy Technol., 3: 420). 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 (Gupta et al., Biotechnol. Biofuels 2020 s13068-020-1656-8).

**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)

The Crop Improvement Group (Reddy) focuses on translational research in the area of agricultural biotechnology and crop improvement, using transgenic and targeted genome-editing technology in the indica rice cultivar to improve rice plant architecture for enhanced productivity. The intention is to simultaneously engineer resistance to multiple herbicides with different modes of action to control weeds, and to promote the cultivation of direct-seeded rice (DSR), thus simultaneously replacing labour-intensive transplantation and manual weeding. In addition, they propose to enhance the plant’s innate immunity by knocking out selected disease-susceptible genes in the rice genome to give durable disease-resistance. The Nutritional Improvement Group (Kaul) has used the latest genetic engineering technologies to improve traits and the nutritional value of cereals, legumes and tomatoes. The Bacteriology Group in Trieste (Venturi) focuses on bacterial interspecies signaling in plant-associated microbiomes and the identification and development of plant bacterial probiotics.

**Highlights in 2020**

The Nutritional Improvement Group (NIC) in New Delhi have made very good progress in developing herbicide-resistant maize, rice, and double herbicide-resistant pigeon pea crops with improved aromatic amino acid profiles (Kaul et al., J Biosci 45:137, 2020) for better weed management and enhanced crop yields. Crops that are resistant to multiple herbicides offer huge advantages to farmers in weed management by circumventing the development of a herbicide-resistant weed population. The NIC group has been independently instrumental in generating a draft genome sequence of Rice Bean (Vigna umbellata) to allow the unravelling of the factors responsible for the late flowering and un-palatability of this under-utilized crop to facilitate for efficient domestication. In addition, a CRISPR-Cas9-based system was developed for Crocus sativus to allow efficient gene knockout or edits in the future (Chib et al., Plant Methods 16:47, 2020). The Bacteriology Group reported on the role of the microbiome in a rice plant disease (Musonerimana et al., Microb Ecol 80:637-642, 2020), and on the mechanisms of plant colonization by novel plant-beneficial bacteria (Mosquito et al., Appl Environ Microbiol 86:e00622-20,2020; Mosquito et al., Mol Plant Microb Interact 33:349-361, 2020), thereby opening the way for the development of novel biofertilisers.
Three Groups in New Delhi are working to understand and improve the adaptation of crop plants towards biotic and abiotic stresses, to improve the sustainable production of food grains. The Plant Insect Interaction Group (Nair) studies the interaction of the rice plant with its major insect pests: the Asian rice gall midge and the Brown Planthopper, which are responsible for considerable yield loss in Asia and Africa. The Plant RNAi Biology Group (Sanan-Mishra) is interested in identifying the miRNA regulatory nodes that influence plant yields in response to challenges imposed by increasing soil salinity, high temperatures and virus infection. The Plant Stress Biology Group (Singla-Pareek) is investigating solutions to increase plant yield under drought and salinity stress. The Biopesticides Group (Ndolo) in Cape Town works towards the discovery, development, formulation, commercialisation and use of biopesticides. This is achieved largely through a programmatic approach, which involves strategic engagement with relevant stakeholders to address the challenges confronting research and development of biopesticide products; and hence promote their application in agricultural production.

**Highlights in 2020**

The groups investigating plant responses to biotic and abiotic stresses continued their outstanding activities during 2020. The Insect Plant Interaction Group has identified several Brown planthopper (BPH) salivary gland proteins that directly interact with BPH resistance genes of rice. In addition, the Group has also looked at the dynamics of the insect microbiome and the role(s) that it might play in plant-insect interactions (Gupta and Nair, 2020, Front. Microbiol, 11:1357). The Plant RNAi Biology Group showed that the adaptability of the Pokkali rice variety to excess salt is due to the genetic regulation of different cellular components by a panel of miRNAs (Goswami et al., 2020, Biomolecules, 10, 498). They also showed that overexpression of an RNA silencing suppressor, encoded by the insect Flock House virus, allowed the plants to tolerate high concentrations of salt (Sinha et al., 2020, Phytoparasitica, 1). This indicated the involvement of key miRNA regulatory nodes by which plants deal with diverse environmental stresses. The Plant Stress Biology Group engineered solutions for abiotic stress tolerance using various target genes (Nutan et al., J. Exp. Bot., 71:490-506, 2020; Singla-Pareek et al., New Phytol 714-721, 2020). The Biopesticides Group reviewed the experiences and perspectives on Spodoptera frugiperda (Lepidoptera: Noctuidae) management in Sub-Saharan Africa, outlining key considerations necessary to develop an integrated approach for management of this invasive pest in the region (Njuguna et al., in press, J. Integr. Pest Manag).
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 carry out 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.

For PhD studies, the ICGEB in Trieste collaborates with top universities such as the International School for Advanced Studies (SISSA) in Trieste, the University of Trento, the 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 2020, a total of 251 Fellows performed research in the ICGEB laboratories. Of these, 80 were funded under the Arturo Falaschi Fellowship Programme and an additional 151 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 2020, of 251 Fellows in the three Components, 59% were women.

The ICGEB SMART Fellowships Programme (Scientific Mobility for Advanced Research Training) has been running for 7 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 and feedback received from the Fellows and the host supervisors shows that it has proven to be extremely useful and beneficial for both parties. In 2020 seven new SMART fellowships were awarded: 3 at the PhD level and 4 at the Postdoc level, involving mobility from Argentina to Chile, from Egypt to Malaysia, from Pakistan to China, from Cameroon to Turkey, from Pakistan to China
and Kuwait, from Morocco to Qatar, from Nigeria to Brazil. Of these Fellows, one was a women and three men (Figure 4).

Table 1

<table>
<thead>
<tr>
<th>Countries of origin</th>
<th>Number of Fellows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa (17+30*)</td>
<td>Burkina Faso (1*), Cameroon (1), Ethiopia (1+1*), Kenya (4+1*), Nigeria (8+2*), South Africa (20*), Sudan (1*), Swaziland (1*) Tanzania (2+1*), Zimbabwe (1+2*)</td>
</tr>
<tr>
<td>North Africa (7+4*)</td>
<td>Egypt (5+2*), Morocco (1), Tunisia (1+2*)</td>
</tr>
<tr>
<td>Asia (21+103*)</td>
<td>Bangladesh (5+5*), China (1), India (10+97*), Malaysia (2), Nepal (1*), Pakistan (2), Vietnam (1)</td>
</tr>
<tr>
<td>South America (11+4*)</td>
<td>Argentina (3), Brazil (4), Chile (4*), Mexico (1), Peru (1), Uruguay (2)</td>
</tr>
<tr>
<td>Central America &amp; Caribbean (1+1*)</td>
<td>Cuba (1+1*)</td>
</tr>
<tr>
<td>Europe (21+28*)</td>
<td>Bulgaria (1*), Croatia (2+1*), Germany (1*), Italy (11+23*), Montenegro (1), Poland (1+1*), Serbia (2), Slovenia (4+1*)</td>
</tr>
<tr>
<td>Middle East (2+1*)</td>
<td>Iran (1), Jordan (1), Turkey (1*)</td>
</tr>
</tbody>
</table>

In 2020, 251 Fellows were on board at the ICGEB Components (those on External Funds are indicated by an asterisk*)
The Covid-19 pandemic has temporarily halted the momentum of the ICGEB scientific programme that every year, since 1989, has seen between 20-30 scientific events on cutting-edge topics in the field of Life Sciences held worldwide, to facilitate interaction between internationally renowned scientists and young researchers from Member States. While only two of the 30 scheduled events in 2020 took place, many of the remaining events have been rescheduled to late 2021 or 2022.

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 four years, the ICGEB has organised or sponsored a total of 97 scientific events with the participation of over 3,500 researchers. Approximately 400 participants receive financial support from the ICGEB to attend these events in a normal year.

Meetings and Courses Highlights

- In 2020, ICGEB’s Principal Investigators remained active on virtual platforms, presenting at over 50 scientific meetings in their fields of expertise worldwide (Tables 2-4 below show a cross-section of events in which the PIs participated).

<table>
<thead>
<tr>
<th>Group Leader</th>
<th>Topic</th>
<th>Organised by</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luiz Zerbini</td>
<td>STARBIOS Final event. Responsible research in Biosciences: challenges for mainstreaming</td>
<td>Starbios-University of Rome, Tor Vergata Funded by the European Union’s Horizon 2020</td>
<td>May 20</td>
</tr>
<tr>
<td>Luiz Zerbini and Dennis Ndolo</td>
<td>South Africa-Angola Virtual Joint Technical Meeting on Agriculture Research Development and Innovation</td>
<td>SA Department of Science and Innovation (DSI)</td>
<td>Sep 20</td>
</tr>
<tr>
<td>Luiz Zerbini and Dennis Ndolo</td>
<td>SA-Ghana Bilateral Bioscience technical meeting</td>
<td>SA Department of Science and Innovation (DSI)</td>
<td>Oct 20</td>
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<tr>
<td>Group Leader</td>
<td>Topic</td>
<td>Organised by</td>
<td>Date</td>
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<tr>
<td>Lawrence Banks</td>
<td>Indo-Italian cooperation for Covid-19: activities and perspectives</td>
<td>Embassy of Italy, new Delhi/Department of Science and Technology</td>
<td>Jul 20</td>
</tr>
<tr>
<td></td>
<td>Unveiling of China RRC</td>
<td>China Medical City, Taizhou</td>
<td>Sep 20</td>
</tr>
<tr>
<td>Emanuele Buratti</td>
<td>Climate pollution and the spread of diseases</td>
<td>Motumundi Festival, Vitale Onlus</td>
<td>Oct 20</td>
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<tr>
<td></td>
<td>New insights in TDP-43 prote-inopathies</td>
<td>XV Congresso Nazionale SINDEM</td>
<td>Nov 20</td>
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<tr>
<td></td>
<td>TDP-43 Frontotemporal dementias and LATE</td>
<td>Societa’ Italiana Neurologia SIN 2020</td>
<td>Nov 20</td>
</tr>
<tr>
<td>Wendy Craig</td>
<td>Biosafety Legal &amp; Administrative Systems – Part A,B</td>
<td>UNEP-GEF/Panama project</td>
<td>Aug 20</td>
</tr>
<tr>
<td></td>
<td>GMO Analysis Methods and their Role in a Biosafety Regulatory Framework - Part A, B</td>
<td>UNEP-GEF/Panama project</td>
<td>Oct 20</td>
</tr>
<tr>
<td>Dimitar Efremov</td>
<td>International Meeting “New frontiers in CLL Research”</td>
<td>European Research Initiative on CLL (ERIC)</td>
<td>Oct 20</td>
</tr>
<tr>
<td>Alessandro Marcello</td>
<td>Affrontare l'emergenza coronavrus. Scambio di buone pratiche e informazioni</td>
<td>IILA Organizzazione Internazionale Latino Americana</td>
<td>Apr 20</td>
</tr>
<tr>
<td></td>
<td>Rebuilding better with STI during Covid-19</td>
<td>Co-organized by DESA, UNCTAD and OICT</td>
<td>Jul 20</td>
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<tr>
<td></td>
<td>Re-purposing drugs for COVID-19</td>
<td>CRS-ECSC (Early Career Scientific Committee)</td>
<td>Jul 20</td>
</tr>
<tr>
<td></td>
<td>Facing the COVID-19 pandemic: the virologist’s viewpoint</td>
<td>Nicolae Testemitanu State University of Medicine and Pharmacy, Republic of Moldova</td>
<td>Oct 20</td>
</tr>
<tr>
<td>Group Leader</td>
<td>Topic</td>
<td>Organised by</td>
<td>Date</td>
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<tr>
<td>Andrés Muro</td>
<td>Promoterless Gene Editing in Crigler-Najjar</td>
<td>American Society of Gene and Cell Therapy (23rd Annual Meeting)</td>
<td>May 20</td>
</tr>
<tr>
<td>Vittorio Venturi</td>
<td>Bioinoculants for a more sustainable agriculture</td>
<td>DSI / ICGEB Covid Colloquia</td>
<td>Dec 20</td>
</tr>
<tr>
<td>Serena Zacchigna</td>
<td>The need for standards in experimental echocardiography - 1st Mediterranean Cardiovascular Workshop</td>
<td>FUJIFILM VisualSonics</td>
<td>Sep 20</td>
</tr>
<tr>
<td>Group Leader</td>
<td>Topic</td>
<td>Organised by</td>
<td>Date</td>
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<tr>
<td>Navin Khanna</td>
<td>COVID-19 Vaccines</td>
<td>Indo-Italian Cooperation for COVID19: Activities and Perspectives</td>
<td>Jul 20</td>
</tr>
<tr>
<td>Shireesh Srivastava</td>
<td>Metabolic differences of E. coli strains as revealed by 13C-MFA: Different E. coli for different products?</td>
<td>Indo-US Interdisciplinary Workshop</td>
<td>Oct 20</td>
</tr>
<tr>
<td>Naseem Gaur</td>
<td>Yeast-based biorefineries using agricultural and forest residues</td>
<td>FEMS and Portuguese Society of Microbiology</td>
<td>Sep 20</td>
</tr>
<tr>
<td>Pavan Jutur</td>
<td>Production of 4th Generation Biofuels</td>
<td>Organised by Science Porter BD, Jahangirnagar University, Dhaka, Bangladesh</td>
<td>Oct 20</td>
</tr>
<tr>
<td>Shashi Kumar</td>
<td>Remodeling of plant metabolic pathways for the biosynthesis of terpenoid drugs for malaria treatment</td>
<td>Key Note Lecture-LifeSciences Discussion Forum, USA</td>
<td>Sep 20</td>
</tr>
<tr>
<td>Neeti Sanan Mishra</td>
<td>MirRORs (miRNA Regulation of response) to salt stress in plants</td>
<td>Bioingene.com platform</td>
<td>Jul 20</td>
</tr>
<tr>
<td>Dinesh Gupta</td>
<td>AI, ICT and HPC oriented research for COVID-19 drugs design, vaccine development, treatment</td>
<td>BRICS Networking Meeting</td>
<td>Jun 20</td>
</tr>
<tr>
<td>Tanushri Kaul</td>
<td>Revisiting CRISPR mediated Crop Improvement.</td>
<td>Dept. of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut</td>
<td>Jun 20</td>
</tr>
<tr>
<td>Dinakar M. Salunke</td>
<td>India Fights Back- AQCH: Plant Based Drug for COVID -19</td>
<td>Rajya Sabha TV</td>
<td>Jun 20</td>
</tr>
<tr>
<td>Syed Shams Yazdani</td>
<td>Endeavors to Develop Advanced Biofuels</td>
<td>Amity University</td>
<td>Aug 20</td>
</tr>
</tbody>
</table>
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 that address 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 between scientists in Member States and 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.

In 2020, the ICGEB also launched a COVID-19 fast track call as a swift response to the pandemic, while nonetheless maintaining high selection standards, with the PIs across the components taking part in the review process.

In 2020 a new initiative awarding CRP Grant Prize Winners was established, where the most successful projects after 3 years of support were highlighted as being worthy of recognition. To date, 580 projects have been funded. Figure 5 reports the number of grants awarded since 2018 and their fields of investigation.

Thanks to the support of our Appointed Governors and Scientific Liaison Officers and the Embassies in Italy and abroad, ICGEB’s efforts to implement and develop ICGEB Awareness Workshops in Member States has continued, with a networking visit and workshop being held in Havana, Cuba in January, 2020, to provide information and advice to young students on how to apply for different ICGEB activities (Grants, Fellowships, Meetings and Courses).

**Figure 5**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>19</td>
</tr>
<tr>
<td>2019</td>
<td>24</td>
</tr>
<tr>
<td>2020</td>
<td>31</td>
</tr>
</tbody>
</table>

Number of CRP - Research Grants awarded 2018-2020 and fields of investigation

Basic Science: 48%
Human Healthcare: 29%
Industry & Environment: 13%
Plant Science & Agriculture: 10%
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 are sent out for peer-review by international experts in the specific field of the application.

In 2020, a total of 568 grant applications were submitted to the national Liaison Officers, of which 165 were forwarded to the ICGEB for consideration. From these, 66 passed to the second round of international peer-review, resulting in funding being awarded to 31 projects. A total of 65 CRP Research Grant-funded projects were ongoing in ICGEB Member States in 2020 (Figure 6).

**ICGEB CRP Prize Winners**

**Dr. José M. Estevez**, Fundación Instituto Leloir-FIL (IIIBA-CONICET), Buenos Aires, Argentina has won a prize for his lab’s project entitled: Master molecular regulators of polarized growth in plant cells.

**Dr. Vjekoslav Tomaić**, Ruđer Bosković Institute, Zagreb, Croatia has won a prize for his lab’s project entitled: Biological factors determining Human Papillomavirus (HPV) driven carcinogenesis.

Plaques are issued to awardees of ICGEB CRP Research Grants.
Knowledge transfer, R&D and assistance on COVID-19

Transferring technology to industry in Member States is one of the statutory goals of the ICGEB. During 2020, ICGEB has done its best to fulfill this mission, and throughout the year has been active in supporting Member States, industries at the local and international level, and its scientific communities during the SARS-CoV-2 pandemic. Technology and knowledge transfer activities, performed in this context, mainly by the Molecular Virology laboratory in Trieste, followed 2 main lines of action:

i. assistance to the local NHS and scientific collaboration with Italian and foreign companies in the field of diagnosis and therapy, mainly in the testing of antiviral compounds, and ii. technical assistance to national companies for the development of safety and sanitisation protocols, which have become essential in the period of co-existence with the virus.

During 2020, the Molecular Virology lab entered 16 R&D and/or Technical Assistance agreements for such activities, many of which were performed free of charge, in a collaborative effort against the pandemic. In some cases ICGEB has recovered some of the costs. Five studies undertaken in partnership with companies showed promising results and are being taken forward to the clinic. Three patent applications have been filed. In addition, the ICGEB offered assistance, particularly in the field of molecular diagnostics of SARS-CoV-2, through the development and sharing of diagnostic protocols, video tutorials for protocol implementation, and essential reagents, all freely available through the ICGEB online “COVID-19 Resources” page. Many public health laboratories and companies in Italy, and other Member States continue to benefit from this platform, which is regularly updated. ICGEB responds in a timely manner to requests for assistance it receives through a dedicated email account, and has provided consultancy and scientific advice and/or reagents to over 40 laboratories worldwide. Technical assistance has been offered also to laboratories in Moldova, Iraq and the Dominican Republic for the sequencing of local isolates of the virus.

Biologics

In 2020, as in-house technology transfer activities performed at the Biotechnology Development Unit (BDU) stalled due to the pandemic, the BDU devoted efforts to 2 major activities: development of online video-based training for ICGEB technologies, and restructuring of the laboratory facility dedicated to the development of technologies for biosimilars production and related bio-analytical services, which has now reached completion.

During the year, the lab personnel underwent training to obtain accreditation to perform bio-analytical services to test biologics in accordance with the EU Pharmacopeia. Such additional services complement the portfolio of activities and training opportunities offered to industrial partners in ICGEB Member States. In December 2020, the BDU signed its first technology transfer agreement in virtual modality with the South African Council for Scientific and Industrial Research (CSIR) for insulin and long-lasting insulin. Other agreements followed in early 2021 with Bangladesh and Iran.
R&D collaborations with industry: Biomedicine and Bioeconomy

In 2020, ICGEB licensed 2 technologies developed by the Molecular Medicine lab to two Start-up companies based in the UK: Purespring Therapeutics licensed a screening program for the functional selection of adeno-associated virus (“AAV”) libraries of secreted factors and miRNAs; the other, to be launched soon, will focus on cardioprotection and licensed a pool of factors identified as having cardioprotective efficacy after myocardial infarction.

The Mouse Molecular Genetics lab entered an agreement with a US based company to perform specific assays/studies on Crigler Najjar Syndrome. The Molecular Pathology lab, active in neurodegeneration, is providing expertise and know-how in the functioning of TDP-43 protein to another US company, while the Neurobiology lab is assisting a third US company to screen for reverse-transcriptase inhibitors utilising its neurodegeneration Drosophila model. The Cardiovascular Biology lab obtained a grant from Bayer, under the “Grants 4 Targets” scheme to advance the research on anti-miRNA-based therapeutics for the treatment of leiomyomas, targeting specifically MiR-148a-3p, towards clinical exploitation.

The Membrane Protein Biology lab collaborated with an Indian traditional medicine company to probe the molecular basis of anti-atherosclerotic activities of ayurvedic formulations. The Yeast Biofuels lab started collaboration with a Canadian company engaged in developing and manufacturing therapeutic products to develop genetically engineered yeast strains producing psilocybin. The Vector Borne Diseases lab is collaborating with an Indian traditional medicine company focused on performing pre-clinical studies to evaluate the efficacy and safety of a specific product against COVID-19.

The Bacteriology lab continues to collaborate with companies to identify bacterial endophytes that can work as plant fertilisers or growth promoters. In 2020 the lab signed new agreements with a company in China (for the colonization and persistence of a specific Bacillus Aryabhattai strain in rice roots), and with a company in Serbia (for the development of a bacterial biostimulant for maize). The Industrial Biotechnology lab entered an agreement for a similar activity with an Italian company, to develop a microbial formulation as a treatment for Plasmopara viticola, affecting Grapevine production.

Technology Transfer Highlights

During 2020, the ICGEB developed and coordinated a project to bring SARS-CoV-2 testing materials from New England BioLabs (NEB®) to countries in need in Africa, with support from the Bill & Melinda Gates Foundation. A critical issue in the current COVID-19 pandemic is access to sufficient and affordable diagnostics. NEB has developed a rapid and cost-effective LAMP colorimetric assay that can detect the presence of pathogen DNA or RNA in approximately 30 minutes compared with the usual 2.5 hours required for standard rt-qPCR method. ICGEB, has brought laboratories in Cameroon, Ethiopia, Kenya, and Nigeria to take part in the pilot, multicentric, observational study, to assess the sensitivity and specificity of this novel diagnostic compared with standard PCR methods. If successful, the intention is to expand this project to other countries across Africa with New England BioLabs committing to provide the reagents and technology in a sustainable manner.
The ICGEB Regulatory Science Group (previously the Biosafety Group) has been providing technical assistance related to the safe and sustainable use of biotechnology to its Member States since 1997. Such assistance has focused primarily on the creation and administration of national biosafety regulations, underpinned with the latest approaches and procedures for Competent National Authorities to be able to critically evaluate relevant scientific and technical information to international standards, and to derive autonomous regulatory decisions in an unbiased and transparent manner. In this way, the Group is involved in the improvement of capacities to ensure regulatory effectiveness in a changing landscape of evolving biotechnologies and human resource mobilisation.

In addition to the activities reported the previous year, the emergence of new biotechnologies, especially gene drives, genome editing and RNAi technologies has resulted in increased requests for support from the Member States. It has also resulted in an opportunity for the Group to further assist the Secretariat of the CBD by updating its technical document on synthetic biology, to support discussions at the next meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). Another emergence, the COVID-19 pandemic, has required the Group to adapt its training and consultancy approaches to rely more heavily on virtual platforms, and for which the Group’s portfolio of eLearning biosafety modules (https://showcase-icgeb.elearning.it/index.html) is coming to the fore.

The Group’s activities, collectively, are assisting the development of robust, non-fragmented regulatory mechanisms that are independent of human resource fluctuations, such that they lead to the availability of healthier and safer food and products from fewer resources, while reducing pressure on natural ecosystems, as well as enhancing the support of value-added commodity trade to support sustainable development.
The ICGEB works actively to partner with Agencies, Academia and Research Institutes, other International Organisations, Foundations, Governments, and the Public Sector. This is to advance progress towards the attainment of the sustainable development agenda through the development of biotechnology.

Some of the Agencies, Institutes and Organisations with whom ICGEB is proud to be partnered.
The ICGEB delivers on its mandate by cooperating with a wide range of partners: Member States and non-member States, multilaterals operating within the United Nations System, other International Organisations, bilateral cooperations, Foundations, academia, research and funding institutions, and the private sector.

During 2020, the ICGEB constituency increased with the new Membership of Angola. Moreover, Djibouti has formally requested the ICGEB Board of Governors to become a Member Country. Several other non-member countries were approached with the aim of eliciting the interest of their Governments and the respective scientific communities, in the activities implemented by the ICGEB.

With regards to partnership with Multilateral Organisations, ICGEB has engaged with the UN system, by participating in and contributing to the debate on Science and Development in the context of the UN Agenda 2030. In particular, within the auspices of the Technology Facilitation Mechanism (TFM), ICGEB participates in the Science Technology and Innovation (STI) Forum and contributed to the publication on Gender and STI. It is also included in the works of the Inter-Agency Task Team (IATT) and its Gender and STI working group. In 2020 the ICGEB presented for the first time in a side event during the Ministerial leg of the High Level Political Forum (HLPF), a presentation on its research activities focused to fight the COVID-19 pandemic. 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.

Furthermore, in April 2020 the ICGEB signed a Memorandum of Understanding with the United Nations Office of South-South Cooperation (UNOSSC).

The agreement is aimed at strengthening each partner’s added value in promoting scientific cooperation between countries in the Global South. The joint work resulted in the ICGEB featuring in their flagship publication “South-South Good Practices Report”, which was launched by the UN Secretary General in September 2020, and in ICGEB being selected as “Partner of the Month” in July 2020, increasing the visibility of the Organization in new development scenarios.
An exciting new partnership was forged in 2020 with the signing of an agreement with the World Academy of Sciences (TWAS) and ICGEB for establishing joint fellowships programs, meetings and exchange of experts, in part supported with the funding provided by the UN Tech Bank for LDCs. The new project is now in the implementation phase.

ICGEB has also become a member of the Tech Access Partnership (TAP), with the UN Tech Bank, UNDP, WHO, and UNCTAD, to support local production of health technologies in LDCs.

In addition, the ICGEB continues to hold observer status within the Meeting of the States Parties of the Biological Weapons Convention (BWC) engaged in the promoting of the peaceful development and use of biotechnology. ICGEB’s 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 particular interest to the States Parties to the Convention.

ICGEB has strengthened the already valuable cooperation with the Istituto Italo Latino Americano (IILA), and in 2020 the parties signed a protocol whereby IILA is funding three CRPs on COVID-19 related research by Latin American investigators.

A further exciting development was the establishment of a collaborative project with the Bill & Melinda Gates Foundation and New England Biolabs (NEB), aimed at establishing rapid COVID-19 laboratory diagnostics programmes in LMICs, targeting, as a pilot, Cameroon, Ethiopia, Kenya, Nigeria and South Africa.

The ICGEB Components have been exploring and realising new remarkable partnerships; in particular New Delhi received a 2-year grant from the Global Health Innovative Technology Fund (GHIT Fund) for the project entitled “Structure-based approach to develop a novel mechanism of action antimalarial with multi stage activity”, and Cape Town was awarded a 3-year grant from the Standards and Trade Development Facility and the US Dept of Agriculture for a project intended to enhance the registration and use of biopesticides.
The ICGEB Communications, Public Information and Outreach Office works to ensure the visibility of the Organisation, its activities, and its dissemination of scientific information to a range of audiences.

**Digital communications**

The ICGEB Website is kept up to date with comprehensive information about the Organisation, its locations, Regional Research and Affiliated Centres, research programmes, latest news, events and details of the various training programmes, facilities and services provided by ICGEB.

In 2020, new areas of the Website were developed, focusing on South-South Cooperation, Women in Science, Projects, and the Alumni Association. The ICGEB’s bimonthly, electronic Newsletter maintains a readership of 30,000, and its social media platforms support active engagement and interaction across the ICGEB constituency. The YouTube, iTunes and Web platforms offer free scientific podcast collections and video tutorials, and promote eLearning and Video On Demand resources that are developed by the Regulatory Science and Biotechnology Development Groups.

**Engagement activities**

ICGEB supports engagement initiatives through the active involvement of its scientific community and these are directed at the wider community, including journalists, students, teachers, and the public. Science & the City Events are informal, public conferences in the local vernacular, designed to facilitate outreach on scientific issues with a societal relevance. This provides a vehicle for scientists, and experts from a variety of disciplines, to meet with members of the public, and to engage in conversation to debate on hot topics in science. It also provides researchers with a comprehensive insight into how society could be impacted by their research. ICGEB hosts public open days to showcase its research and coordinates tours and visits to its laboratories for interested groups, individuals or the press. It participates in educational programmes supporting school students and teachers, and is a strong presence at science fairs to support its scientists and promote ICGEB activities.
Publications

ICGEB produces publications every year for various audiences, including scientists and the non-specialist public.

The Annual Report is published once a year after approval by the Council of Scientific Advisers and covers the past calendar year. It includes research, education, and technology transfer highlights. The Strategic Plan is published following approval by the Council and the Board of Governors and presents ICGEB’s activities in the context of the United Nations 2030 Agenda and the Sustainable Development Goals.

General and unit overview brochures are produced, as are posters for calls for the International PhD and Postdoctoral Fellowship training programmes and annual scientific Meetings and Courses.

Media relations

The Public Information Office aims to provide high quality information to the media, covering important research news and scientific developments, to represent the best of ICGEB. It works with journalists interested in research and services across ICGEB’s three locations and strives to help find experts; and to arrange interviews, filming requests, and visits. The Organisation is building media contacts worldwide who receive our press releases. The office also organises placements.

Podcast
100,000 Viewers
650 movies
Life Sciences

2,000 subscribers
Health & Medicine
and Science
Top views in USA, Italy, India, UK Germany, Japan, Australia and Canada

>1,800 Followers
>670 posts

>11,000 Followers up one third since 2019
ICGEB Alumni Group
with over 450 members

>19,000 Followers (+ 20% a year)
most popular among the 25-34 age-group

>11,000 Followers reaching up to 100,000 impressions a month
The Financial Statements of the ICGEB are prepared in accordance with International Public Sector Accounting Standards (IPSAS). The overall ICGEB 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. 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-ICGEB Research Grants).

Table 5A reports the ICGEB’s Core Funds for financial year 2020, whereas Table 5B reports the revenue generated by External Funds in 2020.

**Table 5A**

<table>
<thead>
<tr>
<th>Revenues (in Euro)</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution of the Italian Government</td>
<td>10,170,000</td>
</tr>
<tr>
<td>Contribution of the Indian Government</td>
<td>4,551,212</td>
</tr>
<tr>
<td>Contribution of the South African Government</td>
<td>1,333,719</td>
</tr>
<tr>
<td>Member States’ Assessed Contributions</td>
<td>736,267</td>
</tr>
<tr>
<td><strong>Total Core Funds</strong></td>
<td><strong>16,791,198</strong></td>
</tr>
</tbody>
</table>

**Table 5B**

<table>
<thead>
<tr>
<th>Revenue from External Funds (in Euro)</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trieste</td>
<td>3,090,663</td>
</tr>
<tr>
<td>New Delhi</td>
<td>3,716,996</td>
</tr>
<tr>
<td>Cape Town</td>
<td>113,298</td>
</tr>
<tr>
<td><strong>Total Core Funds</strong></td>
<td><strong>6,920,957</strong></td>
</tr>
</tbody>
</table>

*Subject to the approval of the Financial statement by the External Auditors*
The main sources of External 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 7 reports the Revenues from External Funds generated by each ICGEB component in 2020.

![External Funds generated by the ICGEB. The pie chart shows the distribution among the three Components](image)

The Centre continues to attract the interest of development partners as well as industry. During the period 2018-2020, the ICGEB received grants from several donors: Acid Maltase Deficiency Association (USA), AIRC (IT), AriSLA (IT), Beneficentia Stiftung (CH), Bill & Melinda Gates Foundation (USA), Biotechnology Industry Research Assistance Council (IN), Department of Biotechnology of India, Department of Science and Technology of India, Indian Council of Agricultural Research, National Research Foundation (SA), NIH (USA), Iceland Liechtenstein Norway grants (NO), Regione Autonoma Friuli Venezia Giulia (IT), Swiss National Science Foundation (CH), Sun Pharmaceuticals (India), UNEP Nairobi Office, Wellcome Trust Alliance (IN), Western Ontario University (CAN), among others.

*25th Session of the ICGEB CSA, Trieste, Italy*
EXPENDITURES

The overall budget implemented in 2020 amounted to €15,664,215, corresponding to 93% of the Core Funds of the Centre (Table 6).

Expenditures (on core funds)  

<table>
<thead>
<tr>
<th>Description</th>
<th>2020 Expenditures (in Euro)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>7,895,624</td>
</tr>
<tr>
<td>Professional Staff</td>
<td>2,433,79</td>
</tr>
<tr>
<td>General Staff and National Officers</td>
<td>4,969,742</td>
</tr>
<tr>
<td>Experts and Consultants</td>
<td>492,091</td>
</tr>
<tr>
<td>Governance</td>
<td>124,265</td>
</tr>
<tr>
<td>Governance &amp; ICGEB Bodies</td>
<td>124,265</td>
</tr>
<tr>
<td>Extramural Activities</td>
<td>1,772,327</td>
</tr>
<tr>
<td>Fellowships</td>
<td>871,476</td>
</tr>
<tr>
<td>Meetings and Courses</td>
<td>16,968</td>
</tr>
<tr>
<td>CRP-ICGEB Research Grants</td>
<td>883,883</td>
</tr>
<tr>
<td>Running of the Laboratories</td>
<td>3,041,107</td>
</tr>
<tr>
<td>Consumables</td>
<td>1,546,751</td>
</tr>
<tr>
<td>Equipment</td>
<td>1,296,044</td>
</tr>
<tr>
<td>Library</td>
<td>137,571</td>
</tr>
<tr>
<td>Travel</td>
<td>60,740</td>
</tr>
<tr>
<td>Premises and Utilities</td>
<td>2,830,892</td>
</tr>
<tr>
<td>Total Core</td>
<td>15,664,215</td>
</tr>
</tbody>
</table>

*The amounts in this table are rounded to the nearest euro. Totals may not add up owing to rounding.*
Approximately 50% of the Expenditures 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 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 €1.8 million of the Core Budget (Figure 8).

*Figure 8: 2020 Core Fund Expenditures by category*

<table>
<thead>
<tr>
<th>Category</th>
<th>Expenditures (2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>50%</td>
</tr>
<tr>
<td>Governance</td>
<td>18%</td>
</tr>
<tr>
<td>Extramural Activities</td>
<td>20%</td>
</tr>
<tr>
<td>Running of the Laboratories</td>
<td>11%</td>
</tr>
<tr>
<td>Premises and Utilities</td>
<td>1%</td>
</tr>
</tbody>
</table>
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, we publish a cross section of grants from our Donors (to the value of 50,000 Euro and over) active during 2020:

**Acid Maltase Deficiency Association - AMDA**  
E. Buratti Mol. Pathology ICGEB Trieste  
**Partners:** Az. Sanitaria Univ. Integrata Udine ASUIUD (University Hospital “S. Maria Misericordia”)  
**Title:** Pre-clinical validation of FDA approved molecules able to rescue GAA pre-mRNA splicing of c.-32-13T>G mutants as therapeutic agents for late-onset Pompe Disease  
**Duration:** 2019-2022

**AIRC Investigator Grant 2018**  
F. Benvenuti Cellular Immunology ICGEB Trieste  
**Title:** Does lung tumour development suppress the presentation of neo-epitopes by type 1 dendritic cells?  
**Duration:** 2019-2024

**AIRC Investigator Grant 2019**  
L. Banks Tumour Virology ICGEB Trieste  
**Title:** Characterisation of the functions of the Human Papillomavirus E6 and E7 oncoproteins  
**Duration:** 2020-2025

**AIRC Investigator Grant 2020**  
S. Zacchigna Cardiovascular Biology ICGEB Trieste  
**Title:** The role of the matrix in cancer protection: lessons from the heart and novel therapeutic opportunities - ERASE  
**Duration:** 2020-2026

**AIRC Investigator Grant 2020**  
D. Efremov, Molecular Hematology ICGEB Trieste  
**Title:** In vivo models to study the role of genetic lesions and microenvironmental signals in driving CLL cell proliferation  
**Duration:** 2020-2025

**AIRC Investigator Grant 2020**  
G. Del Sal Cancer Cell Signalling ICGEB Trieste  
**Title:** Metastatic disease: the key to unmet need in oncology - 5 per mille 2019  
**Duration:** 2019-2026
Projects 2020

**AriSLA**
E. Buratti Molecular Pathology ICGEB Trieste
**Title:** Defining the role of hnRNP proteins in enhancing TDP-43 pathology - PathensTDP
**Duration:** 2019-2022

**Assicurazioni GENERALI**
A. Marcello Molecular Virology ICGEB Trieste
**Title:** Identificazione di Coronavirus SARS-CoV-2 e definizione della risposta cellulare innata ed adattiva
**Duration:** 2020-2022

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**Bill & Melinda Gates**
A. Marcello Molecular Virology ICGEB Trieste
**Partner:** New England Biolabs, Chantal Biya Int. Reference Centre in Cameroon, Ethiopian Biotech Institute (EBTI), Kenya Medical Research Institute - KEMRI College of Medical Sciences, University of Maiduguri, Department of Medical Laboratory Science -Nigeria
**Title:** COVID-19: Establishing rapid laboratory diagnostics programs in LMICs
**Duration:** 2020

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**Biotechnology Industry Research Assistance Council (BIRAC)**
V. S. Chauhan ICGEB New Delhi
**Partner:** Syngene International Ltd
**Title:** A Phase I, clinical trial to assess the safety and immunogenicity of *P. falciparum* vaccines
**Duration:** 2018-2020

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**Biotechnology Industry Research Assistance Council (BIRAC)**
R. Nanda Translational Health ICGEB New Delhi
**Partner:** 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
Projects

Biotechnology Industry Research Assistance Council (BIRAC)
V.S. Chauhan ICGEB New Delhi
Title: Development of dipeptide based targeted nanoformulation for breast cancer
Duration: 2020-2022

Biotechnology Industry Research Assistance Council (BIRAC)
S. Sunil Vector Borne Diseases ICGEB New Delhi
Title: Translational research consortia TRC for Chikungunya virus
Duration: 2019-2023

Beneficentia Stiftung
A. Marcello Molecular Virology ICGEB Trieste
Title: Renovation and daily running of BL3 Laboratory
Duration: 2020-2022

Department of Biotechnology (DBT)
V.S. Chauhan Malaria Biology ICGEB New Delhi
Title: Translational research and clinical development of malaria vaccine candidates
Duration: 2019-2022

Department of Biotechnology (DBT)
S. Yazdani Microbial Engineering ICGEB New Delhi
Title: Development of Paenibacillus polymyxa as a platform for production of branched chain alcohols
Duration: 2019-2022
Projects

Department of Biotechnology (DBT)
M.K. Reddy Crop Improvement ICGEB New Delhi
Title: Editing rice genes through CRISPR/Cas9 technology for enhanced and durable blast resistance in rice
Duration: 2020-2022

Department of Biotechnology (DBT)
D. Salunke Structural Immunology ICGEB New Delhi
Title: Organizing an International summit on women in STEM
Duration: 2020

Department of Biotechnology (DBT)
S. Kumar Rhode and N. Gaur Metabolic Engineering ICGEB New Delhi
Title: Genetic engineering of microalgae for producing alkanes for further applications
Duration: 2020-2022

Department of Biotechnology (DBT)
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 (DBT)
S. Kumar Metabolic Engineering ICGEB New Delhi
Title: Chloroplast metabolic engineering of Artemisia annua for enhancing artemisinin biosynthesis
Duration: 2018-2021

Department of Biotechnology (DBT)
S. Kumar Metabolic Engineering ICGEB New Delhi
Partners: Jamia Hamdard
Title: Synthetic biology approach for producing artemisinin in edible plant and effective Malaria treatment by oral delivery of plant cells
Duration: 2018-2021
**Projects**

**Department of Biotechnology (DBT)**
S. Yazdani Microbial Engineering ICGEB New Delhi

**Partners:** 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

**Department of Biotechnology (DBT)**
N. Sarovar Bhavesh Transcriptional Regulation ICGEB New Delhi

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

**Duration:** 2018-2021

**Department of Biotechnology (DBT)**
D. Kumar Cellular Immunology ICGEB New Delhi


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

**Duration:** 2018-2021

**Department of Biotechnology (DBT)**
P. Jutur Omics of Algae ICGEB New Delhi

**Title:** Demonstration of algal chassis for the photoautotrophic production of isoprenoids

**Duration:** 2019-2022

**Department of Biotechnology (DBT)**
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:** 2019-2022

**Department of Biotechnology (DBT)**
D. Salunke Structural Immunology ICGEB New Delhi

**Title:** Targeting drug resistance in tuberculosis and malaria

**Duration:** 2019-2022
Projects

Department of Biotechnology (DBT)
S. Yazdani Microbial Engineering ICGEB New Delhi
Title: Indian Marine cyanobacterial host for production of drop-in fuels
Duration: 2019-2022

Department of Biotechnology (DBT)
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

Department of Science and Technology (DST)
A. Sharma Structural Parasitology ICGEB New Delhi
Title: Biomolecular characterisation of Malaria parasite drug target dihydropteroate synthase
Duration: 2018-2021

Department of Science and Technology (DST)
A. Sharma Structural Parasitology ICGEB New Delhi
Title: Hit to lead development of potent anti-parasitic natural product scaffolds
Duration: 2019-2022

Department of Science and Technology (DST)
A. Arulandu Membrane Protein Biology ICGEB New Delhi
Title: Design, validation and development of novel peptidomimetic
Duration: 2020-2022

EMBO
D. Kumar Cellular Immunology ICGEB New Delhi
Title: EMBO symposium titled Mycobacterial heterogeneity and host tissue tropism
Duration: 2020
Projects

FONDAZIONE CARIPLO
Subcontract of a H2020 financed project
A. Marcello Molecular Virology ICGEB Trieste
**Partners:** Fondazione Istituto Nazionale di Genetica Molecolare, Università di Milano - Bicocca
**Title:** Unraveling the innate immune response towards SARS-CoV2 (INNATE-CoV)
**Duration:** 2020-2022

Fondazione CRTrieste CARDIOGEN
M. Giacca Mol. Medicine ICGEB Trieste
**Partners:** Azienda Sanitaria Universitaria Integrata di Trieste ASUITS (Struttura Complessa di Cardiologia)
**Title:** CARDIORIGEN
**Duration:** 2019-2022

Fondazione SNAM
A. Marcello Molecular Virology ICGEB Trieste
**Title:** SNAM for COVID-19
**Duration:** 2020-2021

Genethon
Subcontract of a H2020 financed project
A. Muro Mouse Mol. Genetics ICGEB Trieste
**Partner:** Genethon
**Title:** “Adeno-Associated Virus Vector-Mediated Liver Gene Therapy for Crigler-Najjar Syndrome” WP5
**Duration:** 2018-2022

Indian Council of Agricultural Research
A. Chandele EMORY- ICGEB Vaccine Program ICGEB
New Delhi
**Title:** Human Monoclonals to COVID-19
**Duration:** 2019-2021
Projects

**Indian Council of Agricultural Research**  
MK. Reddy Crop Improvement ICGEB New Delhi  
**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

**Indian Council of Medical Research**  
T. Kaul Nutritional Improvement of crops  
**Title:** Re-designing rice crops for improved grain micronutrient quality using CRISPR-Cas9/Cpf1 genome editing  
**Duration:** 2019-2021

**Indo-French Centre for the Promotion of Advanced Research**  
A. Mohmmed 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:** 2019-2022

**Ministero della Salute**  
D. Efremov Molecular hematology ICGEB Trieste  
**Partner:** CRO Aviano  
**Title:** VLA-4 IN CLL  
**Duration:** 2018-2022

**Ministero Sviluppo Economico**  
M. Viviani Fundraising TT & Innovation ICGEB  
**Title:** CUTTING 2020  
**Duration:** 2020-2023

**National Eye Institute of the National Institutes of Health**  
F. Pagani Human Molecular Genetics ICGEB Trieste, Massachusetts General Hospital  
**Partner:** Massachusetts General Hospital  
**Title:** A novel exon-specific U1 snRNA strategy to correct splicing in Familial Dysautonomia  
**Duration:** 2018-2022
**PROJECTS**

**National Institutes of Health**
A. Sharma Structural Parasitology ICGEB New Delhi  
**Title:** Exploiting diversity oriented chemical synthesis for combating chronic parasitic infection  
**Duration:** 2020-2023

**National Research Foundation**  
South Africa/ SWISS Joint Research Cooperation Programme  
L. Zerbini Cancer Genomics ICGEB Cape Town  
**Partners:** 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

**National Research Foundation**  
South Africa/ SWISS Joint Research Cooperation Programme  
L. Zerbini Cancer Genomics ICGEB Cape Town  
**Partners:** 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

**Norway Grants Fund**  
A. Marcello Molecular Virology ICGEB Trieste  
**Partners:** Veterinary Res. Institute - Czech Republic, Chumakov Federal Scientific Centre - Russia, Biomedical Research Centre Slovak Academy of Sciences, Norwegian Institute of Public Health - Norway, Umea University - Sweden  
**Title:** TBFVnet: surveillance and research on tick-borne flaviviruses (TBFV)  
**Duration:** 2020-2024

**Provincia Autonoma Bolzano Alto Adige**  
INTERREG ITALIA-AUSTRIA 2014-2020  
S. Zacchigna Cardiovascular Biology ICGEB Trieste  
**Partners:** EURAC, MUIC, CUAS  
**Title:** INCardio INTERREG Italia-Austria  
**Duration:** 2017-2021

**Nirvana Life Science Inc.**  
N. Gaur Yeast Biofuel ICGEB New Delhi  
**Title:** Psilocybin producing S. cerevisiae strain with the yield of 1000 mg/L in laboratory scale fermenter (500ml)  
**Duration:** 2020-2021

**Provincia Autonoma Bolzano Alto Adige**  
INTERREG ITALIA-AUSTRIA 2014-2020  
S. Zacchigna Cardiovascular Biology ICGEB Trieste  
**Partners:** EURAC, MUIC, CUAS  
**Title:** INCardio INTERREG Italia-Austria  
**Duration:** 2020-21
ICGEB Annual Report 2020

PROJECTS

Regione Autonoma Friuli Venezia Giulia
L.R. 19/2000
S. Zacchigna Cardiovascular Biology ICGEB Trieste

**Partners:** 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:** 2018-2021

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Regione Autonoma Friuli Venezia Giulia
L.R. 45/2017
N. Skoko Biotechnology Development Unit ICGEB Trieste

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

**Duration:** 2017-2021

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Regione Autonoma Friuli Venezia Giulia
L.R. 17/2014
M. Giacca Molecular Medicine ICGEB Trieste

**Partners:** Azienda Sanitaria Universitaria Integrata di Trieste ASUITS (Struttura Complessa di Cardiologia)

**Title:** Cardiomiociti da cellule staminali per una cardiologia personalizzata – CardioStem

**Duration:** 2019-2022

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Regione Autonoma Friuli Venezia Giulia
L.R. 17/2014
S. Zacchigna Cardiovascular Biology ICGEB Trieste

**Title:** ComUnicaRe per crescere In SAlute - Curiosa

**Duration:** 2019-2022

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A. Marcello Molecular Virology ICGEB Trieste

**Partners:** Valdoltra Orthopedic Hospital (Slovenia), University of Lubiana, Faculty of Chemistry and Chemical Technology, Dott. Dino Paladin, Jafral

**Title:** Diagnosi di infezioni prostetiche in ortopedia con metodi innovative basati sull’uso di batteriofagi – IMBI

**Duration:** 2019-2021

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POR FESR 2014-2020
S. Zacchigna Cardiovascular Biology ICGEB Trieste

**Partners:** Vivabiocell, Zeta Research, Università degli Studi di Trieste

**Title:** PREFER

**Duration:** 2018-2022
**Projects 2020**

**SunPharma International**
N. Khanna Translational Health ICGEB New Delhi  
**Title:** Dengue Vaccine Programme  
**Duration:** 2016-2021

**Swiss National Fund**
M. Giacca Molecular Medicine ICGEB Trieste  
**Partner:** University of Lausanne Medical School  
**Title:** Regenerative strategies for heart disease via targeting the long noncoding transcriptome - SINERGIA  
**Duration:** 2017-2021

**The Broad Institute**
A. Sharma Structural Parasitology ICGEB New Delhi  
**Title:** Structured-based approach to develop a novel mechanism-of-action antimalarial with multistage activity  
**Duration:** 2020-2021

**UNEP Nairobi**
W. Craig Regulatory Science ICGEB Trieste  
**Title:** AUNEP-GED Project for sustainable Capacity Building for Effective Participation in the BCH in Italy  
**Duration:** 2020

**Wellcome Trust Alliance**
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

**Western Ontario University**
E. Buratti Mol. Pathology ICGEB Trieste  
**Title:** Full length RGNEF and/or “RGNEF leucine–rich domain” as a therapeutic target in ALS  
**Duration:** 2019-2022
## ICGEB AT A GLANCE

### INSTITUTIONAL
- Founded: 1983
- Fully operational: 1987
- Components: 3
- Full Member States: 66
- Additional Signatory Countries: 19

### PERSONNEL
- Total Personnel: 703
- Scientific Personnel: 564

### RESEARCH
- Research Groups: 46
- Active Research Grants: 143
- Publications since 1988: >3000
- Publications in 2020: 244

### FELLOWSHIPS
- Fellowships awarded since 1988: 1618
- Fellows on board 2020: 251
- PhD students on board 2020: 199

### MEETINGS & COURSES
- Meetings and Courses since 1988: 600

### GRANTS
- CRP-Research Grants since 1988: 611
- CRP-Research Grants 2020 awarded: 31
- Countries with ongoing CRP Grants: 35

### OUTREACH
- Podcasts: >650
- iTunes and YouTube Downloads: >100,000/year
- Social Media: [ICGEB on Social Media]
Three easy steps to Membership

1. The Government sends a written request to the ICGEB to become a member
2. This request is presented to the Board of Governors for approval
3. Once accepted, the Government deposits the Instrument of Accession to the Statutes of ICGEB, with the UNSG, Treaty Section, office of Legal Affairs, New York and becomes a full Member of the ICGEB
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 Bustamanete, MEXICO
Richard J. Roberts, USA
Mohammed Sebaihia, ALGERIA
Carmen Socaciu, ROMANIA
Ramesh V. Sonti, INDIA
Inder Verma, USA
Khatijah Yusoff, MALAYSIA

(*) Nobel Laureate