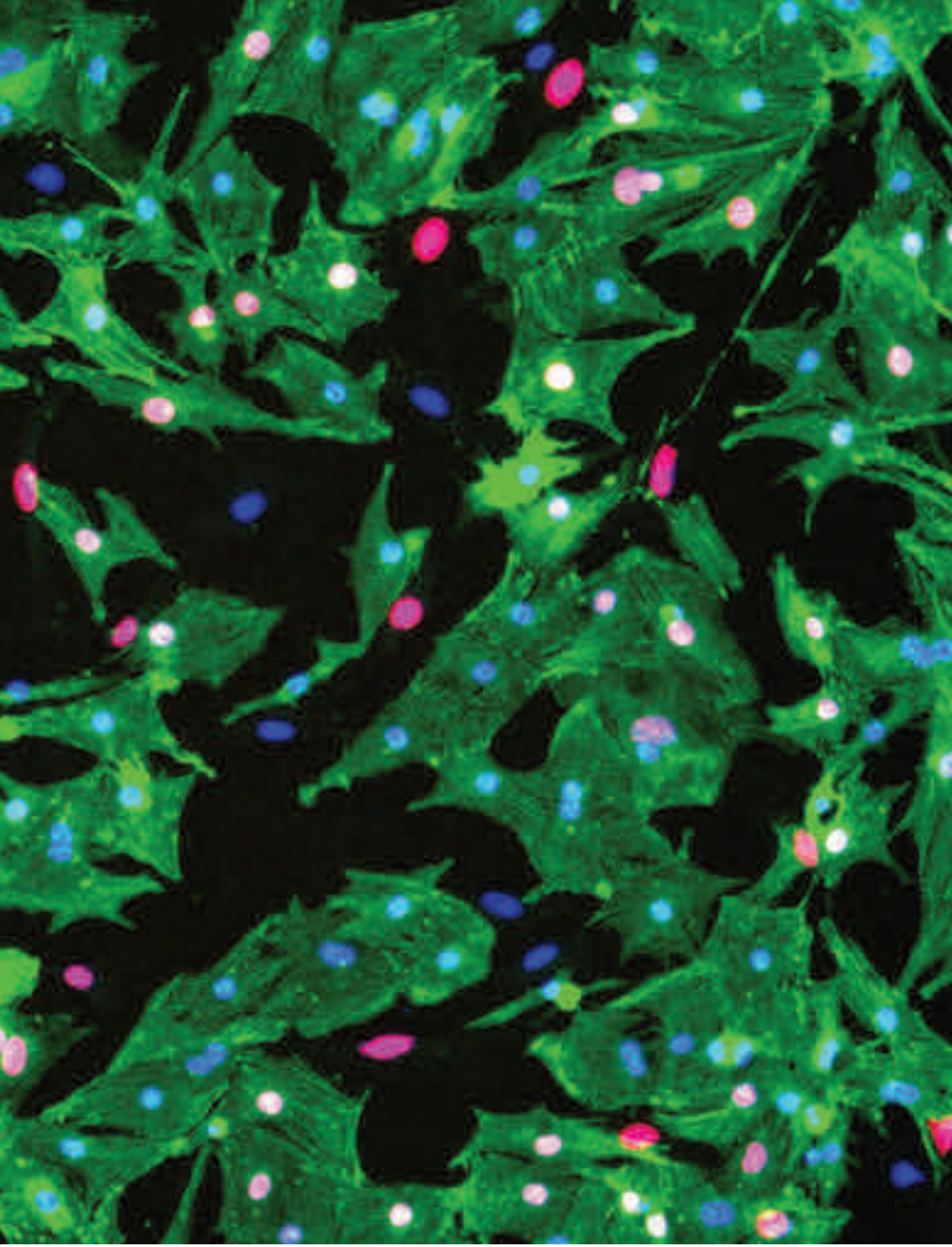
# ICGEB

International Centre for Genetic Engineering and Biotechnology


## 30 YEARS OF BIOTECHNOLOGY FOR GLOBAL DEVELOPMENT

ICGEB International Centre for Genetic Engineering and Biotechnology | Developing Knowledge



*Cardiac cells treated with a microRNA that increases their proliferation*

## A message from the Director-General

*The ICGEB is a unique International Organisation operating within the United Nations System, in that it carries out advanced research and education in its own laboratories in Trieste, Italy, New Delhi, India and Cape Town, South Africa. As such, the Organisation is at the interface between academic research and industrial application in biotechnology, a key sector for global development.*

*Pharmaceuticals and vaccines obtained thanks to genetic engineering, biological products to improve agriculture and reduce its impact on the environment, and new strategies for the production of clean energy are some of the fields of application that can ensure global, sustainable development.*

*International cooperation in science represents one of the most effective ways to promote global growth, provides solutions to hunger and medical needs and ensures a proper response to the many societal challenges the world over.*

*The ICGEB is grateful to its many Member States for their continuous support in these areas of activity over the past 30 years.*

Mauro Giacca

# the ICGEB

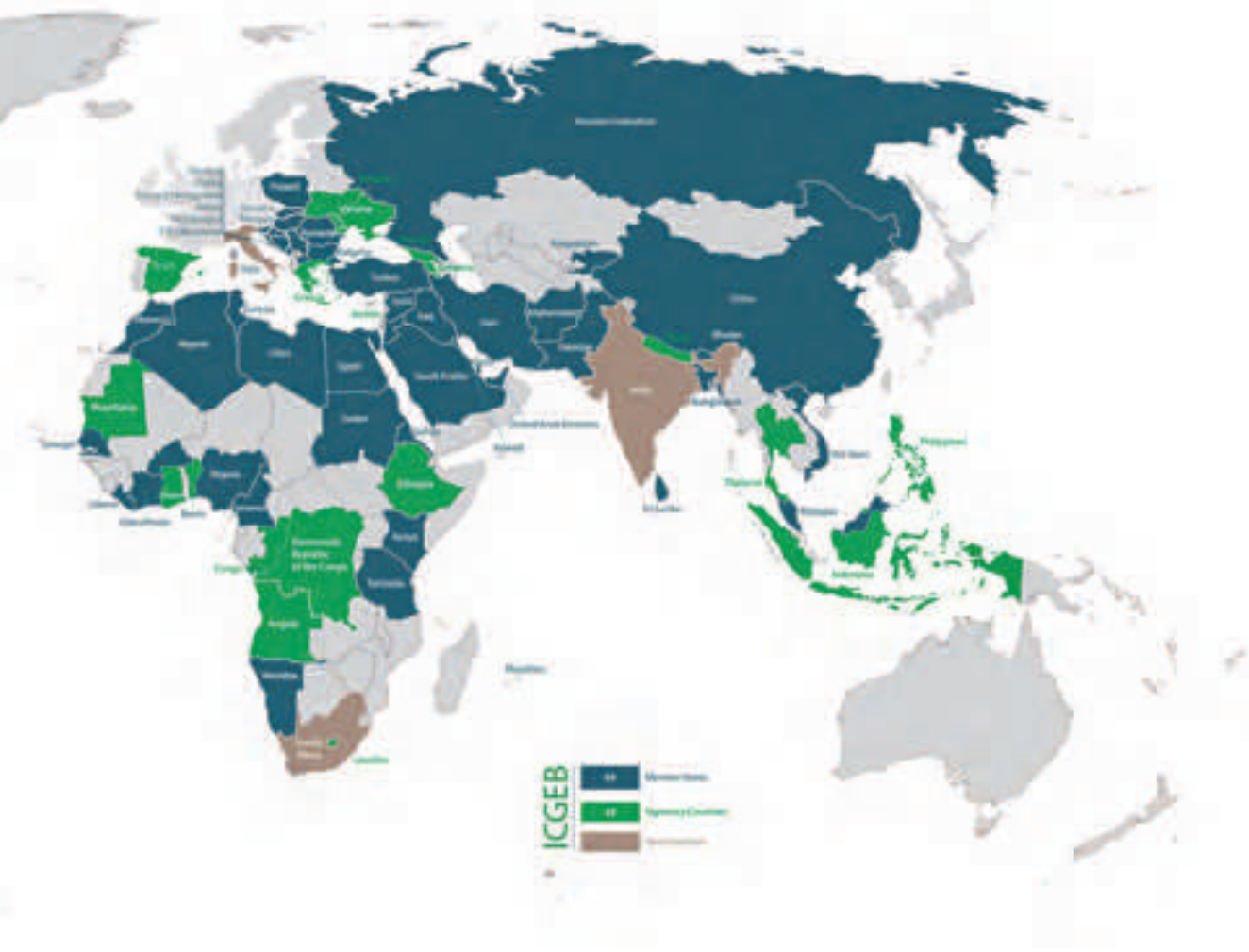
## The Story

The ICGEB is an international, nonprofit, research organization operating since 1987 within the **United Nations Common System**. Established as a special project of UNIDO in 1983 as a **Centre of excellence** for research and training in molecular biology and genetics for the benefit of **developing countries** and economies in transition, it became fully autonomous in 1994. The Centre contributes to solving some of the major problems affecting health, nutrition, agriculture and industrial development in the field of **biotechnology**.

## Member States

The ICGEB is supported by **64 Member States**. Its main laboratories are located in Trieste, Italy, New Delhi, India and Cape Town, South Africa, with a network of over 40 **Affiliated Centres** in its Member States. The Headquarters of the Centre are in Trieste, Italy.

The activities of the ICGEB are headed by a Board of representatives of its Member States. An international **Scientific Council**, comprising fifteen acclaimed scientists, including **Nobel Prize laureates**, sustains its scientific activities.




*The ICGEB is supported by over 60 Member States (shown in blue on the map).*


ICGEB Director, Arturo Falaschi with UNIDO Director General, Mauricio de Maria y Campos, 20 February 1996, Transfer of Assets UNIDO-ICGEB

# The ICGEB mandate

A Centre of excellence for research, training and technology transfer to industry in the field of biotechnology to promote sustainable global development.

## Developing knowledge

# the ICGEB LABORATORIES

**18** Research Groups
**200** researchers from over 25 different nationalities

Research Programmes in **biomedicine**

Trieste, ITALY

New Delhi, INDIA

**25** Research Groups
**400** researchers

Research Programmes in **infectious diseases, plant biotechnology** and **biofuels**

Cape Town, SOUTH AFRICA

**4** Research Groups
**50** researchers

Research Programmes in **infectious** and **non communicable diseases**

## Facilities

*In the three ICGEB Components general use equipment and specialised services are available to the research groups. These include resources for cell culture and manipulation; instrumentation for advanced optical microscopy; instrumentation for advanced protein research and proteomics; a BL3 safety laboratory for the handling of class 3 pathogens; a viral vector producing facility; a computer facility dedicated to genomics and biotechnology, a high-throughput facility for whole genome siRNA and small molecule screenings.*

## Funding for research projects

*In addition to the support provided by Member States, between 2003 and 2015 ICGEB has obtained over 690 grants for specific projects, to the value of approximately 93 million Euro, mainly from:*

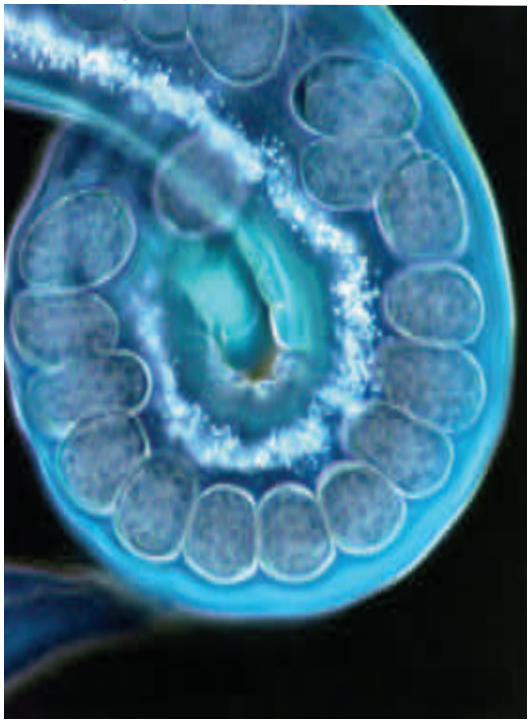
*the European Commission;*
*from the USA: Bill & Melinda Gates Foundation, JDRF, NIH and Leukemia&Lymphoma Society;*
*from Canada: Canadian Grand Challenges Scheme;*
*from the UK: Wellcome Trust, Royal Society and AICR;*
*from France: AXA Foundation and AFM;*
*from Italy: Telethon, AIRC and AriSLA.*

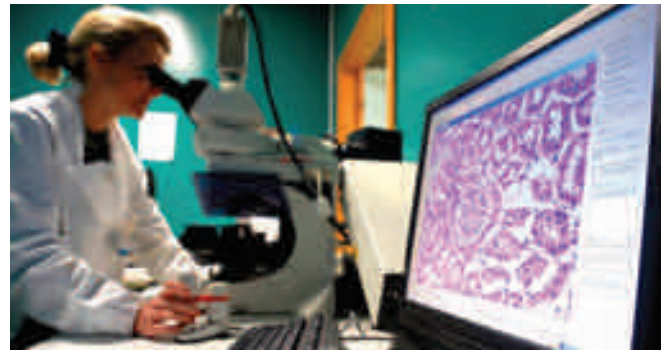
*Additional funding for ICGEB activities has been provided by national Government bodies, including:*

*the Ministry of Education and Research and the Ministry of Health in Italy;*
*the Department of Biotechnology in India;*
*the National Research Foundation and Medical Research Council in South Africa.*

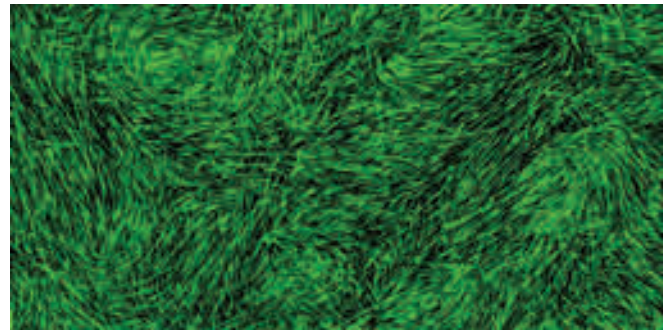
*Recently the ICGEB has also obtained approximately 4.5 million Euro through agreements with international, biotech companies.*

*Nippostrongylus brasiliensis worm with eggs*





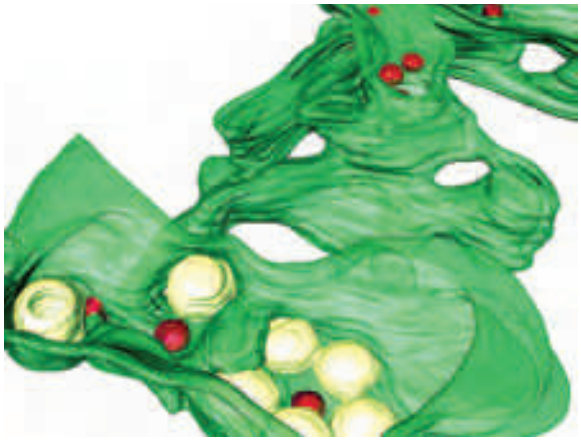
*Skeletal muscle cells*



# SCIENTIFIC RESEARCH

The ICGEB undertakes advanced research in various sectors of modern molecular genetics and biotechnology.

In *Trieste*, the laboratories are active in the field of biomedical research, in particular **virology** (HIV/AIDS, papillomavirus, dengue and rotavirus), **immunology** (tumour vaccines), **molecular genetics** of simple and complex hereditary diseases (including cardiovascular diseases and cancer) and **neurobiology** (the study of dementias). The Centre is also state-of-the-art in its use of gene therapy and stem cells for non communicable diseases, in particular myocardial infarction and heart failure.



*Replication of the Tick-borne encephalitis virus, a problem of increasing importance in Northern Italy.*

In *New Delhi,* studies mainly focus on **malaria**, **tuberculosis** and **hepatitis**, with the development of new diagnostic systems and vaccines, and in the field of **agricultural biotechnology** and the production of **biofuels**.

In *Cape Town,* studies are in **infectious diseases** that affect the African continent, in particular HIV/AIDS, malaria and several **parasitic diseases**.

## Results

The ICGEB publishes the results of its scientific research in **top international scientific journals**. Since 1988, over **2700** publications have been generated by researchers at the three ICGEB Components.

Over the last five years alone, ICGEB articles have appeared in Nature, Science, Cell, Nature Medicine, Nature Reviews Cancer, among others.

The ICGEB laboratories represent a tangible example of global **excellence in research** in Italy, India and South Africa, and the ability to attract young talented students.

## SOME RECENT DISCOVERIES

*At the ICGEB Trieste, a laboratory has discovered small RNAs that, used as pharmaceutical products, induce heart regeneration after infarction; the discovery is advancing towards clinical application (Nature 2012, 492, 376).*

*Another research group has understood where the HIV virus becomes integrated in the DNA of the cells that it infects, causing them to become immune to drug therapy (Nature 2015, 521, 227)*

*At the ICGEB New Delhi, an innovative vaccine for malaria is in the clinical experimental phase in humans ((Malaria Vaccine Development Program, www.mvdp.org.in); other researchers have discovered human genes that regulate infection by the tuberculosis bacteria (Cell 2010,140, 731)*

*At the ICGEB Cape Town, a research group contributes to the activities of the international consortium that has recently described the expression and function of the human genome (Science 2015, 347, 1010; Nature 2014, 507, 462)*

# NOBEL PRIZE LAUREATES, HEADS of GOVERNMENT and MINISTERS

## *Visit* ICGEB

Abdus Salam, Nobel laureate (right) with Arturo Falaschi and Irwin Gunsalus, Directors of ICGEB. ICGEB Trieste, 1987

Rita Levi Montalcini, Nobel laureate (second from left), visiting ICGEB laboratories in Trieste, 1989

Carlo Rubbia, Nobel laureate (left) with Arturo Falaschi. ICGEB Trieste, 1988

Arthur Kornberg, Nobel laureate (left) at the CSA, ICGEB Trieste, 1994

Princess Chulabhorn Walailak from Thailand visiting ICGEB Trieste,1995

L. Cavalli Sforza, Joshua Lederberg (Nobel laureate), A. Falaschi and Arthur Kornberg (Nobel laureate), (left to right), at ICGEB Trieste, 1998

Carlo Azeglio Ciampi, President of Italy visiting ICGEB Trieste, 2002

Paul Nurse, Nobel laureate (right) with Arturo Falaschi, ICGEB Trieste, 2002

Carlo Azeglio Ciampi, President of Italy visiting ICGEB New Delhi, 2005

Timothy Hunt (Nobel laureate, left) and Richard Roberts (Nobel laureate, right) with Mauro Giacca at the CSA, ICGEB Trieste, 2005

Thabo Mbeki, President of South Africa (left), with Francisco Baralle, Director of ICGEB, at the inauguration of the ICGEB Cape Town Component, 2007


Henri Dzinotyiwey, Minister of Science and Technology of Zimbabwe (left) at ICGEB Cape Town, 2012

Julia Gillard, Australian Prime Minister (left), visiting ICGEB laboratories in New Delhi, 2012

Naledi Pandor, Minister of Science and Technology of South Africa (second from right) visiting ICGEB Trieste, 2012

Giorgio Napolitano, President of Italy (left) and Mauro Giacca at the Quirinale Palace in Rome, 2014

# TRAINING

One of the most defining characteristics of the ICGEB is its contribution to post university training of scientists from Member States.

Each year, the ICGEB assigns to young scientists a series of **fellowships** to undertake research in its laboratories. These fellowhips are awarded to obtain the title of **PhD** (doctor of international research) or undertake research at the **Postdoctoral** level (Postdoc). The fellowship programme is named after the memory of **Arturo Falaschi**, the mind and driving force of the Centre.

Since1988, ICGEB has awarded almost **900** Postgraduate and Postdoctoral fellowships to researchers from over 64 countries, for a total of more **1,500** man/years of research funds.

Also in the context of its training programmes, the Centre funds and organises over **20 annual meetings**, **workshops** and **practical** and **theoretical courses** on avant-garde topics in the field of Life Sciences, with an aim to facilitate contacts amongst scientists of an affirmed international level and young researchers from Member States.

*Participants at the Leishmania Course at ICGEB Trieste in 2015*

Since 1988, the ICGEB has organised over 500 scientific events with the participation of over **23,000 researchers**.

Each year more than **1,000** scientists visit Trieste alone, to participate in ICGEB meetings and courses.

## Biotechnology

*Since the end of the 1970's, genetic engineering technologies (the method of cut-and-paste that enables segments of DNA to be transferred from one organism to another) and, more in general, the possibility to produce proteins and to culture microorganisms and plants with specific genetic modifications, have made available an entire series of products with vast medical and industrial applications.*

*Proteins for medical therapy, such as insulin and interferons, vaccines against several types of viruses, monoclonal antibodies for tumour therapy, genetically modified plants that resist adverse climatic conditions, non-toxic pesticides based on proteins of insects and microorganisms able to produce ethanol as a source of energy, are only a few of the products that are available thanks to biotechology.*

*Today, gene therapy and the use of stem cells are at the forefront of research and constitute innovative biotechnology applications that permit regeneration of damaged organs and the development therapies for diseases of broad medical and social impact, among which cardiovascular disease and dementia.*

## The International Fellowship Programme

*Each of the three Components runs an international PhD Course, open to young graduates from Member States.*

*In Italy, the ICGEB collaborates with the University of Trieste and with several other academic institutions of national and international repute, such as the "Scuola Normale Superiore" in Pisa, the International School for Advanced Studies (SISSA) in Trieste, the Open University in the UK.*

*In New Delhi, a PhD Course is run in collaboration with the well renowned Jawaharlal Nehru University.*

*In Cape Town, the PhD Course is carried out with the University of Cape Town, one of the most prestigious African universities.*

*Right: ICGEB PhD graduates at the Open University, UK*


*Above: children of an ICGEB Trieste fellow upon their return to their native country.*
*Visits by foreign researchers contribute in an important way to spreading culture in the world.*



*Right: ICGEB Fellowships Programme call for applications 2017*

# Funding for Research

Funding opportunities for Member State laboratories are made available through the ICGEB Research Grants - Collaborative Research Programme (**CRP**), which is a dedicated **source of funding** aimed at **financing projects** addressing original scientific problems of particular relevance for the host country and of regional interest.

Established in **1988**, the programme aims to stimulate collaborative research in Member States and with the ICGEB Component laboratories, to promote **training of young scientists** and facilitate the creation of appropriate research facilities.

The programme provides support for research projects in basic science, human healthcare, industrial and agricultural biotechnology and bioenergy.

To date, the programme has funded approximately **450 projects**, for a global financial committment of almost **19 million Euro.**

*The call for CRP Research Grants for 2017*

# Technology Transfer to Industry

Transfer of technology to industry in Member States is one of the major goals of the ICGEB. A dedicated unit in Trieste develops technologies for the production of **biological generics**, including insulin, erythropoietin, interferon and other products obtained through genetic engineering. Transfer of these technologies and patent licensing have been concluded with industrial partners located in Argentina, Brazil, China, Cuba, Egypt, India, Iran, Pakistan, South Africa, Sri Lanka, Syria, Turkey, United Arab Emirates, United States of America, Uruguay and Venezuela. Most of the companies involved in these technology transfer activities are now producing biosimilars that are sold on the domestic markets and successfully compete on the international arena.

The laboratories in New Delhi have a long-standing experience in the production of low-cost **diagnostic kits** for infectious diseases (in particular, HIV, hepatitis B and C and dengue) and, more recently, celiac disease. Over 20 of these kits are currently on the market in 40 developing countries and are also in use by the World Health Organization for their programs.

Finally, both the Trieste and New Delhi ICGEB Components are actively pursuing the generation of innovative vaccines against **infectious diseases**. A vaccine against dengue has recently been licensed to the largest biotechnology company in India to proceed towards clinical development; another vaccine against **malaria** is in its clinical experimentation phase.

## Patents

*The Centre patents the results obtained through its research. Approximately twenty patent applications have been deposited over the last 4 years from the labs in Trieste and New Delhi. Among these, one is for an innovative method for the production of a vaccine against dengue fever; another protects the discovery of a series of small RNAs to be used as pharmaceutical products to stimulate the regeneration of the heart in patients that have suffered infarction.*

*Left: ceremony of the launch of the diagnostic kit for celiac disease at ICGEB New Delhi, with the Indian Minister for Research, Jitendra Singh (centre) in October 2014.*
*Right: some of the diagnostic kits produced thanks to ICGEB technologies.*


# other Institutional Activities

ICGEB has been committed to the promotion of the safe, ethical and **sustainable use of biotechnology** and in monitoring its impact on society for over 20 years.

The Centre represents a scientific point of reference for the States that have ratified the Protocol to the Convention on Biological Diversity (Cartagena Protocol) for the safe use of **genetically-modified organisms** (GMO).

Thanks to the substantial support from the Bill&Melinda Gates Foundation (over 8 million Euro since 2008), the **Biosafety Group** of the Centre develops a project to train legislators in Sub-Saharan Africa involved in the regulation of GMO's in agricolture. The project includes a Masters Course in agriculture biotechnology, undertaken with the University of Adelaide in Australia, the organisation of workshops and courses to facilitate exchanges with the GMO authorities in Canada and Australia.

Since 1994 the ICGEB participates in the initiatives related to the implementation of article X of the **Biological Weapons Convention** (BWC) promoted by the United Nations.

Finally, the ICGEB is one of the founding members of the United Nations Inter-Agency Committee on Bioethics (UNIACB) established in 2003 and approved by the Secretary General of the United Nations, active in various sectors of Bioethics.

## Some of the organisations with which the ICGEB collaborates:

- *AMCOST - African Ministerial Conference on Science & Technology of the African Union*
- *CBD - Convention on Biological Diversity*
- *CEI - Central European Initiative*
- *CGIAR - Consultative Group on International Agricultural Research*
- *COMSATS - Commission on Science and Technology for Sustainable Development in the South*
- *CRISAT - International Crops Research Institute for the Semi-Arid Tropics*
- *EMBL - European Molecular Biology Laboratory*
- *FAO - Food and Agriculture Organisation of the United Nations*
- *ICTP - Abdus Salam International Centre for Theoretical Physics*
- *NEPAD - The New Partnership for Africa's Development*
- *SISSA - International School for Advanced Studies*
- *TWAS - The World Academy of Sciences*
- *UNIDO - United Nations Industrial Development Organization*
- *UN Inter-Agency Committee on Bioethics*
- *UN Office for Disarmament Affairs*
- *WHO - World Health Organization*

*The activity of the ICGEB is specifically mentioned in the Report of the Secretary General of the United Nations regarding the implementation of Resolution 58/200 of 2004 and in the Resolution of the General Assembly of the United Nations 16/205 "Science and Technology for Development" of 2006.*

# OUTREACH and Public Engagement

ICGEB supports podcasting through both its Website, YouTube and on **iTunes U**; a vast learning resource offering free educational content that users can download straight to computers and mobile devices via the iTunes Store. ICGEB provides a range of high-quality, audiovisual assets used in its international seminars and meetings and courses, lessons and public events, **freely accessible** for sharing by the public, to communicate the diversity and strength of its international research.

ICGEB Trieste was the first academic institute in Italy to upload movies offering free, specialised, international, scientific content on the iTunes U - Beyond Campus platform in 2011. Its current collection holds over **400 films** in **36 categories** in Health & Medicine and Science.

The ICGEB laboratories in Trieste welcome **hundreds of visitors** a year, including school and university groups. Laboratory personnel also actively participate in the annual Open Days and strongly support local, national and international outreach activities for the lay public.

One such example is "Trieste Science & the City", first organised by ICGEB Trieste on themes of scientific interest for the general public in 2013. The latest series of Trieste Science & the City 3 was also filmed and aired on Italian **national television** and **radio**, in 2016. Episodes include presentations by three international experts and open Q&A with the public and events are moderated by the Director-General, on topics such as vaccinations, GMOs, aging, and genetic manipulation.


*School visit at ICGEB Trieste*

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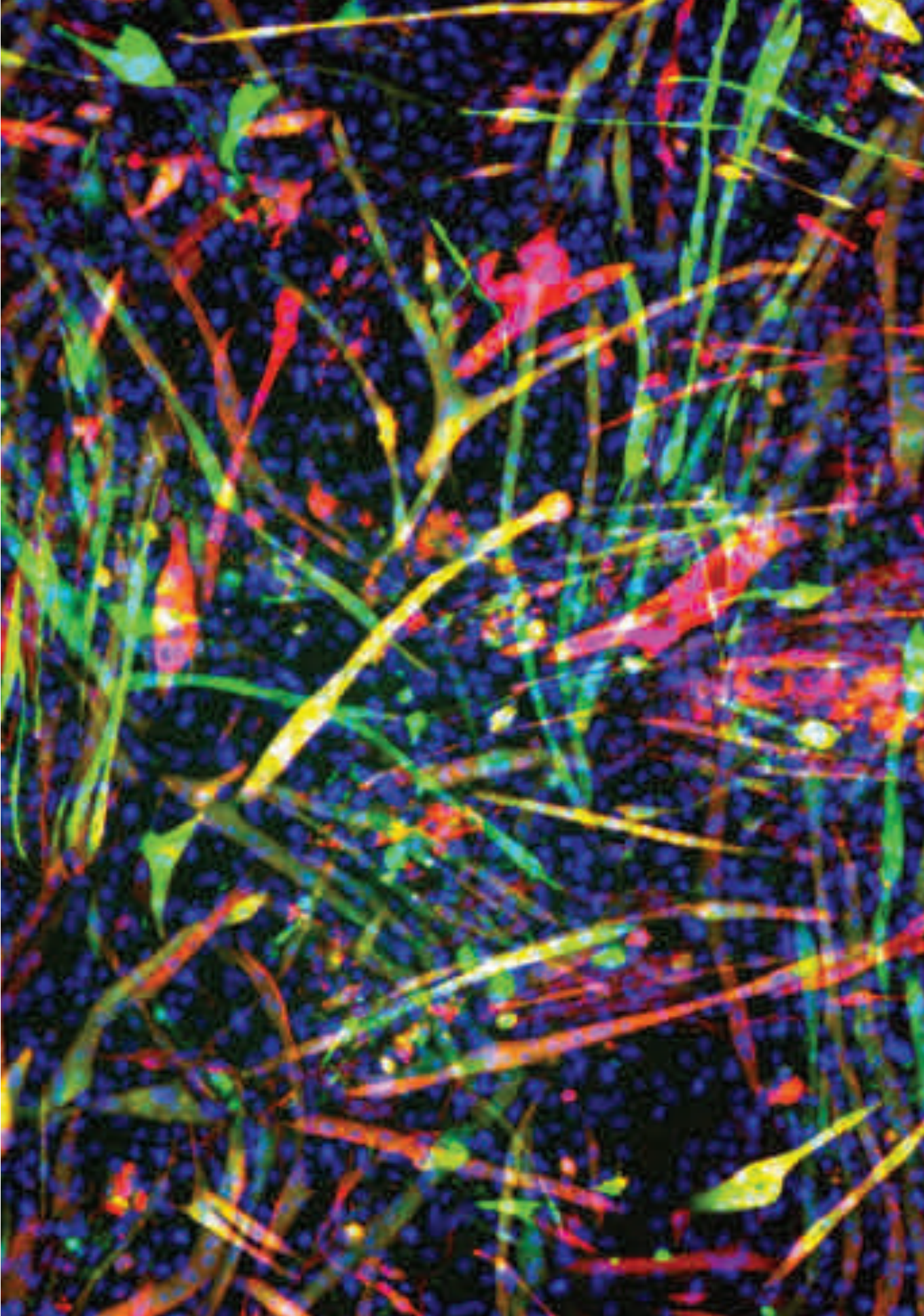

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