

# 2022



**PROJECT 2022**

**International Year  
of Basic Sciences  
for Development**

*Année internationale  
des sciences fondamentales  
au service du développement*

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# Basic sciences are the *sine qua non* for sustainable development

Agenda 2030 for Sustainable Development is the ambitious program that the Member States of the United Nations have agreed on to ensure a balanced, sustainable and inclusive development of the planet.

Basic sciences have an important contribution to make to the implementation of this programme. They provide the essential means to meet crucial challenges such as universal access to food, energy, health coverage and communication technologies. They enable us to understand the impact of the currently nearly 8 billion people on the planet and to act to limit, and sometimes even to reduce it: depletion of the ozone layer, climate change, depletion of natural resources, extinction of living species.

Applications of technology are easy to recognize. On the other hand, contributions of basic, curiosity-based, sciences are not well appreciated. They are nonetheless at the basis of major technological advances that stimulate innovation, as well as essential for training future professionals and for developing capacity of populations who can take part in decisions that affect their future. UNESCO is well aware of this: its Recommendation on Science and Scientific Researchers, revised in 2017, recalls the importance of bringing together politicians, scientists, diplomats, international organizations, entrepreneurs and every goodwill person.

The International Year of Basic Sciences for Development, that we propose to organize in 2022, will focus on these links between basic sciences and the Sustainable Development Goals. This will be a unique opportunity to convince all stakeholders that through a basic understanding of nature, actions taken will be more effective, for the common good.



Photo credit: Michel Spiro

**Michel Spiro,**  
*President-designate of IUPAP,  
leader of the IYBSD project*

# Basic sciences at the heart of Agenda 2030

**We will need science to achieve the Sustainable Development Goals: its results, their transformation into innovations, but also its methods of cooperation.**

Agenda 2030, adopted in 2015 by the United Nations General Assembly, is an integrated vision for the sustainable development of all the world's populations. It is articulated into 17 Sustainable Development Goals (SDGs) towards which we must collectively strive. Several of these SDGs are explicitly linked to scientific advances: Health and well-being (SDG 3); Clean water and sanitation (SDG 6); Affordable and clean energy (SDG 7); Climate action (SDG 13); Life below water (SDG 14); Life on land (SDG 15). But in fact all SDGs require the input of science and technology.

Basic sciences help to identify mechanisms to adequately use knowledge and transfer technology. The States that agreed to Agenda

2030 recognize this, since they have at the same time created the Technology Facilitation Mechanism. In particular, the latter organizes the annual Forum on Science, Technology and Innovation for Sustainable Development Goals.

In addition, basic sciences provide essential tools to ensure multicultural dialogue, political stability and peace, essential to the implementation of these SDGs. They provide the training skills and know-how necessary for the application of innovations that countries need to move from general goals to effective actions. The operational models and practical ways of networking developed by the basic sciences community will contribute to ensuring the effective implementation of the SDGs.



*“Basic science entails thinking out of the box; it leads to new knowledge and offers new approaches which, in turn, may lead to practical applications. This takes patience and time and, thus, constitutes a long-term investment but basic research is the prerequisite for any scientific breakthrough. [...] Basic science and applied science thus complement each other in providing innovative solutions to the challenges humanity faces on the pathway to sustainable development.”*

UNESCO Science Report 2015: Towards 2030



## *Basic sciences in our lives*

- **The WEB** was invented at CERN from the need for global collaboration for experiments in fundamental physics and it has been developed thanks to powerful algorithms.
- **Vaccination** has been strengthened and developed through the identification of the viral origin of many diseases.
- **GPS** would not have been possible without Einstein's theory of General Relativity and Quantum Physics.
- **Our mobile phones** would not exist without material sciences that enabled the invention and miniaturization of the transistor, and mathematics that are the basis of all software.
- **HIV/AIDS treatments** significantly extend the lives of people infected through an understanding of how retroviruses work.

## *And in our future*

- **Artificial intelligence**, which is based on theories and methods developed in mathematics, statistical physics and signal processing, will have an influence on all aspects of our societies.
- **Progress in DNA sequencing**, thanks to biomathematics, chemistry and physics, is now guiding medicine towards more effective individualized treatments, against cancer, for example.
- **Renewable energy production and storage** depend on advances in physics, chemistry and material sciences.
- **Pollution reduction** as well as sustainable and healthy nutrition all depend on green chemistry.
- **The fight against non-communicable diseases**, such as diabetes or obesity, which are spreading across the planet, will depend on knowledge from fundamental biology.

# An international year: what for?

**The International Year of Basic Sciences for Development will mobilize stakeholders at all levels for a better integration of scientific results into public decision-making processes and for the inclusive development of basic sciences.**

## **Enhancing inclusive participation in science**

The participation of all individuals who wish to, whatever their origin, their social or geographical position, or their gender, is essential for the progress of basic sciences. The International Year will affirm the need for inclusive research and will lead initiatives to advance it. In particular, it will highlight women scientists at the highest level. In connection with international scientific unions, it will support the organization of high-level scientific conferences in developing countries. Political leaders will be invited to promote the circulation of all scientists, to attend such conferences and for fellowships and exchange programmes.

## **Strengthening education and scientific training**

Science education from an early age has two advantages. First, it gives appetite for research and encourages people to pursue scientific careers, which is essential for the development of humanity. Secondly, the scientific methods and curiosity can be brought to many other areas of personal, professional and social life: this contributes to the education of responsible and autonomous citizens. The International Year will promote education and teacher training. It will promote the dissemination of good practices and will highlight the successful stories from countries that have significantly developed this area.



Photo credit: One Laptop per Child



Photo credit: Bloomsberries

## **Financing basic science**

In 2000, the Member States of the European Union have committed to devote 3% of their GDP to financing R&D programmes. The African Union Member States have made a commitment up to 1% of their GDP. However, most of the countries are far from their goals. Still, examples of South Korea, Israel and Japan – the top three countries in R&D investments – show that such expenses allow the development of the economy and of the international influence. During the International Year, examples of financial support to fundamental will be showcased, including their results, and the replication of these experiments will be encouraged.

## **Generalize open access**

Open access to scientific results is nowadays a hot topic within the community. Several initiatives, such as Plan S, proposed by the European Commission, have been launched to develop scientific dissemination. The International Year will be an opportunity for governments and international organizations to continue to work towards the publication in open access, and at acceptable costs for authors and their institutions, of all the results of fundamental research and all the documents necessary for its production. This will promote the global circulation of knowledge and encourage interaction between scientists.

# Themes

**The International Year of Basic Sciences for Development will be developed on the basis of themes identified as priorities by UNESCO and the United Nations. It will encourage exchanges between scientists and all categories of stakeholders, whether from grassroots communities or political decision-makers and international leaders, as well as associations, students and local authorities.**

## *Strengthening the presence and the visibility of women*

**According to the UNESCO Institute for Statistics, less than 30% of scientists worldwide are women.** The gender gap is particularly wide in many developing countries. Scientific progress is thus deprived of the creativity of a significant part of humanity.



Photo credit: Bengt Nyman

**Frances H. Arnold,**  
*Nobel Prize in Chemistry 2018*



Photo credit: Andrea Kane/  
Institute for Advanced Study

**Karen Uhlenbeck,**  
*Abel Prize 2019*

Mathematics and natural sciences have a long tradition of very important contributions by women, but these are insufficiently recognized, as also evidenced by the overwhelming majority of men among the winners of the major international scientific prizes, and more generally in scientific management bodies. Girls and young women lack iconic figures with whom they can identify as scientists. It is only one of many social, psychological and economic barriers to women's academic success and scientific careers.

There are many initiatives around the world to strengthen the participation of girls and women in science. Which ones work? What are the evidences of their effectiveness? Can effective practices be replicated in other contexts? How do we know that?



Photo credit : Bengt Nyman

**Donna Strickland,**  
*Nobel Prize in Physics 2018*



Photo credit : Bengt Nyman

**Tu Youyou,**  
*Nobel Prize in Physiology  
or Medicine 2015*

## *Basic sciences as sources of international dialogue and peace*

### **Science contributes to development through its capacity to foster dialogue and peace.**

The role of CERN, founded in 1954, in the reconciliation in Europe after the Second World War and in the continuation of relationships between the Western and the Eastern Blocs throughout the Cold War, is well known. A more recent example is SESAME, a synchrotron radiation facility. Built in Jordan, this laboratory has as other founding members: Cyprus, Israel, Palestine, the Islamic Republic of Iran, Pakistan, Egypt and Turkey. We can also mention the effort that the Inter-Parliamentary Union is currently deploying, with the support of scientists, to promote water supply projects in the Middle East region, or initiatives to get scientists from North and South Korea to collaborate, together with colleagues from other countries.

Thus, scientists have built an efficient “micro-society”, based on a collaborative - but competitive - multicultural approach substrate to problems solving. They built diversified laboratories in which they train the new generations in an environment without borders, focused on competence, aims and innovation. This model could inspire, in other areas, collaborations that would aim at being effective, inclusive and multicultural.



Photo credit: Dean Calina / IAEA

## *A global public good*

### **The basic sciences are a global public good:**

citizens and all organizations can use them for education, innovation and prosperity. They bring universal values of integrity, critical approach, creativity and friendship by sharing the ideal of knowledge and discovery. It is also a global public good because the more we use it, the more we contribute to its enrichment and the more we contribute to reducing inequalities in the world.

Over time, scientists have learned not only to collaborate peacefully for a common (and apolitical) goal. They have also learned that no ambitious effort can achieve its results without involving all stakeholders since the beginning of the process. These stakeholders are not only scientists, but also political decision-makers, the financial and economic communities and society as a whole.



Photo credit: Kevin Gill

## *Innovation and economic development*

**What is the purpose of your research?** All scientists in the basic sciences are confronted with this question. They can rarely give an immediate answer: fundamental research is motivated by curiosity, not by the aim to solve practical problems or to develop innovations.

However, the technological innovations which we use on a daily basis are all based on discoveries in the basic sciences. Laser, which was at its beginning only a “solution without a problem”, has invaded industry, medicine and consumer goods. The discovery of DNA, of its structure and of the mechanisms it is involved in in our cells, has paved the way for gene therapy, personalized medicine and diagnostic methods. Chemical analysis methods ensure food safety.

Also in terms of methods, innovation and entrepreneurship can be inspired by scientific practices.

So, not giving up, and changing your course in acknowledging your past mistakes are among the keys to success in science, but also in all areas driven by individual or collective initiative. As they explore completely new questions, scientists in the basic sciences often take dead ends, or make hypotheses that prove to be wrong. They learn during their training to make the best of it.

Secondly, it is increasingly clear that open innovation stimulates much more growth and transfer of knowledge and of technologies, for the benefit of the whole society, than intellectual and industrial secrecy. By developing open science concepts and by implementing data and information sharing, in the respect of competition, the basic sciences are today at the forefront of this “co-opetition” movement.



Photo credit: Ness Kerlon for AusAID

## *Some questions to explore*

- How do basic sciences contribute to the development of common values and codes of conduct on the planet?
- How can the dialogue initiated by scientists contribute to supporting development and peace?
- How can basic sciences foster more balanced relationships between countries at different levels of economic development?
- In what ways do science projects promote regional dialogues?
- Could diplomats, politicians and scientists be inspired by each other to fulfill their missions?

## Education and human development

**Inequalities in education are obstacles to the harmonious development of societies and, to a large extent, to democracy.**

At school, science is too often seen as without interest in the context in which students live, which causes their boredom and passivity throughout the learning process. This turns out to be a problem for countries that do not manage to train sufficient numbers of engineers, scientists or physicians. Above all, it produces misinformed societies, even hostile towards science.

However, this is not unavoidable. Science in the classroom can be a moment of curiosity and joy. Teachers are the key to the success of this teaching. They can be greatly assisted by scientists who develop specialized resources to make the scientific process more understandable. Students, especially the youngest, also have a role to play. Children are key agents of change, in their infinite capacity for activism to create a better world. We must not only transfer to children the ability to understand science and technology: we must also communicate to them the desire to act on the world using their knowledge.



Photo credit: Thyagu Ganesh

## Meeting global challenges

**In September 1987, with the signing of the Montreal Protocol, countries have given themselves the ability to fight the extension of the seasonal hole in the atmospheric ozone layer above Antarctica.**

The existence of this phenomenon had only been confirmed by scientists in 1984. This agreement is emblematic of the international community's capacity to mobilize, with the help of scientific results, to meet global challenges.

Today, global warming and its consequences (sea level rise, transformations of biodiversity or changes in the freshwater supplies) is at the heart of complex negotiations, in which scientists, gathered together in particular in the IPCC, have an important part to play. Human impact on the environment and the extinction of species are also the subjects of regular international

meetings at the highest level. These are just a few examples of the challenges that we face on a global scale: emergence of new diseases, development of renewable energies, elimination of weapons of mass destruction...

How can scientists be better listened to and solicited to inform decisions on these questions that concern us all?



Photo credit: Jean Fotos

# A long record of international cooperation

**S**cience has been bringing people together across borders for a long time.

Scientists and scholars have always corresponded with their counterparts, even when far away, making progress by sharing their discoveries, and sometimes their mistakes. In the 19<sup>th</sup> century, with the creation of the International Polar Year, this cooperation has taken a global dimension.

Scientific exchange and collaboration, and the relationship between science and society, have changed scale in the 20<sup>th</sup> and 21<sup>st</sup> centuries. Shortly after its creation, the UN promulgated International Years on themes considered as priorities. In the scientific field, already in 1961, the International Health and Medical Research Year was intended to develop international collaboration, under the aegis of WHO.

Since 1998, technology and science have regularly been at the origin of international years organized under the authority of UNESCO, or with its very active participation.

**1998**

*International Year  
of the Ocean*

**2003**

*International Year  
of Freshwater*



**2005**

*International  
Year of Physics*



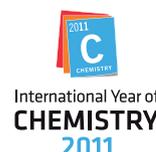
**2008**

*International Year  
of Planet Earth*



**2009**

*International Year  
of Astronomy*



**2011**

*International Year  
of Chemistry*



**2014**

*International Year  
of Crystallography*



**2015**

*International Year  
of Light and  
Light-based  
Technologies*



**2019**

*International  
Year of the  
Periodic Table  
of Chemical  
Elements*

*The International Year of Basic Sciences for Development, that we propose to promulgate for 2022, will complement and broaden this picture, while giving great importance to the social role of science.*

*As countries around the world are committed to achieving the Sustainable Development Goals, scientists must play their part.*

# The International Year events

## Opening ceremony

*Geneva, Switzerland*

**A day of conferences with scientists from of all parts of the world.**

Panels will present iconic advances in the field of sustainable development due to research in basic sciences. Young scientists will present their work and explain the importance of basic sciences, and how they empower them to answer to development challenges. The role of women will be particularly highlighted.

In partnership with the European Organization for Nuclear Research (CERN), this day will allow in particular to also involve the staff of the United Nations Office in Geneva.



Photo credit: Dennis Jarvis



Photo credit: VBzi

## The development of basic sciences in Africa

*Addis Ababa, Ethiopia*

**Basic sciences need Africa, and its brains:** by 2050, half of the world's young people under 25 years of age will live on this growing continent.

This event will highlight the scientific achievements of African scientists and the role of the centers of excellence set up on the continent. It will also showcase successful initiatives in education, higher education and international cooperation.

Organized in collaboration with the African Union and UNESCO, this event will have a general public component, aimed at inhabitants of the Ethiopian capital city.

## All over the world

*Events organized at national, regional or local level will be part of the International Year of Basic Sciences for Development. The aim is to organize events around the world, to inspire new initiatives everywhere. All or part of these events will be broadcast live on the Internet so that the International Year can stimulate reflection.*

## International high-level symposium

*Quy Nhon, Vietnam*

**Leading scientists and decision-makers from the world**, in particular from developing countries, as well as representatives of companies and non-governmental organizations will meet for several days to exchange and debate on the different ways in which basic sciences are factors for peace at the national, regional and international levels, factors of social and economic prosperity, and they allow the improvement of the conditions of living of populations. Participants will propose, at the end of this meeting, recommendations on the achievement of the Sustainable Development Goals adopted in 2015 by the United Nations General Assembly.



## Basic sciences and education

*São Paulo, Brazil*

**Education is the basis for a good consideration of basic sciences by society.** While Brazil will celebrate in 2022 the 200th anniversary of the proclamation of its independence, its economic centre, São Paulo, which is also the most populated city in South America, is a natural choice to bring together international experts of education to science and to sustainable development. In this country where there has been considerable progress in recent decades, they will exchange their experiences with governmental leaders and non-governmental organizations engaged in the implementation of the SDGs, and will examine what methods and practices could be disseminated in different parts of the world



*will be networked by the secretariat of the International  
share examples of good practices and achievements  
re science contributes to the achievement of the SDGs.  
e Internet, then published online in several languages,  
n and inspire action around the world.*

# 1922 - 2022

## Celebrating two centenaries

### **IUPAP**

Physicists in their laboratories need to communicate with the international community. They exchange, thanks to journals, manuals, conferences, international symposia, seminars, conferences, visitors, postdoctoral fellows and many other means. Physics does not know national borders.

In their classes, physicists require no less : up-to-the-moment textbooks, audiovisual media, softwares and access to international experts versed in physics education are of growing importance.

Communication on projects and programmes in progress around the world is crucial. However, there are obstacles to this free flow of scientists, information and ideas. They are most often of financial or logistical origin, but sometimes they also have political, legal or administrative causes.

Contributing to the lowering of these barriers and promoting trade and circulation is the aim of the International Union of Pure and Applied Physics (IUPAP). Founded in 1922 in Brussels by physicists from thirteen countries, it now has 57 national members. Its first president was Sir William Bragg (Nobel Prize, 1915).



### **Niels Bohr's Nobel Prize**

In 1922, the Nobel Prize was awarded to the Danish physicist Niels Bohr *“for his services in the investigation of the structure of atoms and of the radiation emanating from them”*.

Not only did he proposed the model of the atom that is taught still today in the first physics classes: Niels Bohr was also among the founding fathers of the quantum theory.

His position at the University of Copenhagen has allowed him to occupy a central role in relationships between physicists during a large part of the 20<sup>th</sup> century, and to welcome many of them into his laboratory. In particular, he had a decisive influence during the Second World War.

## ***Steering Committee***

### **Composition**

Its president is Michel Spiro, President-designate of IUPAP.

Its members represent the scientific unions as well as governmental and non-governmental international organizations.

### **Missions**

- Overall management of the International Year.
- Coordination and organization of international events.
- Within it, an Executive Steering Committee will ensure the effective day-to-day management with the help of the international secretariat.

## ***International Advisory Committee***

### **Composition**

Representatives from countries all over the world.

### **Missions**

- Make proposals on the IYBSD program.
- Implement IYBSD 2022 activities by taking into account needs and characteristics of the different countries and regions.

## ***International Secretariat***

### **Composition**

Luc Allemand, director of Afriscitech.com, is in charge of the General Secretariat.

Project delegates, professionals of project management, communication, etc., will bring their experience depending of needs, in a decentralized way.

### **Missions**

- Coordination of international events.
- Communication and international press relationships.
- Production and feeding of the website.
- Community management.
- Resource and linkage centre for the network of national nodes and for local event organizers.

## ***International Scientific Committee***

### **Composition**

High level scientists.

### **Mission**

- Provide comments and ideas for the program and validate its scientific content.



Photo credit: Editor B

*“In developing countries, thousands of young minds are ready to assimilate the basic sciences and design progress necessary for a more harmonious development. It would be a shame to deprive the world of all those brains that are just waiting to imagine the future, probably in a different way, since it will be possible for them to enter directly into science at the highest level.”*



**Nicole Jeanne Moreau,**  
**President of the International Program**  
**on Basic Sciences, UNESCO**



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**[www.iybsd2022.org](http://www.iybsd2022.org)**

*“In most of the cases, political leaders are mainly concerned with applied sciences, which provide quick solutions. However, it is most often after long and in-depth research on issues that can be very theoretical, and with many failures on the road, that the scientific revolutions that drive technological transformations are born.”*



**Tran Thanh Van,**  
**Founder of the International Center**  
**of Interdisciplinary Science and Education (ICISE),**  
**Vietnam**