



# IMMUNOWATCH

SPECIAL EDITION - 4TH UPDATE 14/12/20



# COVID-19



# INTRODUCTION

## MabDesign and the COVID-19 pandemic

**T**he COVID-19 pandemic was matched by an unprecedented mobilisation of the French immunotherapy network and the pharmaceutical industry at large. Indeed, at the time of publication, three French companies already have preventive and/or therapeutic candidates currently undergoing Phase III clinical trials. In parallel, several bioprocessing sites across France have secured contracts for the production of both drugs and vaccines against SARS-CoV-2. These tremendous results were made possible through accelerated R&D as well as production and distribution logistics combined with facilitated access to information, resources and potential collaborators. MabDesign has been continuously adapting its actions and services to further support and enhance this nationwide pandemic response. Our latest and ongoing contribution to the fight against COVID-19 is through this special edition of Immunowatch and its regular updates.

**M**abDesign's Immunowatch is a one-of-a-kind information monitoring newsletter in the field of immunotherapy which aims at providing members of our association with the most recent and relevant data gathered or generated through the key expertise of MabDesign and its collaborators in scientific research, business intelligence, market analysis and intellectual property. Its original format has been modified to cater for the fast evolution of the response to the COVID-19 pandemic and allow rapid and pertinent updates. Immunowatch is done in collaboration with the MAbMapping Unit of the Ambition Recherche & Développement (ARD) Biomédicaments 2020 Phase II programme, funded by the Centre Val de Loire region.



**BIOPHARMACEUTICALS**

*Innovation Dynamics in Health  
IN REGION CENTRE-VAL DE LOIRE*





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## COVID-19: Message from MabDesign president, Francis Carré



*Amidst these singular times of health crisis linked to the COVID-19 pandemic, pharmaceutical companies and the scientific community at large were both expected to rapidly rise up to the challenge of providing a timely yet adequate response in terms of research findings on SARS-CoV-2 together with solutions such as diagnostics tools, treatments and vaccines. And the pandemic response was not long in coming. Within weeks of WHO's official statement on the novel coronavirus beginning of 2020, there were already reports of pharmaceutical and biotechnology companies initiating R&D of innovative or repurposed products and services. Despite lockdowns in several countries and other restrictions, we have witnessed an 8-fold increase in the COVID-19 therapy and vaccine pipeline since April combined with an increasing number of diagnostic tools receiving market approval. France's immunotherapy network has significantly contributed to these achievements in the fight against COVID-19. In parallel, a growing number of major collaborations, deals and licensing agreements between companies worldwide, including French ones, is further contributing to finding efficient solutions to the pandemic. Interestingly, these have transcended the pharmaceutical field. We, at MabDesign, have been actively contributing to the COVID-19 response by amending our services and the format of our scientific events and that of our training sessions for our continued commitment towards the French Immunotherapy network despite the current sanitary measures and restrictions. Since May, we have launched, and have regularly updated, the special edition of our information-monitoring letter Immunowatch to provide our network with the most recent and pertinent information on the COVID-19 response. In this third update, we have included new sections on the recently marketed drugs and vaccines and drug-candidates currently undergoing Phase III clinical trials together with the latest updates of the usual sections.*



# AVAILABLE COVID-19 treatment and drugs\*

The COVID-19 outbreak in the city of Wuhan, China was first reported to the World Health Organization in late December 2019. While the disease was reaching pandemic proportions in a matter of weeks, the pharmaceutical industry and the scientific community were already researching and developing treatments and vaccines against SARS-CoV-2. Despite lockdowns in several countries and resulting delays in drug R&D, 10 treatments and vaccines have been made available since August 2020 although on restricted geographic zones (either country or region).

## Vaccines

Drug name	Company Name	Drug Geography	Vaccine type
BNT-162b2	BioNTech SE / Pfizer	England & Saudi Arabia	mRNA vaccine
Coronavirus Disease 2019 (COVID-19) Vaccine Gam-COVID-Vac	Gamaleya Federal Research Center of Epidemiology and Microbiology	Russia	Recombinant Vector Vaccine
EpiVacCorona	The State Research Center of Virology and Biotechnology VECTOR	Russia	Subunit Vaccine

## Treatments

Drug name	Company Name	Drug Geography	Target	Mechanism of Action
Remdesivir	Gilead Sciences	UE + Japan	RNA Polymerase	RNA Polymerase Inhibitor
Levilimab	Biocad	Russia	Interleukin 6 Receptor (IL6R)	Interleukin 6 Receptor (IL6R) Antagonist
Olokizumab	R Pharm	Russia	Interleukin 6	Interleukin 6 Inhibitor
Favipiravir	Dr. Reddy's Laboratories Ltd Kromis R-Pharm	Russia + India	RNA Polymerase	RNA Polymerase

## FDA emergency use authorization

Drug name	Company Name	Molecule type
bamlanivimab	Eli Lilly and Co	Monoclonal Antibody
REGN-COV2	Regeneron	Monoclonal Antibody
baricitinib	Eli Lilly and Co	Small molecule

\* All data has been generated by MabDesign unless stated otherwise

# COVID-19 PIPELINE\*



## KEY FIGURES



Companies developing at least one product



Unique molecules in the pipeline

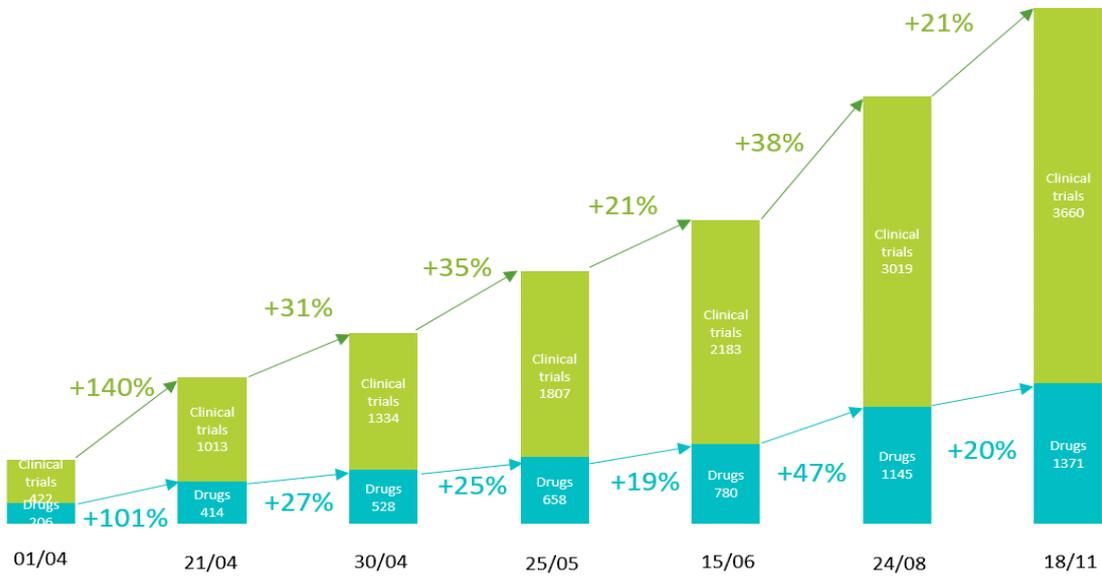


Clinical trials



Ongoing trials

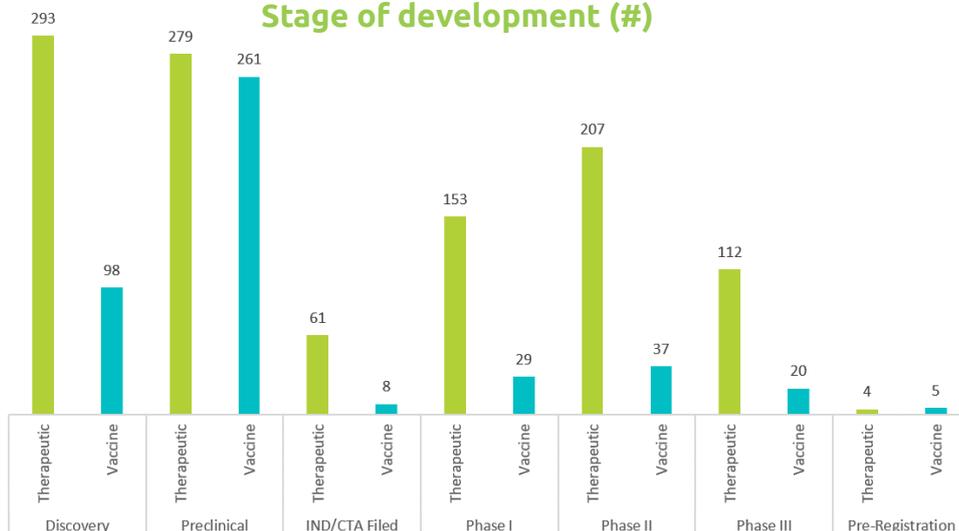
## Significant increase in the pipeline over the last 12 months



## Type of clinical studies



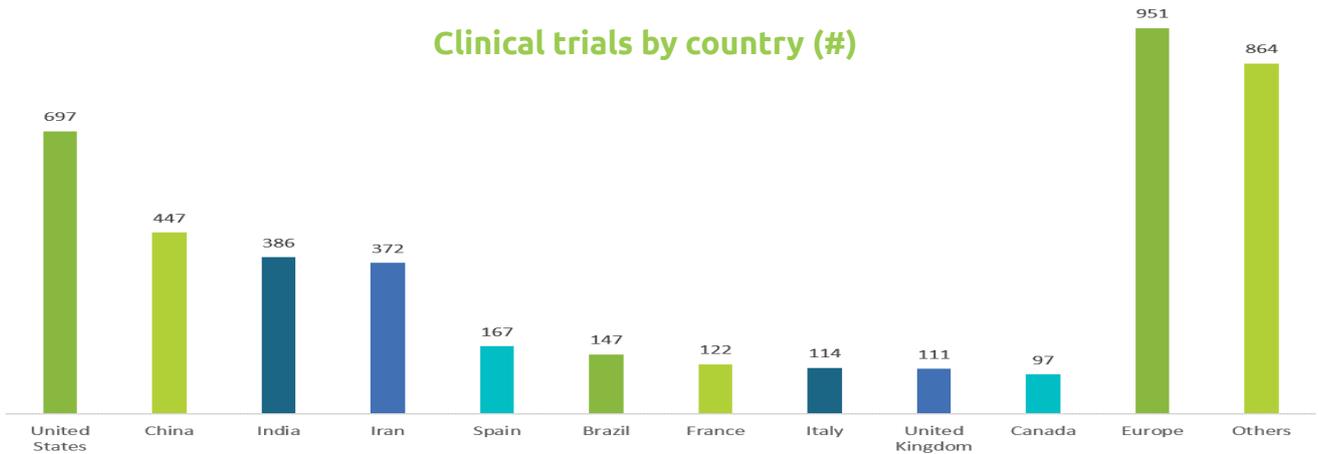
## Stage of development (#)





# COVID-19 PIPELINE\*

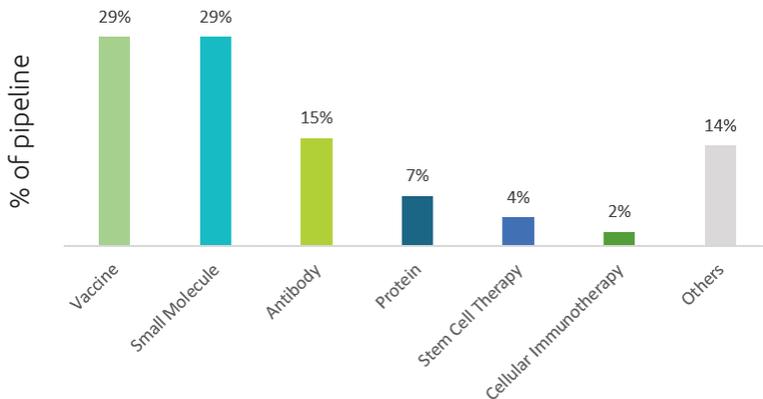
### Clinical trials by country (#)



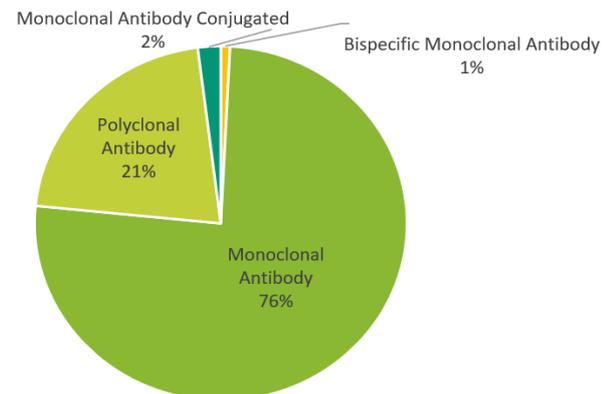
## Immunotherapy as frontline treatment for COVID-19

Several types of immunotherapy are being evaluated in the hope of providing solutions to tackle the COVID19 pandemic.

### Type of immunotherapy being developed



### The antibody pipeline



### Vaccine technology used



Majors companies developing: mRNA vaccines- Moderna, CureVac, Translate Bio, BioNtech, ETherNA  
 DNA vaccines- Inovio Pharmaceuticals, Linea Rx, AnGes

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# COVID-19 PIPELINE\*

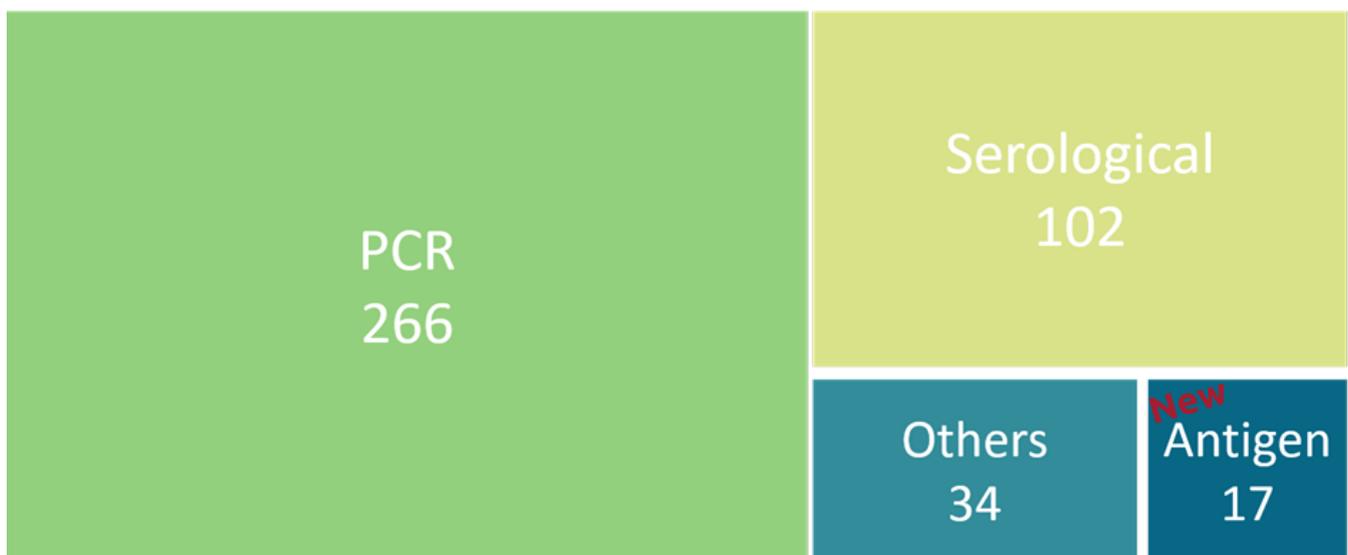
## Several COVID-19 diagnostic tools are already available

Tackling the COVID-19 pandemic does not only involve therapeutic or preventive treatments but also effective diagnostics tools. In the last few weeks, several new antigen-based diagnostic tests offering fast and reliable results have received regulatory clearance.



Commercially available tests

### Type of test<sup>1</sup>



\* All data has been generated by MabDesign unless stated otherwise

1. Latest update 30/11/2020 Source : <https://www.360dx.com/coronavirus-test-tracker-launched-covid-19-tests>

PCR: polymerase chain reaction, direct detection of the virus through amplification of its genetic material

Serological: Detection of virus-specific antibodies which are produced by the immune system



# COVID-19 PIPELINE: FOCUS PHASE 3\*

## Vaccines in phase 3

Drug name	Company name	Vaccine type
AZD-1222	AstraZeneca Plc	Recombinant Vector Vaccine
BBIBP-CorV	Sinopharm Group Co Ltd	Inactivated Vaccine
BNT-162b2	BioNTech SE / Pfizer	mRNA Vaccine
Coronavirus Disease 2019 (COVID-19) vaccine	CanSino Biologics Inc	Recombinant Vector Vaccine
Coronavirus Disease 2019 (COVID-19) vaccine 2	Sinopharm Group Co Ltd	Inactivated Vaccine
IMM-101	Immodulon Therapeutics Ltd	Inactivated Vaccine
JNJ-78436735	Johnson & Johnson	Recombinant Vector Vaccine
mRNA-1273	Moderna Inc	mRNA Vaccine
MV-130	Immunotek SL	Inactivated Vaccine
mycobacterium w (heat killed)	Cadila Pharmaceuticals Ltd	Inactivated Vaccine
NVX-CoV2373	Novavax Inc	Subunit Vaccine
Picovacc	Sinovac Biotech Ltd	Inactivated Vaccine
VPM-1002	Serum Institute of India Ltd	Live Attenuated Vaccine

## Therapeutic products in phase 3

### Companies with products in phase 3, by country (#)



drugs in phase III

### Type of products actually in phase 3



\* All data has been generated by MabDesign unless stated otherwise



# COVID-19 PIPELINE: FOCUS COMPANIES IN FRANCE\*

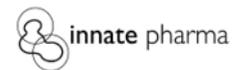
## Products in phase 3

Drug name	Molecule type
Hydroxychloroquine	Small molecule
Bio-101	Small molecule
ABX-464	Small molecule



## Products in phase 2

Drug name	Molecule type
Masitinib	Small molecule
Glenzocimab	Antibody
GNS-561	Small molecule
Avdoralimab	Antibody
CYT-107	Protein
SP-0253	Subunit Vaccine
XAV-19	Antibody



## Products in phase 1

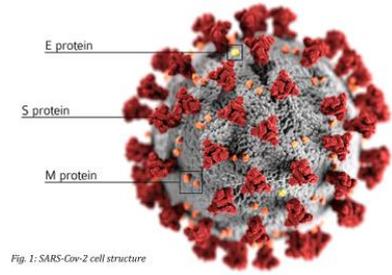
Drug name	Molecule type
Aldesleukin	Small molecule
Motrem	Peptid
Ivermectin	Small molecule
MRT-5500	mRNA Vaccine



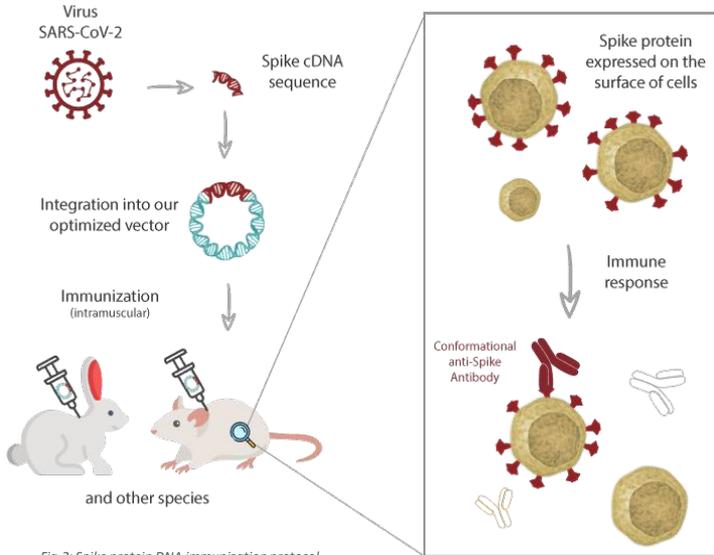
# ACCELERATE YOUR COVID-19 RESEARCH WITH COVALAB

**SARS-CoV-2** (Severe Acute Respiratory Syndrome Coronavirus 2) also known as 2019 nCoV (2019 Novel Coronavirus) represents a pandemic threat that has been declared a public health emergency of international concern by WHO.

SARS-CoV-2 is an enveloped, single, and positive-stranded RNA virus. The virus encodes four major structural proteins that have played important roles in causing the infection: **Spike protein (S protein)**, **nucleocapsid protein (N protein)**, **membrane protein (M protein)**, and **small envelope protein (E protein)** (Fig.1).



## DNA IMMUNIZATION: NEW GENERATION OF ANTI-SARS-CoV-2 ANTIBODIES



Covalab has developed new DNA immunization technology allowing the development of specific, high affinity and conformational antibodies (Fig.2).

The optimized plasmid can be injected through an intramuscular injection to all species without using the low efficient and cost-effective gene-gun or electroporation technics. For the structural proteins of SARS-Cov-2 (S, N and E proteins) mouse and rabbits were immunized with the respective plasmid constructs and a significant and specific immunresponse was obtained after 3 intramuscular injections. Several monoclonal antibodies were developed against the full spike protein with high affinity and specificity to RBD, S1 and S2 proteins.

Compared with the conventional immunization with recombinant RBD protein, the conformational antibodies didn't react with the RBD in denatured WB (Fig.3).

### Advantages of our DNA immunization:

- **No antigen** (protein or peptides) needed
- **Simple:** intramuscular injection and no need for gene-gun or electroporation
- **Rapidity:** rapid immunresponse (few weeks)
- **Conformational antibodies:** required for diagnostic and therapeutic

### Validation of conformational SARS-CoV-2 antibodies

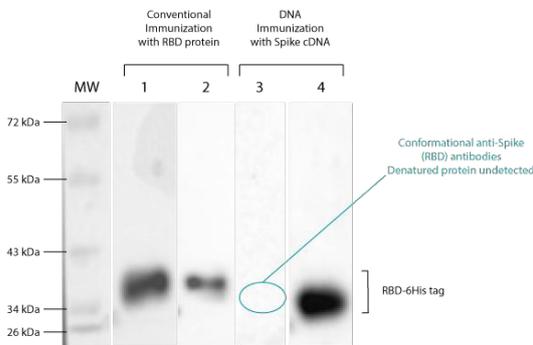


Fig. 3: Western Blot analysis (gels: 7,5%) of human SARS-CoV-2 Spike RBD-6His-tag protein (500ng/well). (1) & (3) nitrocellulose membrane incubated 1h with mouse serum (1/500) and then visualized with an HRP anti-mouse IgG antibody (1/2000). (2) & (4) the same membranes incubated 1h with an anti-His-tag antibody (1/2000) and then visualized with an HRP anti-mouse IgG antibody (1/2000).

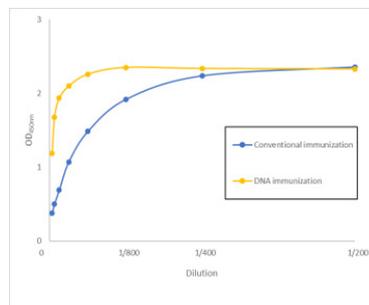


Fig. 4: Comparative ELISA tests for the immunoreactivity evolution of mouse serum against human SARS-CoV-2 S1 protein (1µg/mL) by conventional and DNA immunization.

### Rapid Diagnostic Tests - CE Marked

#### SARS-CoV-2 IgG/IgM Antibody Rapid Test



Detection of IgM and IgG antibodies against Spike protein in human blood sample

#### SARS-CoV-2 Antigen Rapid Test



Detection of N protein in the patient's sample

## SARS-CoV-2 PRODUCTS:

RECOMBINANTS PROTEINS	ANTIBODIES	RAPID DIAGNOSTIC TEST KITS – CE Marked
<ul style="list-style-type: none"> <li>- Spike S1 Protein</li> <li>- Full lenght Spike protein*</li> <li>- Spike S2 protein*</li> <li>- RBD Protein</li> <li>- N Protein</li> <li>- E Protein*</li> <li>- M Protein*</li> <li>- ACE2 Protein</li> </ul>	<ul style="list-style-type: none"> <li>- Anti-Spike S1 Protein</li> <li>- Anti-Spike RBD protein</li> <li>- Anti-Spike S2 protein</li> <li>- Anti-E Protein</li> <li>- Anti-M Protein</li> <li>- Anti-N Protein</li> <li>- Anti-ACE2 Protein</li> </ul>	<ul style="list-style-type: none"> <li>- SARS-CoV-2 IgG/IgM Antibody Rapid Test*</li> <li>- SARS-CoV-2 Antigen Rapid Test</li> </ul>
<p>*Currently under validation</p> <p>*Approved by the National Reference Center (CNR) of the Pasteur Institut. Appears on the list of tests authorized by the French government and distributed by Covalab: <a href="https://covid-19.sante.gouv.fr/tests">https://covid-19.sante.gouv.fr/tests</a></p>		

## CONTACT:

For more information on our COVID-19 related products, contact us :  
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# GLOBAL COLLABORATION FOR THE FIGHT AGAINST COVID-19



Partnering agreements between healthcare companies



Licensing agreements

Companies all over the world are partnering up during this global health crisis in order to develop a treatment. Such collaborative endeavours go beyond the realms of the healthcare sector and include IT companies offering innovative solutions. In parallel, we are also witnessing an increasing number of licensing agreements between companies to further COVID19 treatment and vaccine R&D.

## Selection of latest major deals related to COVID-19

ANNOUNCED DATE	DEAL DESCRIPTION	TYPE OF PRODUCT
05/11/20	<b>NEW</b> BioNTech and Fosun Pharma Terminates Agreement for COVID-19 Vaccine Strategic Alliance in China	Vaccine
28/10/20	<b>NEW</b> Novartis Enters Option to Licensing Agreement with Molecular Partners to Develop Two Darpin Therapies Designed for Potential Use Against COVID-19	Antivirals product
22/10/20	<b>NEW</b> Roche Enters into Collaboration with Atea Pharma	Antivirals product
22/10/20	<b>NEW</b> IAVI and Serum Institute of India Enter into Co-Development Agreement with Merck for Covid-19	Antibody
01/09/20	<b>NEW</b> Oxford Biomedica Signs Supply Agreement with AstraZeneca to Expand Manufacturing Support of COVID-19 Vaccine Candidate, AZD1222	Vaccine
25/08/20	<b>NEW</b> AbbVie and Harvard University Enter into Research Partnership	Unknown
19/08/20	Roche Enters into Agreement with Regeneron Pharma to Develop REGN-COV2 Against COVID-19	Antibody
07/08/20	Takeda Pharma Enters into Licensing Agreement with Novavax for COVID-19 Vaccine Candidate	Vaccine
21/07/20	IRBM Enters into Research Agreement with Merck to Develop Peptides Against Coronavirus	Peptide
14/07/20	IQVIA Enters into Collaboration with AstraZeneca for COVID-19 Vaccine	Vaccine
02/07/20	Tesla teams up with CureVac to make 'RNA microfactories' for COVID-19 shot	Vaccine
12/06/20	PeptiDream Enters into Collaboration with Merck for COVID-19 Therapies	Peptide
10/06/20	Catalent Enters into Agreement with Spicona to Develop COVID-19 Vaccine	Vaccine
09/06/20	Twist Bioscience and Serimmune Enter into Collaboration to Identify COVID-19 Therapeutic Antibody Candidates	Antibody
05/06/20	AbbVie Enters into Co-Development Agreement with Harbour BioMed, Utrecht University and Erasmus Medical Center for COVID-19	Antibody



# GLOBAL COLLABORATION FOR THE FIGHT AGAINST COVID-19

## Selection of latest major deals involving French companies

ANNOUNCED DATE	DEAL DESCRIPTION	TYPE OF PRODUCT
01/12/20	<b>NEW</b> RD-Biotech, company of the mAbexperts group, is producing plasmid DNA for Big Pharma companies	Vaccine
24/11/20	<b>NEW</b> Recipharm announces signature of letter of intent for aseptic fill-finish manufacturing of Moderna's COVID-19 vaccine candidate (mRNA-1273)	Vaccine
23/11/20	<b>NEW</b> HiFiBio Therapeutics Enters into Partnership with Pharmsynthes and Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry (IBCh) for SARS-CoV-2 Neutralizing Antibody in Russia	Antibody
19/11/20	<b>NEW</b> Coronavirus: French group, Delpharm, will produce the vaccine from Pfizer and BioNTech	Vaccine
05/11/20	<b>NEW</b> ABL Europe, University Clinic of Tuebingen and Prime Vector Technologies Enter into Development Agreement for COVID-19 Vaccine	Vaccine
14/11/20	<b>NEW</b> HiFiBio Therapeutics Enters into Co-Development Partnership with ABL Bio for COVID-19 Antibody	Antibody
15/06/20	Novasep will produce AstraZeneca's vaccine in Europe	Vaccine
08/06/20	Cynbiose and the academic laboratory Virpath have partnered up in a R&D collaborative project linked to the COVID-19 pandemic	Unknown
13/05/20	Eurobio Scientific SA, an in vitro medical diagnostics company, has partnered with Hospices Civils de Lyon (HCL), to develop a library of anti-SARS CoV-2 antibodies	Antibody
11/05/20	ABL applies its expertise in custom manufacturing virus-based therapeutics to accelerate the Institut Pasteur and Themis' coalition COVID-19 vaccine development	Vaccine
24/04/20	To fight the Covid-19 pandemic, Owkin launches the Covid-19 Open AI Consortium (COIA), to bring innovative discoveries and concrete results to medical research.	Others
22/04/20	Valneva and Dynavax Technologies Enter into Collaboration to Advance Vaccine Development for COVID-19	Vaccine
15/04/20	LFB and the biotech company Xenothera sign an agreement for the production of the first clinical batch of a drug candidate	Antibody
14/04/20	Sanofi and GlaxoSmithKline to Enter into Co-Development Agreement for Covid-19	Vaccine
06/04/20	CSL Behring Enters into Co Development Agreement with Takeda Pharma, Biotest, Bio Products Laboratory, LFB and Octapharma for Treatment of COVID-19	Antibody
27/03/20	Sanofi Pasteur Enters into Co-Development Agreement with Translate Bio to Develop Novel mRNA Vaccine Candidate Against COVID-19	Vaccine
20/03/20	Smart-Bioscience has been selected by the American company Ligandal as a European partner of its peptide-based vaccine program against Coronavirus SARS-Cov2 (Covid-19)	Vaccine
16/03/20	Sanofi and Regeneron to Enter into Collaboration for COVID-19	Antibody



# BIOPRODUCTION SITES FOR COVID-19 VACCINES AND DRUGS IN FRANCE

On top of its significant pipeline of COVID19 curative and prophylactic candidates, France is also involved in the large scale production of biologics including vaccines against SARS-CoV-2. For far, we have identified 8 bioprocessing sites across 5 regions further underlying the recognised local know-how and capacity in biopharmaceutical production.

FAREVA



CureVac and Fareva sign agreement for fill & finish manufacturing of CureVac's COVID-19 vaccine candidate, CVNCOV



SANOFI

Sanofi will produce its vaccine antigen in collaboration with GSK at the Vitry-sur-Seine site.



Delpharm has entered into an agreement with BioNTech to manufacture the BNT 162b2 vaccine to prevent Coronavirus infection.



ABL applies its expertise in custom manufacturing virus-based therapeutics to accelerate the Institut Pasteur and Themis' coalition COVID-19 vaccine development



Recipharm announces signature of letter of intent for aseptic fill-finish manufacturing of Moderna's COVID-19 vaccine candidate (mRNA-1273)



Sanofi Pasteur's Marcy-l'Étoile site will be responsible for fill-finish manufacturing of the vaccine in collaboration with GSK.

FAREVA

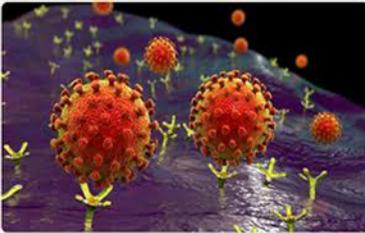


CureVac and Fareva sign agreement for fill & finish manufacturing of CureVac's COVID-19 vaccine candidate, CVNCOV



LFB's biomanufacturing site in Alès will manufacture Xenothera's drug candidate, XAV-19.

### Build your own SARS-CoV-2 serological assay with the Diaclone Tool Box



#### FOR 5 x 96 TESTS

##### ◆ SARS-CoV-2 recombinant proteins:

- Spike S1 RBD protein (HIS tag)
- Nucleoprotein (HIS tag)

##### ◆ Anti-SARS-CoV-2 monoclonal antibodies:

- Anti Nucleoprotein (Human IgG1)
- Anti Spike S1 (Human IgG1)

##### ◆ Secondary anti-human:

- Anti-human IgG (HRP conjugate)
- Anti-human IgM (HRP conjugate)

##### ◆ TMB substrate

*On demand: anti human IgA, Stop reagent, wash buffer, assay buffer, plates and plastic covers.*

- ✓ All products are developed in our laboratories
- ✓ Ready-To-Use reagents
- ✓ Possibility to supply all reagents individually

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# THE FRENCH RESPONSE TO COVID-19

## The French immunotherapy network

Since the beginning of the outbreak in France, MabDesign has been making an inventory of its members from the French immunotherapy network involved directly in the fight against COVID-19 to showcase their expertise and/or help them identify new collaborators. Below is the latest update of this inventory. The latter and the corresponding database (see below) is updated weekly.

### Companies involved directly in the COVID19 response



### Companies providing solutions and collaborations



MabDesign has also created an online database summarizing the involvement and expertise of every entity listed above. The database can be accessed [here](#) together with the contact list [here](#).



# THE FRENCH RESPONSE TO COVID-19

In France, there has been a rapid mobilization of key actors of the pharmaceutical and healthcare sectors to join this combat against COVID-19 by initiating, pursuing or enhancing their activities to provide innovative solutions and develop efficient treatments. MabDesign has been monitoring and communicating regularly on this pertinent information to our network. We here summarized these latest activities pertaining to the development of therapeutic products and/or diagnostics tools.

## Companies developing diagnostic tests

**New Enalees** and Bertin Technologies, in collaboration with **Institut Pasteur**, have developed an ultra-rapid diagnostic test to immediately isolate infected individual as it can provide within 30 minutes a more reliable result than salivary or antigen tests.

**New Biotem**, in collaboration with a multidisciplinary team (LBPA, Université CNRS-ENS Paris-Saclay et Hôpital Bichat AP-HP), has developed the AmpliFlow® SARS-CoV-2 kit to further strengthen their arsenal of rapid diagnostic tests for COVID19.

**New BioSella** is now proposing a complete solution for the detection of SRAS-CoV-2 with the BioExtract® Premium Mag extraction kit and the Bio-T® kit TriStar Covid-19. This new solution has been evaluated by the Centre National de Référence des Virus des Infections Respiratoires and is under license from Institut Pasteur.

**New CellMade** can produce, since the 20th of October, the necessary reagents involved in the manufacturing of 100 000 PCR tests per week.

**New Toda Pharma's** Coronadiag + test is a rapid immunochromatography assay for the detection of IgG and IgM in whole human blood. It allows for rapid and reliable detection of the 2019-nCoV virus (Coronavirus; SARS-CoV2) within just 15 minutes from a single drop of blood.

**BioMerieux** : The company have developped 2 diagnostic tests

- ARGENE SARS-CoV-2 R-GENE® test uses RT-PCR technology to detect specifically SARS-CoV-2 virus.
- BIOFIRE® FILMARRAY® test integrates SARS-CoV-2 virus, in addition of 21 pathogenic agents the most frequently responsible for respiratory infections and detects in 45min.

**NG Biotech**, a Breton start-up, prepare a salivary test, after developping and marketing a serological test, NG-Test® COVID-19.

**Skigenics** is providing their expertise in transcriptomic analysis for the development of a blood signature for COVID19.

**Innobiochips** has received support from the Ministry of Defense to develop COVID19 serological test.

**Kelindi**, in patnership with Pasteur Institute, Docapost and Allianz, has launched the maladiecoronavirus.fr platform for self-evaluation of COVID19 symptoms and eventual orientation to health services.

**Mobidiag**, in partnership with Autobio Diagnostics, chinese leader of clinical diagnostic, is now providing rapid anti-SARS CoV-2 tests to detect coronavirus infections from serum, plasma or blood samples in less than 15min.



# THE FRENCH RESPONSE TO COVID-19

## Companies developing diagnostic tests

**CLEAN CELLS** is currently developing its own COVID-19 detection tests pour biological products (raw material or end products) in line with regulatory bodies.

**IDvet** has launched a new serological test to detect antibodies against COVID-19 with a specificity of 99.9%, significantly lowering the rate of false positive results. More than a million tests have already been produced.

**AAZ** has developed COVID-PRESTO®, a rapid serological test to identify immunization (apparently protective) against COVID-19.

**Poly-Dtech** has launched several serological tests to identify individuals immunised or not against COVID-19.

**Eurobio Scientific** has announced the CE marking for its EBX 041 SARS CoV2 proprietary test, developed specifically for the clinical diagnosis of COVID-19. This is a multiplex kit with three targets: two for identifying the virus and one target for a control integrated into each patient test.

**BioSpeedia (spin-off from Institut Pasteur)** has developed a one step rapid test for Novel Coronavirus SARS-CoV-2 IgM/IgG in serum, plasma, fingertip blood or whole blood samples of pneumonitis patients or suspected cases.

**Theravectys** is developing a serological test to identify immunized people among the general population.

**Biosynex** is currently working on three diagnostics solutions for COVID-19 based on PCR and immunochromatography technologies.

**Bforcure** has developed a machine powered by FASTGENE™ technology which is able to detect the presence of pathogens, including the novel coronavirus, within minutes.

**Novacyt** has teamed up with the UK contract manufacturing company Yourgene Health to support the production of the test, developed by Novacyt's molecular diagnostics UK division Primerdesign.

**C4Diagnostics** has launched its C4Services as a solution to companies and institutions to test for the presence of the COVID-19 virus on their premises.

**BioMérieux** has announced that its subsidiary, BioFire Defense, has received Emergency Use Authorization by the U.S. Food and Drug Administration of its BIOFIRE® COVID-19 test for use in CLIA moderate and high complexity clinical laboratories to detect SARS-CoV-2

**SKILLCELL** and **SYS2DIAG** (a **CNRS/ALCEDIAG** joint laboratory) are developing EasyCOV, a fast-acting saliva-based screening test for Covid-19, with support from the PMB and TRONICO teams.

**RD-Biotech** has partnered with the Belgian company Coris BioConcept for the production of its new IVD rapid test COVID-19 Ag Respi-Strip.

**Eurofins** has developed several testing and service offering to support healthcare practitioners and authorities around the world as well as the biopharmaceutical industry respond to the COVID-19 crisis.



# THE FRENCH RESPONSE TO COVID-19

## Companies developing treatments or vaccines

**New HiFiBio Therapeutics**, announced the successful completion of the first cohort of the Phase I study (NCT04590430) of HFB30132A, a SARS-CoV-2 neutralizing antibody for the treatment and prevention of COVID-19.

**New Acticor Biotech** : Glenzocimab (Fab-9O12) is under development for the treatment of SARS-Cov-2-related acute respiratory distress syndrome, acute ischemic stroke and pulmonary embolism.

**New** The biotech company **Divincell**, specialized in the development of nano-vehicles capable of transporting drugs in the body, offers this mode of administration to fight against Covid-19.

**CEA** and **INSERM** collaborate to develop a vaccine against COVID 19, from technology Lipidots® of CEA-Leti.( synthetic lipidic nanoparticles)

**Fab'entech** launch a program to develop immunotherapy treatment by using polyclonal antibodies against COVID-19

**Inotrem** has received regulatory clearance to conduct a Phase IIa clinical trial of nangibotide in Covid-19. Nangibotide is a TREM-1 pathway inhibitor

**Vaxinano** is starting collaborations on the rapid development of an anti-Covid-19 vaccine.

**AIOVA**, the young biotech from Grenoble, has published results of their vaccine technology and is providing its ADN vaccine platform for the development of innovative solutions to protect humans and animals against viral emergencies.

**Aqemia** is providing screening services for the 3000 drugs on the market which have already been tested in humans and are easily available in sufficient quantities, in hope of repurposing some of them as a COVID19 treatment.

**OSE Immunotherapeutics** has announced a new COVID-19 prophylactic vaccine program.

**Eukarÿs** is making the C3P3 system available to any academic research team working on the biology of the SARS-CoV-2 virus in support of the scientific community mobilized against the 2019 coronavirus pandemic.

**Abivax** receives ANSM and Ethics Committee clearance to test its development candidate ABX464 in 1,034 Covid-19 patients in randomized Phase 2b/3 clinical trial.

**Pasteur Institute** is currently working on three different COVID19 vaccine R&D projects.

**RevImmune** COVID-19 program is proposing the use of IL-7 (CYT107) to prevent patients who are in the hospital for COVID-19 from progressing to having to be treated in the ICU or progressing to needing more than 4L/minute of supplemental oxygen.

**AB Science** has been granted authorization by ANSM to initiate Phase 2 study evaluating masitinib in combination with isoquercetin for the treatment of COVID-19.



# THE FRENCH RESPONSE TO COVID-19

## Companies developing treatments or vaccines

**OSIVAX** is currently working on a large spectrum vaccine against coronaviruses.

**Plate-Forme CHEM-Symbiose** has joined the multidisciplinary, large-scale virtual screening project to look at 1.5 billion small molecules in order to identify candidate compounds that are likely to inhibit the SARS-CoV-2 virus.

**Pharnext** and the University Hospital Institute Méditerranée Infection announce a joint effort to evaluate repurposed drugs for potential use against the covid-19 virus.

**Apteus** has decided to share its unique collection of molecules TEE Library®, with several research teams from the Institut Pasteur de Lille are currently working on Covid19 to explore the opportunities for drug repositioning to fight corona viruses.

**Signia Therapeutics** is using its SIGNATURA® platform to repurpose drugs in view of finding new therapeutic solutions against COVID-19.

**Medesis Pharma** is applying its patented technology, originally developed to treat radiation-induced pulmonary lesions, to treat COVID-19 patients with similar lesions

**MedinCell** is evaluating the efficacy of its 'BEPO' technology and the use of Ivermectine (a long-acting anti-malarial drug) as a treatment for COVID-19

**Xenothéra** is applying its innovating technology of polyclonal humanized antibodies to target SARS-CoV-2, the causative agent of the COVID-19 pandemic

**Genoscience Pharma** is working on a chloroquine analog as a COVID-19 treatment  
Biophytis has initiated clinical testing of its Sarconeos treatment for patients with COVID-19-associated acute respiratory distress syndrome (ARDS)

**Sanofi** has announced that it is currently involved in vaccine and antibody development against COVID-19. The company is also going to produce batches of Hydroxychloroquine for clinical trials

**Valneva** is leveraging its technical and platform capabilities to develop an inactivated, whole virus vaccine candidate against the current coronavirus threat

**Iltoo Pharma** is developing an IL2R agonist to stimulate T cell response against COVID-19

**Innate Pharma** is conducting Phase II clinical trial, evaluating the safety and efficacy of its antiC5aR antibody, avdoralimab (IPH5401), in COVID-19 patients with severe pneumonia.

**Hemarina** is evaluating the efficacy of its M101 molecule, a universal oxygen transporter derived from marine worms, to treat ARDS in COVID-19 patients.

**Theravectys** is currently working on an antibody vaccine against COVID-19 & A multivalent and universal T-cell vaccine to address all current and previous coronavirus strains as well as future

Our team will be communicating regularly on all the French companies and institutions involved directly or indirectly in the pandemic response. To join the inventory, please fill in the online questionnaire [here](#) or send your latest news to our communication department (laure.delhon@mabdesign.fr)



# FUNDING AND AID FOR THE COVID-19 RESPONSE

## Funding schemes

### International

Research Grant for pandemic preparedness by MERCK - Deadline: none

<https://www.merckgroup.com/en/research/open-innovation/2020-research-grants.html>

### European

AI and robotics solutions for the COVID-19 crisis. Deadline: 31/12/2020

<https://ec.europa.eu/eusurvey/runner/15e8809f-a702-fff6-b68d-9b69f98cdc2b>

PRACE support to mitigate impact of COVID-19 pandemic. Deadline: not specified

<https://prace-ri.eu/>

### French

RAPID (régime d'appui à l'innovation duale). Deadline : none

<https://www.defense.gouv.fr/aid/deposer-vos-projets/subventions/rapid>

Appel à projets thématique Covid-19 - Accélérateur 21 La Croix Rouge

<https://21-croix-rouge.fr/programme-entrepreneuriat/>

L'appel à projet TOUS UNIS CONTRE LE VIRUS de Fondation France. Deadline : not specified

<https://www.fondationdefrance.org/fr/tous-unis-contre-le-virus-la-fondation-de-france-lap-hp-et-linstitut-pasteur-lancet-un-appel-la>

### Regional (More information on the websites of the various French health clusters)

DIM ELICIT projets mettant en œuvre des technologies ou des méthodes innovantes en lien avec l'analyse, le diagnostic et/ou le traitement pour combattre le SARS-CoV2 en Ile de France. Deadline : 31 décembre 2020.

<https://www.defense.gouv.fr/aid/deposer-vos-projets/subventions/rapid>

## Results of previous funding schemes

37 projects has been selected following the call for proposal launched by the Ministry of the Armed Forces to fight against COVID-19

<https://www.defense.gouv.fr/aid/actualites/pres-de-quarante-projets-selectionnees-dans-le-cadre-de-lappel-a-projets-lance-par-le-ministere-des-armees-pour-lutter-contre-le-covid-19>

### National mapping of the different initiatives linked to the French response to COVID-19

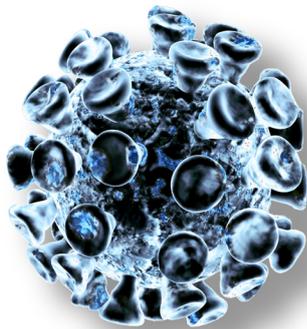
The **six French Health Clusters** namely, Atlanpole Biotherapies, BioValley France, Eurobiomed, Lyonbiopôle, Medicen and Clubster NSL have joined forces to create this national mapping. Read the press release [here](#) and access the mapping [here](#).

# Texcell

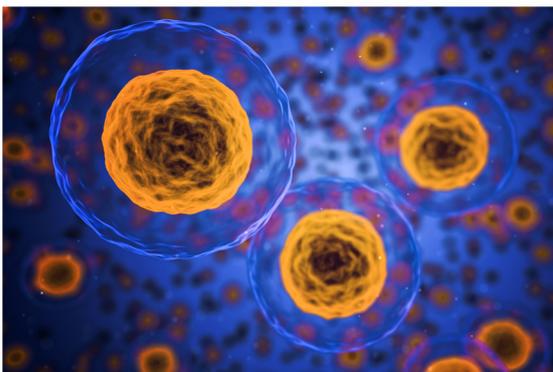
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# SCIENTIFIC LITERATURE ON COVID-19

As of going to press, more than 7000<sup>1</sup> scientific articles on the current COVID19 pandemic have been published in 2020 worldwide. The aim of this section is obviously not to cite all of them but rather to provide an overview of the translational nature of the research work being conducted on the virus and the outbreak.

## **Age-specific mortality and immunity patterns of SARS-CoV-2.**

O'Driscoll M., Dos Santos G.R. et al. Nature 2020. <https://doi.org/10.1038/s41586-020-2918-0>

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## **Mechanisms of SARS-CoV-2 Transmission and Pathogenesis**

Andrew G. Harrison A.G, Tao L. et al. Trends in Immunology 2020. <https://doi.org/10.1016/j.it.2020.10.004>

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## **Identification of Required Host Factors for SARS-CoV-2 Infection in Human Cells**

Daniloski Z., Jordan T. et al. Cell 2020. <https://doi.org/10.1016/j.cell.2020.10.030>

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## **SARS-CoV-2 epitopes are recognized by a public and diverse repertoire of human T cell receptors**

Alina S. Shomuradova A.S., Murad S. Vagida M.S. et al Immunity 2020. <https://doi.org/10.1016/j.immuni.2020.11.004>

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## **Transmission heterogeneities, kinetics, and controllability of SARS-CoV-2**

Kaiyuan Sun et al. Science 2020 <https://doi.org/10.1126/science.abe2424>

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## **Considerations for diagnostic COVID-19 tests.**

Vandenberg O., Martiny D. et al. Nat Rev Microbiol 2020. <https://doi.org/10.1038/s41579-020-00461-z>

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## **Targeted intracellular degradation of SARS-CoV-2 via computationally optimized peptide fusions.**

Chatterjee P., Ponnampati M. et al. Commun Biol 2020. <https://doi.org/10.1038/s42003-020-01470-7>

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## **Development of humanized tri-specific nanobodies with potent neutralization for SARS-CoV-2.**

Dong J., Huang B. et al. Sci Rep 2020. <https://doi.org/10.1038/s41598-020-74761-y>

1. Keyword search on Pubmed.gov on 26/04/20 for 'COVID19' OR 'Sars Cov 2' OR '219-nCOV' OR 'novel coronavirus' with 2020 as year of publication



# SCIENTIFIC LITERATURE ON COVID19

## **The Human Leukocyte Antigen Class II Immunopeptidome of the SARS-CoV-2 Spike Glycoprotein**

Michael D. Knierman M.D., Lannan M.B. et al. Cell Reports 2020. <https://doi.org/10.1016/j.celrep.2020.108454>

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## **Prospects for a safe COVID-19 vaccine**

Barton F. Haynes et al. Science Translational Medicine 2020 <https://doi.org/10.1126/scitranslmed.abe0948>

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## **Structural basis for potent neutralization of SARS-CoV-2 and role of antibody affinity maturation.**

Hurlburt N.K., Seydoux E. et al. Nat Commun 2020. <https://doi.org/10.1038/s41467-020-19231-9>

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## **Preexisting and de novo humoral immunity to SARS-CoV-2 in humans**

Kevin W. Ng et al. Science 2020. <https://doi.org/10.1126/science.abe1107>

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## **Combining Antivirals and Immunomodulators to Fight COVID-19**

Vincent Feuillet V., Canard B. et al. Trends in Immunology 2020. <https://doi.org/10.1016/j.it.2020.11.003>

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## **Bi-paratopic and multivalent VH domains block ACE2 binding and neutralize SARS-CoV-2.**

Bracken C.J., Lim S.A. et al. Nat Chem Biol 2020. <https://doi.org/10.1038/s41589-020-00679-1>

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## **Nanoparticle Vaccines Based on the Receptor Binding Domain (RBD) and Heptad Repeat (HR) of SARS-CoV-2 Elicit Robust Protective Immune Responses**

Ma X., Zou F. et al. Immunity 2020. <https://doi.org/10.1016/j.immuni.2020.11.015>

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## **The emerging role of neutrophil extracellular traps in severe acute respiratory syndrome coronavirus 2 (COVID-19).**

Arcanjo A., Logullo J. et al. Sci Rep 2020 <https://doi.org/10.1038/s41598-020-76781-0>

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## **SARS-CoV-2 structure and replication characterized by in situ cryo-electron tomography.**

Klein S., Cortese M. et al. Nat Commun 2020. <https://doi.org/10.1038/s41467-020-19619-7>



# SCIENTIFIC LITERATURE ON COVID19

## **Functional SARS-CoV-2-specific immune memory persists after mild COVID-19**

Lauren B. Rodda L.B., Netland J. et al Cell 2020. <https://doi.org/10.1016/j.cell.2020.11.029>

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## **Versatile and multivalent nanobodies efficiently neutralize SARS-CoV-2**

Yufei Xiang et al. Science 2020. <https://doi.org/10.1126/science.abe4747>

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## **HDL-scavenger receptor B type 1 facilitates SARS-CoV-2 entry.**

Wei C., Wan L. et al. Nat Metab 2020. <https://doi.org/10.1038/s42255-020-00324-0>

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## **Antibody-mediated disruption of the SARS-CoV-2 spike glycoprotein**

Wrobel A.G., Benton D.J. et al. Nat Commun 2020 <https://doi.org/10.1038/s41467-020-19146-5>

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## **SARS-CoV-2 mRNA vaccines foster potent antigen-specific germinal center responses associated with neutralizing antibody generation**

Katlyn Lederer K., Diana Castaño D. et al. Immunity 2020. <https://doi.org/10.1016/j.immuni.2020.11.009>

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## **Cellular events of acute, resolving or progressive COVID-19 in SARS-CoV-2 infected non-human primates.**

Fahlberg M.D., Blair R.V. et al. Nat Commun 2020. <https://doi.org/10.1038/s41467-020-19967-4>

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## **Eliciting B cell immunity against infectious diseases using nanovaccines.**

Singh A. Nat. Nanotechnol. 2020. <https://doi.org/10.1038/s41565-020-00790-3>

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## **Upper airway gene expression reveals suppressed immune responses to SARS-CoV-2 compared with other respiratory viruses**

Mick E., Kamm J. et al. Nat Commun 2020. <https://doi.org/10.1038/s41467-020-19587-y>

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## **Coronavirus biology and replication: implications for SARS-CoV-2.**

V'kovsk P., Kratzel A. et al. Nat Rev Microbiol 2020. <https://doi.org/10.1038/s41579-020-00468-6>

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# COVID-19 AND INTELLECTUAL PROPERTY

Both innovative and routine approaches are being used in this global involvement of developing effective diagnostics tools and treatment for COVID-19. These rely partly or solely on proprietary technologies, expertise, scientific know-how and molecules whether serving their intended use or having being repurposed. In parallel, we observed the emergence of a COVID19-specific patent landscape within months only of the outbreak at its epicenter in Wuhan. We here provide a summary of this landscape for 2020.



Covid-19 related patents in 2020

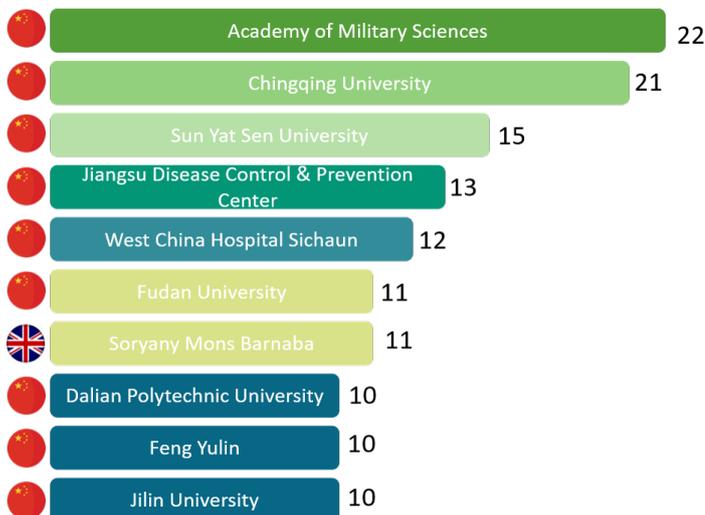
## Top 3 Technological domain



## Country of publication (excludes EP and WO)



## Top 10 portfolios



Patents linked to therapeutics



Patents linked to diagnostics



Patents linked to vaccine

\* Keyword search for Covid 19 and associated variantes under independent claims, title or abstract in the Orbit patent database



# MABDESIGN UPCOMING EVENTS ON COVID-19

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<https://www.i4id.org/>



# MABDESIGN'S REPOSENSE DURING THE COVID19 PANDEMIC

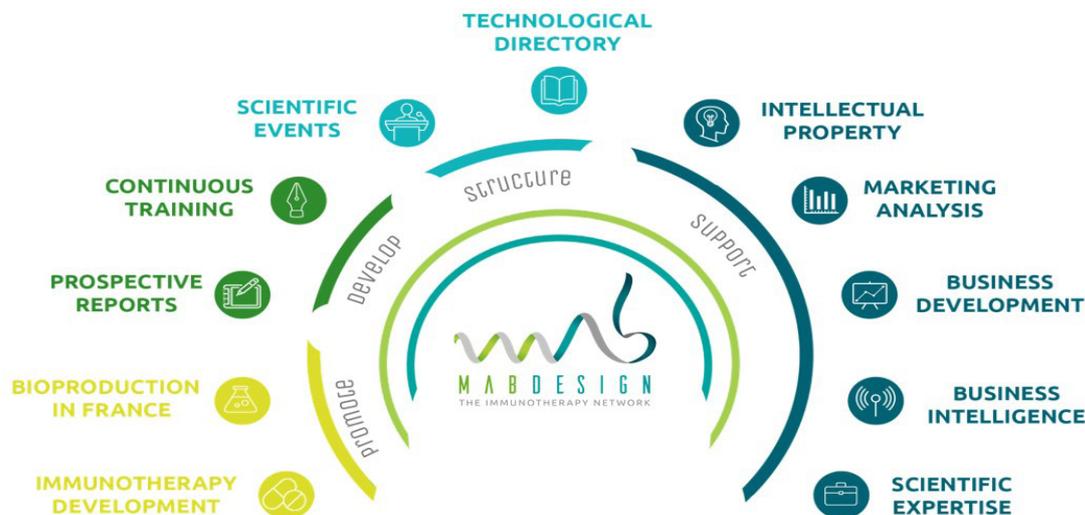
## MORE NEWS ARE ON THE WAY!

### To be kept in the loop, register to our newsletter

Our different departments will be providing regular updates of the COVID-19 pipeline, the inventory of companies involved in the response, the latest French news and the patent landscape through our newsletter. Register [here](#).

## About MabDesign

- **MABDESIGN** is a French membership organization in the field of immunotherapy. Created in 2014 MABDESIGN is managed by DBV Technologies, Lyonbiopôle, Pierre Fabre and Sanofi.



- **Operational since September 2015**, MABDESIGN has over 170 members, including pharmaceutical and biotechnology companies, service providers, training organizations, and equipment suppliers at the cutting edge of technology.



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