

SCIENCE - ACTION PLAN

Aim - preventing the COVID-19 pandemic

CONTENTS

PREVENTION OF COVID-19 PANDEMIC – PRESENT SITUATION	3
ANSWER OF NATIONAL SCIENTIFIC SYSTEM TO PANDEMIC.....	3
THEMATIC TENDER OF THE CROATIAN SCIENCE FOUNDATION	3
ACTIVITIES OF PUBLIC SCIENTIFIC INSTITUTIONS FOR PREVENTION OF THE PANDEMIC AND FIGHT AGAINST IT.....	7
WORK ORGANIZATION IN PUBLIC SCIENTIFIC INSTITUTES	8
PARTICIPATION IN EUROPEAN COMMISSION ACTION PLAN FOR THE AREA OF RESEARCH AND DEVELOPMENT	9
<i>AD-HOC</i> WORKING GROUP	9
NETWORK PAGE ONE-STOP SHOP CORONAVIRUS FUNDING	10
COVID-19 DATA PLATFORM	10
INTERNATIONAL DONOR CONFERENCE FOR GLOBAL ANSWER TO COVID-19	11
ACTIVITY PLAN FOR THE SYSTEM OF SCIENCE IN THE COMING ACADEMIC YEAR.....	11
ACTIVITY PLAN OF THE CROATIAN SCIENCE FOUNDATION	11
FUTURE THEMATIC TENDER OF THE CROATIAN SCIENCE FOUNDATION	11
T-AP COVID-19 RESEARCH PROGRAM.....	12
THREE SCENARIOS OF WORK ORGANIZATION IN PUBLIC SCIENTIFIC INSTITUTIONS.....	13
ACTIVITY PLAN ON EU LEVEL.....	14
NEW PROJECTS – ESF COVID-19 PROJECTS FROM SCIENCE.....	14
CONCLUSION	15

PREVENTION OF COVID-19 PANDEMIC – PRESENT SITUATION

Research and innovations have a predominant role in overcoming the crisis created by COVID-19 pandemic that has an unseen effect on health system, society, and economy. Only by means of high quality research work can we answer a number of present global challenges – from discovery of vaccine to providing improvement of economy in the shortest possible time. It is only if such research is made in Croatia, by experts in Croatian institutions, that Croatia can independently and in a timely manner analyse and monitor the pandemic situation and react to it efficiently – both with relevant measures and with future medications and vaccines.

ANSWER OF NATIONAL SCIENTIFIC SYSTEM TO PANDEMIC

THEMATIC TENDER OF THE CROATIAN SCIENCE FOUNDATION

Croatian Science Foundation (HRZZ) has, within its mission, announced a tender called *Control of contagious diseases caused by coronaviruses and social and educational aspect of pandemic*. The tender is intended for research groups that can contribute to solve presently greatest research challenges with the aim of saving human lives and preserving health and welfare of inhabitants of the Republic of Croatia.

Both basic-level and applied research work that creates new knowledge and improves the existing knowledge on contagious diseases caused by coronaviruses, as well as research dealing with social aspects of pandemic and its effect on education system are financed.

The expected results are top-level scientific discoveries that will move the boundaries of knowledge dealing with coronaviruses, specifically SARS-CoV-2 virus and the new contagious disease COVID-19 and their wider social effects.

Research topics partly follow the recommendation of the World Health Organization for COVID-19 illness, as well as already started and internationally recognized research directions of the Croatian research groups in virology, virus immunology and infectology, control of serious crisis and its repercussion on mental health, as well as organization and implementation of distance learning on all the educational levels.

The tender budget amounts to 14 000 000, 00 kunas that are provided in the state budget for the year 2020.

Research topics covered by this tender are:

1. Immune response and development of new approaches to COVID-19 diagnostics

1.1. The existing diagnostics is still insufficiently standardized and the development of the new sensitive, specific, simple, inexpensive and exact methods is required

1.2. Analysis of the coronavirus genome (sequencing) and analysis of mutations in order to understand their importance for immunological control, their tendency to accumulate mutations, as well as characteristics specific for the given microregion

1.3. Research of the immune response, pathogenesis and consequences of SARS-CoV-2 infection

2. Development of new vaccines, treatments, medications and preparations for COVID-19 inhibition

2.1. Development of new antiviral preparations designed against SARS-CoV-2 and design of medications for COVID-19 therapy

2.2. Research of protective capacities of different SARS-CoV-2 immunotherapeutic antiviral preparations on the models of experimental animals

2.3. Development of experimental vaccines including vectors for transferring COVID-19 vaccines and research of their protective effect

3. Social aspects of COVID-19 pandemic

3.1. Psychosocial consequences of crisis measures in COVID-19 pandemic control, factors of risk for mental health and welfare of general and vulnerable population

3.2. Crisis communication regarding COVID-19 pandemic dealing with decreasing fear, stereotypes and uncertainty, thus reinforcing responsible individual and group behavior and confidence in the bodies of public authorities

4. Educational aspects of pandemics

4.1. Effects of changes in paradigm of learning process and evaluation and successful models of implementation of distant learning outcomes in elementary, secondary and higher school education. Technological assumptions and development of human potential for successful organization and implementation of distant learning

4.2. Application of great quantities of data, analysis of learning and particularly analysis of data from virtual environment in order to improve teaching and also as a basis for bringing of strategic decisions in education

On July 10, 2020 financing contracts were solemnly handed over to the following 11 projects:

1. *Otpornost hrvatskog društva uslijed COVID-19 pandemije – SOCREs* (voditelj doc. dr. sc. Branko Ančić, Institut za društvena istraživanja u Zagrebu)

2. *Dosta skrivanja CoV-2: Uspostava baze monoklonskih protutijela na SARS-Cov-2* (voditelj doc. dr. sc. Ilija Brizić, Medicinski fakultet Sveučilišta u Rijeci)

3. *Obnavljanje društva: Longitudinalno istraživanje društvenog oporavka u Hrvatskoj nakon pandemije koronavirusa* (voditeljica prof. dr. sc. Dinka Čorkalo Biruški, Filozofski fakultet Sveučilišta u Zagrebu)

4. *Stvaranje preduvjeta za uvođenje SARS-CoV-2 seroterapije u Hrvatskoj (CoVig)* (voditeljica: dr. sc. Beata Halassy, Sveučilište u Zagrebu, Centar za istraživanje i prijenos znanja u biotehnologiji)

5. *Atenuirani β -herpesvirus sa snažnim imunomodulatornim kapacitetom kao vektorsko cjepivo protiv SARS-CoV-2* (voditeljica: prof. dr. sc. Astrid Krmptić, Medicinski fakultet Sveučilišta u Rijeci)

6. *Glikani kao biomarkeri i funkcionalni efektori teškog oblika COVID-19* (voditelj: prof. dr. sc. Gordan Lauc, Genos d. o. o. za vještačenje i analize)
7. *Višeslojni okvir za karakterizaciju širenja informacija putem društvenih medija tijekom krize COVID-19* (voditeljica: izv. prof. dr. sc. Ana Meštrović, Sveučilište u Rijeci, Odjel za informatiku)
8. *Inhibitori koronavirusnih makrodomena – novi pristup liječenju bolesti uzrokovane koronavirusima* (voditeljica: dr. sc. Andreja Mikoč, Institut Ruđer Bošković)
9. *Život u doba bolesti COVID-19 – socijalne implikacije za sigurnost i dobrobit ranjivih skupina u europskom kontekstu* (voditeljica: doc. dr. sc. Dalida Rittossa, Pravni fakultet Sveučilišta u Rijeci)
10. *Varijabilnost sojeva koronavirusa SARS-CoV-2 i genetička podloga domaćina kao biomarkeri za otkrivanje čimbenika rizika tijekom pandemije COVID-19* (voditelj: prof. dr. sc. Kristian Vlahoviček, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu)
- 11. MANIPULIRANJE IMUNOLOŠKOM MEMORIJOM, RAZVOJ NOVIH STRATEGIJA U SVRHU STVARANJA BOLJEG MEMORIJSKOG CD8 T-STANIČNOG ODGOVORA PROTIV COVID-19 NAKON CIJEPLJENJA (VODITELJ: ROF. DR. SC. FELIX WENSVEEN, MEDICINSKI FAKULTET SVEUČILIŠTA U RIJECI)**

With regard to supplements of EC regulations connected to COVID-19 epidemic, and particularly the Commission's Temporary frame for measures of government support, provision of additional funds from European Fund for Regional Development are considered within the Competitiveness and Cohesion Operative Program for research of vaccines and of possibility of financing different medical answers to epidemic.

Having in mind the given circumstances, funds awarding should be performed in as quick and efficient way as possible, taking into account the fact that the potential applicants are already working or have all the preconditions for quick beginning of activities.

Ministry of Science and Education has identified 22 project propositions for award of irrevocable resources for detection, prevention and prevention of COVID-19 pandemic.

The projects have been selected according to applications sent to invitation of the Ministry of Science and Education announced on April 1, 2020 with the aim of establishing the European data platform for fight against COVID-19 pandemic (<https://mzo.gov.hr/istaknute teme/natjecaji-196/uspostava-europske-podatkovne-platforme-za-borbu-protiv-covid-19-pandemije/3642>).

In order to select the best potential applicants, the applications for the tender of the Croatian Science Foundation "Control of contagious diseases caused by coronaviruses and social and educational aspects of pandemic (IP-CORONA-2020-04)" announced on March 30, 2020, were also used (<https://hrzz.hr/otvoren-natjecaj-upravljanje-zaraznim-bolestima-uzrokovanim-koronavirusima-te-drustvenim-i-obrazovnim-aspektima-pandemije-ip-corona-2020-04/>).

It is the aim of this tender to improve understanding of biology and pathogenesis of coronavirus, specifically the SARS-CoV-2 virus and the contagious disease COVID-19, to control the crisis during and after epidemic caused by coronaviruses and organize implementation of distant teaching on all the educational levels.

The identified 22 project proposals, with estimated value of about 20 million Euros, must be implemented in the Thematic priority area of the Smart Specialization Strategy of the Republic of Croatia 2014-2020 – Health and Life Quality in order to be acceptable for financing from European Fund for Regional Development.

Project proposals, among other things, include the following activities:

- Establishment of relevant methodology for testing the quantity of the infective virus in a given sample
- Sequencing the virus with the aim of molecular-epidemiological tracking of strains circulating in Croatia and tracking the SARS-CoV-2 evolution during the illness
- Development of sensitive and specific biosensors for detection of SARS-CoV-2 virus that would provide quick, accurate and inexpensive testing of samples
- Development of serological test, i.e. the reagent kit for detection of SARS-CoV-2 specific antibodies
- Analysis of the complete virus genome
- Development of innovative protocols of superresolution microscopy by which we could monitor the virus behaviour during all the stages of its cycle
- Detection, isolation, and molecular characterization of SARS-CoV-2, as well as virus persistence
- Development of experimental vaccination vector against SARS-CoV-2
- Investigation of the way in which SARS-CoV-2 virus affects the activation of the immunological system and its interaction on endocrine
- Investigation of the way in which the type 2 diabetes patients are much more sensitive than the other groups and the mechanisms behind this sensitivity
- Determination of clinical and laboratory characteristics of the illness and its outcome in hospitalized patients
- Implementing the clinical study of development of the existing COVID-19 diagnostics, research of the new diagnostic approaches to COVID-19
- Development of distant learning organization with the aim of implementing the teaching process during pandemic
- Starting the development of commercial RT-PCR diagnostic tests.

Project proposal holder institutions are:

- University of Zagreb, Center for Research and Knowledge Transfer in Biotechnology
- University of Rijeka, Department for Biotechnology
- Institute Ruler Bošković

- University Hospital for Infectious Diseases „Dr. Fran Mihaljević“
- University of Rijeka, Faculty of Medicine
- University of Zagreb, Faculty of Science
- Croatian Institute of Public Health
- Teaching Institute of Public Health Dr. Andrija Štampar, Zagreb
- University of Zagreb, Faculty of Organization and Informatics
- Genos
- Biognost
- Biocenter.

In order to start the procedure of grant awards Ministry of Science and Education requires information regarding the funds secured and approval for starting the awarding procedure from the part of the EU Ministry of Regional Development and Funds, which is the Governing Body of Operating Program Competitiveness and Cohesion.

With the aim of quick award granting, the Ministry has started defining the conditions for funding procedure and the preparation of the tender text.

ACTIVITIES OF PUBLIC SCIENTIFIC INSTITUTIONS FOR PREVENTION OF THE PANDEMIC AND FIGHT AGAINST IT

On April 15, 2020 the Ministry of Science and Education sent a letter to public scientific institutions asking them to provide information regarding the way in which the particular institutes are scientifically engaged regarding causes and consequences of COVID-19 illness, and the way in which they address actual social challenges during the fight against pandemic (for example, making teaching and video materials and other teaching materials for elementary and secondary schools, as well as other kinds of cooperation with schools, 3D printing of the necessary equipment for hospitals, cooperation with higher education institutions regarding online teaching, etc.)

Institute answers showed a very wide span of activities in this sense, showing in this way how they are conscious of necessity of their additional engagement and contribution in providing answers to a number of global challenges which the Republic of Croatia is meeting at that moment and will probably meet in future – from actions directed to slowing down expansion of coronavirus to reactions directed to soothing its consequences on human health, from discovery of vaccines to saving economy from collapse. Also, the scientists have become conscious of the importance of their role in communication with the citizens in the process of shaping the public opinion and acting as indispensable advisors to those who bring decisions in a number of areas, from health care to education and economy.

In short, it is possible to sum up activities of the institutes in the following way: implementation of research in all the areas connected to the virus and illnesses they are causing, participation in performing on-line teaching and cooperation with higher education institutions as well as all the accompanying activities (consultations, mentoring), implementation, arrangement and correction

of teaching materials, research regarding influence of pandemic on working and social spheres of life as well as on individual persons (e.g. employability and employment processes), maintenance and participation in maintaining the webinars.

Many institutes have pointed out implementation of different activities in the area of science popularization, such as online lectures and media appearances through which they try to popularize existence and activity of virus to broader population, thus positively affecting general condition of population, for example through data bases including jokes, photo and video clips, by which we could fight against pandemic via humour.

Cooperation of institutes with government bodies and institutions in the Republic of Croatia and also with foreign organizations and scientists is widely present as part of common research on this topic. Institutes also cooperate with economic subjects on, e.g. development of applicative solutions in order to facilitate digital business activities.

Numerous scientists of institutes that participate in the area of natural sciences, biomedicine and health care are, in case of need, made available to hospitals and to the Croatian Institute for Public Health

WORK ORGANIZATION IN PUBLIC SCIENTIFIC INSTITUTES

Work of 25 public scientific institutes and three institutions of particular government importance (National and University Library in Zagreb, Lexicographic Institute Miroslav Krleža and Croatian Academy of Science and Arts) during the pandemic was organized in accordance with the *Decision of the Government of the Republic of Croatia regarding work organization of the bodies of state administration during the epidemic of COVID-19 illness caused by the SARS-CoV-2 virus*, with certain adaptations regarding specific activities of these institutions and/or their special engagement in fight against pandemic. With *Decision on work organization, schedule of work and working hours during COVID-19 epidemic caused by SARS-CoV-2 virus*, working elements were defined, such as composition of crisis headquarters within institutions, working hours and schedule of working in teams, in groups of employees who are, with regard to the type of working place and/or personal reasons, allowed to continuously work from home, as a measure connected to space disinfection, keeping the social distance, etc.

With certain exceptions and specific cases, general conclusions regarding work organization are the following:

- Composition of crisis headquarter: director, director aides, institution secretary, head of the professional services, head of occupational safety and security jobs
- Working hours and work schedule in teams: regular working hours, employees divided in two groups for work by two weeks
- Organization of work from home: making two-week working plans, implementation of work report, keeping meetings via online services, continuous availability during the work hours

- Separate groups of employees provided with a possibility of work from home: employees older than 60, persons suffering from chronic diseases and pregnant women, employees whose coming to work is limited with public transport, etc.
- Measures of behaviour and protection: coming to institution spaces only during the working period in which employees are deployed, avoiding close personal contact within at least two meters in the closed area and one meter in the open space, ban on holding meetings and gatherings of more than five persons, ban on coming to work for employees with increased body temperature and respiratory disorders, space disinfection between two groups.

With regard to earthquake that on March 22, 2020 hit the town of Zagreb, in which spaces of 21 institutions were more or less affected (seven out of these institutions at one moment had the mark of insufficient usability of space), work of more than 2 400 employees took place in more or less difficult conditions.

During work organization in the time of pandemic, all the institutions adhered to all the measures prescribed by the Croatian Civil Protection Headquarters in an appropriate manner.

PARTICIPATION IN EUROPEAN COMMISSION ACTION PLAN FOR THE AREA OF RESEARCH AND DEVELOPMENT

The EU leaders pledged to do all that is possible to support research and to coordinate the efforts within the European scientific and research community. They also pointed out that there was an urgent need for exchange of scientific information and cooperation, both in EU and worldwide. During the informal videoconference kept on April 7, 2020 under the Croatian presidency of the EU Council, ministers responsible for research and innovation supported the first 10 priority actions of the first ERAvsCorona action plan that arose from the dialogue between the European Commission Services and the national ministries. ERAvsCorona action plan covers short-term and medium-term actions of pandemic prevention. It determines the key measures to be implemented both on the level of the European Commission and on the level of the Member States, with the aim of better coordination of activities, common support to research and innovations and cooperation in knowledge transfer.

ERAvsCorona action plan consists of ten points encompassing the plan for coordination of financing of research and innovation, supporting clinical trials, making tender for financing the projects in Obzor 2020 program for innovative and quick answers to coronavirus, increasing support to innovative firms, enabling the other financial sources to contribute to research and innovations, creating the network page with comprehensive data regarding financing connected to coronavirus, approach to research infrastructures, platform for data exchange and Pan-European Hackathon.

The Republic of Croatia is included in implementation of ERAvxCorona action plan via Ministry of Science and Education (MZO).

AD-HOC WORKING GROUP

It is the aim of the *ad-hoc* working group to enable on EU level coordination of vaccine development, therapy and diagnostics from research stage to application stage. Experts from all the Member States participate in it. As national experts MZO appointed prof. Stipan

Jonjić, PhD and prof. Alemka Markotić, PhD. The working group is divided into four subgroups.

Clinical trials subgroup coordinates implementation of big multicentric clinical trials all across Europe, which provides a way to a wide network of clinical trials within EU.

Vaccine production subgroup coordinates survey of all the possible plants for vaccine production that can be used for any successful vaccine candidate.

Testing subgroup coordinates recognition of research and development strategies for improving testing techniques and equipment (and discovery of virus and discovery of antibodies) and harmonization of test performance criteria.

Financing subgroup deals with mapping of efforts for national research financing.

NETWORK PAGE ONE-STOP SHOP CORONAVIRUS FUNDING

The Era Corona platform on network pages of the European Commission is the place that provides comprehensive information on funding of research and innovations connected to coronavirus pandemic prevention.

All the forms of financing provided by the Commission, as well as financing on the national level for all the Member States, including Croatia, can be found on this platform.

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/covid-19>

COVID-19 DATA PLATFORM

On April 20, 2020 the European Commission with several partners started the European COVID-19 data platform in order to provide quick collection and exchange of available research data. The Platform is a part of the Commission ERAvsCorona action plan and it represents another milestone in EU efforts to support researchers both in Europe and worldwide in fight against epidemic.

In order to support the initiative of the European Commission to establish the European COVID-19 data platform, Ministry of Science and Education in cooperation with the Croatian Science Foundation and the Croatian representative in European Open Science Cloud (EOSC) Council started collecting information on all the relevant research activities and resources that can be made available during COVID-19 pandemic and SARS-CoV-2 virus.

Due to establishment of the global data platform, the scientific sector of the Republic of Croatia can itself contribute to the fight against COVID-19 pandemic and its consequences. In addition to its importance on the global level, this platform will also be of a great help to the Croatian research groups that will be able to see data on all the relevant research activities and resources in one place and will be able to network their activities.

As the next step, European Commission suggests the establishment of national EOSC/Covid-19 teams that would cover the area of research, control of data, health care and policies.

Such national coordination teams could help in bringing together national researches connected to COVID-19 activities and help in communication with great European research infrastructures participating in the fight against pandemic, such as EMBL-EBI and ELIXIR.

Ministry of Science and Technology has established the national team in the following composition:

1. Research coordinator: Irena Martinovic Klarić, PhD, Croatian Science Foundation
2. Scientific policy coordinator: Sonja Lesjak, PhD, Ministry of Science and Education

3. Technical coordinator: prof. Kristian Vlahoviček, PhD, University of Zagreb, Faculty of Natural Sciences and Mathematics
4. Health care coordinator, Bernard Kaić, PhD, Croatian Institute for Public Health

HACKATHON #EUVSIVIRUS

European Commission has organized hackathon in cooperation with organizers from a number of countries including Croatia. It is expected that this hackathon will shorten implementation time of innovative solutions for pandemic prevention since innovators will be able to apply work that has already been made by other European innovators, instead of starting from zero. More than twenty thousand innovators have participated in this event. Croatian Agency for Small Business, Innovations and Investments (HAMAG-BICRO) has participated as national body supporting 281 Croatian businessmen in Paneuropic hackathon #EUvsVirus. Among joint projects there was one project of the Croatian business firm and four teams that included representatives from Croatia.

INTERNATIONAL DONOR CONFERENCE FOR GLOBAL ANSWER TO COVID-19

International donor conference was led by the President of the European Commission Ursula von der Leyen with participation of the President of the European Council Charles Michel, the UN Secretary General Antonio Guterres, the WHO Director General Tedros Adhanom Ghebreyesus, as well as the representatives of foundations and institutions. It was the aim of the conference to raise funds for research financing in diagnostic, cure, and discovery of vaccines against the new coronavirus, all with the aim of strengthening the public health system. The conference included some fifty states and on the first day 7, 4 billion euros was collected. Prime Minister Andrej Plenković announced contribution of one million Euros from the part of the Republic of Croatia. The funds will be intended for speeding up development, production and approach to vaccine as well as better diagnostic and therapy for COVID-19.

ACTIVITY PLAN FOR THE SYSTEM OF SCIENCE IN THE COMING ACADEMIC YEAR

It is hard to predict the epidemiological situation from September on, or the measures that will be prescribed on the national level. The role of research and innovations continues having a great importance in recovery from pandemic and prevention of the future pandemics. It can be predicted that priority research topics will still be connected to coronavirus pandemic and its prevention, as well as with soothing the potential consequences. It is necessary to offer a greater support to research of these priority topics and ensure that decision bringing on the national level should be in line with scientific facts.

ACTIVITY PLAN OF THE CROATIAN SCIENCE FOUNDATION

FUTURE THEMATIC TENDER OF THE CROATIAN SCIENCE FOUNDATION

Croatian Science Foundation within its mission plans to announce a tender that would focus on cooperation with economy in recovery from pandemic. The tender will be directed to research groups that can contribute to solving the greatest current research challenges in order to save human lives and preserve health and welfare of inhabitants of the Republic of Croatia.

The expected effects are top level scientific discoveries that will push the boundaries of knowledge on coronaviruses, specifically on SARS-CoV-2 virus and the new contagious disease COVID-19 and their social effects.

We are considering research topics dealing with COVID-19, that will be adapted to recommendations of the World Health Organization and internationally recognized research tendencies of the Croatian research groups in virology, virus immunology and infectology, control of large-scale crisis situation and its consequences on mental health, as well as organization and implementation of distance teaching on all the educational levels. In time of pandemic traffic goes through radical changes, thus it is necessary to conduct research and suggest solutions regarding remediation of consequences as well as different organization of overall traffic system in case pandemic lasts.

We are planning to speed up the process of project approval and to increase flexibility of project implementation.

T-AP COVID-19 RESEARCH PROGRAM

Since 2020, Croatian Science Foundation has participated in international collaboration. Transatlantic Platform (T-AP). T-AP includes cooperation in the area of humanistic and social sciences among public national organizations for financing of science in the countries of South America, North America and Europe, and it includes support to research cooperation and adoption of policies dealing with research requirements in 21st century.

On May 18 Croatian Science Foundation received the suggestions of T-AP collaboration members regarding the foundation of **T-AP COVID-19** research program as the next T-AP tender.

Initial working title of the possible T-AP COVID-19 program would be **“Recovery, Renewal and Resilience in a Post-Pandemic World”**. General aim of the program should focus on gathering evidence about long-term consequences of COVID-19 pandemic and on bringing information about policy and practice decisions on how the world comes back to life (e.g. behavioral, cultural, economic, educational, ethical, philosophical and social questions).

Some examples of types of questions that could be included in T-AP program:

- Which are probable permanent changes in the structure of economic activity? How will it affect different society groups, different economy sectors and different regions?
- Which are medium-term and long-term effects on individuals and on families, of the demand that people stay at home, for example in the area of family violence, children care, insults, homelessness, drug and alcohol abuse?
- How will work force and education systems change in the world after COVID-19? What is its probable long-term effect on education results? (It would be important to make it possible here that on all education levels could be evaluated existence of great changes in the system.)
- What support systems offered by government and non-government agencies were best in managing the crisis and how should they handle support in future, after COVID-19?
- What could be long-term pandemic effects on environment? Will crisis resolution at the same time bring to climatic changes?

- What are probable permanent changes in behaviour of individuals, e.g. in the area of work practice, home and international journeys and consumption?
- How will institutions and management models change?
- What do we learn in this moment of history about human situation? How does it affect art and culture as well as other forms of human expression?
- Covid-19 effect on public approach to culture and art and our interaction with them, and COVID-19 as a source of digital innovations in approach to culture and education.

On May 28, 2020 Board of Directors of Croatian Science Foundation (HRZZ) accepted the proposal of description of tender content for the following TAP tender. The tender will be announced in 2021. Ministry of Science and education (MZO) and HRZZ have planned to set aside for the tender about 200 000 euros (up to three Croatian research groups could participate).

THREE SCENARIOS OF WORK ORGANIZATION IN PUBLIC SCIENTIFIC INSTITUTIONS

With regard to epidemiological situation and protection measures that will be prescribed from the part of Civil Protection Headquarters of the Republic of Croatia, it is possible to predict the work of public scientific institutes and the National and University Library in Zagreb, of Lexicographic Institute Miroslav Krleža and Croatian Academy of Science and Art via three potential scenarios:

1. regular work of all the mentioned institutions, compliance with basic measures of behaviour and protection – work in regular working time of all the employees of the institutions, all complying with basic measures such as keeping social distance, increased disinfection of the area, availability of disinfectants for employees and users etc.
2. custom work of all the given institutions, including compliance with increased measures of behaviour and protection – foundation of crisis headquarters, work during regular working time through work in teams (during one or two weeks) together with organization of work from home and compliance with all the measures and recommendations as they are pointed out in the chapter 'Work organization in public scientific institutes (taking into account potential specific characteristics of the institutions)
3. custom work of the institutions that can particularly contribute in situation of epidemic, with full suspension of work in all the other institutions – in this extreme case work organization of 22 public scientific institutes and three other institutions is envisaged in such a way that all employees work from home, whereas the work of 3 separate public scientific institutes would be organized through work in teams, according to situation, specific characteristics of the institute and activities they are implementing.

With regard to their regular activities, the Ministry has singled out the following public scientific institutes as the ones that have potential and possibility to additionally contribute in the fight against epidemic:

- **Ruđer Bošković Institute** – it is the mission of the Institute, among other things, to implement research work in the area of natural and biomedical sciences with the vision of becoming a recognized top-level European center of scientific excellence.

The following activities can be singled out: research and experimental development in natural, technical and technological sciences; research and experimental development in biomedical, biotechnical and biotechnological sciences; computer programming, consultations and activities connected to them; data processing, server services and activities connected to them; internet portals, professional jobs dealing with protection from ionizing radiation; services of sterilization and material modification by ionizing radiation; toxicological and pre-clinical pharmacological testing and expertise for biologically active matters and their preparations; development and application of analytical and diagnostic methods; diagnosing, prevention and suppression of contagious and other diseases of organisms living in water, land and air.

- **Institute for Medical Research and Occupational Medicine** – it is the mission of the Institute, among other things, to push the boundaries of discoveries regarding the effect of anthropogenic factors on health and environment with the idea that by applying and developing innovative multidisciplinary research it contributes to improvement of people's health and to environment protection in the Republic of Croatia. We can single out the following activities: research of effects of selected chemical, physical, biological and psychosocial agents on physiological, pathological, morphological and biochemical characteristics of organisms, organs, cells and molecules; research of interaction between environmental and constitutional factors in development of health disorders connected with work, as well as transfer of research results in economy via improvement of the system of safety of work and programs of protection of the workers' physical and psychical health: development and application of mathematical and statistical models; development and application of methods of molecular modeling.
- **Croatian Veterinary Institute** – it is the mission of the Institute, among other things, to implement scientific and professional-diagnostic-analytical activity through which the Institute gives its contribution to performing veterinary activities in the Republic of Croatia. We can single out the following activities: research of people's health protection from contagious and parasitic diseases transferable from animals; research of means and procedures for reliable discovery of illnesses and determining the causes of diseases.

ACTIVITY PLAN ON EU LEVEL

Ministry of Science and Education (MZO) will continue participating in activities connected to ERAVsCorona action plan, both through *ad-hoc* working group and through visibility of information regarding national financing of research connected to COVID-19 on the ERACorona platform.

Gathering information on all the relevant research activities and resources that can be put at disposal during research of COVID-19 pandemic and SARS-CoV-2 virus, as well as publication of this information on the global COVID-19 platform. This global platform is indispensable for quick gathering and exchange of available research data, and it will provide both to researchers and to general public a clear survey of activities and of scientific results.

NEW PROJECTS – ESF COVID-19 PROJECTS FROM SCIENCE

MZO is planning to start and finance the program of strengthening the existing scientific capacities connected to basic level research activities with the aim of prevention and detection of COVID-19 pandemic, if the required financial resources are approved from the European social fund for this purpose.

In order to be successfully included in answering the questions that will contribute to pandemic prevention, Croatian scientific community must strengthen the existing scientific capacities, through strengthening their human potential, via connecting the scientists into a network, and via cooperation within the community itself, with the aim of giving quick answer to scientific challenges created by pandemic. Encouraging networking and cooperation would in the long run strengthen Croatian scientific capacities and it would contribute to more successful applications to competitive European projects. Such strengthening of the Croatian scientific community would decrease departure of excellent researchers from Croatia and would considerably contribute to increasing circulation of brains by creating the competitive scientific environment in the Republic of Croatia.

The users of this program would be public scientific research institutions (entered in the Register of scientific organizations led by MZO), and total requested amount is 20 000 000, 00 Euros.

CONCLUSION

Scientific system in the Republic of Croatia has a very high potential for the creation of new knowledge and innovations that could contribute to recovery from pandemic and prevention of the new crisis. In order to fully harness this potential, it is necessary to provide system efficiency, adequate research financing on the national level, better support to research community in using the EU funds, and greater recognizability of research and innovation values from the part of other participants.

Top scientific and innovation results cannot be implemented if scientific system of higher education is not competitive on the world level, if student and expert mobility is low and if there is not a close cooperation between science and economy. Unfortunately, the Republic of Croatia is close to the rear of EU in all these parameters. The Republic of Croatia is facing an additional problem, and it is increasing emigration of scientists, professionals and students to the scientifically more developed countries, due to better and more perspective conditions of study and research.

There is therefore a great need for comprehensive reformation of the scientific system of higher education. It is the only way by which the Republic of Croatia can successfully compete with universities, polytechnic, higher education institutions, scientific institutes and high-tech firms in EU.

MZO has prepared a suggestion of the new law on science and higher education. Via a number of measures this law aims to strengthen competitiveness of higher education and scientific system on the world level, it also encourages student and expert mobility (brain circulation) and particularly increases close cooperation between science and economy. This law would make it possible for the best scientists and professionals to realize their ambitions in the Republic of Croatia, and the best students could continue studying, and later on working in Croatia. Interest of top world scientists and professionals for cooperation with our institutions of scientific, higher education, and high-tech firms is also encouraged.

In order to fight pandemic, strengthening and networking of scientific capacities is necessary, since they can contribute to better understanding of coronavirus biology and pathogenesis, specifically SARS-CoV-2 virus and COVID-19 contagious disease. To be successfully included into answering the questions that will contribute to prevention of pandemic, the Croatian scientific community should strengthen the existing scientific capacities, through strengthening their human potentials, increasing networking of

scientists and encouraging cooperation within the Croatian scientific community with the aim of quick retrieval of the answers to scientific challenges brought about by pandemic. Encouragement of networking and cooperation would in the long run increase the Croatian scientific capacities and contribute to more successful applications to competitive European projects. Such strengthening of the Croatian scientific community would decrease emigration of excellent researchers from their homeland and would considerably contribute to strengthening of brain circulation by creating a more competitive scientific environment. All the given measures and initiatives are crucial in order to provide to the Republic of Croatia long term independent and successful dealing with all the aspects of pandemic.

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