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## **The essential role of therapeutic chemistry in the treatment of viral diseases**

The therapeutic arsenal for containing viral epidemics has a double foundation: vaccination and antiviral drugs. Depending on the nature of the virus, one of the two approaches may be ineffective. This is the case with AIDS, a disease for which no effective vaccine has yet been developed and whose control currently depends on some twenty chemical drugs, "small molecules" capable of inhibiting the functioning of viral enzymes. Such inhibitors are also very effective in the treatment of hepatitis C.

To date, it is clear that there are no chemical antiviral drugs effective against SARS-CoV-2, due to the lack of basic and industrial research in this field. The rapid development of effective vaccines against SARS-CoV-2, on the other hand, gives us hope of emerging from this pandemic, in particular with the new mRNA vaccines. The design and production of this new class of vaccines is the result of the successful convergence of molecular and cellular biology with therapeutic chemistry. It was achieved by using enzymes to synthesize nucleic acids from basic chemical entities and advanced physicochemical knowledge. Lipid-based nanocarriers allow the encapsulation of unstable mRNA and its delivery to the cytoplasm. Without the contribution of these scientific fields, and more particularly of therapeutic chemistry, these vaccines would not have been developed.

The viral pandemic we are experiencing is a reminder of the importance of developing antiviral and vaccine research at the same level. This implies financial efforts that would have been considered costly before the pandemic, but whose amounts are derisory compared to the human and economic costs of the health crisis that we have been enduring for more than a year.

This health crisis has shown that France is lagging behind in the development of vaccines and we must ask ourselves why this is. As for drugs, although our country has long been a land of drug creation, it has not produced a single drug to treat AIDS, because of lack of support in the field of antivirals. This is all the more unfortunate when one considers that nearly two-thirds of the new drugs developed every year are of chemical origin and provide the bulk of treatments for common diseases.

Has the country of Pasteur, who, we should remember, was a chemist, lost its grip on the design of vaccines and chemical drugs? To ensure continuity between basic research and therapeutic innovation, it is essential to set up a vast national program for the design and development of antiviral chemical agents in support of researchers in molecular disciplines. It is essential to trust our talented researchers, pharmacists and physicians and to avoid suffocating them with unnecessary tasks. If we do not give hope to our young talents, they will be ready to turn to countries that innovate. These are not far away; several European countries have just demonstrated this.

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