

2014

Report  
Institut  
Pasteur  
International  
Network



# THE WORLD OF PASTEUR

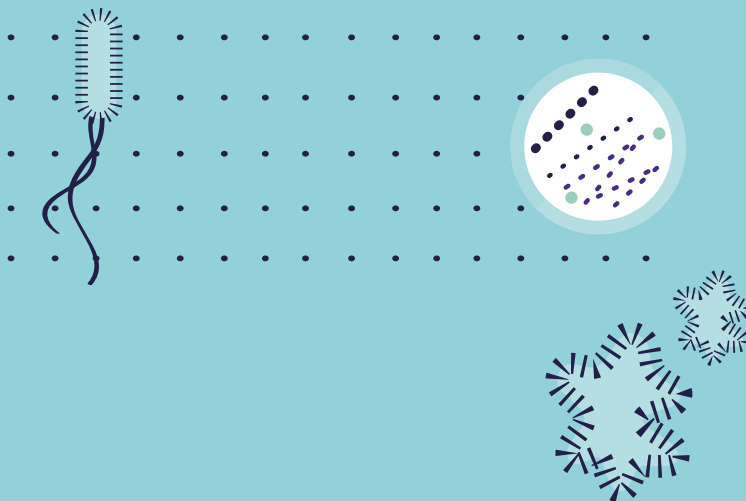
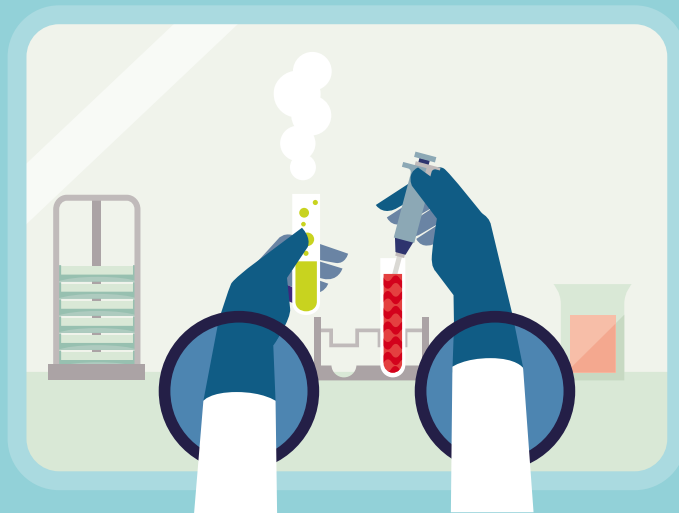


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## PUBLIC HEALTH AND RESEARCH INSTITUTES WORLDWIDE



# CHRISTIAN BRÉCHOT

President of the Institut Pasteur

“Because it brings together institutes that share, beyond a name, a common commitment, the Institut Pasteur International Network holds a unique position in the world.”

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**B**ecause it now comprises 33 institutes in 26 countries and on 5 continents, because it carries out jointly missions in research, public health, education and knowledge transfer, and because it brings together institutes that share, beyond a name, a common commitment, the Institut Pasteur International Network holds a unique position in the world. United in its diversity, the network has become, with passing years and programs, a community, cooperating to maximize the

impact of the research and public health actions of its researchers.

The network thus has an unequalled capacity for responding to tomorrow's major challenges in research and public health. The epidemic caused by the Ebola virus is a striking example: in research, since the Institut Pasteur's teams in Lyon, Dakar and Paris were the first to characterize the virus and to establish diagnostic tests in the field, in March 2014. Research efforts are now being concentrated on the development of rapid reliable diagnostic tests, and on vaccines and new therapeutic agents. In respect to public health, the institutes of the international network responded promptly and rallied to bring early and long-lasting support to the field. The creation of a new Institut Pasteur, in Guinea, meets this need to combine research, public health and educational actions throughout the world and in the field. Finally, by training and educating health staff on-site, the Institut Pasteur International Network has been acting for a strong response from the local authorities.

In August, the Institut Pasteur decided to combine its forces internally to establish a task force in response to the epidemic, gathering together scientists from all 32 Institutes, all over the world.

Institut Pasteur is also working to strengthen integration and increase interaction between its members, by developing its incentive research programs to that they systematically include several network members, by facilitating mobility of researchers between different institutes, and by creating research consortia

that bring our members together. Institut Pasteur makes many and varied instruments available to encourage joint research projects: transversal research projects, Inter-Pasteurien Concerted Actions, research consortia, joint units, and four-year research groups (G4) are all examples of these. These various instruments are not simple, artificial schemes for unifying our organizations, but the very roots of our future success.

The Institut Pasteur International Network is also at the core of the creation of the Center for Global Health Research and Education, designed to unify interdisciplinary teams, throughout the world, around large projects in research, public health and education. Organized around regional “hubs,” this Center will draw heavily on the major assets offered by the network.

In future, we will have to push back the limits and frontiers of our actions, by establishing new regional partnerships and developing collaborations with other international initiatives and networks. Major challenges must be faced; among them the growth of our actions in Africa and in the Carribean, with their extraordinary prospects for development but with major health crises, as well as the establishment of links with the scientifically emerging states and with BRIC (Brazil, Russia, India and China).

Institut Pasteur is and will remain an international research institute based in France.







## FRANÇOISE BARRÉ-SINOUSSE

Honorary President of the Institut Pasteur International Network and Nobel Prize in Medicine in 2008

“In the face of emerging epidemics, let us recall the lessons of the fight against AIDS!”

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**T**he Ebola epidemic now raging in Western Africa brought back to life sobering memories of the HIV epidemic's first stirrings. While the two viruses have little in common from the biological standpoint, when it comes to transmission mode and the symptoms caused, the epidemics which they generate share the fact that they do not result only from a public health problem. They are also the consequence of social, cultural, political, economic and still other factors.

One of the successes in the fight against AIDS resides in the creation of horizontal networks that cut across several areas of activity, beyond the biomedical, such that a continuum was formed and coordinated action made possible on all aspects required for effective response. The action taken by civil society and the local communities was and continues to be essential. In the 1980s, before they became involved, the information, education and counselling programmes provided on AIDS struggled to find their way, often proving ineffective against the fear, rejection, discrimination and even violence to which the impacted populations were subject, and sometimes healthcare providers too. Faced with the urgent need to take action, many international initiatives, due to lack of consensus and coordination, sometimes ended up adding

confusion to the situation in the most impacted countries. The similarities with the Ebola epidemic were in that respect striking to those who experienced the initial years of AIDS. AIDS community players recognised this and resolutely stepped forward, bringing their expertise into the arena and adapting it to the newly-emerging epidemic.

Let us follow their lead and take down the walls that divide so that we can mutually gain from our respective experiences. As the first to confirm Ebola cases and reaching the site swiftly after discovery, the Institut Pasteur International Network demonstrated its ability for rapid-response and international mobilisation. Many research projects are currently under-way in order to improve diagnosis and develop vaccine or therapeutic strategies. Let us draw inspiration from the fight against AIDS to go even further in building or participating in major programmes combining multi-disciplinary research with public health, in the North as in the South. The AIDS epidemic taught us that the sovereign interest is that of patients. Let us show that we have learned that lesson as other epidemics emerge.



## MARC JOUAN

International Vice-President

“An international network always at the forefront of public health issues.”

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**2**014 was marked by the emergence of a new form of Ebola epidemic, affecting several countries in West Africa. This crisis led to an unprecedented mobilisation of the Institut Pasteur International Network both over time and intensity. The rapid setting up of scientific teams from the institutes in Dakar, Cameroon and Paris, enabled, with the support of AFD and French Red Cross, the arrangement of a laboratory with appropriate diagnostic means in endemic areas. One year after the start of the epidemic, teams from the Institut Pasteur are still in the field.

In addition to the mobilisation in Africa, interventions are realized in other parts of the world, in response to epidemics such as chikungunya in French Guiana and Guadeloupe or dengue in Asia and Pacific Region.

Over the year 2014, the network also started a series of infrastructures' modernization, building new laboratories in accordance with international standards, with more efficient diagnostic means and offering maximal security for people and environment.

The creation of a new Institut Pasteur in Guinea, whose foundations were laid in 2014, illustrates the international network's potential of development to take part, beyond the sole response to epidemic emergency situation, in a long-term cooperation.

Nowadays, backed by its international reputation of excellence, the international network is developing new partnership, based on French and international institutional stakeholders, and the development of international cooperations with new countries (Sudan, India, Mexico, Japan...).

As 2016 will mark the 125<sup>th</sup> anniversary of the Institut Pasteur in Ho Chi Minh City, first Institut Pasteur created outside of France, the Institut Pasteur International Network confirms, through its reactivity during health crisis and its involvement in long-term surveillance and research programs, its international key role in the service of public health.

## A GLOBAL NETWORK ON THE

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## CONTINENTS

### AMERICAS

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**Brazil**  
Oswaldo Cruz Foundation (FIOCRUZ)

**Canada**  
INRS-Institut Armand Frappier

**Uruguay**  
Institut Pasteur in Montevideo

**France**  
Institut Pasteur in Guadeloupe  
Institut Pasteur in French Guiana

### EUROPE

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**Belgium**  
Scientific Institute of Public Health (Brussels)

**Bulgaria**  
Stephan Angeloff Institute

**France**  
Institut Pasteur (Paris)  
Institut Pasteur in Lille

**Greece**  
Hellenic Institut Pasteur (Athens)

**Italy**  
Institut Pasteur – Cenci Bolognetti Foundation (Rome)

**Romania**  
Cantacuzino Institute

**Russia**  
Institut Pasteur in Saint Petersburg

### AFRICA

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**Cameroon**  
Pasteur Centre in Cameroon

**Côte d'Ivoire**  
Institut Pasteur in Côte d'Ivoire

**Guinea**  
Future Institut Pasteur in Guinea

**Madagascar**  
Institut Pasteur in Madagascar

**Niger**  
Centre for Medical and Health Research (CERMES) (Niamey)

**Central African Republic**  
Institut Pasteur in Bangui

**Senegal**  
Institut Pasteur in Dakar

### ASIA-PACIFIC

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**Cambodia**  
Institut Pasteur in Cambodia

**China**  
Hong Kong University – Pasteur Research Pole  
Institut Pasteur of Shanghai – Chinese Academy of Sciences

**France**  
Institut Pasteur in New Caledonia

**Korea**  
Institut Pasteur Korea

**Laos**  
Institut Pasteur in Laos

**Vietnam**  
National Institute of Hygiene and Epidemiology (Hanoi)  
Institut Pasteur in Ho Chi Minh City  
Institut Pasteur in Nha Trang

### MAGHREB-IRAN

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**Algeria**  
Institut Pasteur in Algeria

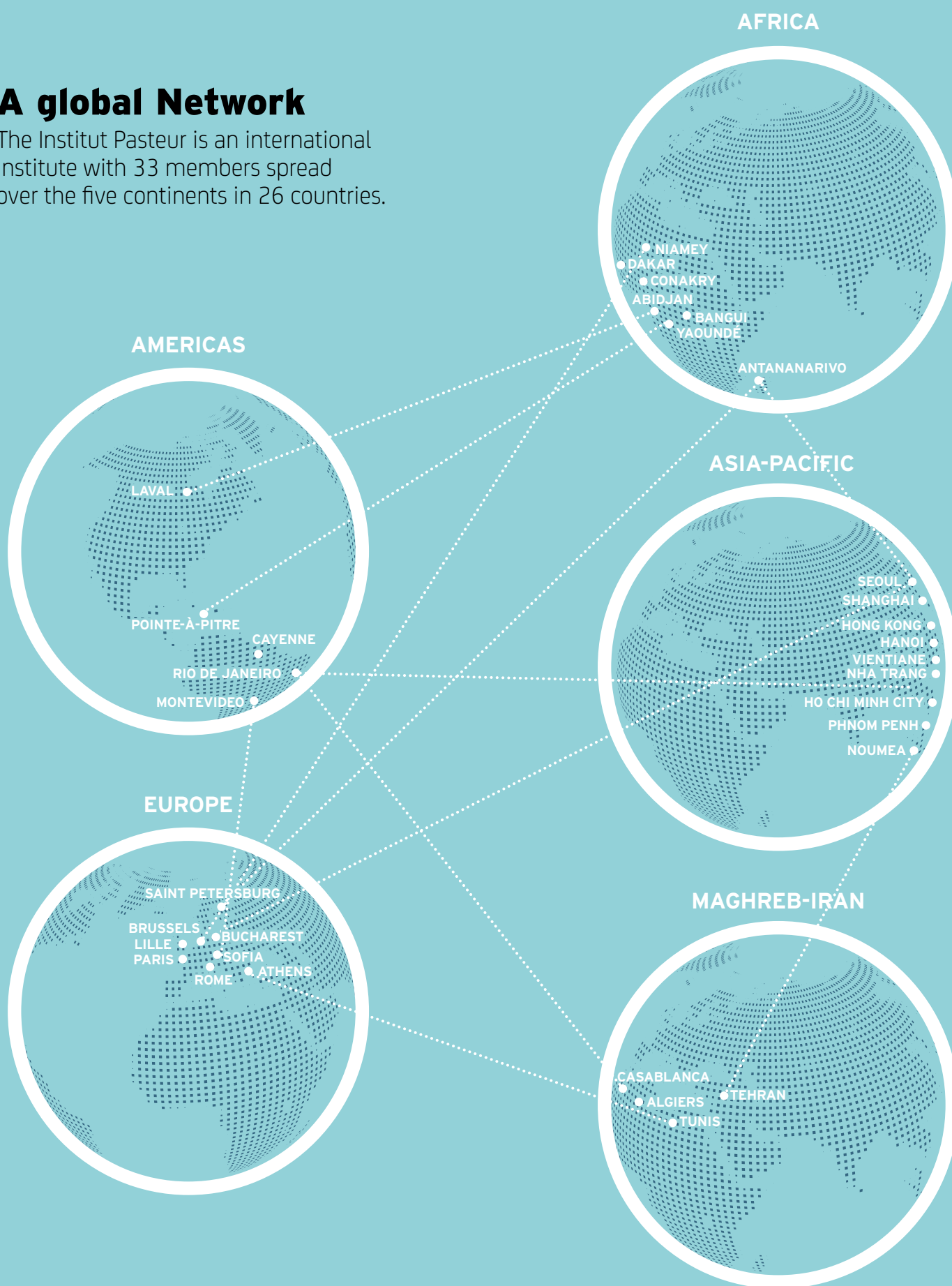
**Iran**  
Institut Pasteur in Iran

**Morocco**  
Institut Pasteur in Morocco

**Tunisia**  
Institut Pasteur in Tunis

# A global Network

The Institut Pasteur is an international institute with 33 members spread over the five continents in 26 countries.





### **THE SCIENTIFIC PUBLICATIONS FROM RIIP**

HAL-RIIP is an online, open, multidisciplinary bibliographical archive dedicated to the Institut Pasteur International Network: <http://hal-riip.archives-ouvertes.fr/>. All publications in which Institut Pasteur International Network researchers have participated are available online, classified by author, institute or topic, along with an overview of progress on ongoing research.

### **THE PASTEUR INTERNATIONAL NETWORK ASSOCIATION**

The Pasteur International Network Association, was created in 2011, to strengthen scientific partnership opportunities. Founded under French association law of 1901, it is designed to assist the research of funding for the implementation of scientific projects. The Association supports the organization of RIIP regional meetings and finances the international courses organized in the RIIP.





23,000 PEOPLE IN 26 COUNTRIES



146 GRANTS FUNDED IN 2013-2014  
32 REGIONAL COURSES FUNDED IN 2013-2014



19 WHO COLLABORATIVE CENTERS

# PUBLIC HEALTH



The institutes within the Institut Pasteur International Network (RIIP) help to improve the health of populations in all countries and regions of the world where they are present, through a wide range of public health activities, including vaccination, voluntary HIV screening, diagnosis of infections and support to national surveillance programs run by the Ministries. The RIIP is able to mobilise in response to epidemics thanks to the most recent techniques, in partnership with national and international institutions such as the WHO.

## SURVEILLANCE AND RESPONSE TO EPIDEMICS

Thanks to its global presence and recognised scientific expertise, the RIIP is a unique instrument for surveillance on infectious diseases and global response to the current major epidemics. The many WHO Reference Centres and Collaborating Centres that the RIIP hosts continuously monitor potentially epidemic diseases, such as the flu, cholera, dengue, yellow fever and emerging infectious diseases.

The RIIP's member institutes have the scientific expertise and diagnostic tests needed to respond directly on the field, and provide technical advice at the national and international levels. The RIIP interacts with the local and international public health authorities and works in close connection with the Ministries of Health, WHO (Global Outbreak Alert and Response Network, GOARN) and Institut Pasteur's The Laboratory for urgent response to biological threats (CIBU), led by Jean-Claude Manuguerra.

### Surveillance

#### Human and Avian Flu in Africa and in Asia

The human flu sentinel network in Africa completes the one already existing in Asia. It was established through a multi-centre study involving six RIIP member establishments in Sub-Saharan Africa: Central African Republic, Côte d'Ivoire, Madagascar, Niger, Senegal and Cameroon. Since the outbreak of A/H1N1 Flu, one of this network's priorities has been to detect it effectively, with preparations to open further sentinel sites alongside the countries' border stations. The network has brought to light for the first time the presence of the influenza virus in Niger and the Central African Republic.

#### Dengue

Institut Pasteur in Cambodia works with the Cambodian National Programme against Dengue and conducts laboratory surveillance of clinical syndromes of severe dengue in patients hospitalised in the public sector at five sentinel sites. A number of different techniques (serological, molecular or viral isolation) are used to identify infection by dengue virus or other arboviruses of medical significance in Southeast Asia (Japanese encephalitis virus, Langkat Virus, Sindbis and Chikungunya).

The on-going surveillance run by Institut Pasteur in Laos since 2012 has made it possible to determine virus serotype proportions and revealed, in June 2012, the emergence of dengue serotype 3. The Institute coordinates a network of 5 hospitals and a private consultation centre, following the 2013 epidemic.

#### Yellow Fever

Yellow fever surveillance has been supported since 2003 by a network of laboratories established by the WHO's Regional Office. Within the network, the unit dedicated to arbovirus and viral hemorrhagic fevers at Institut Pasteur in Dakar serves as the regional reference laboratory. Yellow fever surveillance is conducted using the suspected cases identified by the healthcare structures of different countries in the WHO network.

#### Enterovirus and poliovirus

The enterovirus surveillance activities run under the Global Polio Eradication Programme have made it possible to establish a circulation map of these viruses in the Maghreb, in Europe and in Africa. Investigations are often conducted to characterise in greater detail the viral strains in circulation and assess the impact of polio vaccine on the population.

#### Leishmaniasis

In Tunisia, data on Leishmaniasis morbidity at the national level and over the past 20 years were collected through surveys of healthcare service providers based in the endemic zone. The ecological information and clinical parameters are currently under review at Institut Pasteur in Tunis, which is concurrently developing a spatio-temporal model to predict the emergence of epidemics.

### Response to epidemics

#### Ebola in Guinea

As soon as the Ebola virus broke out in Guinea, Dr Amadou Sall's team (Institut Pasteur in Dakar) went to Conakry. This team trained Guinean technicians in sampling and diagnosis techniques specific to Ebola. Dr Amadou Sall's team is also dedicated to studying, through investigative work in cooperation with local partners and Simon Cauchemez (Paris), how the Ebola virus is transmitted between individuals in different contexts. It also heads field trials on a rapid-diagnosis test for Ebola.

In addition, Institut Pasteur has set up in Guinea Forest Region a diagnostic laboratory in a treatment centre managed by French Red Cross. In December 2014, an agreement was signed to have an Institut Pasteur built in Guinea. The new Institut's activities will be focused on diseases with high epidemic potential, in particular, viral haemorrhagic fever and arboviruses.

#### Chikungunya Epidemic

In 2014, Institut Pasteur expressed its commitment to the fight against the Chikungunya virus epidemic in the Antilles-Guyane Region through research conducted by Institut Pasteur's scientists in Paris and in French Guiana. Involved in the efforts since the very start of the Chikungunya epidemic, Institut Pasteur in Guadeloupe and in French Guiana contributes alongside 6 international reference laboratories in the Americas Zone - Instituto Pedro Kouri (Cuba), Instituto Nacional de Enfermedades Virales (Argentina), Evandro Chagas (Brazil), CARPHA (Trinidad and Tobago), CDC Fort Collins (USA), CDC Porto-Rico - providing the biological tools needed for rapid diagnosis and epidemiological surveillance in the America zone countries.

A special focus is placed on developing diagnostic methods enabling rapid differentiation of Chikungunya virus infections due to the dengue virus, running surveillance on virus mutations and modelling the epidemic.

#### Fighting the plague in Madagascar

The plague, endemic to the Madagascar countryside, has caused multiple deaths on the island, and the WHO sounded its alert on 21 November 2014, when after 10 years out of the picture, the plague came back on the scene in the capital city of Antananarivo. A special action committee has been set up with the support of the African Development Bank, and includes members from the WHO, Institut Pasteur in Madagascar, the French Red Cross and several Madagascar ministries. It is in charge of organising rat extermination and insecticide spraying to kill rat lice, which are vectors of the plague, as well as providing supplementary training to healthcare workers and those responsible for informing the population about plague spreading risks.

Institut Pasteur in Madagascar hosts the WHO Collaborating Centre for Plague and the Central Laboratory for Plague Research. It is involved in Public Health initiatives and contributes actively to epidemiological surveillance across the Indian Ocean zone (Comoros and Seychelles Islands).

## NATIONAL AND INTERNATIONAL TECHNICAL EXPERTISE

The RIIP hosts a large number of national and international reference centres on infectious diseases and resistance to anti-microbial agents. The National Reference Centres act as both observatories on communicable diseases in the countries where they are found, while the WHO Collaborating Centres operate a similar function for the WHO network. The national and regional reference laboratories are recognised by the national ministries of health for their skill in the diagnosis of certain diseases.

### Within the RIIP

WHO Collaborating Centres, WHO national reference centres and laboratories and regional laboratories.

	WHO Collaborating Centres (WHOCC)	WHO national reference centres and laboratories (acknowledged by WHO)	Regional Reference Laboratories
Pasteur Centre in Cameroon		Flu. Yellow Fever. Poliomyelitis. Measles.	Bacteriology (WHO) Avian Flu (WHO). Food-related infections (WHO). Poliomyelitis (WHO).
Institut Pasteur in Bangui	Arbovirus. Haemorrhagic fevers. Flu. Rabies. HIV/AIDS.	Measles. Rubella. Haemorrhagic Fevers. Rabies. Flu.	Poliomyelitis (WHO).
Institut Pasteur in Côte d'Ivoire		Arbovirus. haemorrhagic fevers.	Avian flu (WHO).
Institut Pasteur in Dakar	Arbovirus. Haemorrhagic fevers.	Flu and respiratory viruses. Poliomyelitis. Measles. Rotavirus.	Avian flu (WHO).
Institut Pasteur in Madagascar	Plague.	Flu. Avian flu. Poliomyelitis. Measles.	Avian flu (WHO).
Institut Pasteur in Cambodia		Flu. Avian flu. Dengue. Rabies.	Antimicrobial resistance. Rapid malaria diagnostic test (WHO). Dengue diagnostic evaluation test (WHO).
NIHE (Vietnam)	Occupational health.	Flu. Poliomyelitis.	
Institut Pasteur in Guadeloupe		Supranational Reference Laboratory for Tuberculosis.	
Institut Pasteur in French Guiana	Anti-malarial drug resistance*.	Arbovirus and <i>Influenzae</i> virus <sup>1</sup> .	
Cantacuzino Institute (Romania) <sup>2</sup>	Flu.	Flu. Poliomyelitis. Measles/Rubella.	<i>Flu</i> (WHO).
Hellenic Institut Pasteur		Flu. Poliomyelitis. Measles/Rubella. Avian flu.	Leishmaniasis. <i>Neisseria gonorrhoeae</i> .
Institut Pasteur in Saint Petersburg		Poliomyelitis. Measles/Rubella.	Poliovirus. Yersiniosis. Viral hepatitis. Measles. Rubella. Rickettsiosis
Scientific Institute for Public Health (Belgium)		Flu. Measles. Rubella. Rabies. Viral hepatitis.	SARS. West Nile Virus. Bacterial Encephalitis. Botulism. Microbiology and Food-Related infections. Listeriosis. Medical Mycology. Salmonella. Shigella. Tuberculosis and Mycobacteria. Toxoplasmoses.
Institut Pasteur in Algeria		Flu. Poliomyelitis. Antirabies Prevention. Measles. Tuberculosis.	
Institut Pasteur in Iran	Rabies.	Arbovirus and haemorrhagic fevers. Rabies.	
Institut Pasteur in Tunis	Leishmaniasis.	Poliovirus. Salmonella. Shigella. Vibrio-Cholera.	Poliovirus (WHO). Measles (WHO).

1. In the Antilles-Guyane Region.

2. Denotes organisations accredited to conduct surveillance, response to epidemics and scientific expertise by ECDC (European Centre for Disease Prevention and Control).



## VACCINATION AND OTHER CARE SERVICES

Vaccines are the most effective weapon to prevent and fight infectious diseases in individuals and populations. Many RIIP Institutes, dedicated to protecting public health, provide vaccination services or support vaccination campaigns at the national level.

### NRC and WHOCC placed under the responsibility of Institut Pasteur (Paris)

#### Areas of action

Arboviruses and viral haemorrhagic fevers  
(NRC - WHOCC)

Arboviruses and *influenza virus*  
(Antilles-Guyane Region) (NRC)

Aerobic bacteria and botulism (NRC)

Anti-malarial drug resistance  
(Antilles-Guyane Region) (NRC - WHOCC)

Pertussis and other *Bordetellosis* (NRC)

Toxicogenic *corynebacteria* (NRC)

Enterovirus  
(viral vaccines - poliovirus) (WHOCC)

*Escherichia coli* and *Shigella* (NRC)

Viral haemorrhagic fevers (Lyon) (NRC)

Flu - *influenza virus* France-Northern Region  
(NRC)

Hantavirus (Lyon) (NRC)

Viral hepatitis B, C and Delta  
(NRC associate laboratory)

Leptospirosis (NRC - WHOCC-FAO)

Foodborne *Listeriosis* (NRC - WHOCC)

Bacterial *Meningitis* (NRC - WHOCC)

Mycology and anti-fungal compounds (NRC)

Human papillomavirus (NRC)

Plague and other *Yersiniosis* (NRC - WHOCC)

Rabies (NRC - WHOCC)

*Salmonella* (NRC)

*Streptococci* (NRC associate laboratory)

*Vibrios* - *cholera* (NRC)

### International Vaccination Centres

The Institut Pasteur in Algeria, Bangui, Cambodia, Dakar, Guadeloupe, Ho Chi Minh City, Iran, Lille, New Caledonia, Madagascar, Morocco, Saint Petersburg, Iran and the Pasteur Centre of Cameroon, are all home to vaccination centres that provide a wide range of essential vaccines.

Anti-rabies vaccination is available at the Pasteur Centre in Cameroon and the Institut Pasteur in Algeria, Bangui, Cambodia, Dakar, French Guiana, Ho Chi Minh City, Iran, Madagascar, Morocco and Tunis. In total, approximately 12,000 anti-rabies vaccinations are administered each year. Celebrations continue in honour of the 125<sup>th</sup> Anniversary of the first rabies vaccine, yet the disease is still ravaging populations across the world.

Institut Pasteur in Paris performs both routine child vaccination and the vaccinations required for international travel, including anti-rabies vaccine.

### Serum and vaccine production or production supervision at specific network institutes

A number of RIIP member institutes are also involved in producing vaccines at the request of countries health authorities and/or WHO. Institut Pasteur in Dakar operates Africa's only unit producing yellow fever vaccine. Institut Pasteur in Ho Chi Minh City and Institut Pasteur in Iran produce BCG and rabies vaccine. Institut Pasteur in Algeria produces vaccines against rabies and typhoid fever, and both imports and distributes several vaccines across the Algerian population. Cantacuzino Institute supervises the production of vaccines against measles, the flu, tuberculosis and DTP. Institut Pasteur in Tunis produces vaccines and serums for the country's needs (intra-dermal BCG vaccine, therapeutic vaccines).



In addition, RIIP Institutes carry out a large number of healthcare missions to local populations, including:

- counselling and voluntary screening for HIV and Hepatitis C
- a wide range of medical tests run by the Centres and Medical-Biological Laboratories (anatomocyto pathology, haematology, biochemistry, immuno-serology, mycobacteriology, microbiology, parasitology, virology)
- microbiological and physico-chemical tests for water, foods and agricultural products, as well as toxicological audits
- support for national and international health programmes against multiple pathologies (HIV/AIDS, tuberculosis, dengue, malaria, etc.), with epidemiological surveys, vaccination programme monitoring, genotyping, clinical trials, etc.
- occupational and school health
- vector control
- health education

# HIGHLIGHTS

## FROM

2013

2014

### SIGNING OF AGREEMENTS

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#### DECEMBER 2014

##### PROJECT ON ENCEPHALITIS IN MYANMAR (BURMA)

The inauguration of the bacteriology and virology laboratories at the National Health Laboratory (NHL) in Yangon (Rangoon) provided an opportunity to make the scientific collaboration with Institut Pasteur official under agreements signed between Institut Pasteur and AFD on the one hand, in the context of the ECOMORE project, and between Institut Pasteur and Total Foundation on the other hand, in the context of the SEAE project in Myanmar, in order to strengthen the abilities of NHL at two levels, namely combating acute respiratory infections in children and research on infectious encephalitis in Southeast Asia.

#### SEPTEMBER 2014

##### FIGHTING VIRAL HEMORRHAGIC FEVERS IN WEST AFRICA

Fondation Mérieux and Institut Pasteur signed an agreement strengthening collaborations in West Africa regarding the Ebola crisis and other viral hemorrhagic fevers. The agreement covers the deployment of a new mobile laboratory (a joint action by DevCO, France Expertise Internationale and INSERM), a training program funded by Institut Pasteur, and improvement in capacity, subject to AFD.

#### JULY 2014

##### DEVELOPMENT OF STRATEGIES TO FIGHT INFANT MALNUTRITION IN AFRICA

Under its Priority Solidarity Fund (FSP), the French Ministry of Foreign Affairs and International Development (MAEDI) signed an agreement with Institut Pasteur that will make it possible to fund a project for developing strategies to combat infant malnutrition in Africa (FSP-MALINEA). This project will combine the abilities of the Institut Pasteur International Network in Africa—Madagascar, Niger, Bangui and Dakar—and the NGOs Action Against Hunger (ACF, Spain and France) and Group For Research and Technology Exchanges (GRET, France). This project will make it possible to assess the interactions between malnutrition and modification of the intestinal microbiome, and propose new strategies for therapeutic feeding of children.





**APRIL 2014**

#### **STRENGTHENING OF THE PARTNERSHIP AGREEMENT BETWEEN IRD AND INSTITUT PASTEUR**

On 16 April 2014, Pr Michel Laurent, President of the French Institut de recherche pour le développement (IRD), and Pr Christian Bréchet, President of Institut Pasteur, signed an amendment to the partnership agreement signed in 2010. This agreement is aimed at developing joint research projects in the overseas regions and collectivities and in countries located in Africa, the Mediterranean, Southeast Asia, Latin America and the Indian Ocean.



**JUNE 2013**

#### **STRENGTHENING OF SCIENTIFIC COOPERATION BETWEEN INSTITUT PASTEUR AND MEXICO**

The renewal of the collaboration agreement between Institut Pasteur and the Mexican National Council for Science and Technology (CONACyT) was signed at the Franco-Mexican Forum for Research and Innovation. It will help to encourage and strengthen the development of specific programs for scientific and technological cooperation during continued interaction with Mexico.



## **MEETINGS**

**NOVEMBER 2014**

#### **MATI (MOROCCO, ALGERIA, TUNISIA AND IRAN) REGIONAL MEETING**

The MATI regional meeting was organized in Casablanca by Institut Pasteur in Morocco. This gathering was a unique opportunity for researchers to explore new areas for cooperation, specific for the region, in health-related fields.

**SEPTEMBER 2014**

#### **SCIENTIFIC SYMPOSIUM OF THE INSTITUT PASTEUR INTERNATIONAL NETWORK**

From 10 to 13 September 2014, Institut Pasteur hosted the international scientific symposium, with the participation of many scientists from the International Network. This event gathered more than 500 international researchers, 32 countries and 14 international institutions. Its aim is to reinforce interactions between scientists.

**AUGUST 2014**

#### **AMERICAS REGIONAL MEETING**

The American regional meeting, bringing together the Institut Pasteur in Guadeloupe, French Guiana and Montevideo, INRS-Institut Armand-Frappier (Canada) and FIOCRUZ (Brazil), was organized by INRS-Institut Armand-Frappier, Laval, as part of the International Union of Microbiological Societies (IUMS) Congress in Montreal. Updates were provided on research on chikungunya, dengue fever, tuberculosis, leptospirosis and leishmaniasis, and the establishment of a regional Bioinformatics Platform.

## INTERVENTIONS

### NOVEMBER 2014

#### A HIGH-TECHNOLOGY DIAGNOSTIC LABORATORY IN MACENTA, GUINEA FOREST REGION

Pr Christian Bréchet, President of Institut Pasteur, visited on November 29<sup>th</sup>, the Ebola Treatment Center at Macenta, coordinated by the Red Cross with support from the French and Guinean authorities. Institut Pasteur has established a diagnostic laboratory there, which will be operated by volunteers.



### NOVEMBER 2014

#### EBOLA, AN INSTITUT PASTEUR IN GUINEA AND A NEW RAPID SCREENING TEST

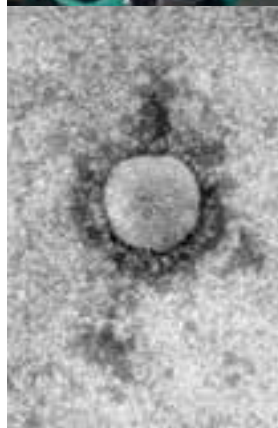
A memorandum of understanding and an agreement on the creation of an Institut Pasteur in Guinea, in Conakry at the end of 2016 were signed on 28 November 2014 between Institut Pasteur, AFD and the Guinean Ministers of Health, Higher Education and Research. This center will focus on diseases with high epidemic potential, and will make it possible to train personnel with the support of other RIIP Institutes in the region. On this occasion, Pr Bréchet announced the development of a rapid screening test for EBOLA (15 minutes instead of 6 hours).



### JUNE 2014

#### INSTITUT PASTEUR IN ALGERIA DIAGNOSES THE FIRST CASE OF MERS CORONAVIRUS

The Directorate General for Prevention at the Ministry of Health in Algeria and Institut Pasteur in Algeria were alerted following the death of a man infected by a new MERS coronavirus subtype (MERS-Cov) while on a pilgrimage in Saudi Arabia. The reference laboratory at Institut Pasteur in Algeria also confirmed a second, less virulent case of MERS-Cov infection.



### FEBRUARY 2014

#### INSTITUT PASTEUR IN GUADELOUPE TAKES ACTION AGAINST CHIKUNGUNYA

Institut Pasteur in Guadeloupe takes action against chikungunya with the development of a rapid detection test that enables its medical biology laboratory to give a result to patients within a maximum of 5 days of taking a blood sample. Having been involved from the onset of the chikungunya epidemic, Institut Pasteur in French Guiana, together with the 6 international reference laboratories in the Americas region, demonstrated the susceptibility of the *Aedes* mosquito to the virus, and helped to provide the biological tools needed for rapid diagnosis and epidemiological surveillance in the countries of the Americas region.

### JUNE 2013

#### INSTITUT PASTEUR IN BANGUI IDENTIFIES A NEW BACTERIUM RESPONSIBLE FOR FATAL MENINGITIS

A team from Institut Pasteur in Bangui (Central African Republic), in collaboration with Bangui Children's Hospital, discovered a new pathogen, *Elizabethkingia anophelis*, which is antibiotic resistant and caused two cases of fatal neonatal meningitis.



## ANNIVERSARIES

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### OCTOBER 2014

#### INSTITUT PASTEUR OF SHANGHAI CELEBRATES ITS 10<sup>TH</sup> ANNIVERSARY

Institut Pasteur of Shanghai, jointly created in 2004 by the Chinese Academy of Sciences, municipality of Shanghai and Institut Pasteur in Paris, celebrated its 10<sup>th</sup> anniversary, on the occasion of the 50<sup>th</sup> anniversary of diplomatic relations between France and China, at a scientific symposium held on 17 October 2014.

### AUGUST 2014

#### 10<sup>TH</sup> ANNIVERSARY OF INSTITUT PASTEUR KOREA

Institut Pasteur Korea commemorated its 10<sup>th</sup> anniversary on 8 August 2014. On this occasion, a scientific symposium was held on a range of themes, from antibacterial resistance, stem cell and neuroglial biology to the latest developments in imaging in the neurosciences.

### JUNE 2013

#### INSTITUT PASTEUR IN TUNIS CELEBRATES ITS 120<sup>TH</sup> ANNIVERSARY

Institut Pasteur in Tunis celebrated its 120<sup>th</sup> anniversary on 17 June 2013. Created in 1893, Institut Pasteur in Tunis is one of the oldest RIIP Institutes. It was crowned with glory in 1928 when its director, Charles Nicolle, received the Nobel Prize in Medicine. Institut Pasteur in Tunis is currently the institution of reference for biomedical research in Tunisia.

### JUNE 2013

#### INSTITUT PASTEUR IN ST PETERSBURG CELEBRATES ITS 90<sup>TH</sup> ANNIVERSARY

Institut Pasteur in St Petersburg, a national Russian institute under the authority of the Ministry of Health, celebrated its 90<sup>th</sup> anniversary, and the 20<sup>th</sup> anniversary of its presence in the RIIP.

### MARCH 2013

#### 60<sup>TH</sup> ANNIVERSARY OF INSTITUT PASTEUR IN CAMBODIA

Institut Pasteur in Cambodia, during the celebration of its 60<sup>th</sup> anniversary, laid the first stone in its regional research platform devoted to the study of communicable infectious diseases and emerging pathogens in Cambodia and other countries in the region. This new platform will come into being through the active support of the French research institutions (Institut Pasteur, IMMI/INSERM, ANRS, AIRD/IRD, Fondation Mérieux and CIRAD).



## INAUGURATIONS

### JANUARY 2014 AND OCTOBER 2014

#### A NEW WHOCC AND AN AMAZONIAN VECTOPOLE FOR INSTITUT PASTEUR IN FRENCH GUIANA

The parasitology laboratory at Institut Pasteur in French Guiana has become a WHO Collaborating Center (WHOCC) for surveillance of resistance to antimalarial drugs. This designation brings to 19 the number of WHOCC in the RIIP, including 8 at Institut Pasteur Paris. The first entomology unit of this scale in French Guiana, the Vectopole Amazonien Émile Abonnenc, inaugurated on 18 October 2014, was funded with support from the European Commission (STRonGer program), Institut Pasteur, Guiana Space Center, Region of Guiana, Rémire-Montjoly Rotary Club of Guiana and EDF Guiana.

### MARCH 2014

#### A REGIONAL PLATFORM FOR INFECTIOUS DISEASES AT INSTITUT PASTEUR IN CAMBODIA

The platform was founded under the authority of the Cambodian Ministry of Health, with the help of funding from the AVIESAN Sud partners. Its objective, in close association with the Ministries of Health, is to meet the challenges of infectious diseases in Cambodia and other countries in the region. High-level research will focus on HIV/AIDS and emerging infectious diseases, particularly vector-borne and zoonotic diseases. In partnership with the Universities, the platform will provide training for young researchers.

### MARCH 2014

#### RENOVATION OF INSTITUT PASTEUR IN MADAGASCAR

The Girard building was brought up to international standards with the help of funding from the French Ministry of Research, together with its own funding. This building houses, in particular, the WHO Collaborating Center for Plague (action and research).

### APRIL 2013

#### INAUGURATION OF A NEW SITE FOR INSTITUT PASTEUR OF SHANGHAI

Institut Pasteur of Shanghai – Chinese Academy of Sciences (IPS-CAS) inaugurated its new site in central Shanghai, on the campus of the Shanghai Institutes for Biological Sciences, in the presence of President François Hollande. The new premises, funded by the Chinese Academy of Sciences, are aimed at being at the forefront of R&D platform technology.



### MAY 2013

#### INAUGURATION OF THE MICROPOLLUTANT LABORATORY AT INSTITUT PASTEUR IN GUADELOUPE

This laboratory, funded by the European Regional Development Fund, with the participation of the Regional and General Councils, now makes it possible to measure and analyze drug and heavy metal residues, as well as many pesticide residues.

### NOVEMBER 2013

#### INSTITUT PASTEUR IN MONTEVIDEO INAUGURATES ITS INNOVATION SPACE

The Institut Pasteur in Montevideo Innovation Space is funded in part by the MERCOSUR structural convergence fund. It offers an infrastructure for hosting young biotechnology companies working in the area of human and animal health. The inauguration was an opportunity to launch the Innovation Space bioincubator, BIOESPINN, funded by Uruguay's National Agency for Investigation and Innovation, and focused on biomedical development and its biotechnological applications.







## AWARDS



### JANUARY 2014

#### **INSTITUT PASTEUR IN MONTEVIDEO: ALEJANDRO BUSCHIAZZO AWARDED THE PRIX FRANÇOIS JACOB 2014**

Alejandro Buschiazzi was awarded this prize for his research centered on the structural study of protein-protein and protein-DNA complexes involved in several diseases, such as leptospirosis and trypanosomiasis.

### DECEMBER 2013

#### **PRIX DEDONDER CLAYTON 2013**

Dr Gody, Head of the Pediatrics Department at the Bangui Faculty of Health Sciences, and Director of the Bangui Pediatric Complex in the Central African Republic (CAR), was awarded the Prix Dedonder Clayton 2013, which will support his team's research in CAR on primary resistance to antiretroviral drugs in children infected with HIV.

## Ebola: the Institut Pasteur in Dakar on the frontline

At the very start of the Ebola outbreak in Guinea, Dr Amadou Sall's team at the Institut Pasteur in Dakar went immediately to Conakry to provide support during the health crisis. This effort, which has continued for more than a year, testifies to the ability of the Institut Pasteur International Network to react, and the quality of its expertise.

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On 20 March 2014, the Institut Pasteur in Dakar received a letter from the Guinean Ministry of Health requesting its support in determining the source of a mysterious hemorrhagic fever affecting 46 people that had already claimed 20 victims in the southeast of the country. Very soon, information from the Unit for the Biology of Emerging Viral Infections in Lyon (Institut Pasteur-Inserm) confirmed that it was the Ebola virus.

### **An incredibly difficult challenge to manage**

The team led by Amadou Sall, Scientific Director of Institut Pasteur in Dakar, who directs the WHO Collaborating Center for arbovirus and hemorrhagic fevers, was then urgently dispatched to Conakry. *“My team arrived on Sunday the 23<sup>rd</sup> at around 8:00 pm, and we went straight to Donka Hospital to install our mobile laboratory. There was a whole series of specimens stored there that came from Guinea Forest Region, some of which had been sent to Lyon. Sylvain Baize had already informed us that it was Ebola, and at about 4:00 am, we had effectively confirmed this result,”* recalls Amadou Sall.

The Institut Pasteur in Dakar was thus the first African body to have installed a laboratory and confirmed suspected cases in Guinea. The team then had very little idea of how the epidemic would grow in the coming months.

It very quickly confirmed the first cases of the disease in Conakry, and subsequently in Liberia. The epidemic then spread to the border area between Guinea, Liberia and Sierra Leone, countries whose health systems are already fragilized by the difficult economic and political situation, making the necessary cooperation and movement of materials more complex. *“Until then, the Ebola outbreaks we had experienced involved relatively limited foci and could be quickly controlled. But then almost overnight we found ourselves confronted by thousands of cases appearing in three countries with multiple foci in both urban and rural areas. This was an incredibly complex challenge for us to manage,”* comments Amadou Sall. Initially there were too few treatment centers, and the rapidly growing fear surrounding the epidemic impeded the ability to respond. Airlines canceled their flights to Conakry. Patients refused to go to the treatment centers. *“At the very start of the epidemic, these were referred to as isolation centers. Since they knew that treatment was purely symptomatic, patients thought that they were getting a death sentence. In time, the first patients to recover left, and that provided a little reassurance, but we still have not won,”* continues Dr Sall.

The team quickly got to work training about ten Guinean technicians to safely take specimens from patients and perform serological and molecular diagnosis of Ebola. From Dakar, it also continued its role as a WHO Collaborating Center, analyzing samples from suspected cases from Senegal, Mauritania, Mali and Angola.

On the research front, Amadou Sall's team, together with local partners, and in collaboration with Simon Cauchemez, who directs the Mathematical Modeling of Infectious Diseases Unit at Institut Pasteur, conducted a survey on patients, families and their neighbors in Conakry, in order to retrace from February to August 2014 the transmission of Ebola between individuals in different situations. This work, published last January in The Lancet Infectious Diseases, made it possible to demonstrate the positive impact of control measures on the growth of the epidemic, while emphasizing the challenges that need to be overcome to contain this epidemic in large urban centers. The results show that in March 2014, transmissions at funerals represented 15%, and those in hospitals, 35% of all transmissions. These proportions subsequently fell to 4% and 9%, respectively, from April, when safety measures for funerals were put in place, and a treatment center opened. *“Using transmission chains as a basis for modeling the impact of interventions, we were able to determine that if we had admitted 10% more patients to hospital, we would have reduced transmission by 26%. On the basis of such findings, WHO implemented a strategy aimed at increasing the number of care centers for receiving patients, and preventing them from remaining in the community,”* explains Amadou Sall.

**“The Institut Pasteur in Dakar was the first African structure to have installed a laboratory and confirmed suspected cases in Guinea.”**

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This work is still ongoing, with the sequencing of strains isolated in Guinea, which will allow study of the virus's potential evolution in time and space, in order to adapt the diagnostic tools if necessary.

The team is also heavily involved in research projects aimed at improving the present diagnostic tools. It directed a field trial in Conakry of a new test that enables reduction of the time to diagnose Ebola to 15 minutes, developed as part of a project funded by the Wellcome Trust

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and the British Government. Amadou Sall is also involved in strategic discussions on diagnosis carried out by the Task Force established by Institut Pasteur last September. Finally, Institut Pasteur in Dakar continues its work preparing and helping countries in the region to manage the emergency. A workshop held in Dakar from 9 to 12 March last brought together participants from some 12 countries, who came to receive training in techniques for diagnosing Ebola. For Amadou Sall, "A health emergency such as the one we are experiencing also shows the strength of the Institut Pasteur network. In Niger, Morocco, Côte d'Ivoire, Cameroon, and in all countries where there is a member of the network—that is where discussion around Ebola diagnosis is initiated. Our geographic position and know-how enabled us to respond very quickly this time. Finally, apart from the technical aspects, the strong link between the field and the researchers in Paris has made it possible to gather complementary

**Official Visit in Guinea**  
During the visit of the president of the French Republic in Guinea, Pr Christian Bréchet, president of the Institut Pasteur, went, on Saturday 29<sup>th</sup> November 2014, in Forest region, South-East of the country, at Macenta treatment center which started its activity on 19<sup>th</sup> November with a capacity of 60 beds. Christian Bréchet visited the diagnostic laboratory set up by the Institut Pasteur.

*expertise very rapidly in order to quickly progress in seeking new strategies for vaccination and treatment."*

Other members of the network are involved in Ebola research. This is particularly the case for the Pasteur Center in Cameroon, which is going to conduct the Phase II clinical trial of the vaccine candidate ChAd3 EBOV, developed by GSK. This vaccine candidate is based on an adenovirus-like chimpanzee-derived pseudovirus, which expresses glycoproteins from the Zaire strain of Ebola virus on its surface. In Cameroon it will be tested on a cohort of 700 adults and 250 children. "The objective of this phase is to ensure that the vaccine candidate is well tolerated and able to induce an immune response," explains Marie-Astrid Vernet, manager of surveillance activity for hemorrhagic fevers. This trial will also be implemented in other sites in Ghana, Mali, Nigeria and Senegal. Hakim Djaballah, Director of Institut Pasteur Korea, is an active participant in the Task Force, to which he contributes the expertise of his Institute in terms of screening to detect new therapeutic compounds.

### The Ebola Task Force

Harnessing Pasteur's expertise and cutting-edge resources, the Ebola Task Force (ETF) was created in August to fight the epidemic. In March 2014, Institut Pasteur was the first to identify and profile the virus. This early engagement and Institut Pasteur's leadership in research were good reasons for Institut Pasteur to spearhead an initiative against Ebola. Since founding the ETF, Pasteurian scientists and public health advocates have worked continually to help create a solution to the epidemic.

## IN GUINEA, EXCEPTIONAL ACTION BY INSTITUT PASTEUR

In March 2014, Sylvain Baize and his team confirmed the first cases of an Ebola outbreak with an unprecedented scale in West Africa. The cases were initially detected in Macenta, in the southeastern Guinea forest region.

Here the Red Cross runs a treatment center in which the Institut Pasteur has established a diagnostic laboratory. Built with the technical expertise of Sylvain Baize and coordinated by the Institut Pasteur Department of International Affairs, this laboratory has high technology equipment and a much higher level of security than

other laboratories installed in other epidemic sites. Since it was launched last November, volunteer teams, such as Jean-Claude Manuguerra's one with two technicians or junior scientists, work for three weeks at a time to screen patients receiving care in the treatment center and analyze specimens taken from people who have died in the community. Apart from Ebola, the laboratory is able to diagnose typhoid fever, Lassa fever and malaria.

Additionally, while traveling in Guinea last November, Christian Bréchet, President of Institut Pasteur, signed an agreement

regarding the creation of an Institut Pasteur in Conakry, which should become operational at the end of 2016. Supported by the French Agency for Development (AFD), this new Institut Pasteur will focus its activities on diseases with high epidemic potential, particularly arboviral diseases and viral hemorrhagic fevers (Ebola fever, Lassa fever, yellow fever, Rift valley fever, etc.), with the aim of making it a major player in research and public health fully integrated with the existing national structures and institutions.



Kathleen Victoir, from the Department of International Affairs and Felix Rey, head of the Department of Virology, coordinate the ETF. They integrate activities of six scientific work packages with these missions: vaccine and treatment development, improved diagnostics, and of course, basic research on the virus.

The vaccine and treatment quest follows two important paths. The first seeks to develop a safe, effective, and affordable vaccine that would work pre-exposure—*before* an individual has been in contact with the virus. The second aim is to create a therapeutic vaccine that would allow treatment post-exposure—*after* an individual has encountered the virus.

“In all countries where  
a Network’s institute is  
present, the reflection on  
Ebola’s diagnosis is settled  
with this institute.”

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Diagnostic efforts also have two aims. The first is to create a fast, easy-to-operate test for field use. Teams are working to develop a second diagnostic with a subtle difference: this one would be so sensitive that it could be used to detect virus even before an individual’s symptoms appear; because of its complexity it would only be used in hospital and university healthcare centers.

Superlative basic research informs these innovations. Genetic sequencing is an important theme. By sequencing the virus from several patients, teams discover who transmitted the virus to whom, leading to greater understanding of the patterns that define the virus’s evolution and transmission.

Studying and detailing the human immune response to the Ebola virus is also a worthwhile focus. There are fascinating questions being explored, such as why people have different reactions to Ebola, and why some people die, while others only get mild symptoms and survive. Answers to these questions will help predict infection outcomes, leading to the design of more effective vaccines and treatment strategies.

The innovations and interventions of the ETF are the result of international collaboration across disciplines and time zones. Daily, the ETF continues to respond to a global crisis with all the scientific strength and talents of a deeply international, interdisciplinary team. The value of this good work will also be of service in the future. The most successful strategies of ETF will form the basis of an Outbreak Investigation Task Force, that is at the ready for—in fact, already responding to—the next outbreak challenge.



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DENFREE:  
towards better  
tools to control  
dengue  
transmission

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Since January 2012, the Institut Pasteur leads the DENFREE programme, one the 3 European Dengue research consortia funded by the European Union under the seventh Frame work programme. Anavaj Sakuntahbai, coordinator of the programme explains its objectives.



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“Dengue, also known  
as dengue fever,  
is a viral disease  
transmitted to  
humans by  
mosquitoes.”

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DENFREE is a multidisciplinary consortium that aims to understand dengue transmission dynamic in several parts of the world and ultimately being able to improve control strategies. We have partners in Cuba, Thailand and Cambodia where we work closely with the Institut Pasteur. So far, the prevention of dengue transmission relies on vector control. When someone with dengue is identified in a hospital, fumigation with an insecticide is carried in his household. Even though the insecticide has been

improved in the past years and can last up to 4 weeks, this is largely insufficient to efficiently control the spread of the disease.

Basically our multidisciplinary approach including epidemiology, entomology, immunology, genetics, meteorology and geography aims at defining when, where and who an efficient intervention to control dengue should target.

Although, the correlation between dengue outbreaks and rainfalls, that induce an increase in mosquitos' density, is largely known we lack precise understanding of the timing of the intervention. One part of our project is to finely analyse 10 years of meteorological and geographical data to try to answer that question. Our hypothesis is that insecticide should be used few weeks before the rain season start.

But the main originality and major focus of our programme is the study of asymptomatic infections. This population has not been so far very much studied, as they are of course, difficult to identify.

In a previous project called DENFRAME involving several members of the international network, it was showed that a high proportion of the family members of patients with acute symptoms of dengue were also infected.

The questions we ask in this programme is who are those people, do they contribute to dengue transmission and if so to what extent.

The first objective is to determine the epidemiological characteristics of the asymptomatic carriers. Dengue infection is very complex because there are four serotypes. Infection by one of these serotypes provides lifelong immunity against this particular serotype. In addition, subsequent infections by other serotypes increase the risk of developing symptomatic dengue by a mechanism know as antibody-dependent enhancement. In our study, we could demonstrate that primary infections occurring early in life, young children are one of the main high-risk group of having asymptomatic infection and transmission of the virus. Another

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“Our multidisciplinary approach aims at defining how to target an efficient intervention to control dengue.”

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group could be people that have already been infected with more than two dengue serotypes and have developed a cross-protective immunity.

Using household investigation done in by the Institut Pasteur in Cambodia, we have already been able to show that indeed these asymptomatic carriers are able to transmit the virus to mosquitoes.

Finally, another objective of the DENFREE project is to perform immunological studies to compare the responses between people who develop symptoms and those who do not. If we are able to identify differences in either the innate or adaptive immune responses between these two groups, it can provide important clues for vaccine development.

Most research in the field of dengue have so far focused only on disease development. Our belief is that it is necessary to tackle both the disease and its transmission if we want to efficiently control the virus. The Institut Pasteur in French Guiana will study the ability of mosquitoes to carry the virus, the Institut Pasteur in Laos conduct a project to establish the kinetic of peripheral blood mononuclear cells in dengue infected patient and to determine the role that this particular blood compartment may play in mosquito infection process. We are also working with the Institut Pasteur in Guadeloupe to develop new insecticides, Institut Pasteur Korea for prognostic markers. This huge mobilization will hopefully bring new tools to address the global health challenge that dengue infection represents.

### Dengue surveillance in Lao PDR

South-eastern Asia is considered as a hyper endemic area for dengue viruses. Despite this classification, precise data regarding viral serotypes and genotypes are lacking in Lao PDR. A surveillance network has been established to reinforce diagnostic capacities in order to document suspected dengue cases and improve the understanding of dengue epidemiology. Under the leadership of Marc Grandadam, head of the Arbovirus and emerging viral diseases laboratory, the Institut Pasteur in Laos coordinates a network of 5 hospitals and a private consultation centre following the 2013 dengue epidemic. The objectives are to reinforce dengue diagnosis and

surveillance in coordination with the national central laboratory in order to provide the Lao Ministry of Health updated information on dengue confirmation rates and on serotypes and genotypes of dengue viruses circulating in Lao PDR. Since 2012, the permanent surveillance in Vientiane city demonstrated the emergence of dengue serotype 3 that rapidly superseded serotypes 1 and 2. Mapping of the cases is used to guide entomologic investigations and vector control campaigns. Dengue strains were isolated from different mosquito species improving knowledge on the transmission cycles of dengue virus in Laos.

### Dengue: a major international health threat

Dengue, also known as dengue fever, is a viral disease transmitted to humans by mosquitoes. In the recent years dengue incidence has dramatically increased in many tropical countries making it one of the most urgent international public health concern. WHO estimates the annual number of cases to be 50 million, including 500,000 cases of dengue hemorrhagic fever, which has a case fatality rate of over 20%. Two and a half billion people live in risk areas. Although initially seen only in the world's tropical and sub-tropical regions, dengue has now reached Europe, where the first two indigenous cases were reported on the French mainland in 2010. The symptoms of dengue can vary from benign stiffness to a lethal haemorrhagic fever. There is no vaccine or specific treatment for





“An early detection  
and an access to  
specific medical care  
dramatically decrease  
the death-rates.”

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dengue. However, early detection and access to specific medical care dramatically decrease the fatality rates.

### **Solving the mysteries of Dengue in Africa**

Although it is known for decades that Dengue occurs in many African countries, there is striking paucity of the availability of diagnostic tools in healthcare settings, rendering burden prediction very uncertain. Recent data suggest that dengue is endemic in 34 African countries but the clinical features of dengue fever being very unspecific, it can be easily misdiagnosed and treated as other very common febrile illnesses in Africa, such as malaria. The Institut Pasteur in Dakar, is conducting a research project based on a cohort that they are following since the early 90's in Kedougou (south-eastern Senegal) that aims to better understand the epidemiology of Dengue and other haemorrhagic fever.

On the opposite, the symptoms of severe dengue are extremely easy to recognize. It is striking that the report of those cases are very rare in the African continent. Because Cuban population is a mix of African and European ancestry, the team of Anavaj Sakuntahbai will conduct genomic research with their partners in the island, to determine whether the African population have genetic features that might protect them from developing severe dengue.

# MAIN PROGRAMMES

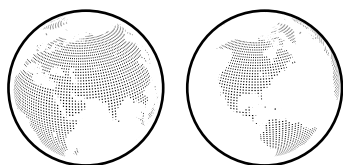


Integrated surveillance networks for infectious diseases in response to new public health challenges

2014 was a turning point in the development of new surveillance and research programmes, facing the challenges of the impact of climatic changes, urbanization and population growth on health.







## SUPPORT, TRAINING AND STRENGTHENING OF CAPACITIES

### “INFLUENZA, RESPIRATORY INFECTIONS AND EMERGING INFECTIOUS DISEASES: SURVEILLANCE FOR BETTER PROTECTION”

In order to develop and strengthen capacity for preparedness and response regarding epidemics of influenza and emerging or re-emerging infectious diseases, the Institut Pasteur and the international network are supporting the public health infrastructures of partner countries in Africa and Southeast Asia in implementing the International Health Regulations (IHR).

#### **Respiratory infections, a major public health problem**

According to WHO, Severe acute respiratory infections (SARI) may be responsible for 3.9 million deaths per year. They are among the main causes of death in children under 5 years, especially in low- and middle-income countries.

Among the acute respiratory infections, “the flu,” often trivialized as a synonym for a cold or “chill,” is a major public health problem. Every year, 5-10% of adults, and 20-30% of children are affected worldwide. The disease may lead to hospital admission and death, particularly among high-risk groups (very young children, elderly or those with chronic diseases). These annual epidemics are responsible for approximately three to five million cases of serious disease, and 250,000-500,000 deaths. In tropical regions, sporadic epidemic outbreaks of influenza may appear throughout the year. The emergence and global spread, in 2009, of a new endemic influenza strain, A(H1N1) and, still more recently, the emergence of a new variant, A(H7N9), demonstrated the need for an effective surveillance network for respiratory infections with a focus on influenza, but including other respiratory viruses as well.

“The expertise of the member institutes of the Institut Pasteur network in the epidemiological and virological surveillance of infectious diseases is therefore a major asset in the guidance for appropriate public health decisions.”



#### **The InPRIS Project**

*(Influenza Preparedness and Response in Support of International Health Regulations)*

For the last 3 years, Institut Pasteur and the international network have been working to establish and strengthen preparedness and ability to respond regarding influenza epidemics in the countries involved (Senegal, Cameroon, Central African Republic and Cambodia), as part of implementing the International Health Regulations (IHR) (2005).

In the partner countries, the main objectives are the following:

- reinforce the Development of Pandemic Influenza Preparedness and Response Capacities in host countries;
- strengthen National IHR Focal Points Communication Capacities on Influenza;
- strengthen existing influenza surveillance networks for seasonal influenza and other respiratory viruses with a laboratory component critical for IHR core capacities implementation.

The InPRIS Project has made it possible to establish surveillance networks, or strengthen existing networks, in the partner countries. Continuous surveillance of respiratory infections in the 47 sentinel sites in Senegal, Cameroon and Central African Republic allows the collection and analysis of nearly 500 specimens per month. Results are then sent to the Ministries of Health in their respective countries.

In Cambodia, the project is mainly directed at surveillance of influenza A(H5N1), known as avian flu, and highly pathogenic. It is therefore centered on continuous virological surveillance of acute respiratory infections, combined with epidemiological studies, especially on transmission from animals to humans (surveillance of live poultry markets) and between humans (monitoring of people who have come into contact with infected people).

In all partner countries in the project, the genetic analysis of circulating influenza viruses helps to guide public health recommendations, especially regarding vaccination, and also helps to bring to



“The continuous surveillance of respiratory infections in the 47 sentinel sites in Senegal, Cameroon and Central African Republic enables the collection and analysis of 500 specimens per month.”

light any mutations, appearance of new strains and resistance to antiviral drugs, and even helps to monitor potential increases in epidemic risk (increased transmission, more pathogenic viruses, etc.). The expertise of the member institutes of the Institut Pasteur International Network in the epidemiological and virological surveillance of infectious diseases is therefore a major asset in the guidance for appropriate public health decisions.

The InPRIS Project has also contributed to strengthening the national capacity of the partner countries regarding crisis communication in the event of an epidemic. Meetings and trainings with those conducting surveillance, with health authorities and national IHR focal points are regularly organized at national and international level in order to improve communication and preparedness for epidemics.



### The ASIDE Project

*(Alerting and Surveillance for Infectious Disease Epidemics)*

At the end of 2014, a new project was created to follow on from InPRIS: the ASIDE Project. Two new countries joined this project, Madagascar and Côte d'Ivoire. With objectives similar to those of InPRIS regarding support for surveillance networks for respiratory infections, this project has a broader scope, since it also includes surveillance of emerging or re-emerging diseases, for example polio caused by wild poliovirus in Madagascar and Cameroon. The development of tools to allow early detection and early warning in the event of an epidemic will be an integral part of the project.

Websites: InPRIS Project (<http://www.inpris.net/>).  
ASIDE Project (<http://asideproject.org/>).

**These projects are funded by ASPR (Office of the Assistant Secretary for Preparedness and Response) within the US Department of Health and Human Services.**



## THE INTERNATIONAL HEALTH REGULATIONS (2005)

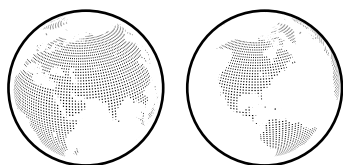


The growing globalization involves an exponential increase in the international movements of people and goods, which may encourage the spread of infectious diseases. Nowadays, a health crisis in one country can have very rapid repercussions on the activity and economy in many parts of the world, as witnessed by the crises associated with severe acute respiratory syndrome (SARS) in 2003 and the influenza pandemic associated with influenza virus A(H1N1) in 2009.

In this context, there is need for a powerful global alert and response network. The 2005 revision of the International Health Regulations (IHR) is aimed at establishing this network to cover infectious diseases, as well as any event (known or unknown) that might constitute a public health emergency of international concern.

The IHR are an international legal instrument that is binding on the 196 participating States in relation to public health, its objective being “to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade.”

<http://www.who.int/ihr/en/>



# MEDILABSECURE

## “SETTING UP A NETWORK OF LABORATORIES TO INCREASE HEALTH SECURITY IN THE MEDITERRANEAN AND BLACK SEA REGIONS”

Today it is largely admitted that strong international coordination is required to efficiently address health threats. The MediLabSecure project aims at enhancing preparedness against vector-borne diseases by setting-up a network of virology and entomology laboratories in 19 participating countries in the Mediterranean and Black Sea regions.

Countries of the Mediterranean and Black Sea regions have common sea borders and, as a result, share common public health issues and threats. The EU funded MediLabSecure project aims at consolidating a laboratory network on the emerging viruses that are pathogens for humans and/or animals. It will represent a cluster for awareness, risk assessment, monitoring and control of these vector-borne as well as respiratory viral diseases. This cluster will require the interaction of four laboratory sub-networks, one for human health, one for animal health, one for entomology and one for public health reinforcement.

The MediLabSecure network encompasses partner countries around the Mediterranean and Black Sea Regions (19 non-EU countries) by means of a collaborative execution of activities to address public health-related national needs. The project is funded by the European Union DEVCO/ EuropeAid for the period 2014-2017. The Institut Pasteur is leading the project and will be counselled by an Advisory Board composed of international experts.

### Project objectives

The overall objective of the MediLabSecure project is to increase, through capacity building, the health security in the Mediterranean Area and South-East Europe Black Sea Region by enhancing and strengthening the preparedness to common health threats and bio-safety risks at national and regional levels by the creation of a network of laboratories, by strengthening the one previously created by EpiSouth plus (see Box). The

“The MediLabSecure network could represent a cornerstone of the preparedness to face a possible emergence of viral diseases in the Mediterranean and Black sea Regions.”



reinforcement of relations of trust in the region is an objective and an instrument in the scope of the project's implementation.

The general objectives of the project are to:

- Create a framework for collaboration to improve integrated surveillance (animal, human, entomological) and monitoring of emerging vector borne viral diseases (arboviruses) and respiratory viruses
- Provide training for public health experts in participating countries to increase the communicable disease control in the Mediterranean and Black Sea region and to recommend and implement public health measures for control where possible
- Promote knowledge development and transfer of biosafety best laboratory practices
- Provide tools for awareness, risk assessment, monitoring and control of the different emerging viruses (transmission, spread, human impact...)

### Selection process: Building the network

The MediLabSecure project is reinforcing the Mediterranean Regional Laboratory Network set-up by the EpiSouth Plus project that included 27 laboratories under the Ministries of Health's tutelage of 24 participating countries. This new network now includes animal virology and medical and veterinary entomology laboratories to develop a “one health” approach to tackle more globally and efficiently the public health threats in the region. Questionnaires on laboratories' scope of activities and capacities have been addressed to candidate laboratories in the regions, directly or via national and regional

“46 laboratories from 19 non-EU countries have been selected to be part of the MediLabSecure network.”

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focal points. A selection committee composed of international experts studied the candidatures of 66 laboratories from 19 non-EU countries and 46 laboratories have been selected to take part in the MediLabSecure network.

### Conclusions & future activities

According to a thorough needs assessment based on questionnaires and conclusions from the recent meeting, tailored trainings sessions will be organized, enabling laboratories to locally implement harmonized and up-to-date techniques to carry out safely and efficiently the laboratory diagnostics of arboviruses such as West Nile, Rift Valley Fever, Chikungunya, and emerging respiratory viruses such as MERS-coronavirus.

By enhancing diagnostic capacities and regional multidisciplinary cooperation, the MediLabSecure network could represent a cornerstone of the preparedness to face a possible emergence of viral diseases in the Mediterranean and Black sea Regions. Moreover, it will extend the trust and collaboration among national Public Health Institutions, officials from Ministries of Health, Animal Wealth and Agriculture to the laboratories.

Website: [www.medilabsecure.com](http://www.medilabsecure.com)



### AT THE BEGINNING, EPISOUTH...

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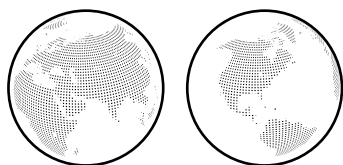


MediLabSecure builds on a network of laboratories previously created by another EU-funded project, EpiSouth. The EpiSouth (then EpiSouth-Plus) projects aimed to create a framework of collaboration on epidemiological issues for enhancing communicable diseases surveillance and control of public health risks through communication, training, information exchange and technical support to countries in the Mediterranean Basin. The approach based on the countries' expectations and on regional needs, facilitated interest in participation. The EpiSouth Plus capacity building events/activities have involved globally more than 200 people from the 27 EpiSouth Countries. In addition to facilitating epidemiological communication and practical training, this regional approach strengthened solidarity and cohesion within the European Community and between EU and non-EU countries. Strategic documents

have been delivered for supporting the EpiSouth Countries in setting up their Preparedness Plans. Ultimately, EpiSouth-Plus contributed to the stability of the region as well as to improve public health protection.

The EpiSouth-Plus project won the 2014 European Health Award at the European Health Forum Gastein, the leading health policy event in the EU.





## SENTINEL NETWORK

### INSTITUT PASTEUR IN MADAGASCAR

The aim of the network set up by the Institut Pasteur in Madagascar is the surveillance of febrile diseases with epidemic potential.

An early detection of these diseases make it possible to give appropriate response and control epidemics.



Epidemics of febrile diseases (e.g. malaria, influenza, dengue, chikungunya, etc.) and the requirements of the new International Health Regulations justified the creation in Madagascar of a sentinel surveillance system for diseases with epidemic potential. In 2014, it relied on 73 community representatives in the Farafangana, Moramanga and Ankazobe pilot districts, and on 34 basic health centers and 18 hospitals covering all the territory and ecosystems in Madagascar. In the event of an epidemic, this network enables early warning, initiation of a rapid response, and availability of regular near real-time data on the main causes of fever. It also makes it possible to identify the causative agent in circulation.

#### Real-time Surveillance

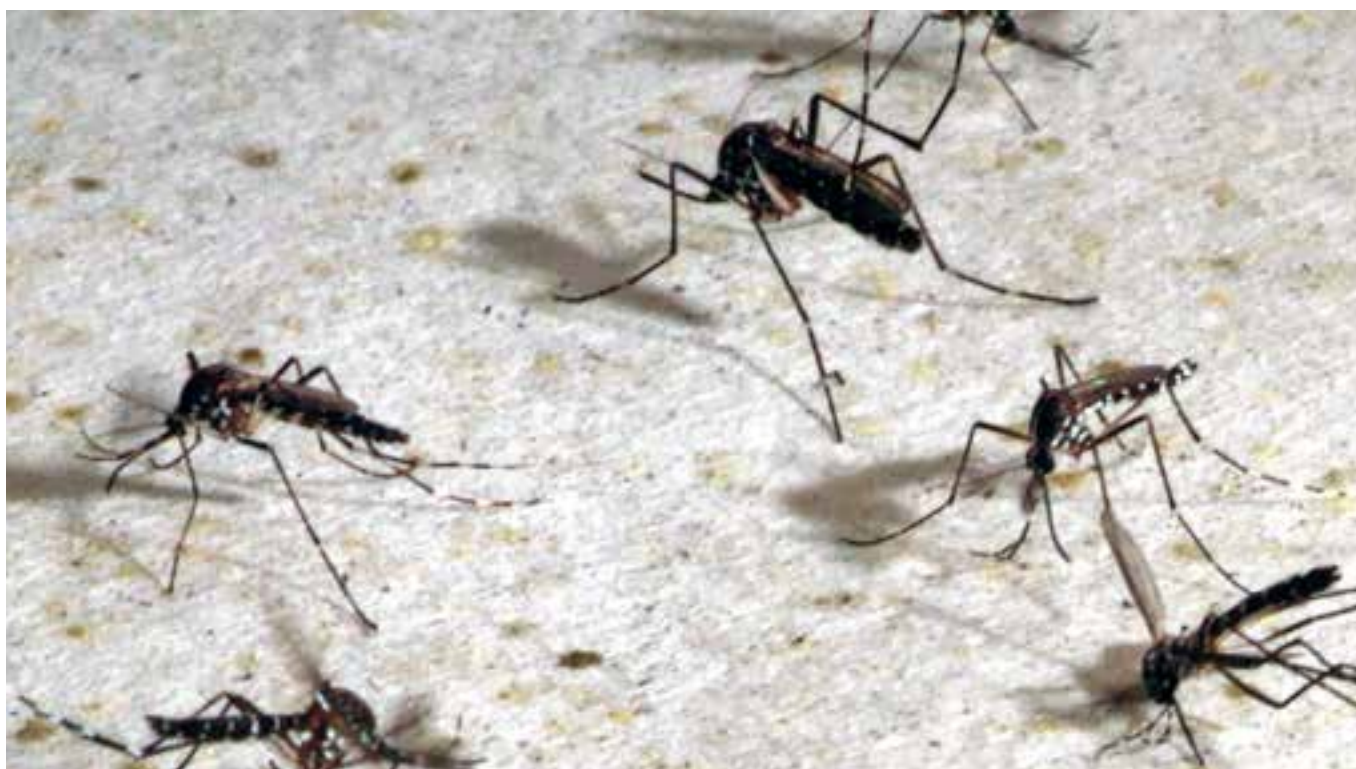
At community representative level, surveillance is based on daily reporting by SMS (short message service) on the numbers of consultations, cases of fever, confirmed cases of malaria (by rapid diagnostic test, RDT), patients transferred to basic health centers, and deaths. At basic health center level, daily reporting by SMS covers the number of consultations, cases of fever, confirmed cases of malaria, suspected cases of arbovirus infection (dengue-like syndromes), and cases of influenza-like illness and diarrhea. At hospital level, surveillance is based on weekly reporting by SMS of the number of admissions, cases of fever, confirmed cases of malaria, cases of acute respiratory distress syndrome, suspected cases of avian influenza, and cases of hemorrhagic fever and serious forms of hepatitis. Data sent by SMS are verified, automatically included in a database, and analyzed in near real-time to look

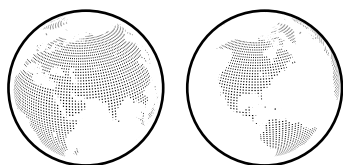


for epidemiological anomalies. This system is combined with biological surveillance of arbovirus infection and influenza to allow the isolation and characterization of the viruses. It is also used to collect *Plasmodium* strains with a view to monitoring chemoresistance to antimalarial drugs.

In 2013-2014, at basic health center levels, febrile syndromes represented 13.4% of reasons for consultation. Malaria, influenza-like illnesses, diarrheas and suspected arbovirus infections represented 16.3%, 29.0%, 7.3% and 1.1% of fevers, respectively. In isolated rural areas of the pilot districts monitored by the networks of community representatives, malaria accounted for 88% of consultations, and the mortality rate associated with malaria was 7.3%. Finally, at sentinel hospital level, febrile syndromes represented 25.5% of admissions. Malaria, acute respiratory distress syndrome and hemorrhagic fevers constituted 20.8%, 8.3% and 0.3% of admissions, respectively.

This sentinel network enabled the early detection of a malaria epidemic in the Farafangana and Mananjary areas, and some epidemics of plague. The quality of its data was verified and validated. This network is currently one of the most reliable sources for surveillance and management of epidemics of febrile diseases in Madagascar.





# TUBERCULOSIS

## RESEARCH INITIATIVES

Tuberculosis is one of the infectious diseases that kill the most around the world. In 2013, 9 million people caught tuberculosis and 1.5 million died from the disease, 95% of tuberculosis deaths occur in low-income countries. Multi-drug resistant tuberculosis is a major public health issue worldwide. 16 institutes of the Network are involved in surveillance and research on tuberculosis.



### **Diagnosis, surveillance and control of tuberculosis: programs developed within the RIIP**

#### **• Upgrade laboratory network for tuberculosis diagnosis and drug testing in africa**

Funded by the OFID (OPEC Fund for International Development), this project includes the National Reference Labs in Togo, Benin, Niger, Guinea Bissau, Burkina Faso, and Pasteur Centre in Cameroon, Institut Pasteur in Bangui, Institut Pasteur in Côte d'Ivoire, with partners: the International Union Against Tuberculosis and Lung Disease; Tropical Medicine Institute (Belgium), Fondazione Centro San Raffaele (Italia), Aarhus University Hospital (Denmark). This project develops diagnostic, training activities and a study on the efficacy of treatment for multi-resistant tuberculosis.

#### **• Support Program to Fight tuberculosis in Gabon**

The objectives are to develop the diagnosis capacities (especially of multi-resistant tuberculosis) of the National Public Health Laboratory in Gabon and to support a community program. The Pasteur International Network Association is coordinating this program funded by the Republic of Gabon, with participation of Institut Pasteur, Pasteur Centre in Cameroon, and in due course Institut Pasteur in Bangui.

#### **• Evaluation of new methods for the diagnosis in childhood intra-thoracic tuberculosis in Sub-Saharan Africa (TB Kids)**

Funded by Total Foundation, it focuses on the identification of algorithms for the best diagnosis in infant tuberculosis in 3 different African settings: Côte d'Ivoire, Cameroon and Madagascar.

#### **• Pediatric Asian African Network for Tuberculosis and HIV Research (PAANTHER 01)**

This project, funded by the ANRS, aims to develop an algorithm to improve the diagnosis of tuberculosis in HIV-infected children from developing countries with high tuberculosis endemic: in Asia (Cambodia, Vietnam) and in Africa (Burkina Faso, Cameroon).

#### **• STATIS randomized controlled trial**

This project, funded by ANRS, aims to compare the risk of death and occurrence of invasive bacterial infection in HIV-1 infected adults under antiretroviral therapy in Cambodia, Côte d'Ivoire, Uganda and Vietnam.



#### • Study of *M. bovis* in Uruguay

This project developed by Institut Pasteur de Montevideo, supported by the Ministry of Livestock, has the aim of typing the most virulent strains of *M. bovis* in Uruguay, sequencing whole genome and developing new diagnostic methods.

#### • Institut Pasteur in Tunis

Improvement of diagnosis for lymph node tuberculosis.

#### • Institut Pasteur in Lille

New tools for tuberculosis control, surveillance, drugs resistance diagnostics and development of vaccines.

#### • Institut Pasteur in Morocco

Project to develop a quick molecular test to identify *M. tuberculosis* and a test to detect mutations responsible for anti-mycobacterial drug resistance.

Partnership for “Mobile Health Tuberculosis”, an innovative electronic system that aims to improve treatments of patients with tuberculosis.

### Discovery of new drugs

#### • Creation of the Unit “Emerging Bacterial Pathogen” in Institut Pasteur of Shanghai

This unit, created in July 2014, directed by Pr. Brigitte Gicquel, aims to discover new drugs against tuberculosis. Several molecules with anti-tuberculosis activity have been identified; one is going to enter a pre-clinical study.

#### • Discovery of new drugs to fight tuberculosis in Gabon

Collaboration between the Institut Pasteur in Paris, the Institut Pasteur of Shanghai and the National Public Health Laboratory in Libreville. New molecules are being characterized by the Institut Pasteur of Shanghai in collaboration with the Fudan University together with the chemicals Chinese Platform. In total, 100 000 molecules have been screened for their anti-mycobacterial activity. 12 candidates molecules will be tested *in vitro* on tuberculosis strains from Gabon.

#### • Overcoming antibiotic resistance

Institut Pasteur in Lille is working on the development of a new class of therapeutic compounds that make *M. tuberculosis* strains hypersensitive to ethionamide. Collaboration with Inserm, GSK, Bioversys, the WellcomeTrust and the TB-Alliance.

#### • Some collaborative projects developed by Institut Pasteur Korea

With Institut Pasteur:



### INTERVIEW WITH AMEL KEVIN ALAME-EMANE



The study I am currently carrying out aims to describe the genetic diversity of tuberculosis bacillus in Libreville in Gabon, and to make a profil of acquired resistance to antibiotics, using several molecular biology techniques: molecular typing and sequencing target genes involved in antibiotic resistance.

Because we do not have access to a biosafety level 3 laboratory, thus bacterial culture at a national level, we choosed to work directly on expectorations.

I have the pleasure to carry out this study at the Mycobacterial Genetic Unit at the Institut Pasteur in Paris. I found there a young, dynamic and nice team. This partnership between the Institut Pasteur in Paris and the National Laboratory of Public Health in Gabon made possible for me to discover a new world, centered on a few key notions: hard work, sharing knowledge, scientific rigour, which I hope I can pass down in the future.

– Genetic study for validation of drugs mechanism of action

– Whole Genome Sequencing of *M. tuberculosis* strain With Institut Pasteur in Madagascar:

Drug susceptibility test for MDR and XDR isolated from patients with pulmonary and extrapulmonary tuberculosis.

### Genetics of *M. tuberculosis*, molecular epidemiology

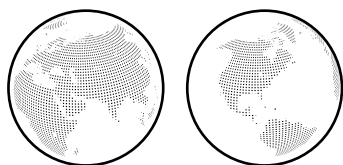
#### • Evolutionary history and global spread of the *M. tuberculosis* Beijing lineage

A consortium including three institutes of the Network (Institut Pasteur in Lille, Saint Petersburg, and Guadeloupe), showed the origin of the “Beijing” line in Asia 7000 years ago, and its propagation along history, associated with human population movements (Merker *et al.*, *Nature Genetics*, 2015).

#### • Projects developed by Institut Pasteur in Guadeloupe, Côte d’Ivoire, Montevideo, Cambodia and INRS-Institut Armand Frappier

On the study of tuberculosis world phylogenetic, sequencing of multi-resistant tuberculosis strains, molecular typing of isolates from different groups of patients, detection of molecular markers, study of genetic determinants and evolution of drug resistance.





# MALARIA

## FIGHT AGAINST RESISTANCE TO ANTIMALARIAL DRUGS

Drug resistances in *Plasmodium* parasites are monitored by institutes of the network and by international partners, to support strategies aimed at the eradication of malaria from endemic countries and the benefit of populations.



With over 200 million cases each year, and nearly 600,000 deaths, malaria remains the most widespread endemic parasitic infection in the world. Resistance of the parasites to conventional antimalarial drugs and to artemisinin derivatives is threatening efforts at control. Institutes of the International Network study the biological, molecular and epidemiological factors that determine the emergence and spread of resistance. Results obtained in 2013 and 2014 are guiding the National Programs for control in the most appropriate choice of treatment, with due regard for the local epidemiological context.

### Finding new tools

Drug combinations containing artemisinin derivatives (artemisinin-based combination therapy, ACT) are recommended for the treatment of *Plasmodium falciparum* infections. Use of ACT has enabled a 30% reduction in mortality, but these gains are now threatened by the emergence of resistance to artemisinin derivatives and partner drugs. In the field, the teams have from the outset had to deal with an absence of phenotypic tests and molecular markers that might be used as surrogate tests of clinical efficacy. This has led our teams to seek new tools better suited to surveillance. Large-scale surveillance of resistance may, however, be possible through the use of a more easily mastered molecular approach in the context of multicenter surveys.

This study was encouraged by WHO, which supports the plan to create a WHO reference center at Institut Pasteur in Paris for artemisinin resistance, while Institut Pasteur in French Guiana has been a WHO Collaborating Center for the surveillance of anti-malarial drug resistance since February 2014.

### Improving the techniques and reinforcing the Network capacities

Infections caused by *Plasmodium vivax*, formerly not included in control programs to any great extent, are now in the majority in many endemic

countries. This species is considered benign by clinicians because it produces infections that resolve spontaneously, but it appears that the overall burden, economic impact, and gravity of these attacks have been underestimated. This parasite is responsible for considerable morbidity, and a mortality level that has still not been fully assessed. Control is complicated by the absence of reliable diagnosis, and by the unique ability of this parasite to be transmitted early in infection, and to cause relapses by the activation of dormant liver stages.

Malaria caused by *P. vivax* is treated with chloroquine. Treatment of these infections is improved by administration of primaquine. There has been a recent emergence of *P. vivax* strains that are multiresistant to antimalarial drugs, creating a new cause for concern. A multicenter study has shown that although they are generally treated with chloroquine, infections caused by *P. vivax* are also exposed to other antimalarial drugs as a result of errors in diagnosis, the presence of mixed infections, and the occurrence of relapses. This concept of indirect selection pressure must be included in policies for management, so as not to compromise the future use of new treatments against this form of malaria.

At the same time as the responses to artemisinin derivatives are being examined, the surveillance of *in vitro* and molecular resistance to more conventional drugs must be maintained, especially in Africa, where the geopolitical conditions do not allow continuous recording of information. This aspect is essential, as some of these antimalarial drugs continue to be used as partner drugs in ACT, and for intermittent preventive treatment of pregnant women, or of children living in areas where seasonal malaria is endemic.

Our teams are participating in this effort at surveillance and improvement of techniques. The Network's capacity for clinical investigations has been increased in recent years. A clinical study conducted by Institut Pasteur in Bangui revealed that ACT retained good efficacy in CAR. In Niger, data collected by teams from CERMES showed that *P. falciparum* remained sensitive to most antimalarial drugs. A gradual return to greater chloroquine sensitivity is actually being seen in southern Niger. These results are encouraging, and validate the health policy implemented in this country with the support of WHO and the Global Fund.



“Face the disease and fight against parasites resistance to antimalarial drugs!”

**Halima Boubacar Mainassara**  
Medical Doctor and PhD student  
at the CERMES (Niamey, Niger)

#### **A new test**

Parasites were collected from patients with disease that was clinically sensitive or resistant to artemisinin, and adapted to *in vitro* culture. These cell lines were then used to develop a “Ring-stage Survival Assay” test to predict the clinical phenotype.

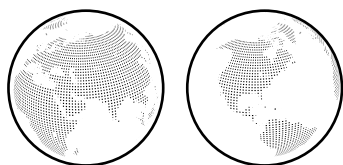
#### **K13 gene from *Plasmodium falciparum***

By sequencing the entire genome of an African strain made resistant to artemisinin in the laboratory, and of clinical isolates collected in Cambodia showing

different levels of sensitivity to artemisinin derivatives, the teams of the Network identified the molecular marker associated with artemisinin resistance. (Ariey *et al.*, *Nature*. 2014 Jan 2;505(7481):50-5).

#### **Field survey**

Sampling campaign conducted in Niger by teams from the Center for Medical and Health Research (CERMES) as part of longitudinal monitoring of malaria cases and surveillance of resistance to antimalarial drugs.



## BIRDY

### FIGHTING ANTIBIOTIC RESISTANCE IN CHILDREN

Antibiotic resistance is an increasingly serious threat to global public health. Low-income countries represent one of the principal environment for the development and dissemination of resistant bacteria. The Birdy project aims to optimize the diagnosis and treatment of bacterial infections, to control the emergence of new mechanisms of resistance and to limit the spread of resistant bacteria.



Every hour, about 200 newborns die worldwide of severe bacterial infections. Whereas the number of new antibiotics developed and approved declined steadily over the past three decades, we observe the emergence of resistance, limiting the available options for treating patients. Indeed, it is estimated that thousands of people die because of these resistant infections and as they are spreading fast WHO has deemed this modern plague a “global health security threat”.

Up to now, antibiotic surveillance networks and epidemiologic research have focused mainly on industrialized countries whereas low-income countries are one of the principal environments for development and dissemination of antibiotic resistant bacteria. Hence developing surveillance and research in these regions is essential to contain the spread of resistant bacteria.

#### **The Birdy (Bacterial Infections and antibiotic Resistant Diseases in Young children among low income countries) program, a unique international epidemiological platform**

In 2012, the Institut Pasteur launched the Birdy project in order to tackle this compelling challenge. It is the first program ever to study a large international pediatric cohort in resource-limited settings and, to specifically focus on severe bacterial infections and bacterial resistance to antibiotics.

This unique initiative combines multidisciplinary collaboration among the scientists from the Institut Pasteur International Network, and local partners, to minimize the consequences of antibiotic resistance on human health in general, and on newborns in particular, who bear the highest burden of bacterial infections.

The study includes both healthcare associated and community acquired infections during neonatal (< 30 days of life) as well as childhood periods (up to 2 years).

Birdy assesses the incidence as well as the burden of severe neonatal and childhood bacterial infections caused by antibiotic resistant bacteria in low income countries. It will also allow for the experimentation of new biotechnological point-of-care tools to diagnose and prevent these infections.





### **A cohort of newborns from low-income countries**

Birdy will follow about 7,500 children from birth to 24 months. At each site, 500 to 1,000 children will be included at birth and their mothers will be sampled for resistant bacteria colonization.

In September 2012, Madagascar was the first site to start with a pilot phase aiming to test the feasibility of the project. The preliminary results confirm the high burden of neonatal infections in the country, and show that a high proportion of pregnant women carry multiresistant bacteria that could be transmitted to the neonates. Now the full program has started in Madagascar. In late 2014, 2 new pilot phases have been launched in Cambodia and in Senegal. Extension to other low-income populations including sites outside of the Pasteur Network are envisaged for the future.

Locally, Birdy will improve the health status of the children recruited within the cohort and will strengthen the childcare capacities (through equipment, enhancement of the medical expertise, sensitization to good and risky practices).

However, the goal of this program is more largely to contribute to increase awareness among national policy makers about improving bacterial diagnosis and controlling antibiotic resistance, by guiding healthcare policy, especially regarding the use and supply of antibiotics and establishing

“This program aims at increasing awareness among national policy makers about improving bacterial diagnosis and controlling antibiotic resistance, by guiding healthcare policy.”

programs to combat resistance in healthcare systems.

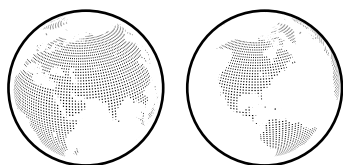
It will also optimize the treatment of bacterial infections by updating WHO guidelines, and stimulate research programs dedicated to assay Rapid Diagnostic Tests adapted to low-income countries for the identification of severe infections and bacterial resistance to antibiotics.

Beyond its main challenge, the Birdy program will also be considered as an international epidemiological platform enabling to nest other innovative research programs mainly but not exclusively in the field of bacterial infections in children of low-income countries.

### **Current supports**

The Monegasque Department of International Cooperation renewed its confidence in the Birdy program (2010 – 2016) by continuing its significant support to the International Coordination of the program (Institut Pasteur) as well as to the Institut Pasteur in Madagascar for implementing the full program in Madagascar after the success of its pilot phase.

The Total Foundation also participated in this program by funding the Institut Pasteur in Dakar for setting-up the pilot phase of the program in Senegal (2014-2017).



## ECOMORE

### IMPACT OF ECONOMIC DEVELOPMENT ON THE ENVIRONMENT AND EMERGENCE OF INFECTIOUS DISEASES

The particularly rapid economic development of South-East Asia countries led to major modifications of ecosystems. It had a considerable impact in terms of populations health and on the emergence of new infectious diseases. The project ECOMORE focuses on understanding and evaluating the risks associated with these diseases in order to set up means to respond efficiently.



The Millennium Ecosystem Assessment reported that, over the past 50 years, humans have changed natural ecosystems more rapidly and extensively than in any comparable period in human history to face growing demands for food, freshwater, timber, and energy. Nowhere has been more affected than the South East Asian countries by this rapid economic development with potential negative impacts for the local population. At present, better understanding and documenting this relationship is critical for assessing the risks the health risks for the local populations swept up in these changes, and shaping future surveillance and control strategies (if any).

The ECOMORE project, standing for ECONomic Development, ECOsystem MODification and Emerging Infectious Diseases Risk Evaluation, faces this issue with a practical research approach. Funded by the Agence Française de Développement (AFD), the project began in March 2014 in four countries of this region: Cambodia, Lao PDR, Vietnam, and Myanmar.

The goals of the ECOMORE project are:

- (i) to better understand the major ecological mechanisms responsible for the emergence of infectious diseases (70% of which are either insect borne or passed between animals and humans);
- (ii) to assess the actual health risks for local communities and benefits of improved surveillance systems in this new ecological context;
- (iii) to provide evidence based recommendations and validated methodological tools to mitigate these risks (if any);
- (iv) to contribute in strengthening national and regional cooperation between major stakeholders (National Partners, WHO, Institut Pasteur International Network, etc.).

ECOMORE developed distinct projects according to the priority topics defined in collaboration with the respective National Health Authorities of each participating countries:

- In Cambodia, the project aims at strengthening the surveillance system and early warning capacity in this perspective by using Dengue as a proxy.
- In Lao PDR, the project aims at scrutinizing the mosquito population changes and its consequence on health of workers and villagers.
- In Myanmar, the project aims at improving diagnosis, surveillance and early detection of SARI with vigilant watch of critical pathogens like SARS, Bird Flu, Coronavirus, etc. in children, one of the more vulnerable populations.



## KEY FACTS

### Partners:

- Institut Pasteur in Cambodia (Phnom Penh);
- Institut Pasteur in Laos (Vientiane);
- National Health Laboratory in Myanmar (Yangon);
- National Institute of Hygiene and Epidemiology in Vietnam (Hanoi).

The Department of International Affairs of the Institut Pasteur, in charge of the global project coordination and promotion for all four country programmes. As well as Health-relevant authorities of the concerned countries (involved from the design of the project), and key topic-specific international organizations (WHO, FAO, etc.) in the knowledge translation.

### 3 types of interventions within the project framework:

- Capacity building for participating laboratories;
- Support for public policies in the area of intervention defined for each country in order to release recommendations for the implementation of appropriate public health measures (primarily dealing with prevention or early warning) at short and long term;
- Networking and sharing methodologies and information at the national and regional level.

For more detailed informations, please visit the website: [www.ecomore.org](http://www.ecomore.org).

- In Vietnam, the project aims at assessing the risks for human health when agriculture move from traditional to more intensive practices because increase of production system likely has related consequences on pollution.

The One Health concept: ECOMORE presents more effective ways to tackle the complexity of emerging infectious diseases than employing a single discipline or a single country approach. Indeed, recognising this interdependence and integrating human medicine, veterinary medicine and environmental science.



## KNOWLEDGE TRANSFER

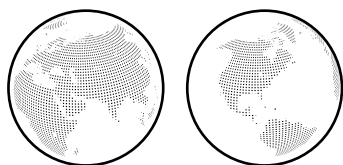
Central to both the planning and the execution of the ECOMORE project is the knowledge transfer.

From inception, ECOMORE has been driven by a determination to advance science and practice and, simultaneously, to demonstrate the impact of the research by bridging

the gap between researchers, policy makers, and clinicians.

This one way flow of knowledge from researchers to potential users is built into the project framework and is spread regularly in each participating country through the National Stakeholders Meetings.





## AFRIBIOTA

### AFRIBIOTA: A FIGHT AGAINST CHILDHOOD MALNUTRITION IN THE DEVELOPING WORLD

Malnutrition is one of the main causes of death and morbidity for children in resource limited settings. Pediatric Environmental Enteropathy (PEE), a chronic inflammatory condition of the gut occurring among children living in unsanitary conditions, is probably a major driver of malnutrition. To better understand and treat malnutrition is an international health priority that the Afribiota project intends to address.

According to WHO, 45% of all child deaths are linked to malnutrition. One in four children under five faces stunted growth. Malnutrition in early childhood leads to diminished physical and mental development, resulting in poor school performance and, on average, 22% less income in adulthood. It is thus a major driver of poverty. Despite decades-long efforts to treat and reduce malnutrition through nutritional rehabilitation, these programs have been undermined by a vicious cycle between malnutrition and infection.

Pediatric Environmental Enteropathy (PEE) is probably one of the leading causes of malnutrition and is also responsible for poor vaccination performance in the developing world. PEE is a chronic inflammatory condition of the gut occurring among children living in unsanitary conditions. In children, PEE appears to result from continuous exposure to a highly microbiologically contaminated environment and is considered an example of the health impact of an imbalanced gut microbiota. According to recent estimates, greater than 75% of all children in the developing world suffer, at different degree of severity, from this syndrome.

Afribiota is a multi-center, cross-sectional study of Pediatric Environmental Enteropathy built around an international consortium of clinicians and scientists from Canada, Central African Republic, France and Madagascar. Coordinated by the Molecular Microbial Pathogenesis Unit of the Institut Pasteur in Paris, it will be performed in Central African Republic and Madagascar, two countries with particularly high proportions of malnourished children according to FAO. This project will be carried out through a partnership which brings together, in Madagascar, the skills

“This project will have an important component of capacity building by the training of young medical doctors, health professionals, scientists and medical anthropologists.”



of the Institut Pasteur in Madagascar, the hospitals Tsaralalana and Joseph Ravoahangy Andrianavalona, and in Central African Republic, the experience of the Complexe Pédiatrique, the Institut Pasteur and the University of Bangui. The Afribiota project works also with two French renowned hospitals: the Hôpital Necker Enfants Malades and the Hôpital Pitié Salpêtrière, and with the University of British Columbia in Canada.

The Afribiota project will integrate a broad range of research disciplines: epidemiology, medical anthropology, psychometrics and development, gastroenterology, nutrition, metabolism, microbiology, genomics and immunology. In addition, the project will have an important component of capacity building by the training of young medical doctors, health professionals, scientists and medical anthropologists from Central African Republic and Madagascar.

The current reference diagnostic test of PEE, a gut permeability test, requires resources and technical knowledge that are frequently unavailable in resource-poor settings. Hence, a primary objective of this program will be to identify, evaluate and validate new candidate biomarkers of PEE, leading to diagnostic tests better fitted for field-use in resource-limited settings. Afribiota will also evaluate socioeconomic, cultural and environmental factors associated with malnutrition and PEE, so as to pinpoint possible entry points for future interventions. Using cutting-edge technologies in microbiology, metagenomics and metabolomics, the Afribiota project will investigate changes in the ecology of the gut of affected children.



## TORCADIA: FIGHTING INFANTILE DIARRHEA IN BANGUI



PEE profoundly affects the healthy development and growth of millions of children throughout the world. Despite its broad recognition as a major global health problem, little research on the subject has been conducted and the underlying etiology is unknown. A more thorough characterization and biological understanding of PEE will contribute to its diagnostics, prophylaxis and treatment, hence enhancing the nutritional and developmental status of malnourished children, boosting their immune status, particularly their response to vaccines and their school performance in impoverished regions.

In 2014, the protocols, the teams in each country and the different international collaborations have been finalized. Thus, the pre-study of the Afribiota project is expected to start in September 2015 in Madagascar and the global project in early 2016 in Central African Republic and in Madagascar.

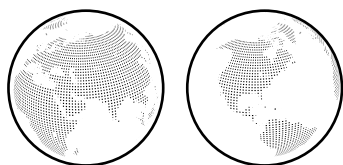
In the Central African Republic (CAR), it is estimated that 30% of babies aged 12-23 months are victims of diarrhea. Furthermore, in conditions like those in the CAR, it is difficult to carry out the additional tests needed to properly characterize the pathogen and tailor the treatment plan. Diagnosis based on the observation of clinical signs leads to overestimation of diarrhea cases of possible bacterial origin. The result is poor management of the children and an inappropriate use of antibiotics that favors the emergence of resistance.

This project, conducted between 2011 and 2014 by Jean-Chrysostome Gody, a pediatrician at Bangui Children's Hospital, and Muriel Vray, an epidemiologist at Institut Pasteur, and funded by Total Foundation, has made it possible to show that the majority of cases of severe diarrhea are due to 5 pathogens: rotavirus (42%), *Cryptosporidium* (25%), astrovirus (11%), norovirus (11%), and *Shigella* (15%). These results confirm the importance of the introducing vaccines, such as the one for rotavirus.

*"Apart from the scientific results, the project conducted in Bangui in particularly difficult circumstances is a perfect example of what operational*

*research can contribute to the tangible improvement of children's health,"* says Muriel Vray. Indeed, this study involved approximately 850 children, 21 of whom were diagnosed HIV seropositive. All were managed and treated for diarrhea or other diseases they might develop. *"The statistics for the Bangui pediatric complex indicate that 10% of children with diarrhea die after leaving hospital. This figure fell to 3% in the study,"* adds Dr Jean-Chrysostome Gody.

This study also made it possible to train a pediatrician from the Central African Republic in two pediatric hospitals in Paris, and to establish in Institut Pasteur in Bangui the molecular biology techniques needed to carry out research on enteric pathogens, techniques that are now in routine use, thus making it possible to reduce the burden of severe diarrhea in Bangui. Finally, funding from Total Foundation has enabled the purchase of a badly needed biological waste incinerator for the pediatric complex.



# MALINEA

## DEVELOPING STRATEGIES AGAINST MALNUTRITION AND CHILDHOOD INFECTIONS IN AFRICA

One in four children in the world, particularly in Sub-Saharan Africa, suffers from malnutrition, which leads to growth retardation and increased mortality, and has the potential to progress to severe malnutrition. The MALINEA project will make it possible, by enlisting multidisciplinary research communities in Africa, to evaluate interactions between malnutrition and modification of the gut microbiota in order to propose new strategies for improving the management of malnourished children.



Despite advances that have decreased by 37% the number of malnourished children since 1990, UNICEF estimates that malnutrition affects 165 million children under 5 years of age (i.e. one in four children). The project's main objectives are to propose new strategies for improving the management of malnourished children and to assess the interactions between malnutrition and modification of the gut microbiota. MALINEA will be implemented in Madagascar, Niger, Central African Republic and Senegal for a period of three years with the support of the French Ministry of Foreign Affairs and International Development (MAEDI).

“The project proposes, via multicenter studies conducted by multidisciplinary research teams, to bring about sustainable improvement in the management of populations of malnourished children using new nutrition strategies.”

This multipartner project combines the know-how and skills of the Institut Pasteur International Network in Africa—Institut Pasteur in Madagascar, the Center for Medical and Health Research



“This project is being conducted under a partnership that combines the know-how and skills of the Institut Pasteur International Network in Africa and the NGOs Action Against Hunger and GRET.”

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(CERMES) in Niger, Institut Pasteur in Bangui and Institut Pasteur in Dakar—and the NGOs Action Against Hunger (ACF, Spain and France) and GRET.

In practical terms, the MALINEA project is divided into three main components:

**Evaluating the association between disruption of the digestive microbial flora and malnutrition**

This component is aimed at studying the differences between the microbiomes and pathogens present in malnourished children and children with normal nutrition, according to country and biotope. These studies will make it possible to develop the skills of national young researchers in the current strategies for molecular identification of microorganisms.

**Improving the management of moderate acute malnutrition by manipulating this microbial component**

The multicenter clinical study of the MALINEA project will make it possible, to compare the efficacy of three protocols for therapeutic feeding: the reference treatment CSB++ (Fortified Corn-Soy Blend), and the same treatment combined with an antibiotic or prebiotic. Their impact on cognitive development and the intestinal flora will also be determined. This project will rely on the experience in clinical research and management of high-level scientific projects of the Epidemiology Unit of the Institut Pasteur Paris and the Institut Pasteur International Network, and will also capitalize on the

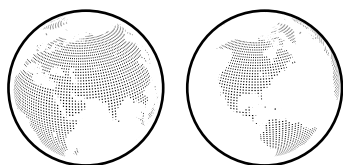


experience of Action Against Hunger and GRET, which have been working for a long time in countries involved in this project.

**Improving the local ability to establish studies on malnutrition by encouraging knowledge transfer and partnership between research institutes and programs to combat malnutrition**

A key part of exploiting and providing feedback on the findings of the project will target the authorities and health structures of each country,

as well as the academic sector. Bursaries will allow students and young researchers to be involved in the project, and to receive training in the methods used in it. The MALINEA project will make it possible to constitute a permanent working group that will continue to work on this theme of “nutrition and infections” in order to develop new projects and respond to other operational issues for the South. This first project thus constitutes the basis for a lasting partnership between the Institut Pasteur International Network and the two NGOs Action Against Hunger and GRET on the theme of nutrition and infection.



## LEISHIELD

### BRING TOGETHER THE TALENTS AND SKILLS TO FIGHT LEISHMANIOSIS

Fighting Leishmaniosis is a major medical challenge. The LeiSHield project gathers a consortium (LeishRIIP) which will make it possible in developing new strategies against the disease and its propagation by the extensive study of parasites involved in the disease and risk mapping.



Protozoan parasites of the genus *Leishmania* generate severe human diseases termed Leishmaniasis. Due to their frequency and the severity of certain clinical forms, these diseases represent a major public health problem and limit the economic growth in various developing countries.

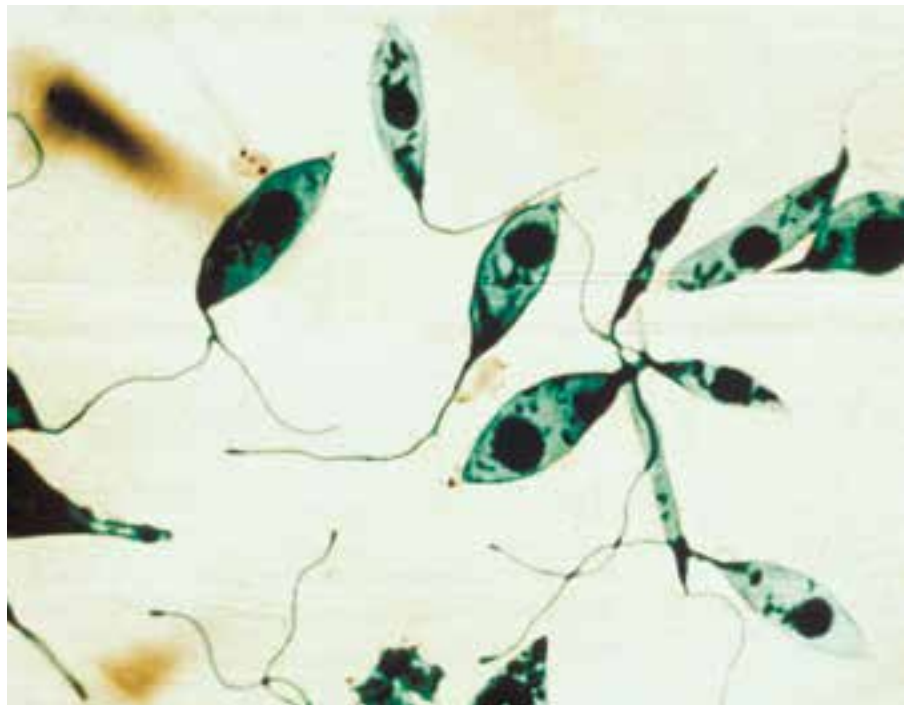
In 2012, visceral Leishmaniasis was declared as new emerging disease in Europe with expected important public health impact due to climate change. The risk of *Leishmania* epidemics in the Maghreb and East Europe, and its northward spread is further supported by recent studies on sand fly distribution and on the detection of *Leishmaniasis. infantum* and *Leishmaniasis. donovani* in previously non-endemic areas. Likewise, urbanization of Leishmaniasis in Europe and South America has been recognized as a new major Public Health issue. Furthermore, the increasing rate of immigration from endemic countries in North and East Africa and the Middle East to Europe significantly enhances the risk of Leishmaniasis emergence.

LeiSHield project will apply high throughput DNA and RNA sequencing on human samples, insect vectors, and parasite field isolates obtained from infected dogs and humans to (i) assess parasite genomic diversity and hybridization, (ii) correlate parasite genotypes with pathology and treatment outcomes, (iii) keep a close watch on distribution of sand fly and *Leishmania* species, and (iv) identify human resistance/susceptibility gene loci for Leishmaniasis.

“The LeiSHield consortium will combine complementary expertise of members and experts in disease-endemic countries.”

### The LeiSHield consortium

The LeiSHield consortium will combine complementary expertise of members and experts in disease-endemic countries that have access to patient samples, vectors, reservoirs, and parasite field isolates, cutting-edge technologies and infrastructures and also combine non-profit organizations and strong industrial partners to translate LeiSHield findings into application for animal and human diagnostics, vaccination, or chemotherapy.



## OBJECTIVES OF THE LEISHIELD STUDY

The ultimate goal of the project is to establish a risk map across endemic areas to inform authorities on the spread of the disease and shield non-endemic areas against emerging cutaneous and visceral Leishmaniasis.

The specific aims are:

**1) To synergize complementary expertise** available in field studies and molecular epidemiology of *Leishmania* infection provided by partners from the “South”, and high-throughput sequencing, bio-informatics, and molecular parasitology expertise provided by partners from the “North”.

**2) To establish a cutting-edge systems-wide** approach applied on a major public health threat, which is novel in parasitic systems. LeiSHield will have an important impact on our limited understanding of parasite intracellular infection, immune evasion, drugs resistance, or host susceptibility to infection with relevance for disease prevention and therapy.

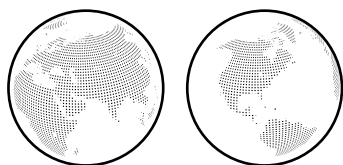
**3) To efficiently apply research findings into pre-clinical and clinical** application through public-private partnerships. LeiSHield will significantly enhance the translational

potential of neglected disease research inside the Institut Pasteur International Network through its focus on bio-marker discovery.

**4) To establish standardize protocols and procedures** used to assess the epidemiology of Leishmaniasis in partner countries. This will have a major impact on risk assessment and anticipation, and will inform health authorities to adapt their public health measures to environmental challenges (e.g. climate change or population migration).

**5) To strengthen research capacities and open new training opportunities** through networking actions, web tools, teaching courses, PhD and postdoc programs, with the objective to transfer cutting edge know-how and technologies.





## SE Ae

### FIGHT AGAINST ENCEPHALITIS IN SOUTHEAST ASIA

Encephalitis represents a major public health problem worldwide particularly in the Asian region. The SE Ae project, launched in 2013, proposes an integrative approach to understand and fight children's infectious encephalitis in Southeast Asia.



#### The threat of infectious encephalitis in Southeast Asia

Encephalitis, or acute inflammation of the brain associated with neurological dysfunction, is mainly of infectious origin. All cases require hospital care. It is of public health concern worldwide because of its high mortality rate and long-term neurological consequences affecting 30% of survivors. In Asia it is one of the most frequent and severe causes of pediatric hospitalization. Yet, despite extensive microbiological investigation and access to molecular biology diagnosis assays, the pathogen agent remains unknown in more than 60% of patients. As a result of the difficulty of microbiological diagnosis in referent hospitals, local clinicians treat acute encephalitis syndrome mostly empirically with uncertain results.

#### The project partners

The SE Ae project, for *South East Asia encephalitis*, that has officially been launched under the aegis of AVIESAN Sud (the French National Alliance for Life Sciences and Health), is an inter-organizational and multidisciplinary initiative. The consortium associates: (i) national health authorities from six Southeast Asian countries (i.e. Cambodia, Indonesia, Laos, Myanmar, Thailand, and Vietnam); (ii) local major university and clinical sites; (iii) key French stakeholders of life and health sciences such as: Institut Pasteur International Network, Inserm, Cirad, IRD - Aix-Marseille University - Ecole des Hautes Etudes en Santé Publique (EHESP), and Fondation Mérieux; and (iv) teams from the Southeast Asian Wellcome Trust Oxford University Major Overseas Programme. The medical and scientific teams involved in the program are recognized nationwide and worldwide for their expertise and contribution in the field of infectious diseases. The World Organization for Animal Health (OIE) also supports the program in order to promote regional and inter-governmental dimension.



### **The Southeast Asia encephalitis project objectives**

Led by Marc Lecuit, Head of the Biology of Infection Unit at Institut Pasteur, and Paul Newton, Director of the Laos-Oxford-Mahosot Hospital-Wellcome Trust Research Unit in Vientiane, the SEAE project strives to reduce the morbidity and mortality associated with encephalitis, by improving prevention, diagnosis and treatment for patients, mainly children. The project addresses major scientific and medical challenges:

- Fill-in the biomedical knowledge gaps regarding acute encephalitis syndrome (pathophysiology, etiology, long term neurological sequelae);
- Strengthen hospital laboratories capacities to enhance health by improving diagnosis and care for patients;
- Discover new and identify unusual pathogens associated with encephalitis;
- Characterize and analyze factors related to clusters of encephalitis cases integrating human health, animal health and environment through a “One Health” approach;
- Through the regional cohort of 3000 children suffering from acute encephalitis, provide current and reliable information and build sustainable national and sub-regional surveillance network to clinicians and public health stakeholders that will help them to better define prevention policies, vaccination strategy, and build preparedness to emerging biomedical risks.

“The medical and scientific teams involved in the program are recognized nationwide and worldwide for their expertise and contribution in the field of infectious diseases.”

### **The outcomes and impacts on research and public health**

- Special efforts are made in the development of innovative regional operating procedures and strengthening laboratory capacity by local health personal training and purchase of specialized equipment. This translates to targeted medical care for children suffering from acute encephalitis syndrome.
- The discovery of new encephalitis etiologies and a complete deciphering of the newly identified pathogens’ genomes will lead to great academic-to-industry translational research, enabling direct applications which will rapidly benefit patients (bench-to-bedside) and at-risk populations.

- Current and evidence-based data will support health professionals and policy makers in reaching a cost-effective use of medical technologies. They will also enable a better definition of prevention policies, vaccination strategies, and to build preparation toward emerging biomedical risks.

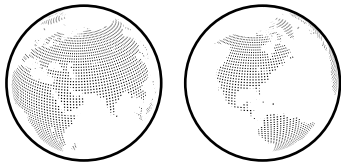
### **The project implementation framework (2013-2020)**

Since the launch of this project in 2013, three selected research organizations and pediatric clinical sites in Cambodia, Laos, and Vietnam have taken a part in it.

- Institut Pasteur in Cambodia and Kanta Bopha Hospital in Phnom Penh, Cambodia
- Lao-Oxford-Mahosot Hospital-Wellcome Trust-Research Unit and Mahosot Hospital in Vientiane, Laos
- National Institute of Hygiene and Epidemiology and National Hospital of Pediatrics in Hanoi, Vietnam

They have been joined by Myanmar in late 2014 where the project has been implemented within the National Health Laboratory and the Yangon Children Hospital. Indonesia and Thailand will be subsequently included as part of the development of SEAE.

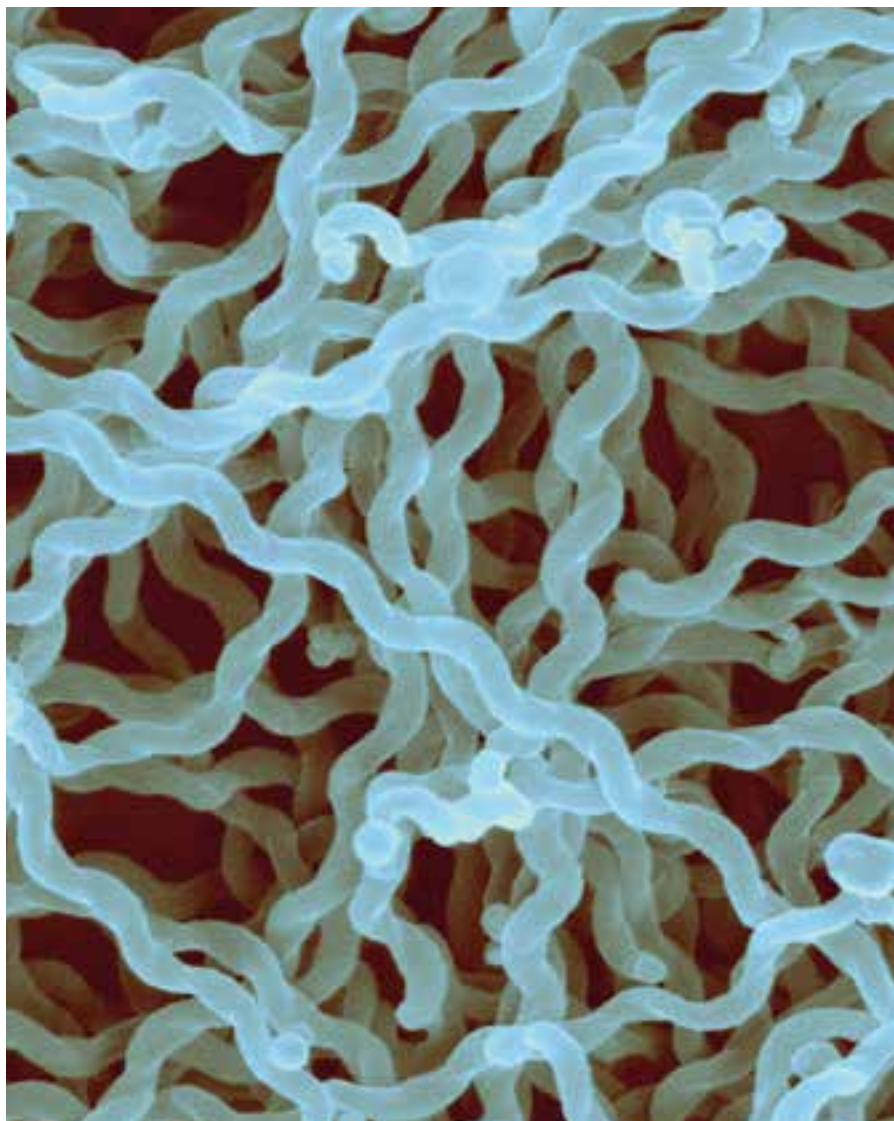




# BIOINFORMATICS

## A BIOINFORMATIC NETWORK WITHIN THE INSTITUT PASTEUR IN MONTEVIDEO

The implementation of an international bioinformatics network is one of the major development challenges of the international network. The Institut Pasteur in Montevideo illustrates the achievements in this area.



Our first mission was to provide support to other campus groups in all fields related to bioinformatics. The unit of Bioinformatics headed by Hugo Naya subsequently developed its own research projects. Data Analysis Methodology, Project on Uruguayan human genome... ongoing projects at the Institut Pasteur in Montevideo are becoming more numerous and open to international collaborations. This bioinformatics network coordinated by Hugo Naya works very closely with Magnus Fontes at the Institut Pasteur in Paris. They jointly organized a bioinformatics course in December 2014 the Institut Pasteur in Montevideo.

We have started to work for the inauguration of the Institut Pasteur in Montevideo in December 2006. Right from the start, as part of the backbone units (Core Facilities), our first mission was to provide support to other groups in all matters related to bioinformatics. At that time the Institut Pasteur in Montevideo had purchased one of the few microarrays platforms in South-America and we spent a lot of time performing experimental design and analyses for several groups, especially in transcriptomics but also in ChIP-chip and genomics. As our capacities rapidly become surpassed, we started to get involved in the training of personnel from different laboratories, which alleviate to some extent part of the analyses, but more importantly, it seems to be an efficient and responsible way to collaborate.

Additionally, we have several research interests, particularly in developing methodologies for data analysis. We have assessed the question of how bacteria cause pathogenicity in humans from genome-coded signatures that explain pathogenicity for all bacterial pathogens, and not restricted to particular taxa. Nowadays, we are enhancing model sensitivity and exploring the possibility of developing a multiclass classifier, that could predict pathogenicity in other hosts besides human, like cattle, plant or fish. As part of our general interest in





bacterial pathogenicity, we are involved in a more specific problem; the study of biofilms formation in *Leptospira*. Despite its importance for human health and animal production, genetic features that determine pathogenic phenotypes in *Leptospira* proved to be elusive. Recently, the ability of biofilm formation has been suggested as a key factor in pathogenesis of leptospirosis and, as mentioned above, little is known about its genetic basis. In this context, we have implemented a comparative genomics analysis to find orthologous genes with functions associated to biofilms formation and performed the first transcriptome analysis regarding expression patterns of genes involved in biofilms formation. As a result we provide a new kind of information that can be proven useful to understand the pathogenesis mechanisms of these bacteria.

The Genome Wide Association Studies (GWAS) were the pioneer efforts to discover the relationship between phenotype and genotype. Despite several claims in regard positive facts on GWAS, some important issues remain unanswered that precluded full exploitation in personalized medicine. We are working in a general framework that allows the integration of different sources of relevant biological information, taking into account the information relating genes to pathways.

“The main goal  
is to develop  
methodological,  
technical and human  
capacities in medical  
genomics.”

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Very recently, the Institut Pasteur in Montevideo launched the Uruguayan Human Genome Project (URUGENOMES) that involves research and training in human genomics, and the sequencing of 80 genomes. After the initial anthropological phase of the project, the main goal is to develop methodological, technical and human capacities in medical genomics. Our group is in charge of this project and for this reason we have started to develop several task-groups, one particularly interesting in genome prediction applied to medical genomics.

In addition, some efforts are also made in exploiting structural biological data, which has also experienced a recent explosion in terms of volume

and quality of experimentally gathered. With some past experience gained in the context of structural genomics programs, our present research in this area is reflected by several active collaborations with experimental groups in house and outside our Institute.

While our research proposal is mainly focused in methodological developments, at the same time, the selected topics of application are intrinsically transversal, involving the research of several groups. For example, in pathogenesis we have a strong collaboration with the group of Dr. Buschiazzi, particularly in the genus *Leptospira*. Several other groups of the institute will benefit from our experience in data-mining and integrative genomics while we benefit from their biological expertise. We are open to collaborate with groups from abroad; from experimental design and data-analysis to people training, we have very fruitful experiences with different institutes.

Finally, we are happy to say that there are now two other research groups working in bioinformatics at the Institut Pasteur in Montevideo. One of them works on simulations in structural bioinformatics while the other works on Machine Learning methods applied to biology.

# TEACHING

# AND

# TRAINING

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An attractiveness policy for a scientific community united by the same goals: sharing knowledge for global health

The most decisive challenge in the coming years is to train the upcoming generations of scientists and public health experts worldwide to promote careers development.

In addition to teaching and training programs organized in the institutes within the Institut Pasteur International Network, the mobility of newly recruited young researchers was set up to reinforce the feeling of belonging to a global network. Alongside, the possibility to create research 4-years groups within the Institut Pasteur International Network, gives the opportunity to internationally-trained postdoctoral researchers, to set up new research groups in their home country.





# TEACHING AND TRAINING

## INTERNATIONAL TRAINING PROGRAMME INSTITUT PASTEUR INTERNATIONAL NETWORK (RIIP)

Institut Pasteur lies at the heart of an extensive international cooperation network dedicated to public health, education and research, with 33 Institutes across the world. Training for researchers is one of the three missions of each institute within the Institut Pasteur International Network.



Strategic challenge, each institute contributes to strengthen scientific capacity and human resources. To achieve this, the RIIP organises international courses and develops training programmes in partnership with universities and local institutions. In so doing, the RIIP contributes to the spread of knowledge as well as to training for the public health researchers and experts of the future, in all regions of the world.

The Calmette and Versin Programme, funded by the International Affairs Department of the Institut Pasteur makes it possible to run an ambitious international training programme for scientists and researchers. It offers a unique

opportunity for training by research. Through this, each year, the Institut Pasteur supports scientists from the South through international fellowships which make it possible for them to take part in courses or traineeships in Paris, in a RIIP institute or other research institution.

### **The most important challenge: strengthening human resources**

It is very important that human resources in public health and research be developed in those countries where resources are currently limited. Multiple efforts are under-way to build critical mass in the young scientist, technician, biologist

and physician populations. Working in cooperation with governments, national and international institutions, and other partners, the Institut Pasteur International Network deploys ongoing education programmes and international programmes for doctoral and post-doctoral researchers, to train, attract and retain scientists in their home countries.

### **Capacity-building through initial and ongoing training within the RIIP**

Faithful to the educational role assigned by its founder, the RIIP institutes contribute to build sustainable scientific capacity and human resources across the world. For this purpose, it provides training programmes in partnership with national universities and local players involved in scientific research. Originally intended for network staff only, these programmes are now open to researchers, technical staff and students from other institutions. Many RIIP institutes are host laboratories for students from national or international universities, especially those at the Undergraduate, Master's or PhD levels. They also serve as the reference establishment for French and foreign trainees taking part in ongoing education for specialised physicians and laboratory technicians. Researchers from the Network contribute to the education of these specialists by running courses and seminars at the graduate-level. There are several centres dedicated to teaching and training across the RIIP (e.g., Cameroon, Madagascar, Niger, Côte d'Ivoire, Bangui, Cambodia, Korea, Vietnam, Montevideo, etc.). We can especially note the Pierre and Anne-Marie Moussa Centre in CERMES (Niamey, Niger) inaugurated in 2012, which contributes to the development of research and teaching in Africa. The Calmette et Versin grants, funded by the International Affairs Department of the Institut Pasteur allows ongoing education, traineeships fostering North-South and South-South mobility in the Network and also participation to international courses.

### **Supporting training by research**

Each year, a large number of scientists from Southern countries come to round out their training by participating to courses or to make a traineeship in Paris, or in the RIIP.

**The study grants from the Calmette and Versin Programme** are intended to support the participation of RIIP scientists (students, researchers, engineers and permanent technical staff) in educational programmes offered at the Institut Pasteur in Paris and in the Network. The

“The RIIP contributes to the spread of knowledge as well as training for public health researchers and experts of tomorrow, in all regions of the world.”

courses supplement the participants' initial training and build up their skills in their core area of research.

**The traineeship grants from the Calmette and Versin Programme** are further aimed at enabling scientists from the South to take part in participation in traineeships (students, researchers and permanent technical staff) at Institut Pasteur in Paris and in the Network. The end-purpose of these traineeships is to extend scientists' skills in their field of research and build capacity in their home institution.

The Principality of Monaco, the Albert II of Monaco Foundation and the Institut Pasteur signed an agreement in 2010 to jointly open a project known as, “Training for Southern Country Players - Specialist Masters in Public Health (speciality: infectious risks), at Pasteur / CNAM School of Public Health”. The project's aim is to enable young health-sector professionals from the African continent to receive some of the best education through a specialised Master's programme, thanks to a **research fellowship funded by the Monaco International Division**. The Specialist Masters in Public Health, resulting from a partnership between Institut Pasteur, Conservatoire National des Arts & Métiers (CNAM) and, more recently, Ecole des Hautes Etudes en Santé Publique (EHESP) in France, trains specifically to deal with public health issues. Students are selected from those specialising in Infectious Risk.

**The conference grants from the Calmette and Versin Programme** are designed to facilitate the participation of young researchers (students, researchers and permanent technical staff) within the Institut Pasteur International Network in major international conferences for oral communication. The end-purpose of these fellowships is to enable RIIP scientists to present their research at international meetings and to extend the Network's visibility.



## SOME EXAMPLES OF PERMANENT RIIP COURSES



- Malaria Workshop - Institut Pasteur in Madagascar
- Courses on Cellular Biology, Virology and Immunology delivered by the Hong Kong University Research Pasteur Pole
- Global Network course on food-born Infectious Diseases and Surveillance of Salmonella, held in Cameroon, Saint Petersburg, Madagascar and Tunis, in partnership with the World Health Organisation (WHO) and United States Centre for Disease Control and Prevention (CDC)
- Course in Bio-Informatics in Maghreb, Africa, Asia, Latin America and Europe
- Theory and Laboratory courses at Institut Pasteur in Montevideo, on new

technologies in structural biology, macro-molecular crystallography and microscopy

- Course on rabies, in Dakar and Cambodia
- Course in statistics (R and STATA Software) in Dakar, Cambodia and Madagascar

For more information:  
[www.pasteur-international.org](http://www.pasteur-international.org)

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# 146

## INTERNATIONAL FELLOWSHIPS IN 2013-2014



### 130

FELLOWSHIPS FUNDED BY THE INSTITUT PASTEUR INTERNATIONAL AFFAIRS DEPARTMENT THROUGH THE CALMETTE & YERSIN PROGRAMME:

### 16

FELLOWSHIPS JOINTLY FUNDED BY THE INSTITUT PASTEUR INTERNATIONAL AFFAIRS DEPARTMENT AND PARTNERS:



### 48

STUDY GRANTS TO ATTEND COURSES

### 63

TRAINEESHIP GRANTS INCLUDING 13 DOCTORAL GRANTS FOR 3 YEARS AND 8 POST-DOCTORAL FELLOWSHIPS FOR 2 YEARS

### 19

CONFERENCE GRANTS TO ATTEND CONFERENCES



### 10

FELLOWSHIPS FUNDED BY THE PIERRE LEDOUX JEUNESSE INTERNATIONALE FOUNDATION

### 5

FELLOWSHIPS FUNDED BY THE MONEGASQUE DEPARTMENT OF INTERNATIONAL COOPERATION

### 1

DOCTORAL FELLOWSHIP FOR 3 YEARS FUNDED BY TOTAL FOUNDATION



“The aim is to enable young internationally-trained researchers from Southern countries to lead innovative research programmes on the infectious diseases impacting their countries.”

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### **How to discover the Institut Pasteur International Network**

#### **An attractiveness and diversity policy for young researchers**

In order to consolidate fundamental research and improve response to new emerging infectious agents, the Institut Pasteur has created the **“Four-Year Groups Initiative”** to support young talented scientists in developing international research groups within the RIIP. The aim is to enable young internationally-trained researchers from Southern countries to lead innovative research programmes on the infectious diseases impacting their countries. This initiative also offers the opportunity to attract dynamic international researchers open to creating new research partnerships. Since 2013, the Institut Pasteur has selected four winners, who went on to establish research groups in Cameroon, Bangui and Madagascar, Dakar and Cambodia.

In order to boost international mobility in the RIIP, starting from 2014, the newly recruited researchers at Institut Pasteur in Paris will work at least 3 consecutive months during the first two years after recruitment within an RIIP institute. Gabriel Lepousez, newly-appointed researcher in the Research Unit on Perception and Memory, headed by Pierre-Marie Lledo, is one of them. He took up his functions at Institut Pasteur in Montevideo, in December 2014.

**The Calmette and Yersin Programme for Doctoral and Post-Doctoral Researchers** offers French and foreign researchers the opportunity to carry out their thesis or post-doctoral work in the RIIP, in countries found in endemic zones and/or those lacking resources.

**The Pierre Ledoux Jeunesse Internationale Foundation**, under the auspices of Fondation de France, has supported training for young researchers for more than fifteen years, by building their understanding of international realities. Born of a partnership between Fondation de France and the Institut Pasteur, this programme funds traineeships in biomedical research for students of French nationality in a developing country within the RIIP network.



#### **Teaching and training: a priority for the Institut Pasteur International Network**

**Every year, more than 100 scientists from the Institut Pasteur International Network take courses or do traineeship in Paris to supplement their initial training.**

**In 2014, 13 courses and workshops funded by the RIIP were given in 7 countries, including 4 in Africa, 3 in Asia, 3 in Latin America, 2 in Northern Africa and 1 in Europe.**

#### **Bringing education to endemic countries**

The RIIP is developing regional- and international-level courses in partnership with universities, healthcare authorities and local players. The training programmes open to local RIIP institute staff, as well as researchers, technical staff and students from outside establishments, make it possible for individuals already recognised for their skill by regional, national and international structures, to further enrich their background. The aim is to improve coordination and dialog by offering training programs in the region's high-priority research areas and in particular courses related to clinical research. The objectives are to promote and provide top-up training for scientists, in particular access to the latest scientific techniques, at different stages of their careers, to facilitate the learning of new methods to achieve technology transfer, to develop closer cooperation between research scientists and to foster the development of innovative regional scientific projects following training.

# TOTAL FOUNDATION

## INSTITUT PASTEUR - TOTAL FOUNDATION: 10 YEARS OF PARTNERSHIP FOR THE BENEFIT OF HEALTH

In 2005, Catherine Ferrant, Managing Director of the Total corporate Foundation and Françoise Barré-Sinoussi, Nobel Prize in Medicine 2008, took the reins of a new partnership between Total and Institut Pasteur. Ten years later, 13 programs are still running and the partnership has been renewed for three years. A longevity that is explained by a willingness to act on a long-term basis for the health of the most vulnerable.

**T**he Total group, considering its international presence, has witnessed the catastrophic impact of infectious diseases in developing countries. *"In the beginning of the 2000s, we decided to act. The Institut Pasteur seemed the most natural partner because of its reputation for excellence and its international stature,"* explains Catherine Ferrant. *"When I met Françoise Barré-Sinoussi, we immediately found ourselves focusing on one common value: solidarity."*

### Two women, a shared commitment...

The partnership would be built around this duo. The two *Dames* shaped it according to their vision, i.e. programs anchored in public health priorities. In more than 30 years of fighting HIV, Françoise Barré-Sinoussi gained unique experience in the implementation of research and public health programs in developing countries; for this reason she has had the role of scientific advisor since the beginning of the partnership. *"I am lucky to be working alongside Françoise. She is a real source of inspiration for us all,"* confides Catherine Ferrant.

Strengthened by their convictions, the two *Dames* travel the field with boundless energy to support and promote projects. *"We are both keen to make our contribution, however modest, to the health of the most vulnerable populations. All of our actions are conducted in cooperation with the local authorities, without whom they could not work. Our position allows us to facilitate this dialog, and sometimes to convey messages for greater equity in access to care,"* says Françoise Barré-Sinoussi.

"Our objective is  
for the field  
programs to have  
a lasting impact  
on public health."

### A genuine impact on public health...

*"Our objective is for the field programs to have a lasting impact on public health, and contribute to the training of healthcare teams and to the strengthening of local health structures,"* says Catherine Ferrant.

This is what contributed to the creation of a program for the prevention, screening and treatment of HIV and STI for truck drivers in Morocco. Conducted between 2007 and 2011 by the Moroccan Association for the Fight Against AIDS (ALCS), this program made it possible to give information to 9,000 truck drivers, and to provide more than 15,000 HIV diagnostics tests, and medical management for people diagnosed seropositive. *"This allowed also for the diagnostic and treatment of other sexually transmitted infections, and to reach sex workers frequented*

*by the truck drivers,"* explains Françoise Barré-Sinoussi. Results of a study carried out in 2012 clearly show the beneficial impact of this intervention on improving knowledge and behavior with respect to STI prevention in truck drivers in Morocco. Two similar programs are being conducted in Burkina Faso by the African Solidarity Association (AAS) and in Cameroon by the Pasteur Center in Cameroon.

Initially focusing on sexually transmitted infections, particularly HIV, the partnership has redirected its efforts toward improving child health. Of the 13 projects currently underway, 11 are devoted to this theme. At the beginning of 2015, a new partnership agreement was signed between Institut Pasteur and Total Foundation for a period of three years, which will make it possible to fund large multidisciplinary projects which can incorporate basic research, clinical or operational components and focused on the study of the vaccine and therapeutic responses in children.





KEY FIGURES FOR THE  
10 YEARS OF PARTNERSHIP

**€13.2 M**  
in financial support from  
Total Foundation

**11**  
research units of  
excellence supported at  
Institut Pasteur Paris

**20**  
research programs  
and public health  
action programs,  
13 of which are ongoing  
in 12 countries in  
Africa and Asia

## PARTNERSHIP

### A PARTNERSHIP ON CHILD HEALTH RENEWED UNTIL 2017

On 26 January 2015, Pr Christian Bréchet, President of Institut Pasteur, and Mr Yves Louis Darricarrère, Chairman of Total Foundation Total, signed a new sponsorship agreement for €6 million, thus extending for a further three years a partnership begun 10 years ago. *"Total foundation is currently one of the main sponsors of Institut Pasteur and its international network. This support will allow us to further strengthen the efforts of our scientists to the benefit of child health in resource-limited*

*countries"* explains Christian Bréchet.

With regard to infectious diseases, this new agreement makes it possible to fund multidisciplinary research projects investigating responses to vaccines and therapeutic agents in children. Proposals submitted in response to the most recent call have been selected following review by international experts. *"We chose to support more ambitious projects than in the past. Our wish is for them to help build genuine multidisciplinary research*

*networks in the South,"* says Pr Françoise Barré-Sinoussi, head of the Retroviral Infections Unit at Institut Pasteur, and scientific advisor to the partnership between Total Foundation and Institut Pasteur for the last 10 years.





## BNP PARIBAS CIB

### BNP PARIBAS CIB SUPPORTS MEDICAL RESEARCH ACROSS THE INSTITUTS PASTEUR INTERNATIONAL NETWORK

BNP Paribas Corporate and Institutional Banking (CIB), leader in solutions to enterprises, sovereign funds, financial institutions and investors, has been working in partnership with Institut Pasteur since 2008 and provides substantial financial support to scientific teams over the world.



2012-2014

#### A WORLD-WIDE ACTION, THROUGH FIFTEEN COUNTRIES

**Action owner**  
BNP PARIBAS CIB

**Funding provided since 2008**  
> €2 MILLION

**Beneficiaries\***  
6 TO 8 INTERNATIONAL NETWORK INSTITUTES,  
2 TEAMS FROM INSTITUT PASTEUR IN PARIS,  
4 TO 7 INTERNATIONAL LABORATORIES WORKING  
IN COOPERATION WITH PASTEUR RESEARCHERS

- Hepatitis (Japan, Spain and Russia)
- Malaria (Brazil)
- Dengue (Hong-Kong)
- Diphtheria (Poland)
- Leishmaniosis (Canada)
- Combined candidate vaccine against measles and AIDS (France and UK)
- Bacterial toxin (Belgium)
- Respiratory Infections (France, Switzerland)
- Cancer (Italy)
- Antibiotic Resistance (Portugal)

#### Objectives

Most of the research projects supported are connected with the public health issues specific to the host countries.

Annual Agreement, latest signed on 8 December 2014

\* non-comprehensive list

## AREVA FOUNDATION

### AREVA FOUNDATION AND INSTITUT PASTEUR, A LONG-STANDING PARTNERSHIP AGAINST THE WORLD'S MOST WIDESPREAD PARASITE INFECTION

The partnership with AREVA Foundation serving the Medical Research and Health Centre of Niger, a member of the Instituts Pasteur International Network, speaks to Areva's desire to support research projects that further the fight against the major threats to public health across the world such as malaria.



2012-2014

#### A WORLD-WIDE INITIATIVE IN NIGER

**Action owner**  
AREVA FOUNDATION

**Funding provided since 2008**  
€207,864

**Beneficiaries**  
MEDICAL RESEARCH AND HEALTH CENTRE  
OF NIGER (CERMES)

#### Objectives

- To provide training and up-skilling to health sector professionals about malaria (Ministry of Health professionals, physicians, laboratory staff, researchers, doctoral students).
- To monitor the efficacy of treatment, in particular resistance to anti-malaria medication and study the genetic diversity of *Plasmodium falciparum* in Niger.

30 September 2011 Agreement

# ROTARY INTERNATIONAL

## INSTITUT PASTEUR AND ROTARY INTERNATIONAL, UNITED IN THE FIGHT AGAINST MALARIA

True to their ethic of assistance and sharing, the Rotary Clubs of District 1660 (Western Paris Region) and Rotary International have been partners to Institut Pasteur since 2008, to support research on malaria. Since 2012, two initiatives have been run to mobilise against malaria, to the benefit of Institut Pasteur in Dakar, Senegal and Pasteur Centre in Cameroon. The Rotary and Institut Pasteur will build on their long-standing ties in 2015 to bring a fourth project for Malaria in Cambodia.



2012-2013

### A WORLD-WIDE INITIATIVE IN SENEGAL

The Rotary Clubs taking part in the initiative

- THE PARIS ALLIANCE PILOT'S CLUB
- 20 CLUBS FROM DISTRICT 1660
- THE KÖLN BONN MILLENNIUM CLUB, GERMANY
- CLUB ALMADIES, DAKAR
- THE ROTARY FOUNDATION
- ROTARY INTERNATIONAL, USA

**Funding provided**

USD 92,800

**Beneficiary**

INSTITUT PASTEUR IN DAKAR

**Objectives**

- An analyser for rapid-detection of both the parasite and level of protection in at-risk populations.
- Training for healthcare professionals to enable medical follow-up of populations in two rural villages, Dielmo and Ndio, located 280 km from Dakar, near the Gambian border.

**Ceremony**

24 October 2013, at Institut Pasteur in Dakar



2013-2014

### A WORLD-WIDE INITIATIVE IN CAMEROON

The Rotary Clubs taking part in the initiative

- THE PARIS PORTE D'ORLÉANS PILOT'S CLUB
- 20 CLUBS FROM DISTRICT 1660
- 4 CAMEROON CLUBS
- THE ROTARY FOUNDATION
- ROTARY INTERNATIONAL, USA

**Funding provided**

€70,000

**Beneficiary**

PASTEUR CENTRE IN CAMEROON

**Objectives**

- Manoka Archipel: Equipment purchase for use in the field and in the laboratory (-112 °F freezer).
- Excellence Hub in Malaria Epidemiology at Centre Pasteur in Cameroon: training, reagents, drugs.

**Ceremony**

19 December 2014 at Centre Pasteur in Cameroon

## PRINCIPALITY OF MONACO

### PARTNERSHIP BETWEEN THE PRINCE ALBERT II OF MONACO FOUNDATION, THE SCIENTIFIC CENTRE OF MONACO, THE DEPARTMENT OF INTERNATIONAL COOPERATION AND INSTITUT PASTEUR

Aware of the impact of environmental changes on human health, Institut Pasteur, the Scientific Centre of Monaco, and the Prince Albert II of Monaco Foundation have decided to combine their efforts, renown and know-how to bring research forward and better serve populations affected by disease. A Framework Partnership Agreement was signed on 21 December 2010 between the Government of the Principality of Monaco, the Prince Albert II of Monaco Foundation and Institut Pasteur.



2010-2014

#### THE SCIENTIFIC CENTRE OF MONACO

(CSM), in charge of conducting scientific research, supporting the action of governmental and international organisations, and stimulating and promoting biomedical research in the Principality.

#### THE PRINCE ALBERT II OF MONACO FOUNDATION

It is aimed at raising awareness at both the population and government levels as to the impact of human activity on natural environments, fostering more respectful behaviour toward the environment and encouraging flagship initiatives and innovative solutions.

#### THE DEPARTMENT OF INTERNATIONAL COOPERATION (DCI)

It is in charge of implementing the international cooperation policy designed to foster compliance with Millennium Development Goals (MDG). The DCI supports projects in favour of underprivileged populations.

<http://www.ec2h-monaco.org/>



2010-2014

#### THE PRINCE ALBERT II OF MONACO FOUNDATION - THE SCIENTIFIC CENTRE OF MONACO (CSM) - THE DEPARTMENT OF INTERNATIONAL COOPERATION (DCI)

Initiatives previously supported

- THE FIGHT AGAINST ACUTE BACTERIAL MENINGITIS IN NIGER
- THE FIGHT AGAINST ANTIBIOTIC RESISTANCE IN CHILDREN (CAMBODIA, MADAGASCAR AND SENEGAL)
- FINANCING STUDENTS FROM "SOUTHERN" COUNTRIES IN PUBLIC HEALTH TO TAKE PART IN THE SPECIALISED PASTEUR-CNAM MASTER'S PROGRAMME

#### COLLOQUIUM: ENVIRONMENTAL CHANGES & HUMAN HEALTH 2012 "ZOO NOTIC AND VECTOR-BORNE DISEASES"

Held on 23 March 2012.

#### PRINCE ALBERT II OF MONACO - INSTITUT PASTEUR AWARD

"The Impact of Climatic and Environmental Change on Global Public Health."



# GLOBAL COMPACT

## FROM SUSTAINABLE DEVELOPMENT TO CORPORATE SOCIAL RESPONSIBILITY

Institut Pasteur is maintaining the momentum of its Green Campus program, which is designed to promote and strengthen its environmentally friendly practices. By confirming its participation in the United Nations Global Compact, it has also developed this commitment into a Responsible Campus approach, incorporating the three dimensions of sustainable development—economic, social and environmental—more widely.

### Participation in the united nations global compact, and communication on progress

Institut Pasteur has been a participant in the United Nations Global Compact since 2010. As a major global corporate citizenship initiative, the compact aims to promote social legitimacy in businesses and organizations in general. The latter thereby undertake to incorporate several principles, regarding human rights, international labor standards, environmental protection and fighting corruption, into their practices, and support and disseminate them within their spheres of influence. In this context, Institut Pasteur organized a presentation of these principles to the directors of the institutes of the Institut Pasteur International Network to encourage them to begin participation by a

similar process to that initiated at Institut Pasteur Paris.

For Institut Pasteur, participation in the Global Compact constitutes a true driving force for the implementation and public dissemination of its environmental and social policies and practices. It generates an ongoing debate on the changes that it needs to make. Institut Pasteur has written three “Communications on Progress” (COP), available on both the United Nations and Institut Pasteur websites, summarizing the improvements made since participation began.

### Improving waste recovery and recycling

For several years, Institut Pasteur has conducted a campaign aimed at improving recovery and recycling of ordinary waste and some types of

hazardous wastes. In December 2013, Institut Pasteur improved the collection of used batteries on its site. In addition to optimizing this collection in the work context, the staff at Institut Pasteur can now include batteries used for private purposes in this stream. For this purpose, Institut Pasteur has joined an approved compliance scheme. It thus meets the regulatory requirements while eliminating the costs of treatment and disposal associated with this collection.

In compliance with Article 204 of the Grenelle 2 Act, Institut Pasteur has implemented segregation of biowaste (i.e. food waste) in its staff canteen since January 2014. Thus approximately 47 tons of biowaste will be collected and dehydrated on-site each year to produce an organic substrate which will then be packaged by a supplier of organo-mineral fertilizer, and distributed to farmers. To facilitate this collection, islands have been installed at the exit of the staff canteen. They make it possible to separate biowaste from inorganic waste, cans, and plastic and glass bottles, which are recovered or recycled.

## WHAT IS CORPORATE SOCIAL RESPONSIBILITY (CSR)?

CSR is the application of sustainable development by companies. It is *“a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.”* (see European Commission Green Paper). ISO Standard 26000 also considers CSR to be the responsibility of an organization in terms of the impacts of its decisions and activities on society and on the environment, to be reflected in transparent and ethical behavior.

At Institut Pasteur, matters of CSR are handled within the “Responsible



Campus” program, particularly under its participation in the United Nations Global Compact (UNGC), managed by the Technical Resources and Environment Department.

Institut Pasteur in French Guiana has been involved in the TEMPO scheme (Travail EMPloi POPulations) run by ARACT (Regional Association for the Improvement of Working Conditions) in French Guiana since 2013. This scheme is aimed at supporting businesses in the region in drafting agreements on “hardship at work,” “employment equality between men and women,” and “intergenerational.”

A project for developing software and equipment for videoconferencing for Institut Pasteur was launched in 2014. The objective is to facilitate international interaction and to contribute to the control of greenhouse gas emissions. Air travel is indeed an important source of greenhouse gas emissions.

# THANKS

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# PARTNERS

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## French and international ministries and agencies

- American Center for Disease Control (CDC)
  - Department of Health and Social Services (DHSS)/APSR
  - Expertise France
  - French Development Agency (AFD)
  - French Ministry of Foreign Affairs
  - French Ministry of Health
  - French Ministry of Higher Education and Research
  - Friends of the Global Fund
  - Medical Research Council (MRC)
  - Mexican National Council for Science and Technology (CONACYT)
  - Monaco's International Cooperation Division
  - National Institute of Infectious Diseases (NIID), Japan
  - Japanese Research Institution for Science and Technology (RIKEN)
  - Union for the Mediterranean (UfM)
  - U.S. Agency for international Development (USAID)
- Research institutions in France - CEA, CIRAD, CNES, CNRS, IFREMER, IMMI, INRA, INRIA, INSERM, INVS, IRD, IRES and agencies - AIRD, ANR, ANRS, AVIESAN.

## International organisations

- World Health Organization (WHO)
- European Union (EU)
- National Health Institutes (NIH)
- European & Developing Countries Clinical Trials Partnership (EDCTP)
- Global Alliance for Vaccines and Immunization (GAVI)

## Foundations, associations and non-governmental organisations

- Action against Hunger
- AREVA foundation
- Bill and Melinda Gates Foundation
- BNP Paribas Foundation
- Doctors Without Borders (MSF)
- Drugs for Neglected Diseases Initiative (DNDi)
- EDF Foundation
- Fondation de France
- French Red Cross
- GRET
- International Rotary Club Foundation and Rotary Clubs in France
- Médecins sans frontières
- Mérieux Foundation
- Michelin Foundation
- Monaco Scientific Center
- Multilateral initiative on Malaria (MiM)
- Pierre Ledoux Jeunesse Internationale Foundation
- Preventive Medicine Agency (AMP)
- Prince Albert II de Monaco Foundation
- Principality of Monaco International Cooperation Department
- Rockefeller Foundation
- Sanofi Espoir Foundation
- Total Foundation
- University Agency for Francophony (AUF)
- Wellcome Trust

## Private sector

- Areva
- AXA
- EDF
- Mérieux Institute
- Sanofi Pasteur
- Veolia

# LIST OF ABBREVIATIONS

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**ACIP** Inter-Institut Pasteur Concerted Action  
**AFD** French Development Agency  
**ANRS** French National Agency for Research on AIDS and Viral Hepatitis  
**BcG** Bacillus Calmette-Guérin (Tuberculosis vaccine)  
**BSL** Biosafety Laboratory Level 2 (BSL2) or Level 3 (BSL3)  
**CERMES** Centre for Medical and Health Research (Niamey, Niger)  
**CDC** Centre for Disease control and Prevention  
**CHARLI** Children's Antibiotic Resistant infections in Low Income countries: an international cohort study  
**CIBU** Laboratory for urgent response to biological threats (Institut Pasteur)  
**CIRAD** French Agricultural Research Centre for International Development  
**DHHS** Department of Health and Human Services  
**EU** European Union  
**FIOCRUIZ** Oswaldo Cruz Foundation (Rio de Janeiro, Brazil)  
**FSP** Priority Solidarity Fund  
**GLODEN** Global Network for Dengue Research  
**IMMI** Microbiology and Infectious Diseases Institute  
**INSERM** French National Institute for Health and Medical Research.  
**NGO** Non-governmental Organisations  
**NIH** National Institutes for Health (Bethesda, United States)  
**NIHE** National Institute of Hygiene and Epidemiology (Hanoi, Vietnam)  
**NRC** National Reference Centre  
**OFID OPEC** Fund for International Development  
**OIE** World Organisation for Animal Health  
**OPEC** Organisation of the Petroleum Exporting Countries  
**PCR-(RT)** Polymerase Chain Reaction (in real-time)  
**PTR** Transverse Research Programme  
**RIIP** Institut Pasteur International Network  
**RIKEN** Japanese Research Institution for Science and Technology  
**WHO** World Health Organization



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