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EDITORIAL

A global health risk

Pr Yasmine Belkaid,
Director General
of the Institut Pasteur

Found in our forests, our gardens and even our city centres, these small, microbe-carrying animals spread dengue fever, chikungunya and Lyme disease with ever-increasing frequency.

This rise in so-called vector-borne diseases is the result of changes that define our era. Climate change, as well as human and commercial flows, are disrupting ecosystems: biological boundaries are blurring, exacerbating health risks and requiring us not only to respond to current crises, but also to anticipate those to come.

Faced with this major challenge, the Institut Pasteur reaffirms its mission by placing global health at the heart of its strategy. The so-called One Health approach, which closely links human medicine, animal health and the preservation of ecosystems, is a priority for our institute.

The forthcoming creation of a unique European-scale research infrastructure, entirely dedicated to the study of vector-borne diseases, is a concrete example of this ambition. By combining the strengths of research, surveillance and innovation, we are combating emerging threats and continuing our fight for progress in public health.

It is by working together, building bridges between disciplines and mobilising all stakeholders, that we will develop sustainable solutions.

Our shared health will be built with you by our side.

SPECIAL REPORT

Mosquitoes, ticks, midges...

Serial biters, the invisible risk

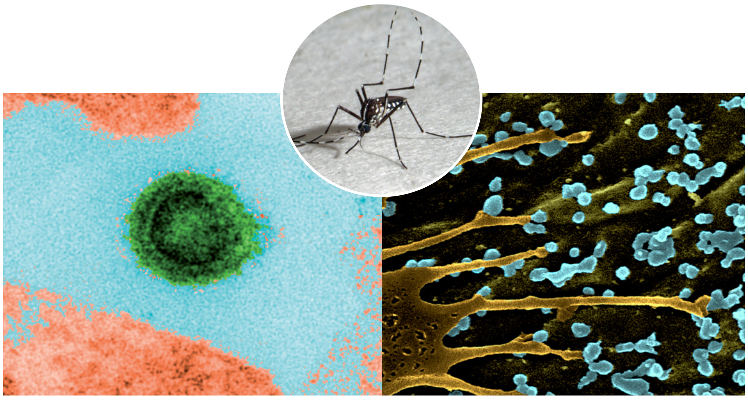
They weigh less than a milligram, measure just a few millimetres, and yet they are reshaping the health landscape in France. Until recently, these diseases were described as "exotic", as they were contracted whilst travelling to distant lands, or were specifically associated with outdoor activities. These vector-borne diseases have now become a common and enduring reality in mainland France.

CONTINUED ON P. 2

In this issue

When mosquitoes and ticks become biological weapons

Dengue, chikungunya, Zika, Lyme disease, malaria and leishmaniasis: these diseases, known as vector-borne diseases, differ from infections such as influenza or Covid-19 in the way they are transmitted. They require a living vector – a mosquito, midge or tick – which, when it bites, transfers pathogens (viruses, bacteria, parasites) that it harbours and amplifies to humans. Acting as mobile incubators, these vectors make these diseases particularly resistant to conventional public health measures. The impact is colossal: vector-borne diseases account for over 17% of infectious diseases and cause more than 700,000 deaths worldwide each year.



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The tiger mosquito (inset photo) can transmit, in particular, the dengue virus (left) and the chikungunya virus (right).

A diversity of vectors, a multitude of threats

Of the 3,500 species of mosquitoes recorded worldwide, only 3 to 6% are harmful to humans. In France, the tiger mosquito (*Aedes albopictus*), which arrived in the Alpes-Maritimes in 2004 and is recognisable by its black and white stripes, it now transmits dengue, chikungunya and Zika in urban areas. The common mosquito (*Culex pipiens*) silently carries the West Nile virus, which causes severe neurological damage. As for sandflies, they are vectors of leishmaniasis, a parasitic disease causing highly debilitating skin or visceral conditions. This condition, found in the Cévennes, the Côte d'Azur, Corsica, Provence and the Pyrénées-Orientales, is now considered an emerging neglected disease in Europe. In tropical areas and disadvantaged regions of Africa, Asia and Latin America, mosquitoes of the genus *Anopheles* transmit parasites of the genus *Plasmodium*, which cause malaria (600,000 deaths per year).

MOSQUITOES

ACTION PASTEUR

Behind the scenes at a **vector breeding facility**

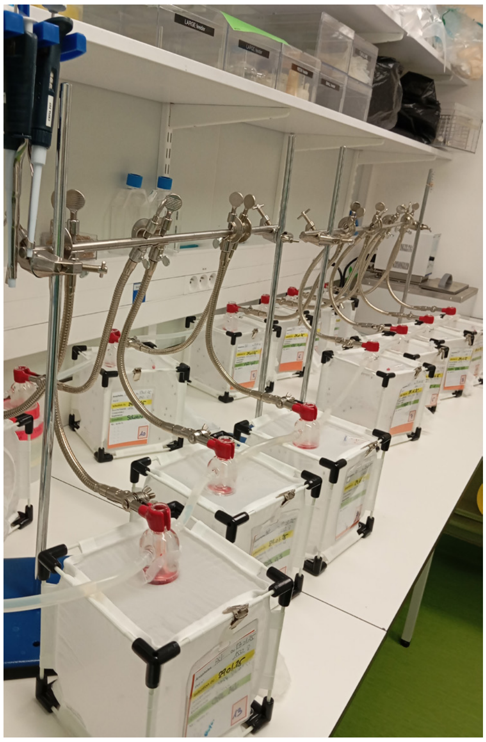
Founded in 2003 by Catherine Bourgoin within the Malaria Biology and Genetics Unit (headed by Robert Menard), the CEPIA platform is dedicated to the mass rearing of Anopheles mosquitoes and the production of Plasmodium parasites – the agents responsible for malaria – for use in basic and translational research.

© E. Hammam

"The aim was to provide biological material to the parasitology teams on the Institut Pasteur campus without them having to manage the complex rearing of vectors themselves" explains **Sabine Thiberge**, head of the Anopheles Production and Infection Centre. This "mosquito nursery" is unlike any other: it is run by a team of seven, who maintain colonies of *Anopheles gambiae* (the main mosquito vector for malaria in Africa) and *Anopheles stephensi* (the main vector in urban areas of India), and cultivate the *Plasmodium falciparum* parasite in fresh blood using a semi-automated system – a meticulously timed production cycle that demands clockwork precision.

"We cultivate the sexual stages of the parasite for 15 days with daily medium changes, including at weekends, then infect the mosquitoes via ***artificial blood meals"*** explains Sabine Thiberge. The mosquitoes' environment must remain stable at a constant 27°C and a minimum of 80% humidity – tropical working conditions for the team.

In early 2028, at the heart of the new infrastructure entirely dedicated to the study of vector-borne diseases, CEPIA will become the Centre for Vector Production and Infection (CPIV), bringing together a breeding facility for most of the vectors responsible for transmitting major pathogens (mosquitoes of the genera *Anopheles* and *Aedes*, sand flies, tsetse flies and ticks). Unique microscopy facilities enabling the imaging of infection at all levels (molecular, cellular, tissue and whole-organism) within highly secure environments will also be made available to research units. ***"The aim is to free scientists from maintenance tasks so that they can focus on scientific experimentation"*** explains Sabine Thiberge. This centre, combining the pooling of expertise and the standardisation of practices, will contribute to an integrated understanding of vector-borne diseases.



© CEPIA

Breeding of *Anopheles* mosquitoes.

UNDERSTANDING

The main vectors and the pathogens they transmit

The vector	Diseases	When should you be wary?
1 **The common tick** *(Ixodes ricinus)*	Lyme disease • Tick-borne encephalitis	March to November
2 **The giant tick** *(Hyalomma marginatum)*	Crimean-Congo haemorrhagic fever	March to August
3 **The tiger mosquito** *(Aedes albopictus)*	Dengue • Chikungunya • Zika	March to October (during the day, peaking in the late afternoon)
4 **The common mosquito** *(Culex pipiens)*	West Nile fever	April to October (night)
5 **Sand fly** *(Genus Phlebotomus)*	Visceral and cutaneous leishmaniasis	April to October (late afternoon and early night)

Unlike insects, which fly through the air, ticks lie in wait in low vegetation. Tiny in size, they attach themselves to the skin for several days, quietly injecting their pathogens. The common tick (*Ixodes ricinus*), which lives deep within our forests, transmits the bacterium responsible for Lyme disease and the tick-borne encephalitis virus. More worryingly, the *Hyalomma marginatum* tick, recognisable by its large size and striped legs, is spreading to the south of France: already present in Corsica, it has been colonising the mainland Mediterranean coast for a decade. As a vector of the Crimean-Congo haemorrhagic fever virus, a serious infection with a fatality rate of up to 40%, it represents a major emerging threat.

Vectors on the rise and evolving

In recent years, vector-borne diseases have spread to new areas, putting 80% of the world's population at risk. In mainland France, 2025 marked a historic turning point: following sporadic cases of dengue and chikungunya (fewer than five per year prior to 2022), local transmission increased fifteen- to twenty-fold, with the tiger mosquito now present in 81 French departments. The West Nile virus, transmitted by the common mosquito, has meanwhile reached the Île-de-France, Auvergne-Rhône-Alpes and Normandy regions for the first time.

At the same time, 50,000 cases of Lyme disease are recorded each year, mainly in the Grand Est, Centre-Val de Loire and northern regions of the country. By 2030, the spread of the common tick *Ixodes ricinus* into the mountains (Vosges, Jura, Alps) could further increase this threat. This resurgence is due to an ecological imbalance caused by a combination of climate change and urbanisation: mild winters and heatwaves are extending the transmission season, whilst larval habitats and vegetation are favouring mosquitoes and ticks respectively.

Continued on p. 5

DENGUE

ACTION PASTEUR

The mosquito's stomach, the black box of viral transmission

© Institut Pasteur / F. Gardy

Sarah Merkling (head of the Insect Immunity and Infection group) is exploring the molecular mechanisms that determine dengue infection and transmission by *Aedes aegypti*, by focusing on the first few hours after the infected blood meal, a decisive phase during which the virus attempts to colonise the mosquito's stomach, an organ that remains poorly understood, unlike the salivary glands. ***"We do not understand why, in certain populations, the virus infects gastric cells and replicates, whilst in other cases it fails to do so"***, explains the researcher.

Her work has revealed a natural dichotomy within a Gabonese population: 50% of mosquitoes are resistant to infection, whilst the other half are susceptible, with a discernible difference emerging within 24 to 48 hours. To decipher these mechanisms, she uses single-cell sequencing and high-resolution 3D imaging on ultra-thin sections of mosquitoes.

Her future research at the CMTV will focus on three main areas. Firstly, it aims to identify the molecular signatures of resistance and susceptibility by combining genomic analysis with cellular profiling, paving the way for mosquitoes with 'super-immunity' that are unable to transmit the virus. It will also assess the impact of extreme weather events (heatwaves, floods) on vector competence. Finally, it will generate synthetic viral populations to monitor in real time the virus's evolutionary adaptation to its host.

This fundamental research is crucial given the limitations of current strategies: insecticide resistance and vaccines that are ineffective or difficult to deploy without prior serology. ***"In the era of climate change, diversifying our approaches has become a matter of urgency"***, she emphasises.

Background photo: Dengue virus type 2.
(© Institut Pasteur/C. Hannoun and C. Dauguet).

Sarah **Bonnet**

Head of the “Ticks” group within the Ecology and Emergence of Arthropod-Borne Pathogens Unit at the Institut Pasteur

© Institut Pasteur / V. Zeitoun

“Ticks in the city: understanding the risks to protect yourself better”

How does your research in the laboratory and in the field shed light on the role of ticks in transmitting organisms responsible for diseases?

In the laboratory, I study the interactions between ticks, their hosts and the pathogens they transmit, notably through the establishment of a tick culture. In the field, I assess the risks associated with ticks in various ecosystems. What is particularly close to my heart is the *One Health* perspective: ticks do not specifically target humans, but are closely linked to wildlife (rodents, birds, deer, etc.) or domestic animals (livestock and pets).

How do ticks develop, and why is the nymph stage so dangerous to humans?

As old as the world itself (270 million years), ticks are found all over the globe. Their life cycle comprises three stages – larva, nymph and adult – and each stage requires one or more blood meals to develop. Ticks are the main vectors of pathogens in Europe. The nymph, which is about the size of a pinhead, is particularly dangerous because it is abundant in infested areas and difficult to detect, whilst also playing a role in the transmission of pathogens such as the bacterium *Borrelia burgdorferi*, which causes Lyme disease.

What are the most surprising findings from your study on ticks in urban areas in Île-de-France?

Since 2022, an innovative project has been exploring the links between urban greening and the emergence of ticks in urban areas across 166 sites spread across the Île-de-France region, arranged according to a gradient of urbanisation.

The results obtained have led to the project being extended for 5 to 10 years, focusing on four priority areas that are monitored on a monthly basis: the forest of Saint-Germain-en-Laye (control site), the Bois de Vincennes and the Bois de Boulogne, such as Montsouris Park, where ticks were detected for the first time within the city limits of Paris. Preliminary results, currently being published, reveal a worrying reality: not only have ticks now established themselves in Paris,

© S. Bonnet

Collecting ticks in Montsouris Park, Paris.

> “Ticks do not fall from trees but lie in wait at the top of the vegetation.”

but some carry pathogens, including the bacterium responsible for Lyme disease. Among the seven tick species identified in Île-de-France (out of the 40 recorded in mainland France and 900 worldwide), other pathogens have been detected, such as parasites of the genus *Babesia* or other bacteria of the genera *Rickettsia* or *Anaplasma*, whilst we are currently investigating the presence of viruses. Our results show that, although there are fewer ticks in urban areas, they are nevertheless more infected than those in forested areas.

Several factors explain this urban expansion: green corridors, which facilitate the migration of wildlife (and the ticks they carry) from peri-urban and rural areas into the city centre and urban heat islands, which extend the ticks’ active season, keeping them active even in winter.

This project highlights the urgent need to adapt public health and urban planning policies to limit the risks, whilst raising awareness among Parisians of these new invisible dangers.

What are your other areas of research?

We are carrying out further research projects to assess tick-related risks in other environments, such as in Germany and Japan (we are an international unit of the Institut Pasteur and Kyoto University). We are working on the development of markers for exposure to tick bites, which would enable us to monitor changes in different tick populations, and on the development of software to identify ticks at the species level. Finally, another project close to my heart is the relaunch of work on a tick vaccine, targeting the vector rather than the pathogens, to prevent bites and thus the transmission of these pathogens.

What societal and public health issues do you highlight?

Surveillance and prevention are crucial. Together with an anthropologist from the Institute (Tamara Giles-Vernick), we are analysing perceptions of tick-related risks. We hope to continue our collaboration with Paris City Hall to raise public awareness, by ensuring our teams are visible on the ground and by implementing communication tools aimed at the general public. I have therefore been involved in the development of the National Health and Environment Plan 4 *“One Environment, One Health”* (2021–2025) to incorporate the risk posed by ticks as vectors into public policy.

Listen to Sarah Bonnet on the programme « [La Terre au carré](#) »
(France Inter, 3 March 2026)

Anticipate rather than react: integrated prevention

With no vaccines or treatments available for most of these diseases, a defensive strategy is giving way to predictive vigilance. The *One Health* approach advocated by the WHO breaks down the barriers between human medicine, veterinary medicine and ecology, and treats these diseases as complex systems in which pathogens, vectors, climate and human behaviour are intertwined. This vision took shape in 2017 with the adoption of *the Global Vector Control Action Plan 2017-2030*, calling on states to make vector control a pillar of prevention.

In France, institutional surveillance (regional health agencies - ARS, Santé Publique France - SPF) is now complemented by a citizen-led network *via* reporting apps, creating a real-time surveillance system.

Continued on p. 6

UNDERSTANDING

Best practices, protection and vigilance

Against mosquitoes

- *Remove standing water (flower saucers, tyres, plastic bottles) where females lay their eggs.*
- *Wear long clothing in the forest or garden, especially at dusk.*
- *Use repellents on your skin and mosquito nets when sleeping.*
- *Report their presence using the free iMoustique® app.*

Against ticks

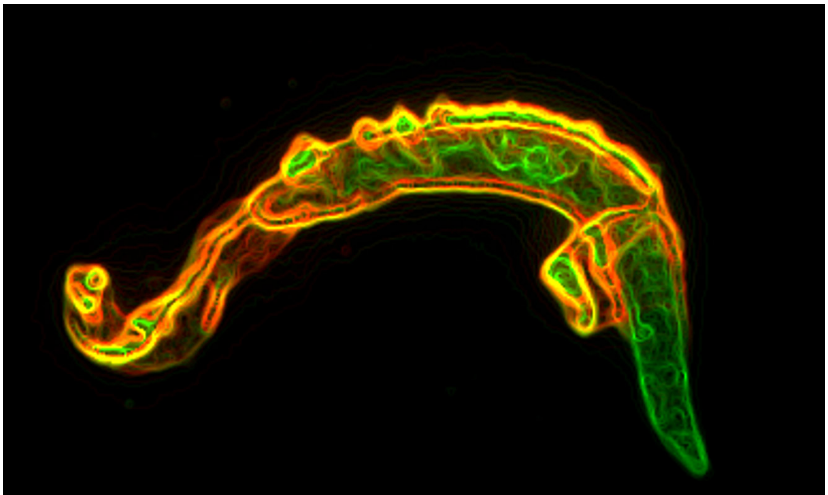
- *In the forest or in green spaces (even urban ones), stay on the paths, tuck your trousers into your socks and wear long sleeves.*
- *Check yourself carefully in the evening when you get home: ticks are often the size of a pinhead (nymph) up to 4 mm (adult). They like to hide in the scalp, groin or body folds.*
- *Remove the tick as soon as possible using a tick remover.*
- *Report their presence using the free app www.citique.fr*

MALARIA

ACTION PASTEUR

A turning point in the fight?

Malaria, a global scourge, is caused by the *Plasmodium falciparum* parasite, transmitted by mosquitoes. A major scientific breakthrough could change everything: antibodies capable of forcing the parasite to self-destruct before it even reaches the liver. Thanks to cutting-edge imaging techniques and the use of fluorescent molecules, **Rogerio Amino** (head of the Malaria Infection and Immunity Unit), has been able to observe the parasite's behaviour following the mosquito bite. Contrary to what one might imagine, the parasite is not injected directly into the bloodstream. ***"It is initially trapped in the skin, where it must locate a blood vessel, invade it, and then migrate to the liver to infect the liver cells",*** explains the researcher. This phase represents a unique therapeutic window of opportunity. Rogerio Amino has discovered that certain antibodies, by binding to a surface protein of the parasite, trigger a chain reaction that weakens it. ***"As it moves to reach the blood vessels, the parasite attempts to shed this 'antibody envelope', leaving fragments of its own membrane behind",*** explains the researcher. Stripped bare and weakened, the parasite then becomes vulnerable to an endogenous cytotoxic molecule and self-destructs.



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The malaria parasite (in green) being "stripped" by a protective antibody (shown in yellow).

The team is collaborating internationally to screen hundreds of antibodies and identify the most effective ones. Identifying a more potent antibody will enable greater efficacy at lower cost, particularly to cover the population that does not respond to vaccines or is seasonally exposed to infection. The team is also developing, in collaboration with biotechnology companies, a multi-antigenic vaccine aimed at providing 100% protection. Currently available vaccines offer temporary protection lasting a few months. ***"Antibody levels drop rapidly. Our aim is to identify combinations capable of inducing a response that lasts longer",*** explains Rogerio Amino. The development of a potent monoclonal antibody or a multi-antigenic vaccine capable of completely blocking malaria infection could be a game-changer in the fight against this insidious disease.

SURVEILLANCE

ACTION PASTEUR

EMa-TIGRE, a pioneering surveillance system

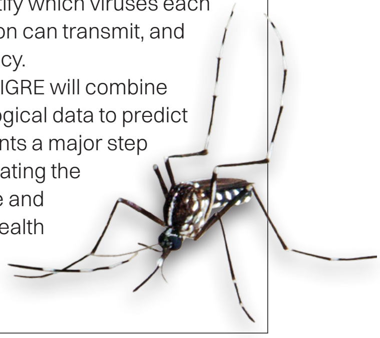
© A. Darmon / Art in Research

Observation of female mosquitoes sorted prior to transfer to the P3 laboratory for an infectious blood meal.

Since May 2025, France has been rolling out a revolutionary tool: EMa-TIGRE (Emergence of Mosquito-borne Vector-borne Diseases Tiger), a systemic surveillance programme covering the whole of mainland France. Its aim? To map the risks of the spread of viruses transmitted by the tiger mosquito *(Aedes albopictus)* and to anticipate future outbreaks. ***"We are drawing up a baseline for 2025–2026, which will serve as a basis for assessing how the risk in 10, 20 or 30 years' time"*** explains **Rachel Bellone**, (researcher in the Arbovirus and Insect Vectors Unit at the Institut Pasteur), project coordinator.

© C. Bohers

But EMa-TIGRE is not limited to the tiger mosquito: *Culex, Anopheles* and other mosquito species are collected twice a month, from May to October, at 105 sites across 13 regions. Each sample is linked to precise metadata (location, temperature, humidity, rainfall), forming a unique biobank for retrospective genetic analysis and monitoring of insecticide resistance.
The effectiveness of the scheme was quickly demonstrated. In 2025, the teams detected the West Nile virus in mosquitoes in Val-de-Marne and Paris, enabling the removal of potentially contaminated blood products and the prevention of transmission *via* transfusion. Another alarming sign: cases of chikungunya began to appear as early as the end of May, compared to the usual August-September. ***"This indicates a high mosquito density very early in the season, driven by mild winters and the tiger mosquito's rapid adaptation to its environment"*** emphasises Rachel Bellone. Mild winters alter the mosquitoes' life cycle: ***"They enter diapause later and wake up earlier"*** explains the researcher. To refine the projections, vector competence tests are currently being carried out on 12 populations of tiger mosquitoes in France, exposed to 10 different viruses. The aim? To identify which viruses each regional population can transmit, and with what efficiency.
Ultimately, EMa-TIGRE will combine climate and virological data to predict risk. This represents a major step forward in anticipating the spread of disease and adapting public health strategies.



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As soon as a locally acquired case is detected, a strict protocol is triggered: epidemiological and entomological investigations followed by targeted mosquito control measures.

In its 2030 strategic plan, the Institut Pasteur has made the fight against these diseases a priority. It is focusing on predictive tools such as the EMa-TIGRE project, which maps the risks of the spread of viruses transmitted by the tiger mosquito *(see box above)*, and is strengthening its capabilities by establishing a research centre entirely dedicated to these threats.

This scientific expertise is accompanied by a collective effort: eliminating larval breeding sites and ensuring personal protection, with every citizen taking an active role in their own health.

Vector reprogramming

Alongside predictive surveillance, a new approach is emerging: mosquito reprogramming. Two promising strategies are taking shape. The first utilises the *Wolbachia* bacterium, which, once introduced into the insect, blocks viral replication and is passed on to offspring, gradually creating a locally immune population. The second relies on genetic engineering: by releasing large numbers of sterilised males into infested areas, their mating with wild females produces non-viable offspring, thereby reducing the vector population without resorting to pesticides.

Towards a new approach to disease control

In recent years, vector-borne diseases have ceased to be a mere theoretical abstraction in France. They represent growing challenges for epidemiology and public health due to climate change and international travel. We are no longer dealing with one-off crisis management, but with a 'new normal'. From predictive surveillance to vector modification, research is now opening up unprecedented avenues for combating these diseases.

REPORT BY THE EDITORIAL TEAM

PROFILE

Javier Pizarro-Cerda

Science, plague and rock 'n' roll!

Javier Pizarro-Cerda inherited a natural curiosity, a love of biology and science, and, incidentally, an unwavering passion for music. After completing his education in Costa Rica, he set off for Europe in order to become a researcher. Today, at the Institut Pasteur in Paris, his work on the plague and other yersiniosis follows in the footsteps of his predecessors and also explores the history of major deadly epidemics. As both a heir to this legacy and, in turn, a transmitter of knowledge, Javier enjoys passing on and sharing his expertise with future generations of researchers.

A tribute to his homeland, Costa Rica

Born in San José, he cherishes memories of the lush natural surroundings he loved to observe. Every day, hummingbirds, finches and motmots would visit the family garden. Costa Rica is home to over 800 species of birds – more than North America and Europe combined. This incredible biodiversity sparked his interest in studying the life sciences.

"As a family, we would set off on Sundays to climb volcanoes at 3,300 metres; on the way to these excursions we would encounter wildlife, and might come across coatis, agoutis, armadillos, sloths, or even monkeys. The vegetation was lush: giant ferns, flamboyant trees, mango trees and orchids... We could also head west to the Pacific coast or, in the opposite direction, eastwards to the Caribbean Sea."

A legacy of science and music

His father, a paediatrician in San José, also conducts research into rehydrating children suffering from intestinal infections.

This work led to the "Pizarro Solution", which is still used in Latin America.

His mother, a bank clerk, sang and accompanied herself on the guitar. Javier inherited this passion: at the Institut Pasteur, together with Latin American colleagues, he founded the *Music Lab*, where Pasteur staff gather to play music. On the Paris campus, he plays jazz standards on the guitar or accompanies Chuck Berry riffs on the double bass.

Crossing borders, opening up to an international scientific community

From biology to microbiology, he trained at the University of Costa Rica, had a particular interest in evolution and genetics, and took French lessons at the *Alliance Française*. For Latin America, France is a country that inspires through its values, its culture and arts.

After university, whilst at veterinary school, he worked with Dr Edgardo Moreno on bacterial diseases, in collaboration with the Marseille-Luminy Centre for Immunology.

At the age of 26, he set off for Europe. After completing his PhD in Marseille, he joined Pascale Cossart's team at the Institut Pasteur for his postdoctoral research, before becoming a research fellow.

"When I arrived at the Institut Pasteur, during meetings, the scientists would look at me strangely; I spoke French with a mix of Costa Rican and Marseillais accents [...] Pascale and I had a close and open relationship. We published some significant findings, including the one concerning the secretion of a natural antibiotic by the bacterium Listeria*."*

Becoming a Pasteurian: a new legacy...

In 2017, he took over as head of the Yersinia unit and the World Health Organisation (WHO) Collaborating Centre for Plague.

A week later, the WHO issued an international alert regarding the worst plague outbreak in Madagascar in over a century. The team set out to strengthen diagnostic capabilities and helped to characterise strains of *Yersinia pestis* in collaboration with the Institut Pasteur of Madagascar.

Following in the footsteps of their predecessors, Javier and his teams developed a vaccine against bubonic plague: 100% success in mice and a patent filed.

In 2022, they were involved in remarkable palaeogenomic research into the Black Death.

By analysing ancient DNA from individuals who died before, during or after the pandemic, they have identified protective genetic variants that are still present today, and demonstrated that the Black Death shaped immune genes, influencing our current response to autoimmune diseases.

"The plague is a fascinating subject because it draws on a wide range of knowledge: microbiology and public health (areas in which our unit has expertise) but also human population genetics, palaeogenomics and history, and we are fortunate to collaborate with colleagues who are experts in these disciplines (such as the historian Patrick Boucheron) who take us on a journey through time and the history of humanity."*

Pathogenic *Yersinia* species: a major public health concern

Their laboratory houses the National Reference Centre for Plague and other yersinioses. Of the 27 species of *Yersinia*, three are pathogenic to humans: *Yersinia pestis*, the causative agent of the plague, and *Yersinia pseudotuberculosis* and *Yersinia enterocolitica*, which cause enteritis. Found worldwide, *Y. pseudotuberculosis* and *Y. enterocolitica* are the third leading cause of bacterial enteritis in Europe, transmitted mainly *via* the faecal-oral route through contaminated food.
The researchers ask two key questions: How do these bacteria circulate in France? What are the sources of human infection? The team's research will soon provide answers to these questions.

"I enjoy passing on my knowledge to the next generation of scientists. I have contributed to practical and theoretical courses in France, Argentina, Costa Rica, Greece and China. I have also taken part, in France, in 'Pint of Science' events, which aim to take science out of the laboratories and encourage interaction with the general public over the course of an evening."

* Recommended reading: ***The Black Death*** by Patrick Boucheron, published on 30 January 2026 by Éditions Seuil, in the *L'Univers historique* collection

Background photo: epithelial cells infected with the pathogen *Y. pseudotuberculosis*
(blue: human cell DNA, green: intracellular niche of the pathogen).

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NEWS

Psoriasis: unravelling the causes of chronic itching

In psoriasis, chronic pruritus remains a distressing and difficult-to-treat symptom, affecting nearly 125 million people worldwide. A previously unknown mechanism linking the immune system, the skin microbiome and sensory nerves has recently been identified*.

During inflammation, an excessive immune response directed against skin bacteria, such as Staphylococcus aureus, can profoundly reshape the skin's innervation. This signal then triggers a proliferation of sensory nerve endings, thereby amplifying the sensation of itching.

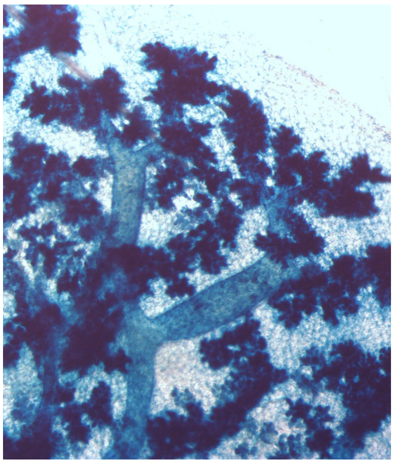
By targeting this mechanism, future therapies could provide better relief from the chronic itching associated with psoriasis, a welcome advance given that the WHO recognised skin diseases as a global health priority in 2025.

** Research carried out by the Meta-organism Unit at the Institut Pasteur, led by Yasmine Belkaid, in collaboration with Michel Enamorado's team at the Icahn School of Medicine at Mount Sinai (New York).*

***POST-PARTUM* BREAST CANCER**

Understanding the mechanisms of breast tissue remodelling

***Post-partum* breast cancers, diagnosed within 5 to 10 years of pregnancy, are associated with an increased risk of metastasis and lower survival rates than those occurring during or outside of pregnancy.**



© Institut Pasteur / Cellular Plasticity in Age-Related Diseases Unit

Distal part of a mouse mammary gland.

A team from the Institut Pasteur* has studied the mechanisms involved in breast involution, the phase of tissue remodelling that follows breastfeeding. A major physiological event but also a critical period, the inflammatory environment created by involution leads to a temporary yet significant increase in the risk of developing *post-partum* breast cancer. Cellular senescence – the permanent arrest of the cell cycle – plays a dual role: essential for the normal remodelling of the gland, it can also be exploited by tumour cells to spread. Experimentally validated, the removal of these senescent cells during the involution phase delays the onset of tumours and reduces the formation of metastases. The risk of *post-partum* breast cancer increases with maternal age, highlighting a major women's health issue that is still largely overlooked. A better understanding of these mechanisms could lead to the development of new preventive approaches to limit this risk.

** Research conducted by Han Li, head of the Cellular Plasticity in Age-Related Diseases Unit at the Institut Pasteur.*

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TRIBUTE

Five female researchers from the Institut Pasteur have their names inscribed on the Eiffel Tower

A symbol of French scientific and technical ingenuity, the Eiffel Tower will pay tribute to 72 women in science by 2027, echoing alongside the 72 scholars selected by Gustave Eiffel in 1889. For the first time, the monument will honour those women who, through their discoveries and their commitment, have left their mark on the history of science. This initiative* embodies the desire to give women their rightful place in the advancement of knowledge and progress.

On 26 January 2026, a multidisciplinary commission presented the Mayor of Paris with a list of 72 names to be added to the exclusively male names inscribed on the frieze of the "Iron Lady".

Among these names, five Pasteurian women are being honoured:

Odile Croissant, a pioneer in the detection of viruses using electron microscopy, worked with Gérard Orth's team to establish the link between papillomaviruses and cancers;

Pauline Ramart-Lucas, a chemist, feminist and member of the Resistance, became the second female professor of chemistry at the Sorbonne in 1935, after Marie Curie;

Hélène Sparrow, a 'microbe hunter', developed the typhus vaccine and protected refugees during the Second World War;

Thérèse Tréfouël, together with Jacques Tréfouël, Federico Nitti and Jacques Bovet, discovered the mechanism of action of sulphonamides, ushering in the era of antibacterial chemotherapy using synthetic drugs;

Agnes Ullmann, an internationally renowned molecular biologist and close associate of Jacques Monod, contributed to our understanding of the genetic regulatory mechanisms essential to vaccine development.

This symbolic recognition highlights the central role of women in the Pasteurian scientific endeavour: research guided by curiosity, boldness and a spirit of humanism which, since Louis Pasteur, have been the hallmark of the Institute.

***An initiative led by the Femmes & Sciences association, with the support of the City of Paris and the* Société d'exploitation de la Tour Eiffel.

Discover Institut Pasteur's digital heritage, curated by the Institut Pasteur's Scientific Information Resource Centre (including the collection dedicated to women at the Institut Pasteur).

DISEASES

What is a **notifiable disease?**

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In France, certain diseases are classified as 'notifiable' (MDO). This means that any doctor, biologist or healthcare professional who diagnoses them is obliged to report them to the health authorities. This system, regulated by law, enables the constant monitoring of the spread of these diseases, the rapid detection of outbreaks and the taking of action to protect the public.

The aim is twofold: to monitor dangerous diseases in real time and to respond immediately in the event of a threat. Thanks to these reports, the authorities can identify an unusual rise in the number of cases, which may be a sign of an outbreak.

This enables appropriate measures to be put in place, such as vaccination campaigns, isolating patients or identifying the source of infection. Furthermore, the data collected contributes to medical research, helping scientists to better understand these diseases and improve prevention and treatment strategies.

The list of MDOs is set by the public authorities and may be adjusted according to health risks. Among the 38 diseases are certain serious infections such as tuberculosis, HIV/AIDS, hepatitis and mosquito-borne infections (chikungunya, dengue and Zika). Other diseases, rarer but just as dangerous, such as rabies, plague or anthrax, are also monitored. Finally, outbreaks of foodborne illness, often linked to contaminated food, are included on this list.

As soon as a healthcare professional diagnoses a notifiable disease, they complete a secure form and send it to Santé publique France. This notification must be made without delay; in some cases, within 24 hours for the most urgent diseases. The information provided is treated confidentially, ensuring patient anonymity.

This system is a cornerstone of public health. Even if certain diseases appear rare, monitoring them helps prevent them from becoming a major threat. It also ensures essential transparency: citizens have access to reliable information on health risks in their region.

If you think you have contracted an MDO, consult a doctor. Only they can make an accurate diagnosis and, if necessary, report the case to the authorities. It is important not to ignore certain symptoms, especially if they match those of a notifiable disease.

Notifiable diseases are an indispensable tool for anticipating, preventing and combating health risks. Thanks to this system, France can respond rapidly to infectious threats and effectively protect its population.

Find out more: *www.santepubliquefrance.fr/maladies-a-declaration-obligatoire*

FOCUS

When memory fades: understanding Korsakoff's syndrome

Korsakoff's syndrome is a severe memory disorder caused by a prolonged deficiency of vitamin B1, which is essential for the brain.

It prevents the formation of new memories whilst often leaving old memories intact. Those affected may therefore recall distant events, such as their childhood, with precision, but forget a conversation that took place just a few minutes ago. They may also invent memories to fill in the gaps, a phenomenon known as "confabulation".

This deficiency most commonly occurs in the context of chronic alcoholism (80% of cases), as alcohol interferes with the absorption of this vitamin. Other factors such as malnutrition, digestive disorders or certain treatments (chemotherapy) can also cause this deficiency. Diagnosis is difficult as the symptoms can be confused with those of other conditions, such as depression or Alzheimer's disease. Doctors use blood tests and imaging brain scans to confirm this. Although brain damage is often irreversible, urgent vitamin B1 supplementation

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can stabilise the condition. Abstinence from alcohol, cognitive rehabilitation and psychological support are also necessary for these patients.

INTERNATIONAL

SURVEILLANCE OF VECTOR-BORNE DISEASES

Training in **medical entomology**

In sub-Saharan Africa, vector-borne diseases remain a public health priority: malaria continues to wreak havoc and dengue, fuelled by climate change and urbanisation, is on the rise.


© OneHealthSecure

Demonstration of mosquito trap installation.

There are still not enough teams trained in vector surveillance and control, leading to under-diagnosis and underestimation of dengue cases among the population. The response must involve an urgent strengthening of local capacity in medical entomology: to recognise mosquito species, identify them, monitor their populations, assess insecticide resistance and devise appropriate control strategies.

To address these gaps, a two-tiered structured training programme was organised jointly by the Instituts Pasteur of Paris, Tunis and Côte d'Ivoire, with funding from *Expertise France*. Divided into two distinct levels, it was designed for professionals responsible for and involved in vector control in six sub-Saharan African countries (Benin, Côte d'Ivoire, Djibouti, Chad, Togo and the Democratic Republic of the Congo). These courses, combining theoretical and practical training, aimed to improve their operational performance and to develop effective control strategies against malaria and arboviral diseases, such as dengue, tailored to local conditions.

FRANCE-BRAZIL COOPERATION

Reducing **dengue transmission**

The Institut Pasteur maintains numerous collaborations in Brazil. Since 2015, a tripartite agreement between the University of São Paulo (USP), Fiocruz and the Institut Pasteur has enabled the support of research projects in areas of strategic importance.

This year, a project examining the impact of climate change on health, with a focus on vector-borne diseases, was selected and launched in early 2026.

This project aims to assess the impact of temperature conditions on the stability and efficacy of two strains of the *Wolbachia* bacterium in order to optimise their long-term deployment.

Controlling the mosquito that transmits dengue, *Aedes aegypti*, using the *Wolbachia* bacterium represents a promising alternative to traditional strategies for reducing dengue transmission.

This project fits perfectly with the strategic priorities of Franco-Brazilian cooperation in research and those of each of the partner institutions.

** Study led by the teams of Anna-Bella Failloux (Institut Pasteur, Paris), Rafael Maciel de Freitas (Fiocruz) and Maria Anice Mureb Sallum (USP).*

ONE HEALTH

A unique network of experts to prevent epidemics

One Health Secure

The *OneHealthSecure* project, coordinated by the Institut Pasteur and funded by the European Union, aims to improve the surveillance of diseases transmitted by mosquitoes and ticks, in order to better anticipate them and mitigate their impact on populations. The project's unique feature is that it brings together specialists in human, animal and environmental health.

OneHealthSecure is a unique network of experts from various disciplines active in the Mediterranean region. It builds on more than ten years of collaborative work to improve the detection of these diseases. The network now brings together more than 400 experts from 110 laboratories and institutions across 23 countries in Europe, the Mediterranean, the Black Sea and the Sahel. The project offers training to strengthen the experts' skills. Events are regularly organised to enable them to exchange ideas and collaborate.

Thus, in November 2025, a meeting was held in Dakar, Senegal, bringing together experts from eight countries in the Maghreb and the Sahel.

During the week, a field day in a rural and forested area provided a practical demonstration of how joint surveillance across human, animal and environmental health operates. Participants attended several technical demonstrations: the capture and health monitoring of birds, the capture and identification of mosquitoes and ticks, as well as the laboratory analysis of the samples collected.

** More information on the* OneHealthSecure *project: www.onehealthsecure.com*

This large-scale network facilitates enhanced interaction and cooperation between professionals, making the "One Health" approach more tangible to better prevent diseases.


© OneHealthSecure

Demonstration of bird capture and health monitoring (measurements, weighing, blood sampling). The birds were then released.

EXPOSITION

The Pasteur Museum beyond its walls

The Paul Éluard Museum of Art and History in Saint-Denis is hosting the exhibition *"Believe and Heal. And Deliver Us from Evil"* from 27 May to 15 November 2026, for which the Pasteur Museum is lending several items from its collections. The exhibition has been designated an exhibition of national interest by the Ministry of Culture.

Through examples drawn from a variety of cultures, the exhibition explores the phenomenon of healing in its religious, magical, medical and scientific dimensions. It examines the links between the many forms of belief and the various methods of treatment found in our contemporary societies. The exhibition highlights a key historical turning point: in the 18th century, the tension between faith and superstition gradually shifted towards the realm of science. The exhibition, featuring contemporary works, draws on an exceptional collection of 285 items from the former Hôtel-Dieu and the apothecary's shop in Saint-Denis.

© Institut Pasteur / F. Gardy

The exhibition also sheds light on the history of the Hôtels-Dieu, places where medical care for the body was long intertwined with Christian rituals and the use of remedies from medicinal gardens, which contained aromatic plants cultivated for their medicinal properties.

For this occasion, the Pasteur Museum is lending 11 items from its collection, including a box of surgical and religious instruments used during the plague epidemics of the 18th and 19th centuries and a Nachet et Fils microscope that belonged to Louis Pasteur (*circa* 1853) – see photos.

For details of the cultural programme accompanying the exhibition, please visit the museum's website: *musee-saint-denis.com*

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Practical information

Venue

Paul Éluard Museum of Art and History
22 bis rue Gabriel Péri
93200 Saint-Denis

Contact

*33 (0)1 83 72 24 57 (reception and bookings) – **musee@saintdenis.fr***

Dates

27 May to 15 November 2026

Museum opening hours

***Tuesday to Friday**: 10:00 am – 5:30 pm*
***Saturday**: 11:00 am – 6:30 pm*
***Sunday**: 2:00 pm – 6:30 pm*

Late-night opening on the last Thursday of the month until 8.00 pm. Galleries close 15 minutes before the times listed above.
Closed on Mondays and public holidays.

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Your company and the 2026 apprenticeship tax

Supporting excellence in training for excellence in research

Every year, the **Institut Pasteur's Teaching Centre** welcomes and trains more than 900 students within its laboratories. Backed by cutting-edge research, this exceptional training programme is part of the **Institut Pasteur's historic mission: to disseminate scientific and medical knowledge and to train** the researchers, engineers and healthcare professionals who will tackle the major health challenges of tomorrow.

The training programmes offered address **the major scientific challenges of our time**: infectious diseases and pandemics, immunology and vaccinology, microbiology and virology, genetics and genomics, climate change and its impact on populations, as well as technological innovations in neuroscience and imaging.

Through the apprenticeship tax, your company can contribute to training the scientific talent that will drive tomorrow's major medical advances.

How? By selecting the Institut Pasteur's Teaching Centre as the beneficiary institution on the ***SOLTéA*** **platform from 26 May 2026.**

Thank you to the 2,270 companies that already support us!

Find out more

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GENEROSITY

The Institut Pasteur relies on donations

As donors and patrons of the Institut Pasteur, you know just how vital your support is to the fulfilment of our mission. At a time when research costs are constantly rising and public funding is declining, science must be championed.

This year, we have decided to raise awareness of our resources. Many people may think that the Institut Pasteur is a public body, funded by the state. However, we want to make it clear that without the generosity of our donors, Pasteurian research could come to a halt.
The fundraising campaign that you will receive in the post or see online, symbolised by an empty laboratory chair, highlights this worrying risk. It is only thanks to your support that we will be able to continue our work!

Under the French tax system, you can choose to use your tax to support research, whether you are liable for income tax or property wealth tax.

Find out more about the IFI: **ifi.pasteur.fr**

On the page *ifi.pasteur.fr*, you will find:

- details of the 2026 tax return schedule;
- a tax guide;
- a calculator to estimate the amount of tax relief you can claim by making a donation to the Institut Pasteur.

Please contact the major donors team with any questions regarding IFI tax matters and to set up your philanthropic project:
Morgann Guyomarc'h 33 (0)1 45 68 87 59 or **Caroline Cutté** 33 (0)1 45 68 81 04

TEMPORARY DONATION OF USUFRUCT

This donation involves transferring, by way of a notarised deed, the usufruct of a property (including income, interest payments or rent) to a foundation, such as the Institut Pasteur, for a minimum period of three years. It remains a highly attractive option for property owners liable for the IFI.

Indeed, the temporary donation of usufruct rights in respect of an investment property, for example, allows the donor to benefit from an exemption from the IFI tax on that property. There is no cap on this tax benefit. Consequently, the rent is received directly by the foundation for the duration of the donation, with the donor regaining full ownership of the property at the end of the donation period. This provision, together with the "IFI donation" mentioned above is the only way to maximise the tax benefits of the IFI linked to your generosity. For full details on how such a donation works, please do not hesitate to contact us so that we can provide you with personalised support throughout the process.

CONFERENCES

We are delighted to invite you to the Institut Pasteur

on Tuesday 23 June 2026

from 2:30 pm to 4:30 pm

"The promise of stem cells in regenerative medicine"

by Michel Cohen-Tannoudji

Epigenomics, Proliferation and Cell Identity Unit


© I. Caillard

"Unravelling the mysteries of ageing using stem cell models"

by Miria Ricchetti

Head of the Molecular Mechanisms of Pathological and Physiological Ageing Unit


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Free lectures (registration required).

Visit:

https://institutpasteur23juin.eventbrite.fr

Subscription and/or support form

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Institut Pasteur – 25 rue du Docteur Roux
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☐ I would like to receive, in complete confidentiality and without obligation, documentation on the possibilities of bequests, donations and life insurance policies for the benefit of the Institut Pasteur.

MY CONTACT DETAILS

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