**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 financial 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…).

**Frédéric TANGY and Hussein Y. Naim**. *Live Attenuated Measles Vaccine as a Potential Multivalent Pediatric Vaccination Vector*. VIRAL IMMUNOLOGY, Volume 18, Number 2, 2005, Pp. 317-326

**ABSTRACT**

Live attenuated RNA viruses make highly efficient vaccines. Among them is the **live attenuated measles virus (MV) vaccine** that has been given to a very large number of children and has been shown to be highly efficacious and safe. MV vaccine induces a life-long immunity after a single injection or two low-dose injections. It is easily produced on a large scale in most countries and **can be distributed at low cost**. Reversion to pathogenicity has never been observed with this vaccine. For all of these characteristics, developing of MV vaccine vector as a multivalent vaccine to immunize children against both measles and other infectious agents such as **human immunodeficiency virus (HIV)**, flaviviruses, **or malaria** might be **very promising for worldwide use**. As MV vaccine is inexpensive to produce, the generation of recombinant vaccines may remain affordable and attractive for the developing word. In this article, we describe the **development of MV vector** and present some recent data showing the **capacity of recombinant MV vaccine to express various proteins from HIV** and West Nile virus. In addition, the ability of recombinant MV to induce specific immune responses against these different pathogens are presented and discussed.