ПАГУОШСКИЙ КОМИТЕТ КАЗАХСТАНА

Национальный Центр Биотехнологии

Biotechnology in Kazakhstan. Global challenges during a pandemic

Pavel Tarlykov, PhD, Head of the Proteomics and Mass Spectrometry Laboratory,
National Center for Biotechnology

Nur-Sultan,
October 21, 2020

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What is Biotechnology?

- **Biotechnology is technology that utilizes biological systems, living organisms or parts of this to develop or create different products.**

- **Biotech corporations are capable of pushing back IT and oil companies, because they are responsible for important areas of our life including health, energy and food.**

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Who is biotechnologist?

Biotechnologists create and improve products and processes for agriculture, medicine, food industry, etc.

Where do biotechnologists work?

- Pharmaceutical companies;
- Food production, perfumery, cosmetics;
- Agricultural and industrial enterprises and farms;

National Center for Biotechnology

Where do Biotechnologists work?

- Labs and research institutes

The National Center for Biotechnology was created by the Decree of the Government of the Republic of Kazakhstan dated August 2, 2005 No. 802 "On some measures for the development of biotechnology in the Republic of Kazakhstan"

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- Global challenges during a pandemic
- Decoding the viral genome
- Biotechnology in disease prevention
- Biotechnology in disease diagnostics

ПАГУОШСКИЙ
КОМИТЕТ КАЗАХСТАНА

Global challenges during a pandemic

The President of Kazakhstan spoke at the 75th session of the UN General Assembly

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Global challenges during a pandemic

- On September 23, 2020, President of Kazakhstan spoke at the general political debate of the 75th session of the UN General Assembly.

- Addressing the participants in the debate, the Head of State noted that the 75th anniversary of the UN is taking place at a time of global challenges. According to the President, the main problem remains the coronavirus pandemic, which causes serious damage to the global economy and is the source of numerous disasters and suffering for people around the world.

- **The head of state proposed to carefully study the idea of creating a Network of Regional Centers for Disease Control and Biosafety under the auspices of the UN. The President expressed his readiness to locate one of these institutions on the territory of Kazakhstan.**

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Global challenges during a pandemic

CLINICAL MICROBIOLOGY REVIEWS, Oct. 2007, p. 660–694 Vol. 20, No. 4
0893-8512/07/$08.00+0 doi:10.1128/CMR.00023-07

Severe Acute Respiratory Syndrome Coronavirus as an Agent of Emerging and Reemerging Infection

Vincent C. C. Cheng, Susanna K. P. Lau, Patrick C. Y. Woo, and Kwok Yung Yuen*

State Key Laboratory of Emerging Infectious Diseases, Department of Microbiology, Research Centre of Infection and Immunology, The University of Hong Kong, Hong Kong Special Administrative Region, China

- Previous epidemics of avian influenza and SARS and MERS syndromes have been triggered by human contact with animals. Despite the fact that it was possible to stop these epidemics and the virus disappeared from the human population, it always remained in a natural reservoir and at any moment could again “jump” onto a human (a threat to biosafety).

- **It is necessary to conduct constant monitoring of the spread of viruses in the natural reservoir, study them and classify.**

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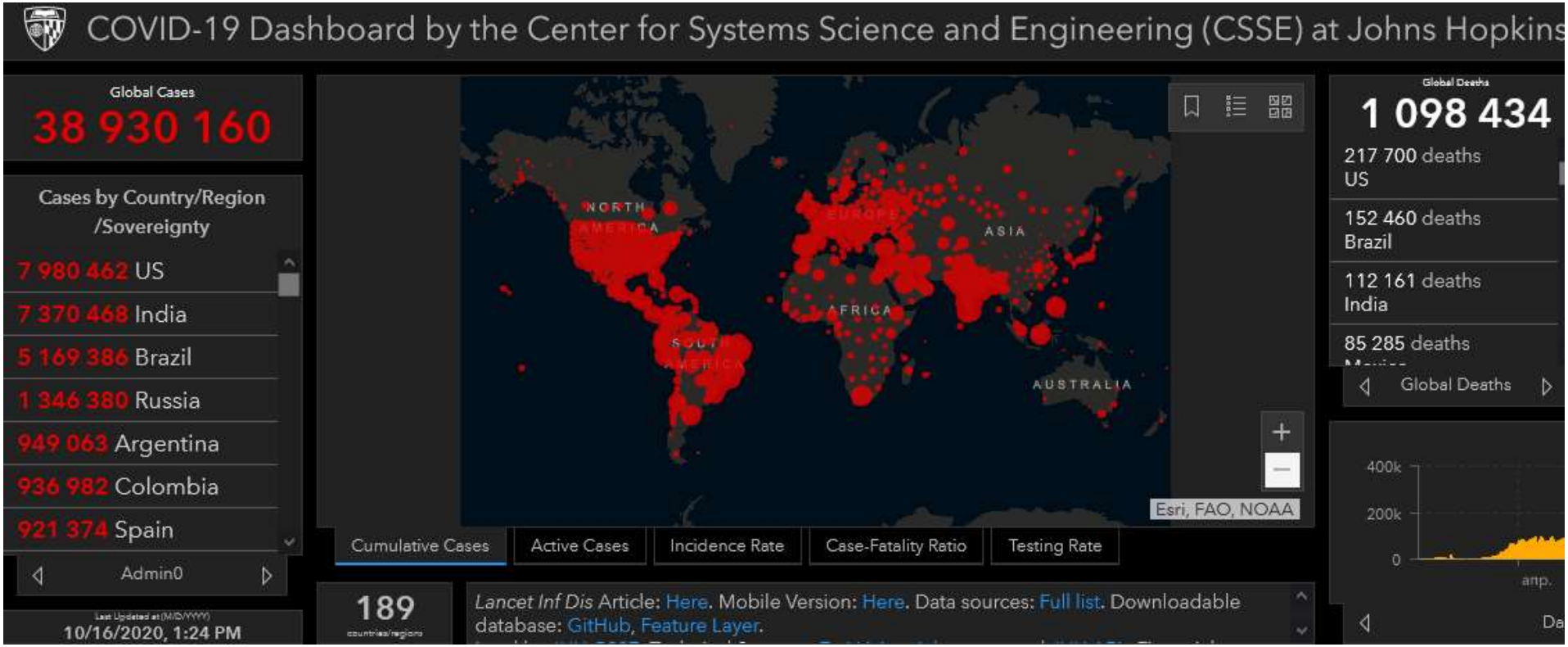
Global challenges during a pandemic



What does an untimely response lead to?

First reported case - Wuhan on December 31, 2019

https://coronavirus.jhu.edu/map.html

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Global challenges during a pandemic

WHO: *Tuberculosis* was the world's *deadliest* infectious *disease*

http://www.who.int/tb/publications/global_report/en/

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Global challenges during a pandemic

COVID-19

39 million people became infected with COVID-19 in just 10 months

COVID-19 over 1 mln deaths in just 10 months

TB

An estimated 10.0 million (range, 9.0–11.1 million) people fell ill with TB in 2018, a number that has been relatively stable in recent years.

10 million people contract tuberculosis every year

Globally, there were 1.2 million (range, 1.1–1.3 million) TB deaths among HIV-negative people in 2018 (a 27% reduction from 1.7 million in 2000) and

~1 mln deaths every year

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Genetic analysis of the virus

- **Decoding the genome gives us an understanding of what we are dealing with!**

- **Initially, it was the decoding of the virus genome that helped to classify it as a new SARS-CoV, or SARS-CoV-2 (they found 82% coincidence with the human SARS-CoV virus, the epidemic of which took place in 2002-2004)**

- **Genome-wide sequencing of the virus in various countries has revealed evolutionary changes and mutations that determine the aggressiveness of the virus. A new type of SARS-CoV-2 virus with a point mutation in the D614G spike protein has been identified.**

- **Genome sequencing data shed light on key epidemiological parameters such as reconstruction of transmission routes, time of origin, identification of possible sources and reservoirs of infection.**

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Genome decoding

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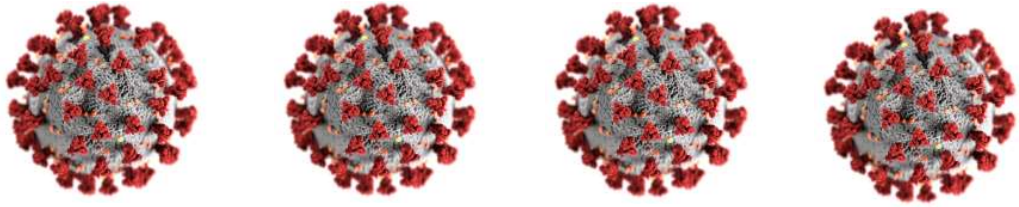
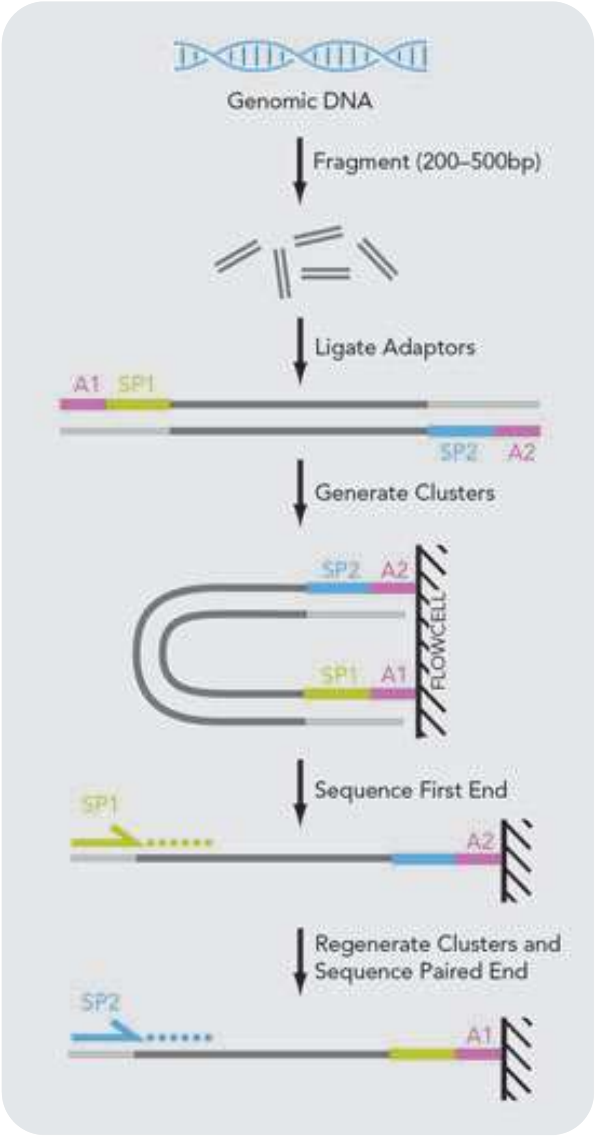


In March 2020, the first 4 genomes of the virus from Nur-Sultan, Kazakhstan were deciphered from biomaterial samples from patients with a confirmed diagnosis of COVID-19.



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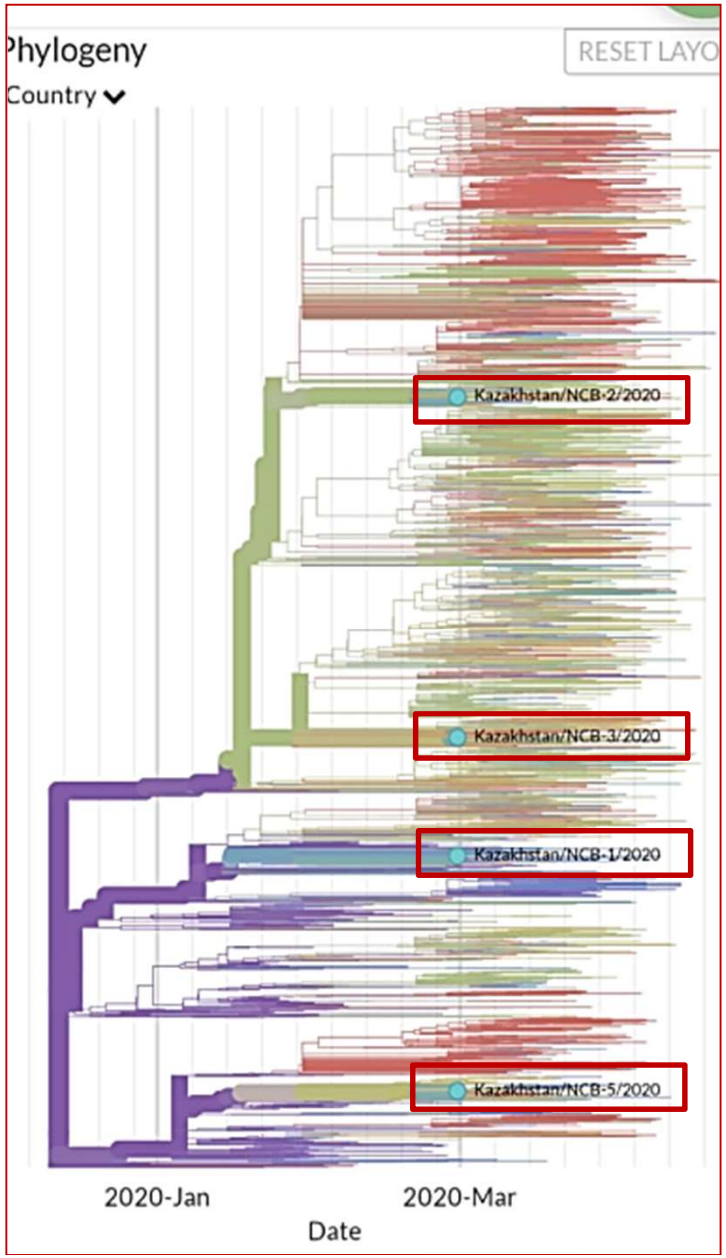
Genome decoding made it possible to identify the source of the infection

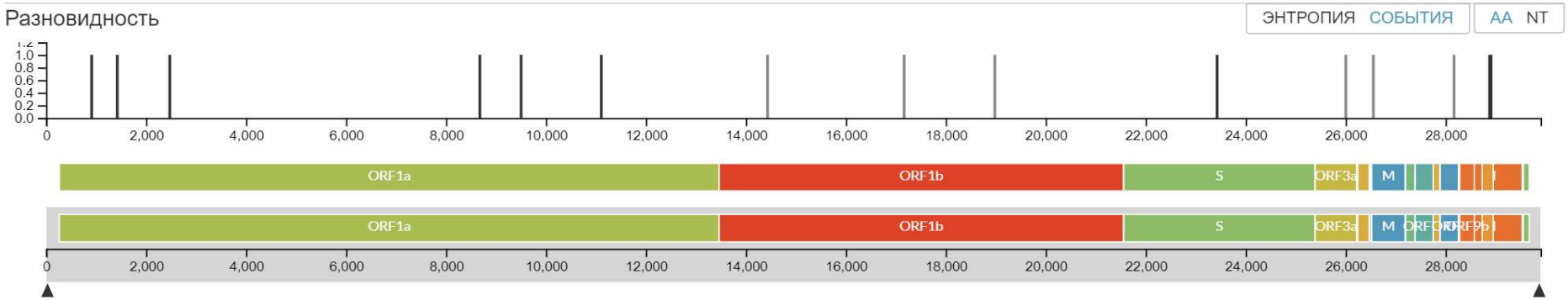
Sources of infection in Nur-Sultan in March 2020 were Iran, England and Spain

Isolates of SARS-CoV-2 from Kazakhstan (March, 2020), deposited in GISAID and NCBI



Isolate	Genbank (NCBI submission ID)	GISAID (Accession ID)	Isolation date 2020	Genome size
hCoV-19/Kazakhstan/NCB-1/2020	MT428551	EPI_ISL_435045	22 марта	29900
hCoV-19/Kazakhstan/NCB-2/2020	MT428552	EPI_ISL_435046	25 марта	29903
hCoV-19/Kazakhstan/NCB-3/2020	MT428553	EPI_ISL_435047	25 марта	29903
hCoV-19/Kazakhstan/NCB-5/2020	MT428554	EPI_ISL_435048	21 апреля	29903

Isolates of SARS-CoV-2 from Kazakhstan (March, 2020)



Genome size is 30 000 nucleotides

Mutations found

Изолят	Нуклеотидные замены	Аминокислотные замены (перечень с указанием кодирующей области генома)
covid-1	C4234T, T16272G, C17141A, T29742G	ORF1b: A1225D
covid-2	G28857T	N: R195I, ORF14: E42*
covid-3	A18956G	ORF1b: N1830S
covid-5	G2448A	ORF1a: G728D

Changes in the genome of the virus have a neutral effect.

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Genomes and monitoring of coronaviruses population

- **In 2016 - 2018 in Kazakhstan, the international project "Coronavirus: Surveillance of the spread and incidence of the disease in Kazakhstan" was carried out.**
- **As part of the project, the spread of the Middle East respiratory syndrome coronavirus among camels and bats was monitored in 7 regions.**
- **As a result of the research, unique genotypes of coronaviruses from bats living in the country were identified**

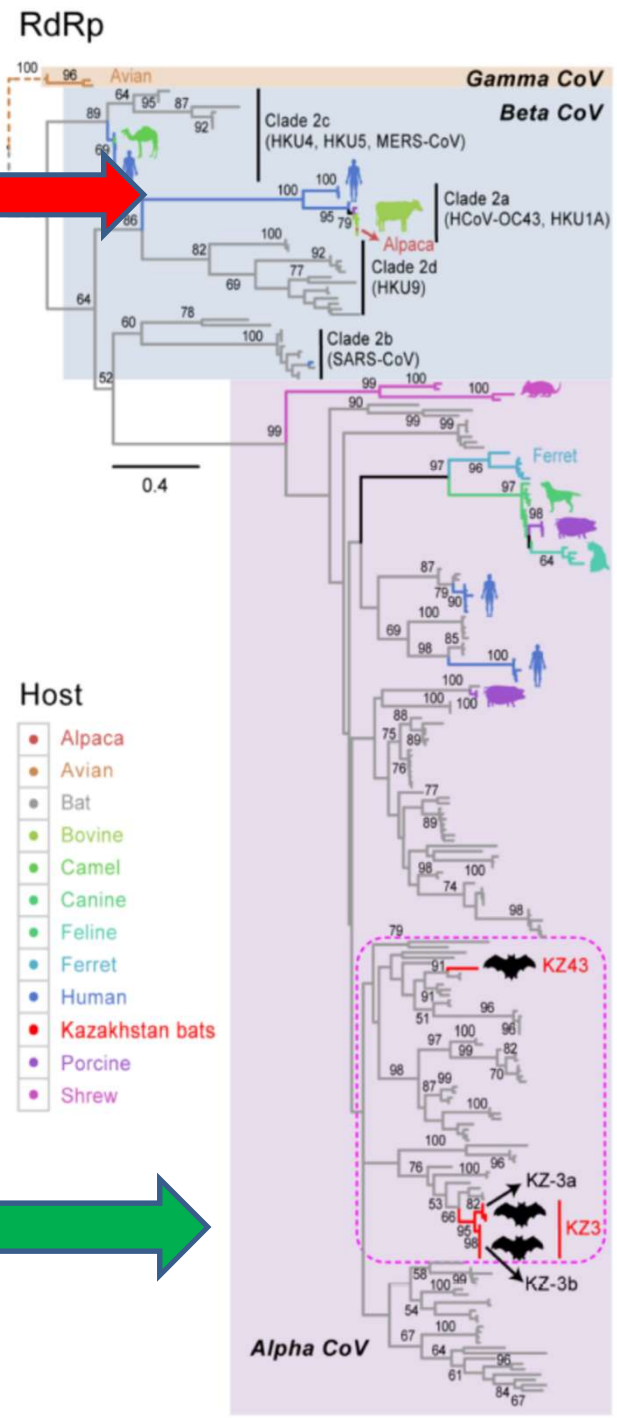
MDPI

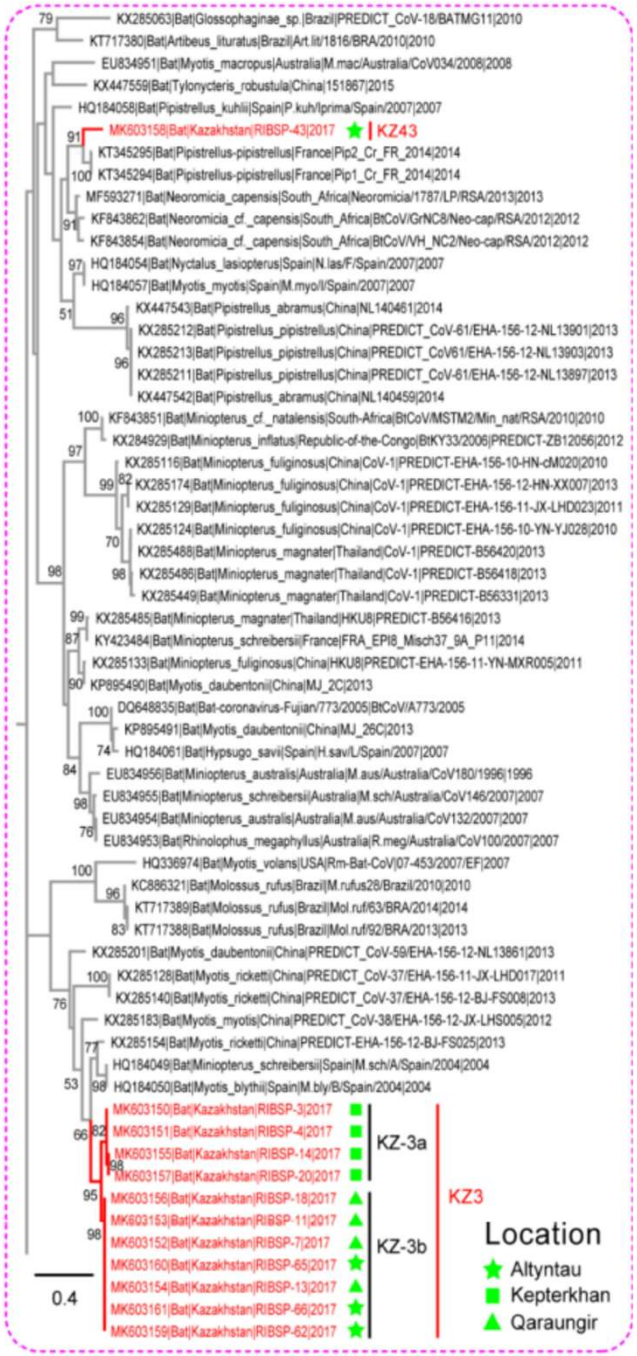
Brief Report

Discovery and Characterization of Novel Bat Coronavirus Lineages from Kazakhstan

SARS-CoV-2
COVID-19
Beta CoV
Family

Local Isolates-
Alpha CoV
Family





The need to decipher the genome. Conclusions

- Monitoring of genetic changes - mutations
- Determination of circulating genotypes (what happens every year with the influenza vaccine)
- Determination of the source of the infection
- The relationship between genotype and disease severity

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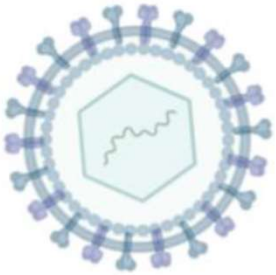
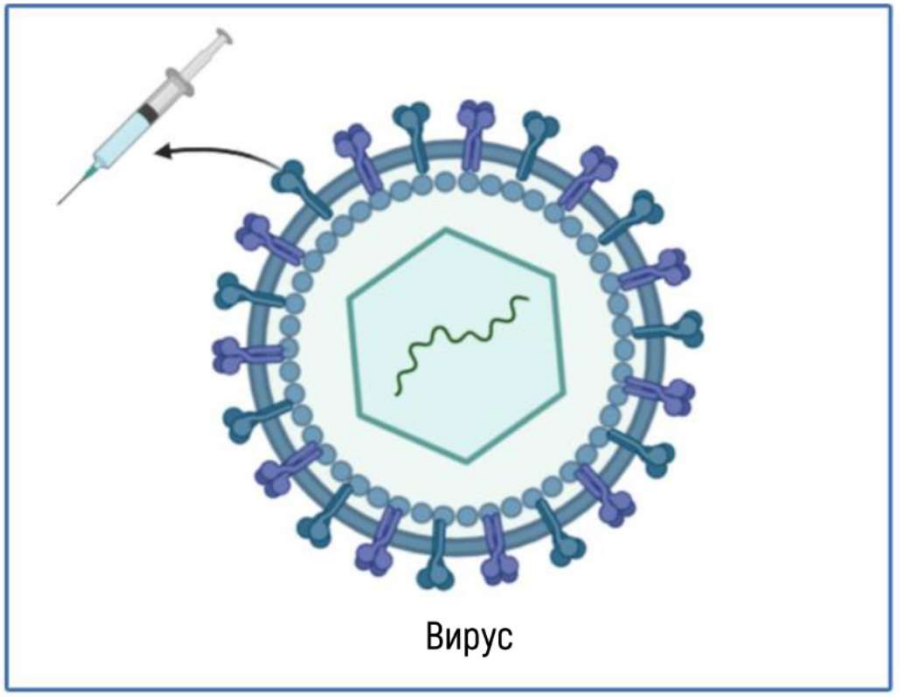
Biotechnology in disease prevention

Живая аттенуированая

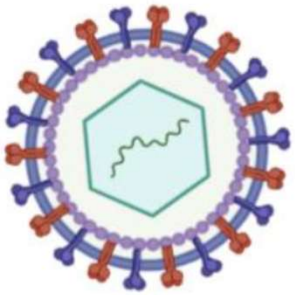


Цельная инактивированная

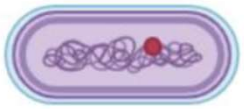


Вирус

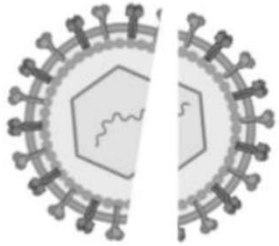
Рекомбинантный вирусный вектор



Рекомбинантный бактериальный вектор

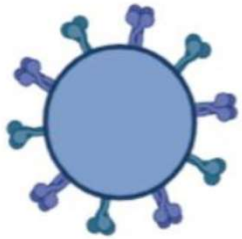


Расщепленная

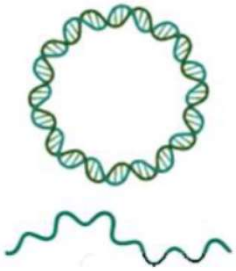


Синтетические пептиды

Псевдовирусы



ДНК или РНК



Рекомбинантная субъединичная

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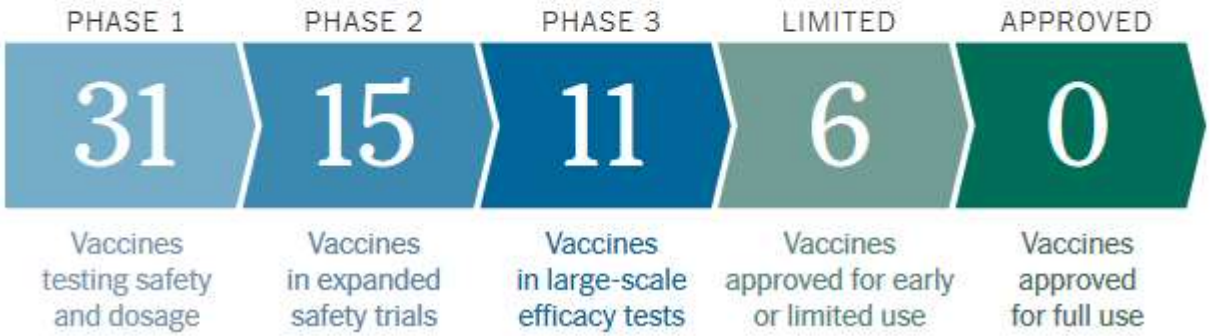
Coronavirus Vaccine Tracker

By Jonathan Corum, Sui-Lee Wee and Carl Zimmer Updated October 16, 2020

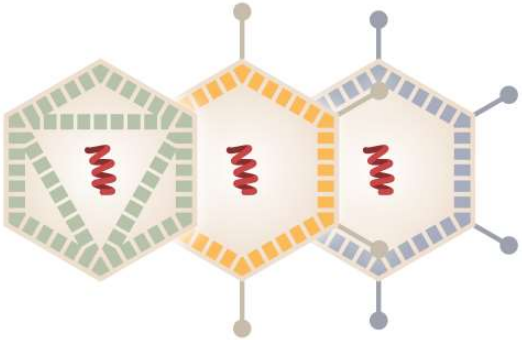


Vaccines based on adenoviral vectors

PHASE 3 APPROVED FOR EARLY USE

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

Sputnik V
Ad5 and Ad26



PHASE 3 APPROVED FOR LIMITED USE

CanSinoBIO

Ad5-nCoV

Contain in their genome an insert coding for a fragment of the SARS-CoV-2 S-protein that induces an immune response

Biotechnology in disease prevention

World Health Organization

Health Topics | Countries | Newsroom | Emergencies

Home / Publications / Overview / Draft landscape of COVID-19 candidate vaccines

Draft landscape of COVID-19 candidate vaccines

9 September 2020 | Publication

1 Kazakhstan inactivated vaccine **QazCovid-in** is registered by WHO as a candidate vaccine for **Phase I and II clinical trials**.
Developer Scientific Research Institute of Biological Safety Problems of the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (NIIPBS)

2 Subunit vaccine based on nanoemulsion adjuvant Developed by the International Vaccine Center of the KazNAU Ministry of Agriculture of the Republic of Kazakhstan and the National Scientific Center for Highly Dangerous Infections named after M. Aikimbaeva MH RK registered by WHO **for preclinical trials**

Recombinant spike protein with Essai O/W 1849101 adjuvant	Kazakh National Agrarian University, Kazakhstan / National Scientific Center for Especially Dangerous Infections

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Biotechnology in disease prevention

- **On September 17, the institute began the first phase of clinical trials of Kazakhstan inactivated vaccine QazCovid-in (44 volunteers, 22 of them placebo).**
- **Minister of Education and Science Askhat Aimagambetov voluntarily vaccinated with QazCovid-in**
- **III phase - at least 3000 volunteers are planned**
- **A vaccine production plant (GMP standards) will be built in Kazakhstan in 2021**

ПАГУОШСКИЙ КОМИТЕТ КАЗАХСТАНА

Biotechnology in disease prevention

- **The goal is not only to create a vaccine against COVID-19, but also to develop a modern technological platform for the development of vaccines against future infections (ensuring the biosafety of Kazakhstan)**

- **Not all vaccine candidates end up with approval and use!**

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Coronavirus medications

2	2	13	2	3
Widely used	Promising evidence	Tentative or mixed evidence	Not promising	Pseudoscience or fraud

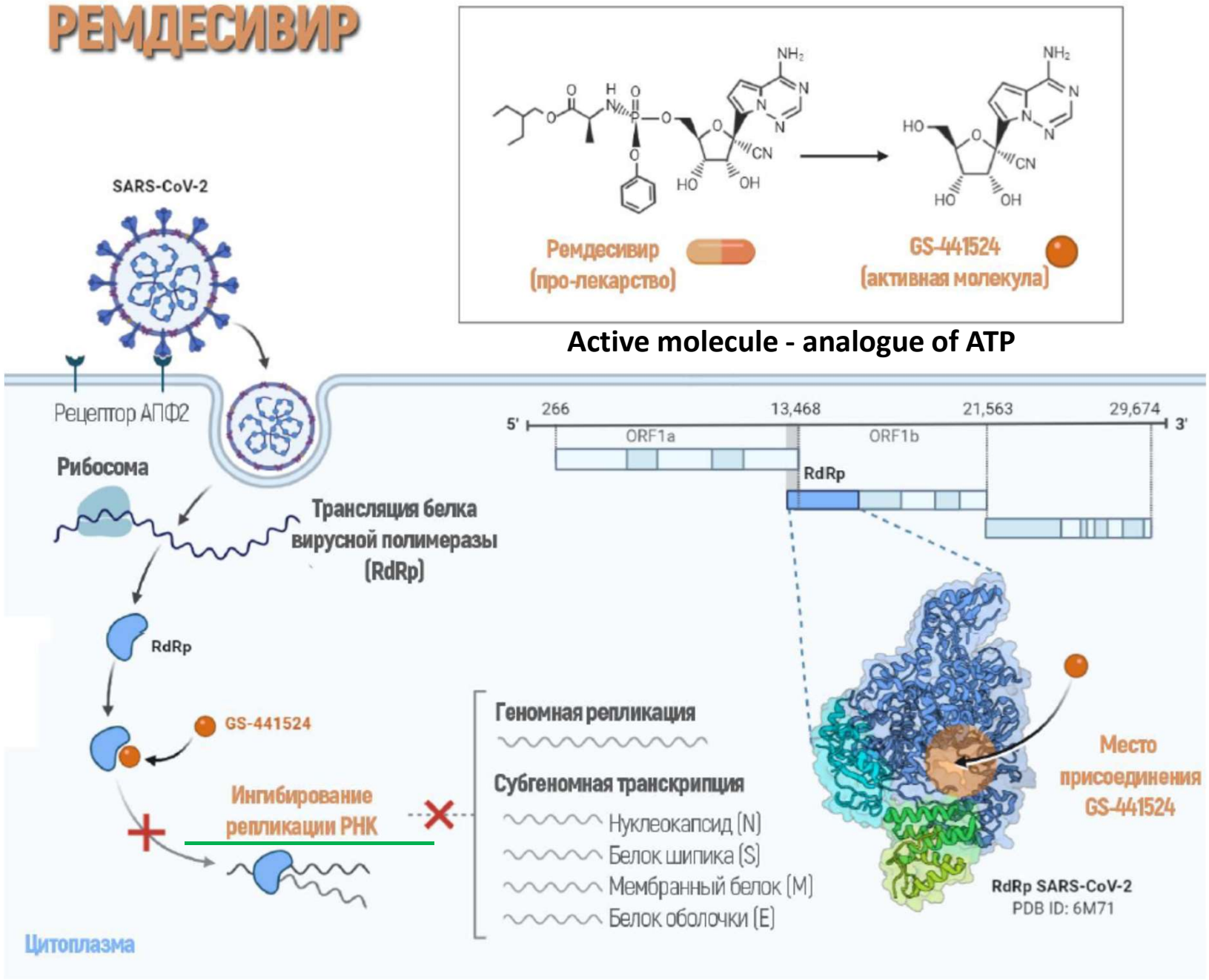
PROMISING EVIDENCE | EVIDENCE IN CELLS, ANIMALS AND HUMANS

EMERGENCY USE AUTHORIZATION

Remdesivir is a new antiviral drug in the class of inhibitors of RNA-dependent RNA polymerase, an enzyme of the virus necessary to copy itself

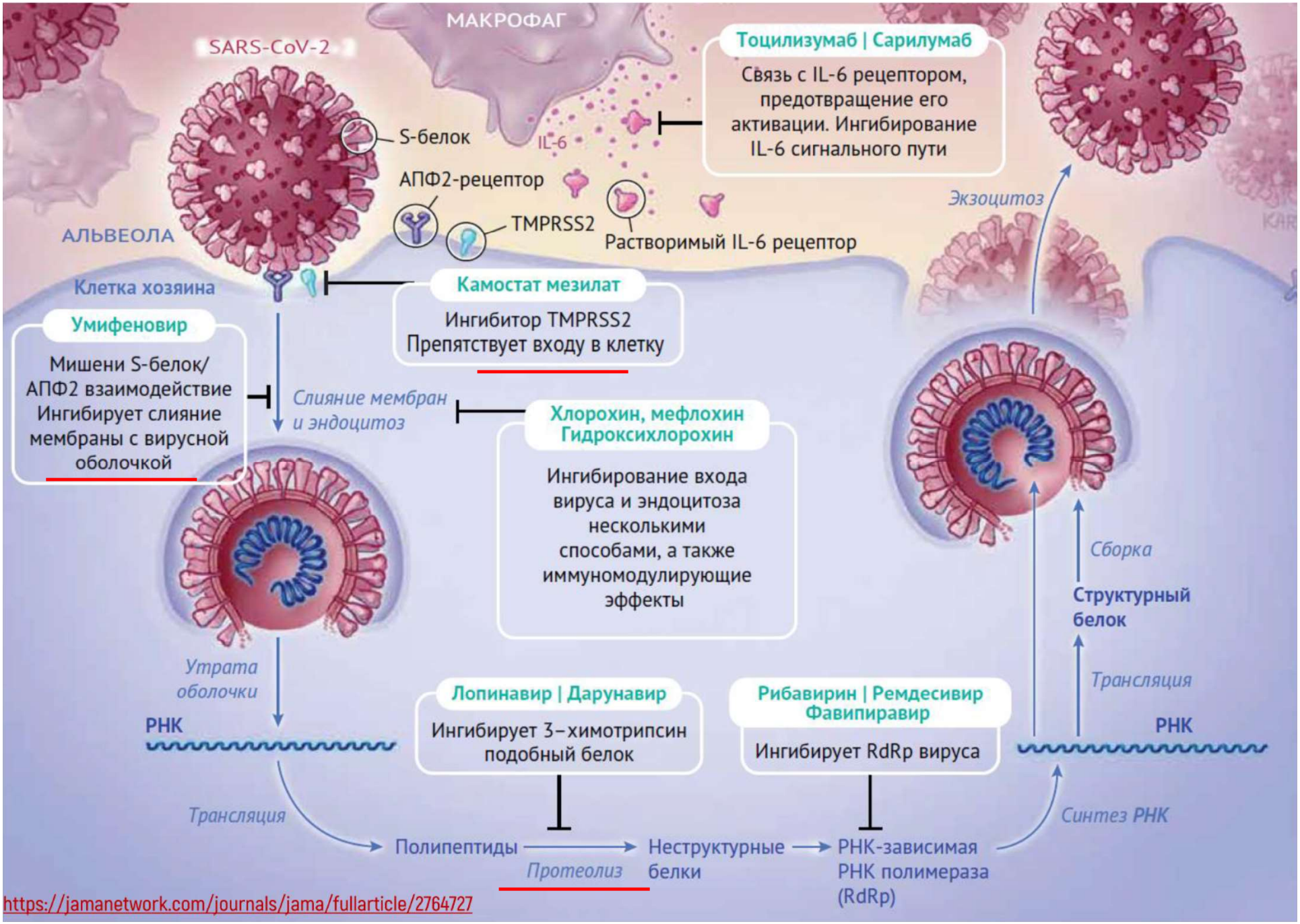
Remdesivir exhibits antiviral activity against a number of single-stranded RNA viruses such as the Ebola virus and coronaviruses (including MERS and SARS viruses)

The search for new antiviral drugs is a very hot topic !!!
There are very few of them!



Active molecule - analogue of ATP

Inhibition of replication - Delayed cessation of the growth of new viral RNA molecules



https://jamanetwork.com/journals/jama/fullarticle/2764727

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Biotechnology in disease diagnostics

Reagent kit for detecting SARS-CoV-2 virus RNA in clinical material by real-time RT-PCR

National Center for Biotechnology

Domestic PCR test for the diagnosis of coronavirus infection

- **In January 2020, NCB scientists developed a test system for diagnosing coronavirus COVID19 within 6 days**

- **The first 250 patients in the Republic of Kazakhstan with suspected infection with a new coronavirus were examined by the test system of the RSE "National Center for Biotechnology" of the CS MES RK**

- **The "Real Time PCR" test system for the diagnosis of coronavirus infection was developed in strict accordance with the WHO recommendations at the Nur-Sultan National Central Hospital, and diagnostic studies were carried out at the Almaty branch of the National Central for Biotechnology (CRL)**

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Production of PCR-based diagnostic kits in Kazakhstan

- In the state register of drugs, medical devices and MT RK, which is maintained by the National ELS (https://www.ndda.kz/category/search_prep), 51 PCR tests with real-time detection are currently registered (https: // www. diamed.rocks/o-nas). 50 of them are registered by one manufacturer Diamed Asia Test LLP

- One of the local PCR tests for coronavirus is "Set of reagents CAMOMILE-SARS-CoV2-PCR for the detection of SARS-CoV-2 virus RNA in clinical material by RT-PCR in real time" Diamed Asia Test LLP.

- Second PCR test for coronavirus is "A set of reagents for detecting RNA of the SARS-CoV-2 coronavirus by PCR with hybridization-fluorescent detection in" real time "

- **There is a demand, but there is practically no domestic production !!!**

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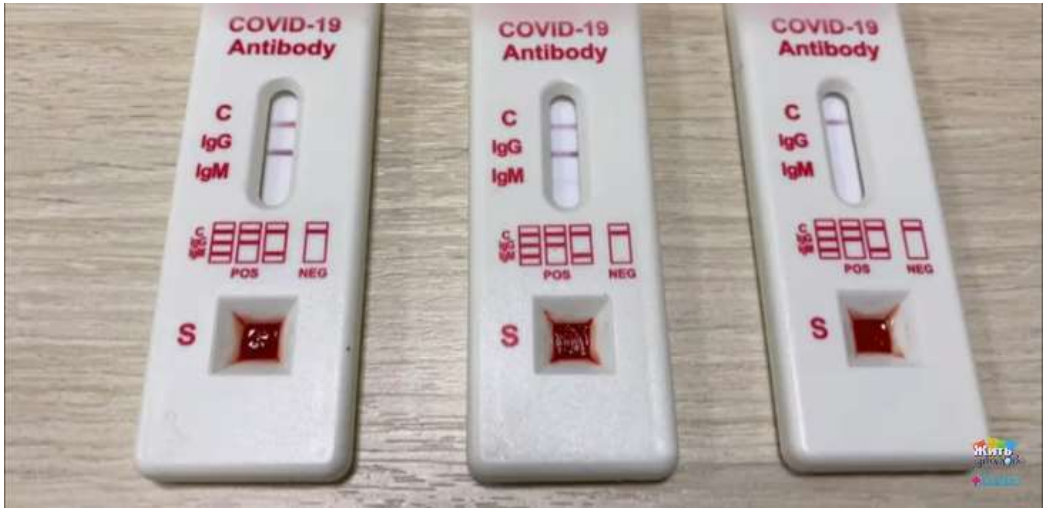
Production of ELISA diagnostic kits in Kazakhstan (antibody tests)

- ELISA tests registered in Kazakhstan is more extensive and includes more than 100 titles, also produced by the only manufacturer Diamed Asia Test LLP.

- The only domestic test for antibodies to coronavirus is the "CAMOMILE-SARS-CoV-2-G / M" kit for detecting antibodies of classes G and M to the SARS-CoV-2 virus by enzyme immunoassay in human blood serum (plasma) "



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FAKE NEWS

Казахстан становится плацдармом биологической войны?

08.04.2020 - 02:00 Автор: nightbomber_y2

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КОМИТЕТ КАЗАХСТАНА

FAKE NEWS

Главная / Новости / Общество /

В Алматы американская биолаборатория не проявляет признаков участия в борьбе с коронавирусом

07.04.2020, 16:09 249103

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КОМИТЕТ КАЗАХСТАНА

FAKE NEWS

- This material is a mixture of lies, manipulation and conspiracy theories that are easily disapproved.
- The laboratory in Almaty is NOT American and has been at the forefront of the fight against coronavirus in Kazakhstan since January 2020 (subordinate to the Ministry of Health, Ministry of Education and Science, Ministry of Agriculture).
- The viruses studied in bats in Kazakhstan belong to a different family of coronaviruses (ALPHA-CoV Coronaviruses).
- The US has indeed co-funded a number of studies under the Cooperative Biological Research Program. And now, we at least know that our bats have the ALPHA family coronaviruses.
- No one could have created a coronavirus that causes COVID-19 in a laboratory.
- The process of creating a modified virus is assembling one virus from parts of several others. If you decode the genome of such a modified virus, you can see the blocks (inserts) from which it was built. More than 100 thousand coronavirus isolates have been read around the world and scientists have not found any inserts.

- **You need to follow only trusted sources such as WHO, FDA, Ministry of Health!**

https://factcheck.kz/claim-checking/verdict/amerikanskaya-biolaboratoriya-i-borba-s-koronavirusom-dekonstrukciya-propagandy/.

Thank you!
Questions?

Tarlykov@biocenter.kz