



**Update from the  
Salvogene Covid-19 Task Force  
on the current status of the most  
promising medications and  
vaccine projects**

Dear Premium Customers,

**The first companies are already starting to trial corona vaccines on humans. Other researchers are testing the effectiveness of existing and newly developed medications. But when will these potential remedies be made widely available? And how much progress has been made with the much-vaunted antibody tests?**

All over the world, virologists, pharmaceutical companies and biotechnicians are conducting research into vaccines, drugs and new test procedures with the aim of getting the coronavirus pandemic under control. In some sectors, a veritable race is on to identify the first effective remedy for this novel pathogen. But how much progress have academic and commercial researchers made so far and what is the potential for the cures they are proposing? Our current view is that existing drugs are the more effective and faster way to bridge the gap until a fully reliable

vaccine becomes available that can be manufactured and distributed in sufficient quantity.

The Salvagene Covid-19 Task Force has taken a look at almost 100 ongoing research projects into substances that might prove effective against Covid-19. To our knowledge, there are more than 300 studies that are either underway or in preparation. The focus here is primarily on drugs that have already been used to treat other diseases, such as malaria, hepatitis or multiple sclerosis. The advantage of this “repurposing” – i.e. the adoption of substances for a different purpose – is that, in the best-case scenario, they do not have to undergo costly and time-consuming testing procedures. Active substances that have already been thoroughly researched can proceed to the clinical trial phase sooner and thus be approved more quickly.

In parallel completely new substances are also being researched, with reference also being made to findings from the related SARS coronavirus outbreak of 2002/03.

Some of our Task Force team are in direct contact with the project groups and report as follows:

## **An overview**

### Vaccines against the coronavirus

More than 60 vaccine projects have already been initiated worldwide. According to the World Health Organization (WHO), two of them have already entered the clinical test phase. Several other manufacturers and research institutions are also gearing up to test their vaccines on volunteers.

## CanSino Biological

The Hong Kong-based biotech company CanSino Biological is working on a vaccine in collaboration with the Institute of Biotechnology in Beijing. The project is funded by the Chinese Ministry of Science and Technology. The vaccine is already being tested on humans. The study, which began in March, involves 108 volunteers from Wuhan who are given the substance in dosages of three different strengths. According to the Chinese authorities, the study will be completed by the end of the year. An earlier outcome is therefore not expected. According to CanSino Biological, a strong immune reaction had previously been observed in tests performed on animals.

## Moderna mRNA-1273

We have been following this project with great interest from the very beginning. A vaccine developed by the U.S. National Institutes of Health in collaboration with the biotech company Moderna has already been tested on humans. This so-called "RNA vaccine" is produced using an innovative technology. In simple terms, the patient is injected with the building instructions for certain parts of the virus in RNA (ribonucleic acid) form. The human body cells use this to construct harmless virus components with which the immune system can practice handling the virus. If it is trained well enough, the immune system can get to grips with the real virus quickly and efficiently as and when it enters the body. A major advantage of the method is that large quantities of the vaccine could be produced quickly. The major disadvantage, however, is that no such vaccine against any disease has ever made an appearance on the market before. The first test subjects were injected with the substance as early as mid-March. Moderna hoped to obtain emergency dispensation to start vaccinating medical staff in the same month. However, the date has now been postponed until autumn. U.S. authorities are working on the basis that the substance could only become widely used in 12 to 18 months at the earliest – with the strong proviso that it proves to be safe and effective.

## CureVac

We also have a direct line to CureVac. The company based in southern Germany is working on a similar RNA-based technology. Over the last few weeks, CureVac has made headlines on more than one occasion. First, when word got around that SAP billionaire Dietmar Hopp is the majority shareholder. Then, when it became known that the U.S. government had signaled interest in buying up CureVac's vaccine rights. However, the vaccine has not yet reached the clinical phase of development, i.e. it has not yet been tested on humans. Nevertheless, CureVac are certainly not reticent in their forecasts. "If all goes well, the vaccine might be available towards the end of the year," said co-owner Friedrich von Bohlen last week. A clinical trial is due to start in early summer. According to statements issuing from the company, the number of volunteers for the trial could be in the tens of thousands. In the medium term, an already existing production facility could be reconfigured to manufacture "between 200 and 400 million vaccine doses per year" to combat the coronavirus pandemic. The first production run is said to be already underway.

## University of Oxford

Researchers at Oxford University plan to start clinical trials of a vaccine as early as April. They hope to have a viable vaccine in less than twelve months. 510 volunteers have been lined up to take part in the study. The vaccine has already been tested on pigs. It is what is known as a "vector-based vaccine". It uses genetically modified harmless viruses into which a component of the target virus has been inserted. In this way, the body is tricked into believing that it has become infected with Covid-19, which then causes it to build up its own immune reserves. The first approved Ebola vaccine, for example, works according to this principle.

BioNTech, Pfizer, Fosun

BioNTech has also entered the race to develop the first corona vaccine. The Mainz-based biotech company is funded by two pharmaceutical giants – Fosun Pharmaceutical from China, which has reportedly contributed €120 million, and the U.S. company Pfizer. A study involving volunteers in Europe, the USA and China is scheduled to start at the end of April. This vaccine will also work with the innovative “messenger RNA” (mRNA) technology whereby the vaccine does not contain the antigen itself, but only the instructions for its makeup.

Drugs to combat the coronavirus

### 1. Antiviral medicaments

Antiviral drugs are used against HIV, SARS, Ebola, hepatitis C and other diseases. Their main purpose is to prevent the viruses from multiplying in the body or penetrating the cells.

Remdesivir

Corona patients with particularly severe symptoms may in future be treated with remdesivir, an active substance that is still awaiting approval, but only in the event that all other remedies have failed. In Germany, however, it has already been granted limited approval. Remdesivir was originally developed by the U.S. pharmaceutical company Gilead Sciences to treat Ebola virus infections but unfortunately proved unsuccessful in clinical trials. Yet according to the World Health Organization (WHO), remdesivir has shown a certain degree of effectiveness against MERS viruses, which is why researchers hope to be able to use it successfully to combat SARS-CoV-2. Several studies are underway and more than 700 patients have already received the drug. Scientists hope that initial results will become available sometime during April. At the end of March, a first trial with the drug also started in Germany as part of an international study

involving around 1,000 patients in 50 or so hospitals around the world. Remdesivir is to be tested on 600 patients with moderate symptoms and 400 with severe symptoms.

## Leronlimab

The antibody substance leronlimab has already been investigated in clinical studies for effectiveness against HIV and breast cancer. The U.S. company Cytodyn is now testing it for suitability in treating Covid-19 patients. Leronlimab was developed to block proinflammatory proteins known as cytokines and thus prevent an overreaction of the immune system, as witnessed in many cases of Covid-19.

## Lopinavir/Ritonavir

Lopinavir and ritonavir used in combination are also a medication against HIV. The U.S. company AbbVie has now made the drug available for SARS-CoV-2 trials. Researchers hope that lopinavir will be effective in preventing the coronavirus from multiplying. Covid-19 patients in China have been treated with the drug, but so far without any significant success. In trials conducted by the Chinese pharmaceutical company Asclepis Pharma, the approved anti-hepatitis drug danoprevir is being used in combination with ritonavir. This use of lopinavir/ritonavir in combination with ribavirin also resulted in a lower mortality rate and a less aggressive disease progression in a clinical trial involving patients during the SARS outbreak in 2003.

## Favipiravir

A drug with the active ingredient favipiravir (also known as faviavir), which is approved in Japan for the treatment of influenza, inhibits the production of a certain enzyme that viruses rely on to replicate. It has been tested by Chinese scientists on more than 300 Covid-19 patients. The Chinese National Medical Products Administration (NMPA) classifies the drug as effective.

However, it is still unclear whether it also helps patients with severe symptoms and how dangerous any side-effects may be.

## APN01

The drug APN01 was originally developed for the treatment of lung damage or acute lung failure. One of its purposes is to prevent viruses from entering the lung cells. It is also believed to prevent the inflammatory response of the lung. One advantage of this active substance is that several studies have already been carried out on patients. Serious side-effects have not yet been identified. The decisive factor in this active substance is the ACE2 receptors in the human body. The virus uses these as a gateway to enter the cells (see our Keynote 14). APN01 has been formulated to mimic these ACE2 proteins. This would induce the virus to latch onto the active substance rather than onto the surface of a cell. The virus would then be naturally excreted along with the drug. The Austrian biotech company Apeiron Biologics plans to test APN01 this month on approximately 200 severely ill Covid-19 patients in Germany, Austria and Denmark.

## Chloroquine and hydroxychloroquine

Chloroquine was originally developed in the 1930s to combat the tropical disease malaria, and may be useful in inhibiting the proliferation of the coronavirus in cells. Researchers in several countries have already tested it on individual Covid-19 patients. The U.S. Food and Drug Administration (FDA) approved the use and/or prescription of chloroquine and its near-relative hydroxychloroquine for teenage and adult in-patients with Covid-19 at the end of March. The German pharmaceutical and chemical group Bayer manufactures the proprietary drug Resochin® containing chloroquine and has already announced that it will step up production. However, we would remind you of our warning that it can have serious side-effects, and we strongly advise against self-medication. Hydroxychloroquine is also being tested in trials. The antimalarial drug had shown positive results, but so far there is no reliable evidence of its efficacy against Covid-19. Here too, experts warn of possible side-effects. For

example, Agence nationale de sécurité du médicament (ANSM) in France published a report in late March on individual cases of serious side-effects in Covid-19 patients. The French authority for drug safety warned in particular of cardiac disorders that can occur, for example, when administered in combination with other drugs. Here too, we would echo the warning of physicians against self-medication.

### Interferons for virus defense

Various substances are being tested for their ability to reinforce the body's natural defenses against Covid-19. Interferons are signal proteins that can improve the performance of the immune system by helping it to better recognize cells that are infected by the virus and thus prevent the virus from multiplying. Alpha and beta interferons play a central role in research on SARS-CoV-2.

### Interferon alpha-1b and interferon alpha-2b

The Cuban company BioCubaFarma and the Cuban-Chinese company Changchun Heber Biological Technology are just two of the research teams who have already carried out tests with these antiviral agents on Covid-19 patients. The drugs have already been approved in some countries, for example as a treatment for hepatitis B or C. BioCubaFarma claims that it can manufacture and supply in large quantities.

### Interferon beta-1a and interferon beta-1b

Drugs with interferon beta-1a and interferon beta-1b are also undergoing trials, for example with the interferon formulation from the German company Merck. The drug is said to have prevented SARS viruses from multiplying in laboratory tests, but it has not yet been approved in the EU. The biotech company Synairgen Research says that it has tested its proprietary drug SNG001 on Covid-19 patients and has had success in treating infections of the pulmonary tract. It is administered via an inhaler and thus reaches the lungs directly.

## 2. Immunomodulators

The immunomodulator group of drugs could also be helpful in treating Covid-19. These are active substances that prevent the patient's immune system from overreacting, thereby preventing potential organ damage. At this point, we would like to warn again about the indiscriminate use of standard vitamin supplements, especially in the USA (Covid-19 Protocols), which trigger precisely this overreaction of the immune system.

### Sarilumab and tocilizumab

The French pharmaceutical group Sanofi and the U.S. conglomerate Regeneron Pharmaceuticals have announced that their immunomodulator sarilumab will be tested on Covid-19 patients in several countries, including Italy, Spain and Germany. The active substance is an antibody that was originally developed for the treatment of rheumatoid arthritis (diseases of the musculoskeletal system). In Covid-19 patients, it is believed to inhibit inflammatory reactions in the lungs. Tocilizumab, another anti-rheumatism drug, is being tested by the Swiss pharmaceutical company Roche and by Chinese researchers on Covid-19 patients with severe pneumonia.

### Fingolimod

Fingolimod, an approved drug developed by the Swiss company Novartis for the treatment of multiple sclerosis, is also being tested on patients by Chinese physicians.

### IFX-1

Also in China, Covid-19 patients with severe pneumonia have been treated with the drug IFX-1. The Jena-based biotech company InflarRx claims to have had encouraging results. The antibody is now being tested on Covid-19 patients for a study in the Netherlands.

### 3. Medicines for patients with lung conditions

Another group of drugs that could be considered for the treatment of Covid-19 are medications for lung patients. Several companies are at the planning stage for studies in this area.

For example, Roche is preparing to test its approved drug pirfenidone, which helps to prevent scarring of lung tissue. The Austrian biotech company Apeptico plans to test solnatide, a medication that is effective against acute lung failure, on patients.

The U.S. company Bioxytran is conducting research on a drug containing the active substance BXT-25 to boost the oxygen uptake of a damaged lung. BXT-25 has been formulated to transport oxygen efficiently through the body for nine hours before it is processed by the liver. The drug can help to supply oxygen to vital organs. In February, the company announced that it was exploring a joint venture with “pharmaceutical multinationals” to develop the drug for the treatment of Acute Respiratory Distress Syndrome (ARDS) in Covid-19 patients.

### 4. New drugs

#### Passive immunization with antibodies

In addition to medicaments already available, new substances to combat the coronavirus are also being developed. Research here is primarily focused on antiviral drugs and on antibodies that could be used to immunize patients. For example, patients could be injected with the blood plasma of recovered Covid-19 patients. The Hannover Medical School, the NRW Heart and Diabetes Center in Bad Oeynhausen and the University Hospitals of Cologne and Münster are involved in such projects. Researchers in Japan and Spain have plans to use the antibodies from the blood plasma of recovered patients to produce a drug for

infusions. The U.S. pharmaceutical company Lilly, together with the Canadian company AbCellera Biologics Inc., wants to gather antibodies from recovered patients and identify the ones that seem best suited to the production of a drug for the prevention and treatment of Covid-19. The target that has been set is to develop potential new therapies and bring them to the clinical trial stage with patients within the next four months.

## TESTINGS

Extensive testing is required for the confinement of the new coronavirus. Here we have to distinguish between two different testing methods. So far the applied PCR tests are performed via swabs and do not require blood draws. They only give information about acute infection.

With the progression and spreading of the virus it gets more important to determine people who already went through infection, sometimes even without knowing. Although it is still not verified if and for how long and how strong after infection an immunization takes place.

Despite the open Questions, all hopes rest on antibody tests, which establish a past infection with Coronavirus. It is assumed that 70 % of the population need to have gone through an infection, until the pandemic can be stopped. Although this also represents a hypothesis which still needs to be validated.

**As part of our new Salvagene immune panel we will implement for our premium clients the currently most reliable tests for Covid-19 PCR and Covid- 19 Antibodies, in order to ensure continuous monitoring and optimization of your immune system.**

More information in the following keynote.

**SALVAGENE HQ**  
Université Paris Sorbonne  
125 Rue Saint-Jacques, 75005 Paris

**SALVAGENE UK**  
52 Grosvenor Gardens • SW1W 0AU London UF  
Tel: 0044 20 3287 0644

**SALVAGENE USA**  
101 Avenue of the Americas, 8th floor • 10013 New York  
Tel: +1 646 583 0370

[info@salvagene.com](mailto:info@salvagene.com) • [www.salvagene.com](http://www.salvagene.com)