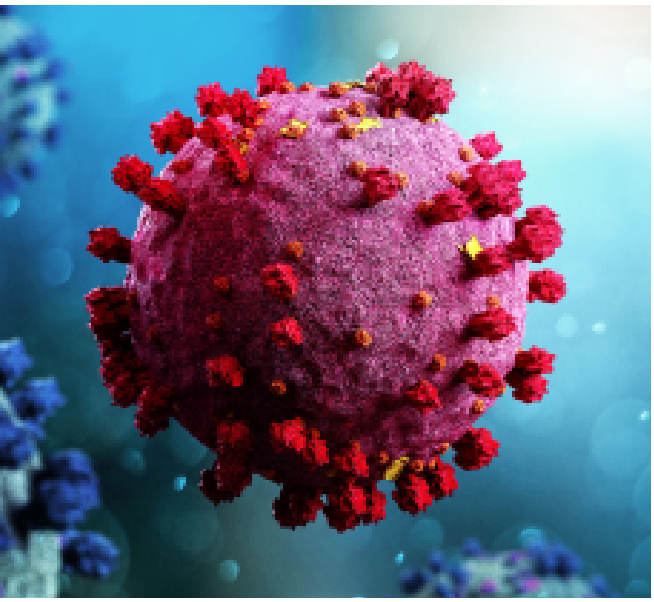
#02
JOURNAL OF PROJECTS

COVID-19: Understand its spread

Based on the pasteurian values they all shared, the Pasteur Network members are still engaged with many countries and their people worldwide. In this issue, we present some examples of the COVID-19 activities implemented within the projects MediLabSecure, ECOMORE 2, REPAIR and «Support to Instituts Pasteur in SubSaharan Africa».

The activities presented in this issue took place thanks to the support of:

SPOTLIGHT



To better understand SARS-CoV-2 in Africa: REPAIR project

Although Africa has not yet known the COVID-19 burden that all feared, it is still important to better understand the circulation and transmission of SARS-CoV-2 and its variants in the continent. The REPAIR project involves all the members of Pasteur Network* in Africa and takes advantage of the environmental, social and economic specificities of each country and each geographical area to understand the impact of the epidemic.

In 2020, the Pasteur Network members were at the heart of the fight against COVID-19, and most of them were appointed national referral laboratory in their country. The ten organizations in Africa (Tunisia, Algeria, Morocco, Senegal, Ivory Coast, Guinea, Niger, Central African Republic, Cameroon, Madagascar), members of the Pasteur Network, have set up a collaborative research programme named REPAIR (Pasteurian International Research in Response to the Coronavirus in Africa) to better understand the SARS-CoV-2 evolution in the African continent.

Coordinated by Institut Pasteur and supported by the French Ministry of Europe and Foreign Affairs, REPAIR is organized around 5 work packages focused on: the development of diagnostic tests and the assessment of their performance, the study of the molecular epidemiology of the virus, the sero-epidemiological survey of SARS-CoV-2, the mathematical modelling of the viral spread and finally the study of the acceptability of social and public health measures.

* formerly Institut Pasteur International Network

« The ten organizations in Africa (Tunisia, Algeria, Morocco, Senegal, Ivory Coast, Guinea, Niger, Central African Republic, Cameroon, Madagascar), have set up a collaborative research programme named REPAIR to better understand the SARS-CoV-2 evolution in the African continent. »

DIAGNOSTIC TESTS: A FIRST STEP TOWARDS THE AUTONOMY IN THE RESPONSE TO OUTBREAKS

During the first COVID-19 epidemic wave in 2020, the world has faced equipment and reagents shortage showing the need for countries to be independent in their capacity to produce them.

Institut Pasteur de Dakar was the first in the continent to develop rapid tests to detect viral antigens and antibodies against SARS-CoV-2. Also, it has developed another test, single-strand RPA, easier to implement. Institut Pasteur de Tunis has made an ELISA test to detect the antibodies against SARS-CoV-2 in the serum of infected individuals. Pasteur Center in Cameroon is designing a colorimetric LAMP test for an easy field deployment. All these reagents are available for the REPAIR consortium members to perform a multicentric evaluation of their performance in the diversity of the African context.

« It is crucial for the African countries to be able to develop and share high quality certified tests for a better preparedness to future outbreaks. The COVID-19 pandemic has highlighted and increased this need. Together, they are now ready for the exploration of the current epidemic and for future emergences" concludes Dr Koussay Dellagi, coordinator of REPAIR at Institut Pasteur.

A COORDINATED AND SYSTEMATIC TRACKING OF VARIANTS

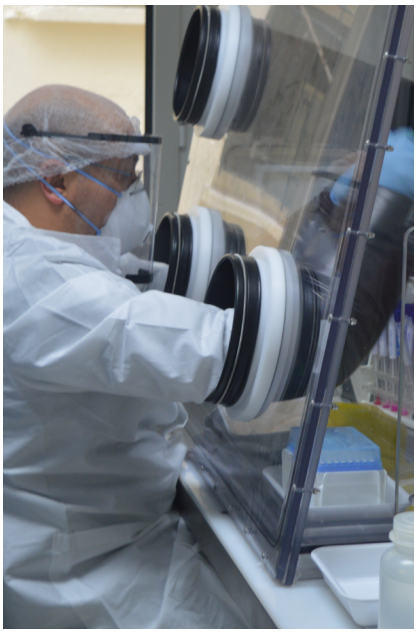
SARS-CoV-2 mutates continuously, like any RNA virus, generating many variants, some of which may have functional and epidemiological consequences. With the support of Institut Pasteur for the shipping of full sequencing equipment and the training for their use, the ten institutes members of REPAIR have been provided with MinIon sequencers allowing the real-time molecular characterisation of the epidemic as well as the identification of dangerous variants.

ESTIMATE THE IMPACT OF THE EPIDEMIC ON POPULATIONS

Thanks to the reagents developed and sent by Institut Pasteur de Dakar and Tunis, serological studies will be lead in the REPAIR partner countries that will analyse the immune response of patients and follow the circulation of the virus among the population.

« Tunisia is facing a third large-scale epidemic wave. In collaboration with the Tunisian Ministry of Health we have launched a national survey to evaluate the seroprevalence of the disease in the whole country. Ten thousand samples were taken across the country. This study showed the heterogeneity of the infection between the regions: although the national average is estimated at 30% of the population that has been in contact with SARS-CoV-2, some regions have been more impacted than others. Potentially, we could also predict where will be the next clusters of infection" explains Dr Melika Ben Ahmed, Head of Clinical Immunology Laboratory at Institut Pasteur de Tunis.

With the geographical, social, economic, and ethnical diversity of the populations studied in these ten countries, it will be possible to better understand the various immune responses according to the infectious history of the individuals. Afterwards, it will be possible to model the circulation and spread of the virus and correlate it to the peculiarity of the countries. Serological and molecular data will predict, among others, the impact of vaccination on the epidemic. ●



Zoom on ELISA test development at Institut Pasteur de Tunis

Dr Melika Ben Ahmed,
Head of Clinical Immunology Laboratory, member of Spread, Control and Immuniobiology of Infections
Institut Pasteur de Tunis.

Dr Chaouki Ben Abdessalem,
Graduate teaching assistant, member of Spread, Control and Immuniobiology of Infections
Institut Pasteur de Tunis

« In Tunisia, we have begun to produce the two N and S proteins of SARS-CoV-2 as soon as we have received the plasmids and protocols sent by Institut Pasteur and University of Hong Kong - Pasteur Research Pole. We needed to produce a large amount of these two proteins to manufacture the serological tests.

The goal has now been achieved: in the framework of the REPAIR project, the tests were optimised and we have then checked their performance. To that end we have included 100 COVID-19 positive patients as well as control subjects that were tested before the pandemic. The results are very good: the sensitivity of our tests is more than 93%.

Our team, 10 persons working 24/7, has kept producing these proteins to send them along with the protocols and reagents to the partner institutes in order to confirm their efficacy. Three partners have already tested them, and their results are good. They all need to validate the test in their own national context before using them for their serological study.»

STUDY

Low number of COVID-19 cases in Lao PDR: a seroprevalence study to confirm these figures

In 2020 when many countries around the world struggled with a large burden of COVID-19 cases, the Lao PDR stood out as a country with low reported numbers of SARS-CoV-2 infections. Was it due to a low circulation of the virus or to an inadequate surveillance system? To answer this question, a seroprevalence study has been conducted by Institut Pasteur du Laos, in collaboration with Institut Pasteur.

Appointed reference laboratory for COVID-19 by its national health authorities, the Institut Pasteur du Laos is at the heart of the fight against COVID-19.

To achieve its mandate additional equipment and consumables were necessary. Several funders, and in particular the Agence Française pour le Développement (AFD), provided an exceptional emergency support via various running initiatives such as ECOMORE II in South-East Asia.

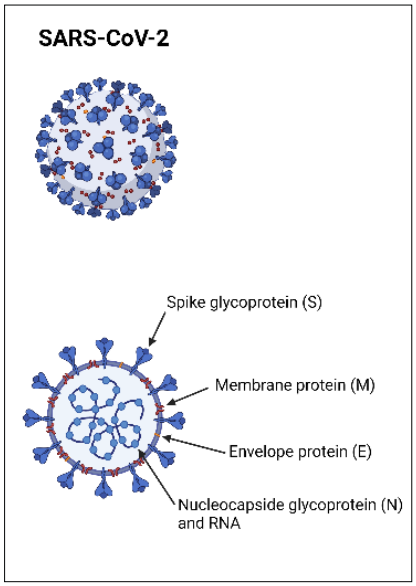
Observing a low number of reported cases of SARS-CoV-2 infection, the virus responsible of COVID-19 disease, the health authorities of Lao PDR have mandated Institut Pasteur du Laos to perform a study in order to understand whether there was an undetected circulation of SARS-CoV-2 within the country.

In partnership with Institut Pasteur, a seroprevalence study has been conducted in 2020 in five provinces. Thanks to the collaboration with Lao Tropical Public Health Institute, Lao University of Health Sciences, Lao National Centre for Laboratory and Epidemiology and Central, Provincial and District Hospitals, more than 3000 participants were included from the general population, healthcare workers and some individuals in contact with the wildlife, which is suspected to be a natural reservoir of many coronaviruses.

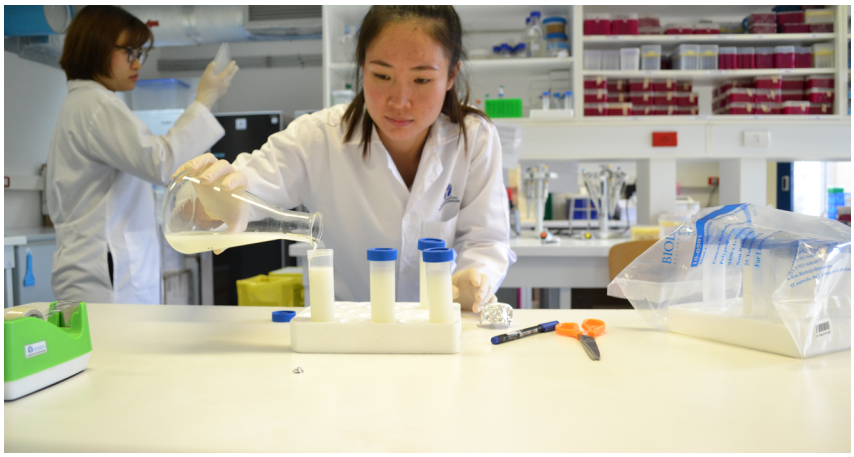
THREE DIFFERENT DIAGNOSTIC TESTS TO CONFIRM DATA

During the study, it was important to corroborate the results of the SARS-CoV-2 diagnostic tests. To that end three different laboratory tests were used to look for antibodies. Two ELISA tests, detecting the antibodies against the SARS-CoV-2 nucleocapsid (N) and spike (S) proteins respectively, and a third, rapid test against SARS-CoV-2 antibodies.

« More than 3000 participants were included from the general population, healthcare workers and some individuals in contact with the wildlife »



"The reason why we used all the three tests is that there is a certain amount of anti-SARS-CoV-2 antibodies cross-reactivity with other coronaviruses. By using different tests, we can be sure that any indivi-



duals positive for all three were infected by SARS-CoV-2", explains Dr Antony Black, Head of Vaccine Preventable Disease Laboratory at Institut Pasteur du Laos.

The participants were therefore considered to being exposed to SARS-CoV-2 when all the three tests were positive. Out of 3000 persons, only two participants had positive results from two tests, and none had positive results from the three tests. These extremely low numbers suggest that there was no circulation of SARS-CoV-2 in Lao PDR in 2020.

Institut Pasteur supported the study by providing the recombinant proteins and plasmids, as well as by helping with the ELISA tests and the interpretation of the results.

« Out of 3000 persons, only two participants had positive results from two tests, and none had positive results from the three tests. These extremely low numbers suggest that there was no circulation of SARS-CoV-2 in Lao PDR in 2020. »

CONCLUSIVE RESULTS FOR LAO PDR

"These results, published in the Lancet Regional Health - Western Pacific, are not surprising", explains Dr Antony Black, "the government put in place some radical measures since March 2020: a three-months lockdown, shutting of schools and entertainment venues, and a mandatory quarantine upon arrival for international travelers, even if their PCR tests were negative.

In 2021, some SARS-CoV-2 infected individuals illegally crossed the border from Thailand, leading to an increased number of imported cases and to a community transmission of the virus in Lao PDR. This proves that barrier measures, large vaccination campaigns, and travel corridors with other countries where the situation is similarly controlled are successful and still needed today. •

Low seroprevalence of COVID-19 in Lao PDR, late 2020
Lancet Regional Health - Western Pacific,
DOI: 10.1016/j.lanwpc.2021.100197

Inaugurated in 2012 by Institut Pasteur and Lao Minstry of Health, Institut Pasteur du Laos has a mandate to fulfill activities of public health:

- Research and diagnostic on emerging infectious diseases and vector borne diseases
- Training, Education and Capacity building
- Technical assistance to National Center for Laboratory and Epidemiology (NCLE) for investigation of epidemics

Institut Pasteur du Laos operations started in December 2011 with 4 laboratories:

- arbovirus and emerging viral diseases
- vaccine preventable diseases
- medical entomology
- parasitology

Among the facilities, there is also a dedicated Training Center for hands-on laboratory training and biosecurity enhancement.

SPOTLIGHT

Two COVID-19 referral centers in Senegal and Cambodia to support their region

With their strong regional position and their expertise, two members of Pasteur Network have been appointed "WHO Global Referral Laboratory for COVID-19". In addition to their national missions, these two institutes have also fought against COVID-19 at a regional level in Africa and South-East Asia. Thanks to the support of historical funders, they were enabled to successfully accomplish their mission.

The primary strategy against COVID-19 was to limit its spread and minimize its burden, which resulted in an integrated fight at several levels: early detection through diagnostic capacities, adoption of public and social health measures, and clinical care at international, regional, and national level.

In this aim, global public health organisations such as the World Health Organization (WHO) or the Center for Disease Control (CDC) have appointed reference institutions for the fight against COVID-19.

Two institutes of the Pasteur Network (formerly the Institut Pasteur International Network) have been appointed "global referral laboratory for COVID-19" by WHO to support their respective regions: the Instituts Pasteur du Cambodge and de Dakar. To date, the two reference laboratories support the diagnostic capacities of their own countries as well as of other institutions beyond their borders.

A look back at two regions of the world, two similar missions and many varied activities. •

Institut Pasteur du Cambodge has greatly contributed to its country's diagnostic efforts and has supported other provincial laboratories in sequencing technics for SARS-CoV-2.

Check out the video

Institut Pasteur de Dakar trained the national laboratories members of the West African Health Organization (WAHO) and carried out the diagnostics of its country and the sub-region. He also developed a diagnostic test, which he evaluated before deploying it to its network.

Check out the video

Institut Pasteur/Department of International Affairs - 25-28 du Dr Roux, 75724 Paris Cedex 15
Editorial: Alice Henry-Tessier - **Design:** Toma Blok / Tom&Fred - **Photo credits:** Institut Pasteur de Tunisie, Institut Pasteur du Cambodge; Institut Pasteur de Dakar; AdobeStock; Institut Pasteur du Laos, Institut Pasteur created with Biorender.com

The Journal of Projects presents examples of Pasteur Network mobilization.
For more information on the projects presented in this issue, please contact: pole-operations@pasteur.fr or cominter@pasteur.fr