



NEWS

from science and research

Folding of SARS-CoV2 genome reveals drug targets – and preparation for »SARS-CoV-3«

For the first time, an international research alliance has observed the RNA folding structures of the SARS-CoV2 genome with which the virus controls the infection process. Since these structures are very similar among various beta corona viruses, the scientists not only laid the foundation for the targeted development of novel drugs for treating COVID-19, but also for future occurrences of infection with new corona viruses that may develop in the future.

The genetic code of the SARS-CoV2 virus is exactly 29,902 characters long, strung through a long RNA molecule. It contains the information for the production of 27 proteins. This is not much compared to the possible 40,000 kinds of protein that a human cell can produce. Viruses, however, use the metabolic processes of their host cells to multiply. Crucial to this strategy is that viruses can precisely control the synthesis of their own proteins.

SARS-CoV2 uses the spatial folding of its RNA hereditary molecule as control element for the production of proteins: predominantly in areas that do not code for the viral proteins, RNA single strands adopt structures with RNA double strand sections and loops. However, until now the only models of these foldings have been based on computer analyses and indirect experimental evidence.

Now, an international team of scientists led by chemists and biochemists at Goethe University and TU Darmstadt have experimentally tested the models for the first time. Researchers from the Israeli Weizmann Institute of Science, the Swedish Karolinska

Institute and the Catholic University of Valencia were also involved.

The researchers were able to characterize the structure of a total of 15 of these regulatory elements. To do so, they used nuclear magnetic resonance (NMR) spectroscopy in which the atoms of the RNA are exposed to a strong magnetic field, and thereby reveal something about their spatial arrangement. They compared the findings from this method with the findings from a chemical process (dimethyl sulphate footprint) which allows RNA single strand regions to be distinguished from RNA double strand regions.

The coordinator of the consortium, Professor Harald Schwalbe from the Center for Biomolecular Magnetic Resonance at Goethe University Frankfurt, explains: »Our findings have laid a broad foundation for future understanding of how exactly SARS-CoV2 controls the infection process. Scientifically, this was a huge, very labour-intensive effort which we were only able to accomplish because of the extraordinary commitment of the teams here in Frankfurt and Darmstadt together with our partners in the COVID-19-NMR consortium. But the work goes on: together with our part-

ners, we are currently investigating which viral proteins and which proteins of the human host cells interact with the folded regulatory regions of the RNA, and whether this may result in therapeutic approaches.«

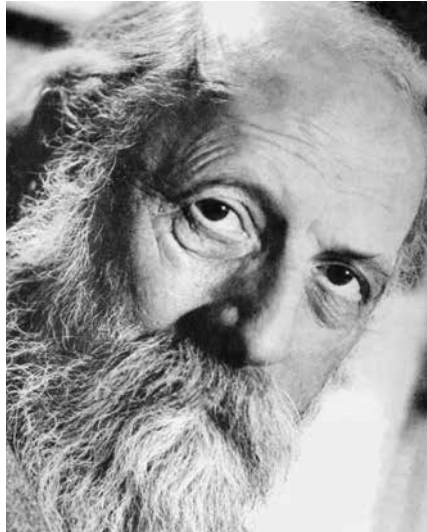
Worldwide, over 40 working groups with 200 scientists are conducting research within the COVID-19-NMR consortium, including 45 doctoral and postdoctoral students in Frankfurt working in two shifts per day, seven days of the week since the end of March 2020.

Schwalbe is convinced that the potential for discovery goes beyond new therapeutic options for infections with SARS-CoV2: »The control regions of viral RNA whose structure we examined are, for example, almost identical for SARS-CoV and also very similar for other beta-coronaviruses. For this reason, we hope that we can contribute to being better prepared for future »SARS-CoV3« viruses.«

<https://tinygu.de/GenomeFolding>

Funding for 24 years of Buber Research

Approximately 40,000 letters from Martin Buber's correspondence with his contemporaries exist, but to this day, they have hardly been accessible. A funding commitment from the federal and state governments should now change this: an academy project for the digitalisation and annotation of this valuable estate will be funded with almost € 400,000 per year. The project by Professor Christian Wiese, scholar in the field of Jewish Studies and holder of the Martin-Buber-Chair in Jewish Religious Philosophy at Goethe University and his cooperation partners Professor Martin Leiner (Friedrich Schiller University Jena), Professor Abigail Gilman (Boston University) and the National Library of Israel is designed for 24 years. As part of the project, the letters, which are primarily located in Europe, Israel and the USA, are now to be collected and grouped according to thematic modules that stretch over several years, and made digitally accessible in close collaboration with the Academy of Sciences and Literature in Mainz. Depending on the content, transcripts and – where necessary – translations from the Hebrew along with annotations will be added.



Important thinker of the German-Jewish intellectual world: Martin Buber

Martin Buber (1868 – 1965) worked at the University of Frankfurt am Main from 1924 to 1933 – first as lecturer and later as honorary professor for Jewish religious teachings and ethics. He resigned from the professorship in 1933 after Hitler took power in anticipation of having his professorship revoked. He sub-

sequently worked on setting up the Central Office for Jewish Adult Education with the Reichsvertretung of German Jews until it was forced to give up its work. Buber emigrated to Israel in 1938 before the November pogrom. Throughout his entire life, Martin Buber was in contact with personalities from all areas of intellectual life, including many writers such as Margarete Susman, Hermann Hesse, Arnold Zweig, Thomas Mann and Franz Kafka. Here, he did not shy away from controversial discussions.

<https://aktuelles.uni-frankfurt.de/englisch/24-years-for-buber-research-in-the-digital-age>

Bioplastics are not harmless

So-called »bioplastics« are marketed as an environmentally friendly alternative to conventional, petroleum-based plastics. They can be made from renewable feedstock, might be bio-degradable or even both. A study published in the journal *Environment International*, however, found the chemicals these alternatives contain are similarly toxic to those in conventional plastics. It is the most comprehensive study to date that analyses the chemical composition and toxicity of bioplastics and plant-based materials and compares them with conventional plastics. It was carried out by scientists from Goethe University led by the Institute for Social-Ecological Research (ISOE) in collaboration with the Norwegian University of Science and Technology.

<https://aktuelles.uni-frankfurt.de/englisch/chemicals-in-bioplastics-not-safer-than-those-in-conventional-plastics>

Public opinion after Berlin terrorist attack

The 2018 attack on the Christmas market at the Gedächtniskirche led to a reduction in the acceptance of refugees among the German population. This is indicated by the results of a study by sociologists Professor Alexander Schmidt-Catran and Dr Christian Czymara from Goethe University. However, the change in acceptance did not take place immediately, but unfolded gradually over several weeks. The trend could not be explained by the media coverage in the aftermath of the attack. In contrast with the change in public attitudes that took place over weeks, the online media analysed in the study reacted very quickly to the attack, and the prominence of the topic in these media ebbed away just as quickly. Attitudes towards immigration in general remained unchanged after the attack.

World record in short time measurement

In the global race to measure ever shorter time spans, physicists from Goethe University Frankfurt have now taken the lead: together with colleagues at the accelerator facility DESY in Hamburg and the Fritz-Haber-Institute in Berlin, they have measured a process that lies within the realm of zeptoseconds for the first time: the propagation of light within a molecule. A zeptosecond is a trillionth of a billionth of a second (10^{21} seconds).

Atomic physicists led by Professor Reinhard Dörner (Goethe University) have determined how long it takes for a light particle (photon) to cross a hydrogen molecule, namely about 247 zeptoseconds for the average bond length of the molecule. The electron shell in a molecule does not react to light everywhere at the same time. The time delay is due to the fact that the information in the molecule only spreads at the speed of light.

<https://aktuelles.uni-frankfurt.de/englisch/physics-zeptoseconds-new-world-record-in-short-time-measurement>

New Centre for German Africa Research

A new hub for German research in the humanities and social sciences in Africa is currently being established at the University of Ghana: the Maria Sibylla Merian Institute for Advanced Studies in Africa (MIASA). The Federal Ministry of Education and Research (BMBF) has



The University of Ghana.

now approved the funding for the main phase. The Centre for Interdisciplinary Research on Africa (ZIAF) at Goethe University and the Point Sud Research Institute in Bamako, Mali, are contributing with an important sub-project for which a further 1.8 million euros have been pledged.

MIASA's tasks include developing an intellectual programme and a research agenda that will strengthen African perspectives in science and politics and thus contribute to reducing global knowledge asymmetries. One thematic focus is on sustainable governance. Current topics such as migration, democratisation and ecological transformation are to be addressed in a more interdisciplinary manner. The project was launched in 2018 and the BMBF has now approved 11 million euros for the main phase.

How cosmic diamonds are formed

Geoscientists at Goethe University led by Professor Frank Brenker have found the largest extraterrestrial diamonds ever discovered in meteorites. Together with an international team of researchers, they were able to prove that these diamonds were formed in the early days of our solar system during the collision of small planets with each other or with large asteroids.

Meteorites come from the asteroid belt that orbits the sun. Ureilites are a special type of meteorite. They are fragments of a larger celestial body – most likely a minor planet – that has been completely shattered by violent collisions with other minor planets or large asteroids. Ureilites often contain larger amounts of carbon, among other things in the form of graphite or nano-diamonds. The diamonds on the scale of over 0.1 and more millimetres now discovered cannot have formed when the meteoroids hit the Earth. Impact events with such vast energies would make the meteoroids evaporate completely. That is why it was so far



Diamonds were once formed during collisions of small planets.

assumed that these larger diamonds – similar to those in the Earth's interior – must have been formed by continuous pressure in the interior of planetary precursors the size of Mars or Mercury.

<https://aktuelles.uni-frankfurt.de/englisch/geoscience-cosmic-diamonds-formed-during-gigantic-planetary-collisions>

Artificial cell organelles for biotechnology

Cells of higher organisms use cell organelles to separate metabolic processes from each other. This is how cell respiration takes place in the mitochondria, the cell's power plants. They can be compared to sealed laboratory rooms in the large factory of the cell. A research team at Goethe University led by Dr Joanna Tripp from the Institute for Molecular Biosciences has now succeeded in creating artificial cell organelles and using them for their own devised biochemical reactions.

This represents a milestone from a biotechnical perspective. Genetically altered yeast cells already produce industrially interesting molecules on a grand scale, such as anti-malaria medicine. However, undesirable by-products or toxic intermediates often occur as well. This is where the synthetic cell organelles can provide a remedy.

<https://aktuelles.uni-frankfurt.de/englisch/researchers-at-goethe-university-create-artificial-cell-organelles-for-biotechnology>

Leppin elected chair of Historisches Kolleg

Professor Hartmut Leppin, scholar of ancient history at Goethe University, has been elected as the new chair of the Historisches Kolleg by its Board of Trustees. The term of office is two years. Leppin succeeds Professor Martin Schulze Wessel, who resigned from the board after ten years in accordance with the statutes.

The Historisches Kolleg was founded in 1980 by the Stiftungsfonds der Deutschen Bank (Deutsche Bank Foundation Fund) and the Stifterverband für die Deutsche Wissenschaft (Donors' Association for the Promotion of Sciences and Humanities in Germany). The sponsor is the Foundation for the Promotion of the Historical Commission at the Bavarian Academy of Sciences and Humanities and the Historisches Kolleg. The fellowships of the Historisches Kolleg allow researchers to work undisturbed on large book projects. The Historisches Kolleg awards the Prize of the Historisches Kolleg to outstanding historians.

How direct democracy affects equality

Direct-democratic (legislative) proposals on social, political or legal equality are primarily aimed at eliminating inequality in society and expanding equality. Studies on Switzerland and the USA had recently led to contradictory results, focusing on dangers posed by direct democracy to equality.

The current study by political scientists at Goethe University on the subject of inequality and direct democracy cannot confirm this sceptical view. However, not every direct-democratic proposal is equally successful: direct-democratic proposals have the best chance of approval when they focus on improving the social and economic situation of population groups. In the case of proposals aimed at legal and political equality, whether the »unequal« groups are considered to belong or not plays a central role. In some societies, for example, equality for homosexuals is taken for granted – direct-democratic votes allow same-sex marriage. In other societies, they are denied this equality.

Differences are also evident between procedures that are brought to parliaments by citizens' initiatives via signature campaigns (bottom-up) or are given a referendum by parliaments (top-down). Bottom-up procedures are much more successful when they strive for social and economic equality in society. Motions are particularly effective when civil society groups join forces with political parties or other groups.



One goal of direct democracy is to promote equality.

Minorities with little influence can gain strength through coalitions, according to the study.

Tsetse flytraps using biotechnology

Because the tsetse fly can transmit sleeping sickness, it is controlled in Africa with insecticides or caught in traps. Bioscientists led by Julia Hitschler from the Institute for Molecular Biosciences at Goethe University have now developed a process with which the attractant for the traps can be produced in yeasts in a biotechnological process. In the future, the researchers hope, the attractants

could be produced cost-effectively on site in rural areas of Africa. For this purpose, the yeasts could grow almost free of charge in nutrient solutions based on plant waste, food or feed residues.

The tsetse fly occurs in large regions of sub-Saharan Africa. The flies feed on human and animal blood, transmitting trypanosoma in the process – small, single-cell organisms that use the flies as intermediate host and cause a dangerous inflammation of the lymph and nervous system in both animals and humans. There is no vaccination for this sleeping sickness; untreated, it usually ends in death. In agriculture, particularly cattle breeding, sleeping sickness – or trypanosomiasis – causes enormous damages in the form of sick and dead animals.

<https://aktuelles.uni-frankfurt.de/englisch/tsetse-fly-traps-biotechnology-for-africas-rural-population>



A tsetse flytrap in Africa.

Judicial deals in practice

In order to quickly obtain a confession and thus shorten proceedings, the judge holds out the prospect of lighter sentences. There has been a legal framework for this type of agreement since 2009: Agreements must be transparent, i. e. documented. The verification of confessions is »compulsory«. And the specific promise of a lighter sentence is not permitted, only an indication of the »corridor« in which the sentence will lie.

In an expert report for the Federal Ministry of Justice, the legal scholars Professor Matthias Jahn (Goethe University), Professor Jörg Kinzig (University of Tübingen) and Professor Karsten Altenhain (University of Düsseldorf) show that all existing regulations are violated in the courts: The plea bargain takes place unofficially, precise details of the expected sentence are given, and confessions are not checked.