

**Professor Jean-Bernard FOURTILLAN**

Chemical Engineer, Honorary Professor of Therapeutic Chemistry and Pharmacokinetics,  
Expert Pharmacologist-Toxicologist specialized in Pharmacokinetics with AFSSAPS (now ANSM)

# FILE 1

## Covid-19 coronavirus is not Sars-Cov-2 coronavirus

Covid-19 was made in France by French scientists at the Pasteur Institute then transferred to Wuhan where the French scientists let it escape, unbeknownst to scientists in the Wuhan laboratory and the Chinese government

When she says, "Covid-19 is not a Chinese virus! ",  
**CHINA DOES NOT LIE!**

Covid-19 helped spark a false pandemic, and spread fear across the world, to make us accept the Covid-19 vaccine.

By seeking to vaccinate the entire world population, the sponsors of this vaccine, Bill Gates and his allies, want to enslave and control us, pursuing two objectives:

- Control the entire world population after having vaccinated it, thanks to the deployment of 5G;
- Limit the world's population.

**This vaccine is very dangerous** because it will cause, in vaccinated people, deleterious immunodeficiency due, in particular, to the HIV sequences of its genome.

**MEN WORLDWIDE MUST REFUSE COVID-19 VACCINE  
THAT BILL GATES AND ITS ALLIES WANT TO IMPOSE ON US**

## Covid-19 coronavirus is not Sars-Cov-2 coronavirus

Covid-19 was made in France by French scientists at the Pasteur Institute, then transferred to Wuhan where the French scientists let it escape, unbeknownst to scientists in the Wuhan laboratory and the Chinese government

When she says, "Covid-19 is not a Chinese virus! ",

**CHINA DOES NOT LIE!**

The Covid-19 epidemic, improperly but deliberately called a pandemic, is not an epidemic caused by the Sars-Cov-2 coronavirus, as we try to make us believe.

The coronavirus Covid-19 is not the coronavirus Sars-Cov-2, but the result of a modification of its genome, in which are inserted, among others, 4 RNA sequences of the AIDS virus. This, in order to make a vaccine of which [Bill Gates](#) and his allies - at the forefront of which are [President Emmanuel Macron](#) and his government, the [Pasteur Institute](#) (as part of Sanofi), the 4 pharmaceutical vaccine makers (Sanofi, GSK, Pfizer, and MSD), with the complicity of most « healthcare » agencies (WHO, FDA, CDC, IOM, NIH, Health part of DHHS, french ANSM, EMEA, etc.), Google, Facebook, Tesla, and many corrupt Experts - want to impose the administration to 7 billions people.

Contrary to what the Pasteur Institute and the French government claim, **Covid-19 is not Sars-Cov-2 coronavirus**, but a Sars-Cov-2 coronavirus modified by genetic manipulation. Indeed, we provide the following proof thereafter: the Covid-19 coronavirus was made, at the Pasteur Institute in France, without the knowledge of Chinese researchers of the Wuhan laboratory and of the Chinese government, by French researchers from the Institut Pasteur.

These latters carried out, probably within the P4 laboratory of the Institut Pasteur of Lyon, a manipulation of the genome of the coronavirus Sars-CoV-2, which they had taken from the laboratory in Wuhan.

**They then transferred the new modified coronavirus, Covid-19, to the Wuhan laboratory, from which they let him escape voluntarily, without the knowledge of Chinese researchers and the Chinese government.**

**Here is what the French researchers at the Institut Pasteur have done:**

### **1 - Transformation of the Sars-CoV-2 coronavirus into Covid-19**

The **Sars-CoV-2** coronavirus is an RNA virus. Using appropriate molecular tools, **they inserted, into Sars-CoV-2's spike glycoprotein** (so-called glycoprotein S, for « Spike »), **4 RNA fragments from HIV**, the AIDS virus, which correspond to short segments of amino acids found in **gp120** and **Gag of HIV-1** (see attached: reference 1 and document 1). Of course, these sequences are not present in any other coronavirus reported to date. **As Dr. Frédéric Tangy indicates in his interview** (document 2), more recent techniques allow immunity to be induced by inserting viral nucleic acids (RNA, DNA) on suitable vectors. Thus, they were able to insert the Nucleic Acid-Ribo sequences (RNA) of HIV into the genome of Sars-Cov-2 (remember that the genome of Sars-Cov-2 is RNA).

## **2 - Manufacture of the Covid 19 vaccine (document 2)**

The complete and detailed « recipe » for the Covid 19 vaccine was given to us by Dr Frédéric Tangy, head of Vaccine Innovation at the Institut Pasteur, in an interview with the newspaper Paris Match, in the 9-15 edition April (see document 2, in attachments).

Thus, as explained perfectly to us by Dr. Frédéric Tangy - who is decidedly very talkative - the spike glycoprotein of Covid-19, which contains the 4 RNA sequences of HIV - which is clear from the group's analysis of Indian researchers, but was hidden by researchers at the Institut Pasteur - is intended, he said, to induce immunity in the vaccine, serving as an antigen after insertion into the genome of the attenuated measles virus ( who remember it is an RNA). But, obviously, it does not tell us that the viral nucleic acids inserted into the genome of the attenuated measles virus are those of HIV. And, since it is not in the Sars-CoV-2 coronavirus genome, one wonders where it came from. Dr Frédéric Tangy, who gave this interview (document 2) before that of Pr Luc Montagnier (document 1), is too talkative.

**3 - Transfer of the new modified coronavirus, Covid-19, to the Wuhan laboratory, from which they let him escape voluntarily, without the knowledge of Chinese researchers and the Chinese government.**

## **IMPORTANT ADDITIONAL INFORMATIONS**

### **1 - The abnormal and strange behavior of President Emmanuel Macron and his government during the Covid epidemic crisis 19**

In the concert of the Heads of State, guarantors, by their functions, of the future and the health of the peoples for which they are responsible, President Emmanuel Macron is the only one to have an incomprehensible, irresponsible and harmful attitude for the French people.

Many additional elements allow us to confirm, if necessary, that this health crisis was triggered by French researchers from the Pasteur Institute, with the complicity and help of the French government, Bill Gates and laboratories pharmaceutical vaccine manufacturers, unbeknownst to Chinese researchers and the Chinese government:

- As soon as COVID 19 was released in Wuhan, the Chinese authorities immediately took the necessary measures to stop the epidemic: wearing masks for the entire Chinese population, strict confinement, use of hydroxychloroquine and screening for the virus while practicing tests across the population. To date, the epidemic has been completely contained in China;

- Conversely, the French health authorities, the Minister of Health Agnès BUZYN, the Director General of Health, Jérôme SALOMON, the new Minister of Health, Olivier VERAN, the President MACRON and his entourage, at the appropriate times, have everything done so that we can not stop the epidemic, while spreading and propagating fear in the population, with the announcement every evening of an exaggerated morbidity, by attributing to Covid-19 deaths due to others pathologies, not documented because of the lack of tests, contrary to what the Chinese Health authorities have done, as follows:

- Agnès BUZYN put hydroxychloroquine on List II poisonous substances in January 2020, claiming that it was toxic, which is incorrect. This has made it impossible to buy hydroxychloroquine without a medical prescription, when it has been sold over the world for over 60 years. In addition, it is surprising that this inexpensive drug, manufactured by Sanofi, the vaccine maker, is currently out of stock in pharmacies;

- Unlike all the other countries in the world, the authorities have done everything to ensure that we do not have masks;

- Unlike all the other countries in the world, the authorities have done everything to ensure that we do not have screening tests;

- The same officials of the Health Authorities, with President MACRON, his gouvernement, and allies, did everything to criticize Professor Didier RAOULT, who is the only specialist in infectious diseases, of world reputation, in France. While he has achieved spectacular results and stopped the epidemic in Marseille area, with the treatment of hydroxychloroquine and Azithromycin, known for its effectiveness and low cost in all other countries of the world. It should be noted that Professor Raoult does not have the same goals as Bill Gates and his allies. He even declared, in an interview with the Paris Match newspaper, edition from April 30 to May 6, 2020, that: « *finding a vaccine against a disease that is not immunizing is an idiotic challenge. Our luck is close to zero!* ». Indeed, he knows, according to the declarations of Professor Luc Montagnier, confirmed by both Indian researchers, Professor Peter Chumakov, and Professor Tasuku Honjo, that the current pandemic is due to Covid 19, which is an artificial virus made by French researchers, rather than the Sars-CoV-2 Coronavirus, as we are led to believe. In fact, in Covid-19, researchers from the Pasteur Institute inserted HIV RNA sequences to make the virus immune, as explained by Dr Frédéric Tangy in Document 2 (part highlighted in yellow).

- Containment was imposed on the population in an authoritarian manner, without any justification, in order to spread fear, to prevent us from communicating with each other, rather than in a salutary spirit to stop the spread of the virus, as the Chinese did.

## **2 - The Covid-19 vaccine is a deadly poison. Its administration to humans constitutes a crime against humanity, to which men all over the world must oppose with the utmost firmness**

As stated by Dr. Frédéric Tangy, head of vaccine innovation at the Pasteur Institute (see document 2), the vaccine will be made by inserting the Covid-19 S glycoprotein into the genome of the attenuated measles virus. However, the decoding of the Covid-19 genome by specialists (document 1), formally reveals the presence of 4 HIV sequences, perfectly identified, which give the vaccine deadly properties associated with an immunodeficiency inherent in the RNA sequences of HIV. In addition, it is certain that this vaccine contains the necessary tattooing material necessary for the chip, which will allow the identification and the permanent control of the vaccinated individuals, thanks to the deployment of 5G.

## **3 - Clinical trials of the Covid-19 vaccine have started completely illegally**

The process for making a Covid-19 vaccine by the Institut Pasteur and its financing by CEPI, was announced on 03/19/2020: [CEPI finances the development of a vaccine against Sars-CoV-2, a project carried out by the consortium of the Institut Pasteur, THEMIS and the University of Pittsburgh](#)

**The first clinical trials of the Covid-19 Vaccine have started at the Jennifer Institute at the University of Oxford** (official announcement dated 04/24/2020):

- Video (04/24/2020): [First clinical trials of the Covid-19 vaccine, carried out in healthy volunteers at the University of Oxford](#)

- Article from the newspaper Marianne (04/30/2020): [Vaccine against Covid-19? It may be soon thanks to an Italian-English collaboration.](#)

As an Expert Pharmacologist-Toxicologist specialized in Pharmacokinetics, I carried out, at the Biomedical Research Center CEMAF (my own company), regulatory phase I studies in humans for 30 years. These studies, it should be remembered, are mandatory for the registration and marketing authorization of new drugs. CEMAF was a Phase I Center, approved by Healthcare Agencies around the world, where I carried out pharmacokinetic and tolerance studies for new drugs when they were first administered to humans, on behalf of pharmaceutical laboratories.

I would like to recall, below, **the mandatory regulatory prerequisites to be fulfilled, to be authorized to administer a new drug, such as a new vaccine, for the first time in humans, that is to say enter this new vaccine in phase I.**

The preclinical file for a new vaccine must contain, as a minimum, the following data:

**1- Scientific file:**

- Galenical dossier, describing the method of vaccine making, carried out according to Good Manufacturing Practices (GMP), certified and signed by an adequate expert;

- Analytical file, describing the nature and concentrations of all the constituents of the new vaccine (active ingredients and excipients), carried out according to Good Laboratory Practice (GLP), certified and signed by an appropriate expert.

**2- Toxicological file**, indicating the results of regulatory preclinical toxicological studies carried out in animals (rats, dogs), evaluating according to standardized standards, the toxicity of the new vaccine. This toxicological file must be certified and signed by an expert toxicologist.

It should be remembered that a new vaccine, like any new drug, which proves to be toxic in animals, cannot be administered to humans. This is the case with vaccines that contain aluminum or Thimerosal, which are administered at doses far above the doses toxic to humans (see File 2).

**During the development stages of a new Covid-19 vaccine, the scientific and toxicological files, certified by the appropriate experts, must be communicated to the following persons:**

- Committee for the Protection of Persons Involved in Biomedical Research (phase I trial in healthy volunteers), under the supervision and responsibility of the Healthcare Agencies of the countries where the phase I trial takes place. The trial cannot not take place without the favorable opinion of the Protection Committee and the authorization of the Healthcare Agency of the country where the test takes place.

- Subjects young adult volunteers, in good health, who participate in the phase I trial. These subjects must sign a certificate of free and informed consent, after having read all of the scientific and toxicological files made available to them by the sponsors of the study (Pharmaceutical laboratories, new vaccine making).

**It is certain that these regulatory prerequisites, necessary for the protection of individuals will not be communicated, for clinical trials of the Covid-19 vaccine, in the same way as they have never been for all the other vaccines marketed in today (see File 2), for undoubtedly unavoidable reasons.**

This has been the case for over 30 years, as recognized by the American government, most of the "healthcare" agencies (WHO, FDA, CDC, IOM, NIH, Health part of DHHS, French ANSM, EMEA, etc.), and pharmaceutical vaccine makers (Sanofi, GSK, Pfizer, and MSD), during the lawsuit won by Robert F. Kennedy Jr ([historic lawsuit lost by the American government](#)).

## CONCLUSION

Men around the world must open their eyes and understand that the real Sars-CoV-2 Coronavirus poses no danger to humanity, unlike Covid-19, the result of an artificial manipulation of the Sars-Cov-2 genome. Covid-19 helped spark a false pandemic, and spread fear across the world, to make us accept the Covid-19 vaccine.

By seeking to vaccinate the entire world population, the promoters of this vaccine against Covid-19, want to enslave and control us, pursuing two objectives:

- Control the entire world population after having vaccinated it, thanks to the deployment of 5G, because this vaccine contains the tattooing material necessary for the chip; which will allow the identification and permanent control of vaccinated individuals;
- Limit the world's population. **This vaccine is very dangerous** because it will cause, in vaccinated people, a deleterious immunodeficiency due, in particular, to the HIV sequences of its genome.

## **MEN WORLDWIDE MUST REFUSE VACCINATION AGAINST COVID-19 THAT BILL GATES AND ITS ALLIES OF THE NEW WORLD ORDER WANT TO IMPOSE ON US**

### **References and documents**

#### **Reference 1** :

Prashant Pradhan, Ashutosh Kumar Pandey, Akhilesh Mishra, Parul Gupta, Praveen Kumar Tripathi, Manoj Balakrishnan Menon, James Gomes, Perumal Vivekanandan1 and Bishwajit Kundu - [Uncanny similarity of unique inserts in the 2019-nCoV spike protein to HIV-1 gp120 and Gag](#) (January 31,2020)

*BioRxiv preprint doi: <https://www.biorxiv.org/content/10.1101/2020.01.30.927871v2>. This version posted January 31, 2020. The copyright holder for this preprint. (which was not certified by peer review) is the author/funder. It is made available under a [CC-BY-NC-ND 4.0 International license](#).*

#### **Document 1**

### **Covid-19 coronavirus is not Sars-CoV-2 coronavirus**

Simultaneously with Professor Luc Montagnier, the analysis of the Covid 19 genome has been clearly confirmed by various authors:

- [A group of Indian researchers has published a complete analysis of the Covid-19 genome](#), which shows, in a formal way, that the genome of this coronavirus contains 4 nucleic acid sequences (RNA) of the HIV virus, the AIDS virus.

- The well-known [Russian microbiologist Professor Peter Chumakov revealed whether the novel Coronavirus Covid-19 was man-made](#). But he clarified that it was not the intention of Chinese scientists to deliberately create a man-made killer, and he said that their aim was only to study the pathogenicity of the virus.

- [Dr. Tasuku Honjo, Japanese Professor of physiology, winner of the 2018 Nobel Prize in Medicine, says that the Coronavirus Covid-19 is not natural, but artificial](#).

On the Covid-19, Professor Tasuku Honjo said: « *If it was natural, it would not have affected the whole world like that. Because the temperature is different in different countries. It would only have affected countries with the same temperature as China. Instead, it spreads in a country like Switzerland, the same way it spreads in desert areas, whereas if it were natural, it would have spread in cold places, but would have died in hot places. I have done 40 years of research on animals and viruses. This coronavirus is not natural. It was made and it is completely artificial... If what I say today turns out to be false, now or even after I die, the government can withdraw my Nobel Prize. But China is lying and this truth will one day be revealed to everyone* ».

## **Interview with professor Luc Montagnier by doctor Jean-François Lemoine**

Health site: Medical Frequency and Why Doctor  
(Thursday April 16, 2020)

### **Dr Jean-François Lemoine**

Hello, it's Thursday, April 16. Very special edition, because today it is devoted to a single, exclusive, but important testimony. At a time when the Chinese version of the Coronavirus eruption (COVID 19) in our lives is particularly undermined, on all sides, and when doubt begins to do its work, Professor Luc Montagnier sets off a bomb, exclusively, in our newspaper. Let us not forget that he is a Nobel Prize in medicine, and he tells a whole other story than the official Chinese version: bat, popular market of Wuhan, bad luck,... to return the origin to the virology laboratory of Wuhan, where some research would have crossed limits, probably in the last quarter of 2019, with the global consequences that we are measuring today.

So listen to it. The argument is supported. Impossible at our level to verify it. And, of course, I asked him the question of conspiracy which will inevitably be raised.

Professor Luc Montagnier, hello!

This Coronavirus (COVID 19) has been decoded relatively easily compared to others, such as that of HIV which won you your Nobel Prize in Medicine; but according to you this decryption is incomplete.

### **Pr Luc Montagnier**

Wuhan's laboratory has specialized in Coronaviruses since the early 2000s. They have expertise in this area, which prompted me to look closely at the description of the genome of this Coronavirus (COVID 19). That is to say the nucleic acid sequence of this virus which is an RNA. This is how this analysis began, which was made not only by me, but also, above all, by my mathematician colleague Jean-Claude Pérez, who now continues to develop what I would call a bio-mathematics, that is to say display the application of mathematics to biology. So he actually delved into the smallest details of the COVID 19 genome sequence. We were not the first, since a group of Indian researchers published, or rather tried to publish, an analysis which shows that the complete genome of this new virus, Coronavirus, has sequences from another virus which, surprisingly, for me, is that of another virus which is HIV, the AIDS virus. This was published by the Indian group. He was forced to retract, because there is enormous pressure on all this, to prevent the truth from being revealed. But scientific truth always ends up dominating, with the emergence of everything we want to hide.

### **Dr Jean-François Lemoine**

You can understand that finding pieces of HIV in this Coronavirus must have troubled you; but is it not simply a natural mutation of this virus in the body of an AIDS patient?

### **Pr Luc Montagnier**

No ! because, if you want, to insert an HIV sequence into the genome of this Coronavirus, you need molecular tools. The patient is not going to do it; he's the laboratory man. A few years ago it was tricky, but now it's much easier.

### **Dr Jean-François Lemoine**

This natural hypothesis having been lifted, it can only be a deliberate maneuver

### **Pr Luc Montagnier**

So the assumption is that this virus leaves the Wuhan laboratory, which is a high security laboratory. This virus has escaped, perhaps its promoters, and therefore the history of the fish market is a great legend, if you ask me. There is very little chance that this is possible.

Initially they worked on a model of Coronavirus which is a bat virus, and it is this virus that they modified.

**Dr Jean-François Lemoine**

But was their goal to make a biological weapon, an aggressive virus, or, what would be more tolerable, to make an AIDS vaccine?

**Pr Luc Montagnier**

I think, and this is the hypothesis which seems to me the most rational, that they wanted to make a vaccine against HIV, using a Coronavirus which, in principle, can be attenuated, and not give disease, like vector carrying antigens, that is to say parts of molecules of the AIDS virus, which can be used for a vaccine.

**Dr Jean-François Lemoine**

So this is the story of the watered sprinkler, tragic version!

**Pr Luc Montagnier**

Here ! It's a sorcerer's apprentice job, if you will.

We know a lot about molecular biology. We can do DIY; but we forgot, or rather we did not perceive, the fact that with our ancestors we have been in nature for millions of years. Nature does not tolerate anything, that is to say that there are harmonizations. This is what my colleague Jean-Claude Pérez has developed a lot in recent years; nature does not tolerate any molecular construction, or, if it suffers, it tries to eliminate them.

**Dr Jean-François Lemoine**

And that's what's going on. According to you, nature offers us a catch-up.

**Pr Luc Montagnier**

So, this is the second part of my message. What is happening is that nature eliminates these foreign bodies from the genome of this Coronavirus (COVID 19), and we are witnessing a number of spectacular mutations, so-called deletions, by this remove pieces of HIV that have been altered. Nature spontaneously removes them, as this Coronavirus passes from one patient to another. We see it now, especially on the American patients who were the last infected, those on the west Pacific coast of the United States. In Seattle, for example, the COVID 19 that infects begins a huge collapse, by deletions in this small part of its genome.

**Dr Jean-François Lemoine**

A glimmer of hope!

**Pr Luc Montagnier**

A glimmer of hope that suggests that, even if we do nothing, things will get better. But still at the cost of many deaths.

I have a proposal to speed up these healings. But I need a lot of means. I think it is possible with interfering waves that would eliminate, including in patients, the HIV RNA sequences inserted into the genome of the COVID 19 Coronavirus.

**Dr Jean-François Lemoine**

Everything you have just explained to us, Professor Montagnier, is both clear but also terrifying. You have the credibility of the recognized researcher and the aura of your Nobel Prize. But don't we risk accusing you of being a conspirator?

**Pr Luc Montagnier**

No, the conspirators are more like the reverse camp, the one who hides the truth. I have a lot of friends in China, and I value China. I spent several weeks in China just before the story of the Coronavirus.

I think the Chinese government would make things much easier by recognizing what happened in its high security laboratory in Wuhan. Anyway, the truth will come out. What

I said about the insertion of foreign sequences, there are not only the sequences of the HIV retrovirus (AIDS virus), there are also other sequences of the germ of malaria, etc.

So all of this indicates that a few people - I don't know who, it's not my role to accuse anyone - may have had the idea, perhaps, of getting an AIDS vaccine, inserting HIV sequences into the genome of this Coronavirus, which led to COVID 19.

If the Chinese government recognizes it, it would make things easier, but it is up to them to shoulder their responsibilities. I repeat that the fact of currently banning the publication of Indian researchers on the origin of this coronavirus (COVID 19), without having the visa of the Chinese government authorities, is an aberration, and, above all, it gives the impression that science now does not depend on the truth, nor on the reality of things, but on the will of people.

It's very, very, bad for the reputation of science. No one will trust what you are told about science when the results are made, right.

This is a very bad position, and I hope that the Chinese government will go all the way. They are starting to recognize that work has been done on the Coronavirus. You should know that there has been significant American financial assistance, at least, and perhaps also scientific, to these Chinese teams. So the origin of this case is not only Chinese. My goal is not to make a police investigation and to accuse people. I think it is a mistake of the Chinese government: Errare Humanum Est!

Another pressing example: Iran killed many people on a plane, mistakenly. They recognized him.

**Dr Jean-François Lemoine**

Thank you Professor Montagnier. It's clear and chilling!

---

## Document 2

### Interview of Dr Frédéric Tangy, head of Vaccine Innovation at the Institut Pasteur, with the newspaper Paris Match, in the 9-15 edition April

Dans cet interview Dr Frédéric Tangy nous apporte la preuve formelle de l'implication des scientifiques français de l'Institut Pasteur, soutenus par Bill Gates et ses alliés :

[President Emmanuel Macron](#) and his government, the [Pasteur Institute](#) (as part of Sanofi), the 4 pharmaceutical vaccine makers (Sanofi, GSK, Pfizer, and MSD), with the complicity of most of « healthcare » agencies (WHO, FDA, CDC, IOM, NIH, Health part of DHHS, french ANSM, EMEA, etc.), and many corrupt experts

Note that Doctor Frédéric Tangy was cited as an inventor in:

- the European patent: [EP 1 694 829 B1](#) (*Nouvelle Souche de Coronavirus Associé au Sras et ses Applications*) ;

- the United States Patent [US 8,343,718 B2](#) (*Novel Strain of Sars Associated Coronavirus and Applications Therof*).

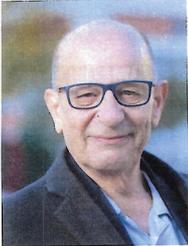
Paris Match du 9-15 Avril 2020

VOTRE SANTÉ

# LE VACCIN

## UNE COURSE CONTRE LA MONTRE !

Compte tenu de la pandémie de **Covid-19** et de sa gravité, la page santé sera entièrement consacrée à ce sujet dans les semaines à venir, jusqu'à extinction du risque.



**Le Dr Frédéric Tangy**, responsable du laboratoire d'innovation vaccinale à l'Institut Pasteur, explique les diverses voies possibles pour élaborer un vaccin contre le Covid-19 et celle qu'il entend privilégier.

Interview **Dr Philippe Gorny**

**Paris Match.** De nombreux projets vaccinaux sont en cours dans divers pays : suivent-ils des approches différentes ?

**Frédéric Tangy.** Il y a plus de 30 projets en cours dans le monde ! Beaucoup proviennent de petits laboratoires de recherche. Selon moi, seuls quatre ou cinq grands acteurs auront la capacité financière et technique de mettre à la disposition des populations exposées un vaccin fiable et efficace. Les projets sont tous actuellement à peu près au même stade. Ils utilisent en revanche des approches différentes. Les meilleurs vaccins, tels ceux contre la variole, la tuberculose, la rougeole ou encore les oreillons, sont élaborés à partir d'un virus vivant atténué : ces vaccins, le plus souvent, permettent d'être protégés à vie après une seule administration ou injection. D'autres peuvent être élaborés à partir de virus inactivés (aussi dits inertes) ; parfois à partir de protéines virales, que l'on peut produire à l'identique par génie génétique (protéines dites recombinantes) ou extraire de cultures cellulaires infectées par le virus contre lequel on veut se prémunir. Il faut ensuite, pour que ces protéines suscitent une réaction immunitaire, qu'elles soient portées par un vecteur qui là encore est un virus, mais non pathogène pour l'homme (par exemple, un adénovirus vivant ou inerte). Enfin, des techniques plus récentes cherchent à induire une immunité à partir d'acides nucléiques viraux (ARN, ADN) pour lesquelles différents vecteurs adéquats existent. Il faut savoir que la fabrication d'un virus vivant atténué est très longue (deux ans), celle d'un virus inactivé assez longue également, avec le risque d'être parfois trop peu immunogène ; quant à celle des autres techniques, elle est plus rapide mais beaucoup plus incertaine en termes d'efficacité, avec de surcroît le besoin d'injections répétées et un coût final bien plus élevé.

**Quelle est l'approche de l'Institut Pasteur ?**

Notre choix se porte sur la technique des virus atténués, la plus fiable, la plus efficace et celle pour laquelle on possède le plus grand recul. Elle s'appuie chez nous sur le virus vaccinal atténué de la rougeole, car nous disposons d'une souche de ce type immédiatement disponible, qui a déjà permis l'élaboration d'une dizaine de vaccins différents. Le vaccin contre la rougeole est utilisé dans le monde depuis quarante ans. Il est totalement sûr : plus de 3 milliards d'êtres humains en ont déjà bénéficié. Le principe va consister à utiliser comme antigène la protéine du virus

Sars-CoV-2 (dite protéine S pour "Spike", qui lui permet de pénétrer dans les cellules humaines), à l'insérer dans le génome du virus atténué de la rougeole qui a la capacité de le présenter aux cellules immunitaires pour identification dans sa forme la plus naturelle, ce qui n'est pas le cas de la plupart des autres technologies. Ainsi pourra-t-on induire une immunité anti-Covid-19 optimale chez les vaccinés après une seule injection. L'Institut Pasteur est soutenu dans cet effort par la Cepi (Coalition for Epidemic Preparedness Innovations), une organisation financière internationale dédiée au développement de vaccins contre les infections émergentes. Nous sommes aussi entourés de plusieurs partenaires techniques (la société Themis, à Vienne, l'université de Pittsburgh...).

**Où en êtes-vous ? Quelles étapes vous reste-t-il à franchir ?**

La fabrication de notre vaccin devrait prendre encore trois mois. Les études de tolérance et de mesure de l'immunité induite chez des sujets sains (phase 1) débiteront en septembre. Elles seront suivies d'études cliniques dites de phase 2 en fin d'année-début janvier, puis par une phase 3 (qui inclura un vaste nombre de sujets). Cela permettrait de rendre le vaccin disponible pour les Français vers le milieu de l'année 2021, projection conforme aux prévisions les plus rapides de l'OMS en la matière.

**Comment selon vous va évoluer le Covid-19 ?**

Je ne peux le dire. Mais si on observe le parcours du virus Sras par exemple, on note qu'il n'a pas été sensible aux variations climatiques : il s'est répandu de novembre 2002 à juillet 2003, puis de septembre 2003 à mai 2004. S'il en est de même avec le Covid-19, l'épidémie pourrait durer encore de nombreux mois. Quant à sa mutation, elle est possible, mais peu probable maintenant. Tant que le Covid-19 trouvera des humains non immunisés à contaminer facilement pour se développer, le ne devrait pas muter.

**Votre conclusion ?**

Pasteur disait : "Le meilleur docteur, c'est la nature. Elle soigne presque toutes les maladies et ne critique jamais ses collègues." Pour bien stimuler le système immunitaire, il faut lui donner ce qu'il sait reconnaître facilement. Si on lui donne une nature modifiée, les réponses immunitaires sont moins performantes voire mauvaises. Je crois beaucoup au vaccin que nous allons produire, car son approche est plus naturelle que celle des autres projets en cours, qui ont néanmoins le mérite d'exister. ■



2 PARISMATCH DU 9 AU 15 AVRIL 2020

**English translation**  
Paris-Match article from April 9-15, 2020

# **THE VACCINE**

## **A RACE AGAINST TIME!**

### **Dr. Frédéric Tangy**

Head of the vaccine innovation laboratory at the Institut Pasteur, explains the various possible ways to develop a vaccine against Covid-19, and the one he intends to favor.

Interview with **Dr Philippe Gorny**

### **Paris Match. Many vaccine projects are underway in various countries: do they follow different approaches?**

**Frédéric Tangy.** There are more than 30 projects underway around the world! Many come from small research laboratories. In my opinion, only four or five major players will have the financial and technical capacity to make a reliable and effective vaccine available to exposed populations. The projects are all currently at about the same stage. They do, however, use different approaches. The best vaccines, such as those against smallpox, tuberculosis, measles or mumps, are made from a live attenuated virus: these vaccines, most often, allow them to be protected for life after a single administration or injection. Others can be made from inactivated viruses (also called inert); sometimes from viral proteins, which can be produced identically by genetic engineering (so-called recombinant proteins) or extracted from cultures infected with the virus against which we want to protect. Then, for these proteins to elicit an immune reaction, they must be carried by a vector which again is a virus, but not pathogenic for humans (for example a living or inert adenovirus). Finally, more recent techniques seek to induce immunity from viral nucleic acids (RNA, DNA) for which different suitable vectors exist. It should be noted that the production of a live attenuated virus is very long (two years), that of an inactivated virus quite long too, with the risk of being sometimes too weakly immunogenic; when that of other techniques, it is faster but much more uncertain in terms of efficacy, with in addition the need for repeated injections and a good final cost higher.

### **What is the Institut Pasteur's approach?**

Our choice is based on the attenuated virus technique, the most reliable, the most effective and the one for which we have the greatest perspective. It is based here on the attenuated vaccine virus of measles, because we have a strain of this type immediately available, which has already allowed the development of a dozen different vaccines. The measles vaccine has been used worldwide for forty years. It is completely safe: more than 3 billion people have already benefited from it. The principle will consist in using as an antigen the protein of the Sars-Cov-2 virus (known as protein S for "Spike", which allows it to enter human cells), to insert it into the genome of the attenuated measles virus which has the ability to present it to immune cells for identification in its most natural form, which is not the case with most other technologies. Thus we can induce optimal anti-Covid-19 immunity in the vaccinated after a single injection. The Pasteur Institute is supported in this effort by Cepi\* (Coalition for Epidemic Preparedness Innovations), an international organization dedicated to the development of vaccines against emerging infections. We are also surrounded by several technical partners (the company Themis\*\*, in Vienna, the University of Pittsburgh...).

**Where are you ? What steps are you left to take?**

The manufacturing of our vaccine should take another three months. Tolerance and induced immunity studies in healthy subjects (phase 1) will begin in September. They will be followed by so-called phase 2 clinical studies, at the end of the year-beginning of January, then by a phase 3 (which will include a large number of subjects). This would make the vaccine available to French people in the middle of 2021, a projection that is in line with the WHO's most rapid forecasts.

**How do you think the Covid-19 will evolve?**

I cannot say. But if we observe the course of the SARS virus for example, we note that it was not sensitive to climatic variations: it spread from November 2002 to July 2003, then from September 2003 to May 2004. If the same is true with Covid-19, the epidemic could last for many more months. As for his mutation, it is possible, but unlikely now. As long as Covid-19 finds unimmunized humans to easily contaminate to develop, it should not mutate.

**Your conclusion?**

Pasteur said: "The best doctor is nature. She treats almost all illnesses and never criticizes her colleagues ". To stimulate the immune system well, you have to give it what it can easily recognize. If given a modified nature, the immune responses are less efficient or even bad. I believe very much in the vaccine that we are going to produce, because its approach is more natural than that of other ongoing projects, which nevertheless have the merit of existing.

---