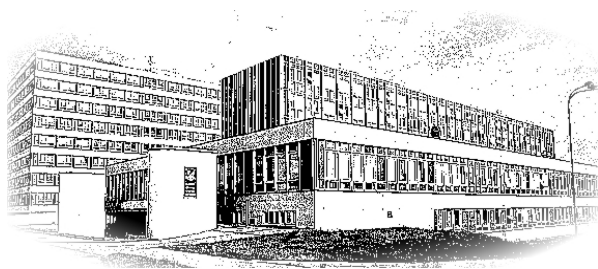


UNIVERSITY OF DEFENCE
FACULTY OF MILITARY HEALTH SCIENCES

ANNUAL REPORT

2020

HRADEC KRÁLOVÉ
CZECH REPUBLIC



Faculty of Military Health Sciences

Hradec Králové

EDITORIAL NOTES

Dear Reader,

This publication presents the main activities of the Faculty of Military Health Sciences of the University of Defence.

The 29th Annual Report includes the principal research and educational activities of the 8 departments, so that it may act as a basis for internal and external evaluation respectively.

Should you require more detailed information about our Faculty, it is available on our website <http://fvz.unob.cz> or <http://www.pmfhk.cz>.

In case of any suggestions or comments to our activities, do not hesitate to contact us at the address listed below.

Vice-Dean for Research
LTC Prof. RNDr. Miroslav POHANKA, PhD, DSc
miroslav.pohanka@unob.cz

Our contact address in different languages is as follows:

Univerzita obrany
Fakulta vojenského zdravotnictví Hradec Králové

University of Defence
Faculty of Military Health Sciences Hradec Králové

Universität der Verteidigung
Wehrmedizinische Fakultät Hradec Králové

Université de la Défense
Faculté de Médecine Militaire de Hradec Králové

Universidad de Defensa
Facultad de Sanidad Militar Hradec Králové

Universitas Defensionis
Facultas Medicinae Militaris Grezreginensis

Třebešská 1575
500 01 Hradec Králové
Czech Republic

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FOREWORD

The Faculty of Military Health Sciences of the University of Defence in Hradec Kralove represents a center of medical education and research of the Czech Army with long-term history in the Czech Republic. The military medical education began in Hradec Kralove in 1951. The school was established by an order of the President of the Republic as the Military Medical Academy, and later a honorary title of "Jan Evangelista Purkyně" was added. Later on, the name was changed to the Military Medical Research and Postgraduate Institute, but the name was reverted back in 1988. In 2004, during professionalization of the army and reorganization of military education the University of Defence was founded. Since then our Faculty has become an integral part of the University of Defence and has been renamed, once again, the Faculty of Military Health Sciences. At present, the Faculty is the only institution, which provides a military medical education at the university level. The Faculty educates students in one accredited Bachelor's study program (Military Paramedic), three Master's study programs (Military General Medicine, Military Dentistry, Military Pharmacy) and eight doctoral study programs. However, our role is not only to educate and train all medical, pharmaceutical and nursing specialists and to maintain scientific excellence, but also to provide a general support to the Military Medical Service.

The very fact that the Faculty has survived all reforms and other changes demonstrates its uniqueness, as well as its high educational, professional and research qualities. The specificity of our educational model lies in a close cooperation with other scientific and educational institutions. Thus the Faculty enjoys close collegial relationships with the Medical and Pharmaceutical Faculties of Charles University, the University of Hradec Kralove, the Faculty of Health Studies in Pardubice, the Faculty Hospital in Hradec Kralove and the Military Medical Agency. Especially the two faculties of Charles University and the University of Pardubice cooperate closely with our school in providing the education to our students. As a result, our Master degree students graduate both from our Faculty and from the respective faculty of Charles University. In 2012, the Central Military Hospital in Prague was declared the Military Faculty Hospital. This medical facility, which we cooperate very closely with, creates a good background for military medical practice for our students. Finally, our school could not thrive without a support from representatives of the city of Hradec Kralove, which our school enjoys ever since its foundation.

At present, the Faculty covers the needs of troops for medical professional training in all specializations, medical science and research. The Faculty has educated many specialists who have been subsequently appointed into key positions both at national and international levels, such as various NATO and EU bodies, United Nations Security Council and World Health Organization boards. The Faculty members are engaged in many research projects awarded

by both national and foreign military, as well as civilian research agencies. The laboratory compartment houses state-of-the-art laboratory technologies focused mostly on projects advancing our knowledge of protection against CBRN agents. The scientific results are published in many respected international journals. The Czech (Medical Service) field hospitals are well-known around the world and highly valued among our NATO allies. Our approach is different from the majority of other services. Our training is both long-term and intensive. Thus the students gain deeper knowledge and skills, as well as awareness of military life. We perceive that education, training and research need to work in synergy and, therefore, the Faculty strives to create a pool of excellent professors, scientists and teachers. The Faculty of Military Health Sciences is an open body for mutual cooperation with scientists and teachers from all democratic countries. In spite of changing priorities in the Czech Military, our focus continues to be on the specialization of the Czech Armed Forces in the nuclear, biological and chemical protection. For many years our specialists have been regularly engaged in humanitarian and military deployments of military medical services abroad. At the same time, our school guarantees both research and fulfillment of training needs for medical corps, specialized forces and for some NATO countries. Nevertheless, our primary concern is to educate and train students and young physicians. This can be hardly possible without our closest partners, international collaborators and friends.

After a long period of personnel and budgetary restrictions, last year brought stabilization of the overall situation of the Faculty. At the same time, however, our school had to face Covid-19 pandemics. Our specialists served in advisory bodies at various levels of pandemics management. Students were directly involved in practical help including contact tracing and health monitoring. Teaching activities had to be reorganized into on-line formats. Despite that, our scientific production rate remained high and both teaching and training activities have been re-organized to provide the best achievable education for students and course attendees. In addition, we have managed to start the first major renovation project, which will bring a significant improvement in the infrastructure and serve as a substantial upgrade of our teaching and research facilities.

In conclusion, I am convinced that all the results and success of our school are possible only due to the ongoing cooperation of our teachers, students and other employees of our Faculty. In addition, we greatly benefit from maintaining a continuing relationship with our graduates and close collaborations with our partner institutions. The next period should, hopefully, bring us another step further in the successful development of the Faculty and its dedicated employees.

Pavel BOSTIK, MD, PhD
Professor and Dean of the Faculty of Military Health Sciences

INTRODUCTION

HISTORY

The Purkyně Military Medical Academy has been a long-term educational and scientific center of the Czech Army Medical Service. There has been a very long history of systematic education of military medical personnel in our country. Its beginnings lie, as in many European countries, in the 18th century. Large, permanent armies were being built and the military medical service became a normal part of these armies. In 1776 the War Council of the Vienna Court issued an administrative order which definitely prohibited the employment of field surgeons in the armed forces who had not studied anatomy and who had not had their knowledge officially examined. This can be considered the beginning of organized education of military medical personnel in our country lasting up to the present days.

The fundamental milestone in the “Austrian” stage was, however, in 1785 with the establishment of the Military Medical (Surgical) Academy named the Josephinum after its founder, the enlightened monarch and father of many political and social reforms, Emperor Joseph II. He saw the mission of the school as fulfilling these tasks:

- education of qualified military surgeons (physicians)
- creation of a learned society for research in medical science
- creation of a permanent field sanitary commission for solving questions concerning combat casualty care.

A number of renowned physicians of Czech origin significantly contributed to nearly 90 years of the school’s history.

The foundation of the independent Czechoslovak Republic in 1918 meant at the same time the creation of a democratic army. The basic element of career military physician training was represented by the Military Medical School. Its establishment was the result of a decision by the Czechoslovak Republic government which by its resolution of 25 June 1926 defined the principles of recruiting professional medical and pharmaceutical personnel to the army. The Military Medical School provided professional training for military physicians and further qualification growth for the performance of higher command functions in the military medical service structure.

The development of the Czechoslovak Military Medical Service in our country was interrupted by the Second World War. When the army was disbanded a number of physicians and medical students participated in foreign and domestic resistance. The largest number of them were concentrated in England. The British government permitted medical students to complete their studies at British universities. They graduated from Oxford University. The Czechoslovak Military Hospital was created at London Hammersmith Hospital. A few courses of the Medical and Pharmaceutical Reserve Officer School were taught in Leamington and Walton-on-the-Naze where the Czechoslovak Brigade's out-patients' department was situated. Thus, the tradition of the Czechoslovak military medical educational system maintained its continuity.

In 1945, the pre-war practice of recruiting professional personnel to the Military Medical Service was rebuilt. The Military Medical School in Prague was renowned. At the same time tendencies referring to the practice of some medical services of the world's leading armies which required the establishment of an independent military medical university were increasing. The results of the Second World War and the growth of new knowledge in the field of medicine and especially military medicine played a significant role in this.

In 1951, a new period began in the development of the Czechoslovak military medical educational system. This period has been permanently connected with Hradec Králové for 55 years. Rapid establishment of the Military Medical Academy (MMA) was possible only due to the fact that it was built on the basis of being a theoretical and clinical part of the Faculty of Medicine – a branch of Charles University established in 1945. Thanks to the reputation of its workers, a majority of whom became employees of the MMA, the school became an educational and scientific center of the Czechoslovak Medical Service and within a short time gained a good reputation both at home and abroad. The MMA has educated a number of outstanding military medical specialists and the first steps of several contemporary top specialists of Czechoslovak medicine were connected with its existence.

Beginning in 1958 and for the next 30 years the military medical system was transformed into the form of the Purkyně Military Medical Research and Postgraduate Institute. Research tasks and activities in the area of further schooling and specialization of military physicians and pharmacists became a fundamental part of its activity. The main portion of a further basic task of the school – the pregraduate training of future military physicians – was taken over by the renewed Faculty of Medicine of Charles University in Hradec Králové. The development of mutual cooperation between these two partner schools, to which the Faculty of Pharmacy of Charles University in Hradec Králové joined in 1976 as a significant guarantee of the education of military pharmacists, has become a part of the military medical system.

HISTORY

In 1988, the school changed its name to the Purkyně Military Medical Academy which, institutionally, reflects more precisely the wide variety of its activities.

In November 1989, the school entered a qualitatively new period of development. It has passed through a transformation which has basically changed some military-professional teaching programs, the organizational structure of the school, personnel support, the composition of the educational staff and so on.

The Academy has been included in the new university educational system and since 1993 (origin of the Czech Republic) has served as a training center for Czech Army medical professionals. It has trained nearly 2600 military surgeons, dentists, and pharmacists till now.

After the transformation of the Purkyně Military Medical Faculty into the Faculty of Military Health Sciences (seated still in Hradec Králové) in 2004, the basic functions and tasks of the school focused on a specialized training of the Czech Army medical officers and research work in the area of military health service.

The Faculty of Military Health Sciences is focused to provide university-level studies from medicine, stomatology, pharmacy and medical rescue. The faculty has also eight PhD programs and provides the upper form of education as well. Since its establishing, the Faculty of Military Health Sciences is a significant school providing not only graduates but also significant research like publications in journal or participating in scientific projects. The results from creative work can be learned just from this report printed annually.

THE MAIN AIMS OF THE FACULTY IN 2020

The Faculty of Military Health Sciences (FMHS) of the University of Defence in Hradec Králové represents a centre of medical education, training and research of the Army of the Czech Republic. It covers entirely the needs of the troops concerning medical professional training in all specializations, medical informatics, science and research.

1. Education

The main aims of the FMHS in the field of education were as follows:

- to provide university-level studies in the subjects of military general medicine (6 years), stomatology, pharmacy (5 years), and medical rescue (3 years)
- to provide postgraduate study for PhD degree (4 years) in the following accredited disciplines:

Epidemiology	Military Hygiene
Field Internal Medicine	Military Radiobiology
Field Surgery	Molecular Pathology
Infection Biology	Toxicology
Medical Microbiology	

According to the needs of the Surgeon General of the Czech Armed Forces and the Military Medical Service Administration, the Faculty provides specialized and lifelong education of doctors, pharmacists and other military medical service personnel in specified branches of the Act No. 95/2004 of the Code about conditions of receiving professional qualification and specialized qualification to perform a medical profession as a physicians, dentists, and pharmacist. It unifies the system of their training with requirements of EU.

The Faculty organizes and provides training for medical personnel in the active duty, physicians and nurses. The Faculty provides professional refresher courses for medical staff, non-medical staff and non-medical personnel serving field medical units and individual units of the military hospital base on select up-to-date topics. The school actively participates in continued training of physicians and health care personnel, who then serve in missions abroad. However, the unique military know-how is also attractive for people, who work

out of the military health care sphere. The FMHS provides courses on the advanced first aid in the field not only for Military Medical Service personnel but also for non-medical professionals of Military Police units, reconnaissance and special units within the frame of the Czech Armed Forces, Rapid Reaction Units of the Czech Republic Police and others.

All soldiers selected for foreign missions attend special courses of an advanced first aid. Training in emergency life support in field conditions is required for medical personnel. The Battlefield First-Aid Courses for physicians and nurses or health care personnel include the problems of CBRNE protection as well and became a standard not only for the entire military medical staff, but also for many other specialists, who are enrolled in foreign missions.

Other courses concentrate on teaching and training of a comprehensive knowledge necessary for providing medical care within the frame of Disaster Medicine. The FMHS also provides other teaching and training activities determined by "The Plan of Courses and Professional Residencies Training of the Czech Armed Forces Medical Service" and "Notification of Director of Personal Section of the Ministry of Defence – Teaching Activities at Military schools and Training Facilities in the Czech Republic and Abroad". It participates in medical personnel training of medical and non-medical specializations under the methodical and professional leadership, in providing instructors for training of advanced categories of medical personnel and in teaching instructors of lower medical specialists training

2. Scientific and research work

The FMHS of the University of Defence provides and solves research tasks for the Czech Armed Forces Medical Service. Well assembled scientific teams focus on individual research tasks using state-of-the-art technologies. Within the Faculty, complex laboratory technologies for scientific work are utilized for scientific advancements, which lead to the improvement of life force protection against CBRNE agents. The high scientific level and the achieved results in scientific and research activities of present teams have enabled to for scientific cooperation with foreign partners. The FMHS is a leading institution in the Czech Republic performing military research within the sphere of CBRNE issues in NATO and EU.

The high-quality research capabilities and international recognition of the scientific teams form a solid base for scientific cooperation with partners in NATO countries, which is financed by the NATO and EU funds. Within the sphere of the science and research, the FMHS fulfilled strategic purposes of the Czech Armed Forces transformation by targeting the priorities of the Army (biological agents, chemical agents, military health care). Furthermore, it joined

the appropriate institutions and organizational structures of NATO and EU countries and obtained original results in these critical areas. From the point of view of specialization and direction of the Czech Armed Forces, the departments of the FMHS solve medical issues of biological, chemical and radiation protection. Previous and current scientific work focuses on medical aspects of the effects of CBRNE agents and several scientifically oriented departments within the FMHS work in collaboration in solving the specific tasks. This fully corresponds with set priorities in the field of scientific and research work of the Army of the Czech Republic. The military medical service organization and management, information systems, research activities of clinical and therapeutic preventive branches represent other important fields of scientific work.

Many invitations to international symposia and conferences as well as a number of publications prove that scientific knowledge is used in education. The FMHS personnel can publish achieved results of their research work, therapeutic preventive activities and educational activities in the journal *Military Medical Science Letters* – the oldest military specialized journal, which has been published since 1925. The journal is indexed in Scopus. As of the last year, the journal is published fully in English. Together with professional scientific results the pedagogical activities are subject of an annual evaluation. Based on the results, the academic staff is successful in keeping a good level of publication activities in journals with impact factor and in other national and foreign journals. This, in turn, enables for relatively broad and successful training activities in the accredited doctoral study programs.

Scientific, research and development activities in the field of medical support include the prevention, diagnosis and treatment of sick and wounded. An integral part of this work is to improve the system of the medical equipment administration and supply support.

Research and development is carried out at 8 departments – Epidemiology, Military Medical Service Organization and Management, Radiobiology, Toxicology and Military Pharmacology, Military Surgery, Military Internal Medicine and Hygiene, Emergency Medicine and Military General Medicine, Molecular Pathology and Biology.

In 2020, scientific work at the Faculty departments focused on CBRNE protection research, projects on pathogenesis of infectious diseases and potential intervention means, prevention in the field of hygiene and epidemiology, topical problems of the field surgery and field internal medicine, topical problems of the organization, management, education and information technology in the Military Medical Service.

The continuous accreditation for proceedings to achieve professorships in the areas of Epidemiology, Medical Microbiology, Toxicology, Field Internal Medicine, Infection Biology and Molecular Pathology and the accreditation for habilitation (associate professorship) in the branches of Hygiene, Preventive Medicine and Epidemiology, Medical Microbiology, Toxicology, Field Surgery, Military Radiobiology, Field Internal Medicine, Infection Biology and Molecular Pathology gives the evidence about the excellent level of achieved results in scientific and research activities of FMHS.

3. Therapeutic activities

Special therapeutic activities were provided especially at the departments of Field Internal Medicine, Field Surgery and General and Emergency Medicine. Close cooperation between these subjects and the health service establishments in the region have been continuously developed. Therapeutic medical care was provided especially in the fields of hematologic intensive care, traumatology, hepatobiliary surgery, plastic surgery at the departments of internal medicine and surgery at the Teaching Hospital.

4. International cooperation

The membership in work groups for coordination and cooperation of military medical research and professional training at NATO (COMEDS, BIOMEDAC, RTA/RTO) and at EDA (European Defence Agency), in work groups of government experts for the Convention on the prohibition of biological, bacteriological, and chemical weapons and their destruction in Geneva and UNO, organizing scientific conferences with international participation, and solving foreign research projects under the cooperation of the FMHS personnel are very important for the presentation of international cooperation results. The priority still remains in cooperation in the frame of the Human Factors Medicine of the NATO Research and Technology Organization and its work groups (TG, WG), CBRNE and Human Factors cooperation within the frame of EDA and additional collaborative research projects with other foreign scientific institutions. Our aim is to intensify international cooperation in NATO focused on scientific support of the armed forces structure.

5. Expert activities

The membership in work groups for coordination and cooperation of military medical research and professional training at NATO (COMEDS, BIOMEDAC, RTA/RTO) and at EDA (European Defence Agency), in work groups of government experts for the Convention on the prohibition of biological, bacteriological, and chemical weapons and their destruction in Geneva and UNO, organizing scientific conferences with international participation, and solving foreign research projects under the cooperation of the FMHS personnel are very important for the presentation of international cooperation results. The priority still remains in cooperation in the frame of the Human Factors Medicine of the NATO Research and Technology Organization and its work groups (TG, WG), CBRNE and Human Factors cooperation within the frame of EDA and additional collaborative research projects with other foreign scientific institutions. Our aim is to intensify international cooperation in NATO focused on scientific support of the armed forces structure.

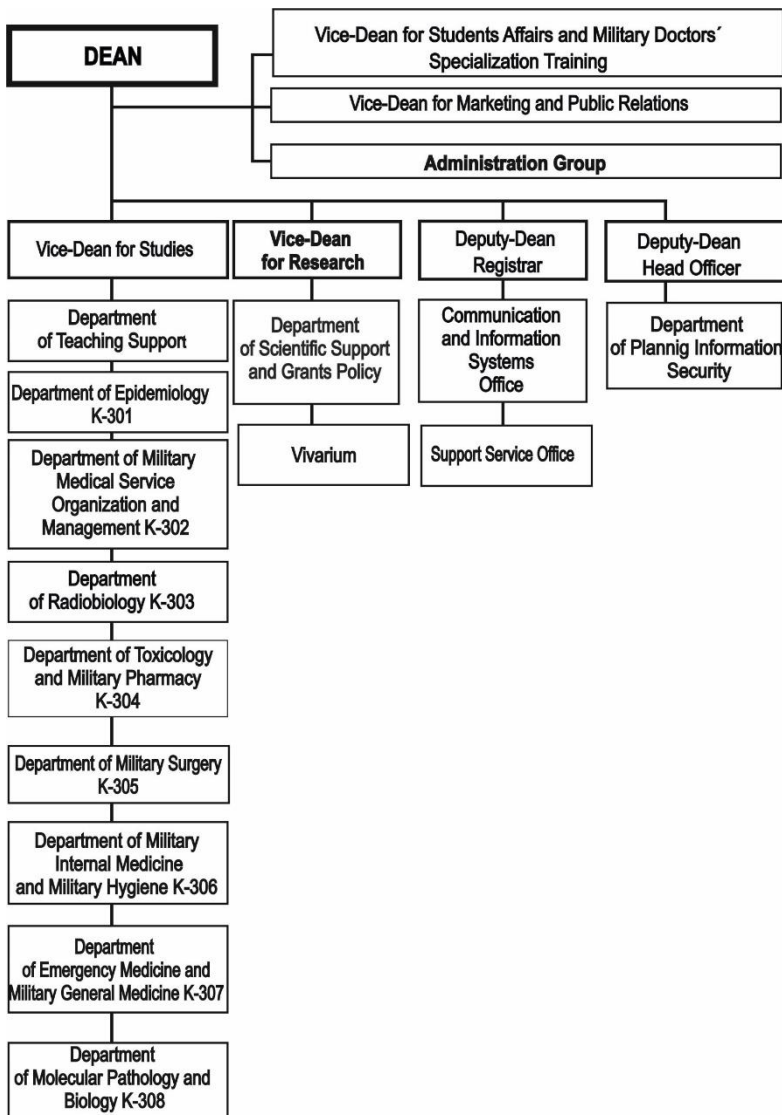
6. Scientific and educational information services

Scientific and educational information services that support the Medical Service of the Czech Republic Army were provided by the Department of Information and Communication Technologies. Numerous literature retrievals, courses, library and printing workshops and other information services support for students, teachers, scientists, postgraduates, doctors, nurses and other medical experts were carried out.

7. Foreign missions

The FMHS performed the preparation of health personnel for humanitarian and peacekeeping missions and members of the FMHS staff participated in several foreign missions.

THE STRUCTURE OF THE FMHS



THE DEAN OF THE FACULTY AND HIS DEPUTIES

Dean:	BOŠTÍK Pavel	email: pavel.bostik@unob.cz
Vice-Dean for Studies	KRUTIŠOVÁ Pavla	email: pavla.krutisova@unob.cz
Vice-Dean for Research	POHANKA Miroslav	email: miroslav.pohanka@unob.cz
Vice-Dean for Marketing and Public Relations	BOŠTÍKOVÁ Vanda	email: vanda.bostikova@unob.cz
Vice-Dean for Students Affairs and Military Doctors' Specialization Training	PLODR Michal	email: michal.plodr@unob.cz
Deputy-Dean – Registrar	KOMÁREK Jan	email: jan.komarek@unob.cz
Deputy-Dean – Head Officer	FLÉGL Václav	email: vaclav.flegl@unob.cz

MEMBERS OF THE SCIENTIFIC COUNCIL

ANZENBACHER Pavel	BOŠTÍK Pavel (Head of the Scientific Council)
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FUSEK Josef	HORÁČEK Jan
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ŠUBRT Zdeněk	

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CHLÍBEK Roman

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KUČERA Tomáš

KUBELKOVÁ Klára (Vice-chairman)

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SMETANA Jan (Head of the Senate)

ŠINKOROVÁ Zuzana

ŽDÁRA Jaroslav

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COUFAL Ondřej

MACHALA Jan

MINAŘÍKOVÁ Anna

MIŠÍK Jakub (Vice-chairman)

MOTKA Jan

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KUBELKOVÁ Klára	KRUTIŠOVÁ Pavla
KULICH Marek	MALÝ Ondřej
MITÁŠOVÁ Klára (Secretary)	PUDÍK Peter (Head of the Education Commission)
ROHLENA Milan (Vice-chairman)	RŮŽIČKA Milan
SMETANA Jan	STŘÍTECKÁ Hana
ŠEBKOVÁ Iva	TICHÝ Aleš
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KRUTIŠOVÁ Pavla	NOVÁKOVÁ Jana (Secretary)
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RECTOR-COMMANDANT



Czech President Miloš Zeman appointed **Colonel of General Staff Assoc. Prof. RNDr. Zuzana Kročová, PhD** the new University of Defence rector in the Throne Room at Prague Castle on 29 July 2020 at the presence of the leading defence personalities headed by Minister of Defence Lubomír Metnar and Chief of General Staff General of the Army Aleš Opata. The new rector appointment based on the proposal from the Minister of Defence. The proposal results from the decision made by the Academic Senate of the University of Defence in accordance with the elections that had taken place during its session 16 June 2020. Colonel Kročová replaced Brigadier General Bohuslav Příkryl in the rector office. The new period begins on 1 August 2020 and lasts till 31 July 2024.

Curriculum vitae

Colonel of General Staff Assoc. Prof. RNDr. Zuzana Kročová, PhD, graduated from physical chemistry at the Faculty of Science of today Masaryk University. In 1993, she joined the Military Medical Academy, which transformed into the Faculty of Military Health Studies under the University of Defence in 2004. She has been appointed the head of the Department of Molecular Pathology and Biology focusing on highly infectious biological agents. She is an expert in the protection against biological substances.

She completed doctoral studies in clinical immunology at the Palacky University's Medical Faculty in 2001 and her habilitation procedures in infection biology programme at the Faculty of Military Health Sciences of the University of Defence in 2013. She became military professional in 2006 and completed General Staff Course in 2015.

DEPARTMENT OF EPIDEMIOLOGY K-301**Educational and Research Staff**

BOŠTÍK Pavel (Head of the Group)	pavel.bostik@unob.cz
BOŠTÍKOVÁ Vanda	vanda.bostikova@unob.cz
HANOVCOVÁ Irena (Head of the Group)	irena.hanovcova@unob.cz
CHLÍBEK Roman (Head of the Department)	roman.chlibek@unob.cz
JANOVSKÁ Sylva	sylva.janovska@unob.cz
MAREK Jan	jan.marek@unob.cz
SIRÁKOVÁ Lucie	lucie.sirakova@unob.cz
SLEHA Radek	radek.sleha@unob.cz
SMETANA Jan (Deputy-Head)	jan.smetana@unob.cz

Technicians

BERNARDOVÁ Marta	marta.bernardova@unob.cz
MALÍKOVÁ Martina	martina.malikovam@unob.cz
SOLÁROVÁ Alena	alena.solarova@unob.cz
VOŽENÍLKOVÁ Kristýna	kristyna.vozenilkova@unob.cz
VYCHYTILOVÁ Pavlína	pavlina.vychytilova@unob.cz

Administrative, Secretarial and Other Staff

LEGERSKÁ Kateřina	katerina.legerska@unob.cz
-------------------	---------------------------

Postgraduate Students

BENKOVÁ Markéta	marketa.benkova@unob.cz
BRIXI Jan	jan.bixi@unob.cz

HAŠKOVÁ Kateřina	katerina.haskova@unob.cz
HEDIMA Nenadi Clare	nenadiclare.hedima@unob.cz
HOLMQUIST Ivana	ivana.holmquist@unob.cz
HYMPÁNOVÁ Michaela	michaela.hympanova@unob.cz
CHMELARĚ Josef	josef.chmelar@unob.cz
KARÁSEK Luboš	lubos.karasek@unob.cz
MACHAČ Jan (till 28 January 2020)	jan.machac@unob.cz
MALIŠ Jiří	jiri.malis@unob.cz
MORAVEC Michal	micah.moravec@unob.cz
NEJTEK Tomáš	tomas.nejtek@unob.cz
POLCAROVÁ Petra (till 23 September 2020)	petra.polcarova@unob.cz
PÚDELKA L'udovít	ludovit.pudelka@unob.cz
RUMLAROVÁ Šárka (since 01 October 2020)	sarka.rumlarova@unob.cz
SIRÁKOVÁ Lucie (since 01 October 2020)	lucie.sirakova@unob.cz
SZANYI Juraj	juraj.szanyi@unob.cz
ŠMAHEL Petr	petr.smahel@unob.cz

The Department of Epidemiology provides and carries out education of students of the University of Defence, Faculty of Military Health Sciences, the Faculty of Medicine and the Faculty of Pharmacy in Hradec Kralove and the University of Pardubice, in the field of general and special epidemiology, infectious disease medicine, travel and preventive medicine, and medical microbiology. Within the framework of the military medical subjects for students of the Faculty of Military health Sciences, the Department provides teaching of military epidemiology and the issue of the protection of living forces against biological attack. Furthermore, the Department arranges and carries out professional fellowships and specialization training of the ACR Hygiene and Epidemiology Service workers, including the training of the ACR officers for

foreign missions. In the military, the Department is the leading workplace in specialization training in Hygiene, Epidemiology and Medical Microbiology. Besides Epidemiology, the teachers of the Department also give lectures in Applied Microbiology, General and Special Immunology, problems of highly virulent infections and selected chapters from Infectiology and the complete issues of Vaccinology. Basic tasks in scientific work have been long term focused on the area of military health protection, CBRN protection with a focus on biological weapons, disaster relief and provision of preventive health care in specific conditions. In the year 2020, the Department was solving several research projects and tasks:

- Testing of resistant enterococci sensitivity to disinfectants
- Surveillance of vancomycin resistant enterococci
- Prevalence of ticks infected with tick encephalitis in military training areas
- Seroprevalence of tick encephalitis antibodies in the ACR soldiers
- Surveillance of tick encephalitis antibodies in adult civil population
- Seroprevalence of type E hepatitis virus antibodies in the ACR soldiers
- Bond of gB protein to chitosan; evaluation of the immune response in a mice model
- Evaluation of VZV strains virulence by the RTCA method
- Testing of the new KAS disinfection effectivity according to the standards; Synthesis and evaluation of novel compounds based on quaternary ammonium salts for eradication of microbial bio films
- AZV-17-31765A Project – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections
- The Department is one of the most recognized centers in the field of vaccination, also respected abroad.

The Department of Epidemiology is the basic expert workplace of the ACR in the field of military health protection against the effects of biological weapons, biological agents and agents of infectious diseases, including the problems of preventive medicine and vaccination. The Department workers are responsible for development of these scientific branches and for the process of standardization in the stated branches within ACR and NATO.

In 2020, the departments members became involved in solving the Covid-19 epidemic, as an expert and advisory body of the Ministry of Health. Members of the department worked in the Central Management Team of the Ministry of Health, in the clinical group and also in the epidemiological group of the Ministry of Health. Prof Chlíbek was also the leader of the epidemiological group of the Ministry of Health.

RESEARCH PROJECTS

BIOFILM – Synthesis and evaluation of novel compounds based on quaternary ammonium salts for eradication of microbial bio films

Marková, A., Marek, J.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201808)

Biofilm is community of microorganisms fixed to the various surfaces (in healthcare, for example, tissues, catheters, cannula plastic implants, teeth and dental implants). Biofilm formation is much better for a number of microorganisms than staying in a planktonic form. Microorganisms are able to differentiate during the biofilm formation and produce specific biofilm phenotype. Formations of flagella and fimbria are genetic modifications enabling initiation of adhesion, however production of extracellular polysaccharide matrix is significant for biofilm protection. Due to polysaccharide matrix are biofilms more resistant against external conditions (mechanical and chemical). In general, planktonic forms of microorganisms are more easily eliminated than their biofilms. Our main research activity will include synthesis of novel compounds based on quaternary ammonium salts and evaluating their eradication ability against pathogenic microorganisms. Minimum inhibitory concentration (MIC) will be measured for all substances, then we will focus on introducing a new MBEC-based methodology for measuring minimum biofilm eradication concentration (MBEC). Our laboratory has appropriate strains of biofilm forming microorganisms (*Pseudomonas aeruginosa*, *Staphylococcus aureus* etc.). Two or three suitable strains will be chosen and we will compare antimicrobial action of new compounds against biofilm and planktonic form. Furthermore, the effect of new compounds will be compared with standards (benzalkonium etc.) The most important outcome of this study is to show the differences in the effectiveness of disinfectants on the microorganisms in two different life forms.

BREASTFEEDING – Factors influencing initiation and continuation of breastfeeding in the South-East United States

Holmquist, I., Bošťíková, V.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201812)

The purpose of this study is to determine and analyze changes in breastfeeding rates and to explore factors influencing initiation of breastfeeding in a hospital

setting with specific focus on the South-East United States and the Czech Republic. Exploring factors that influence initiation of breastfeeding in hospital settings is especially important because most of currently available studies only review the effects of direct breastfeeding interventions, rather than the role of policies and pro-breastfeeding programs. Data about the effect of policies and pro-breastfeeding programs are rarely collected and reported. This study will compare and contrast practices, policies and pro-breastfeeding interventions in the South-East United States with practices, policies and pro-breastfeeding interventions in the Czech Republic.

MBEC – MBEC assay: The method modification for individual bacterial strains and multiple-species biofilms

Hympánová, M., Marek, J.

Supported by the Ministry of Education, Youth and Sports, 2019–2021 (Project No.: SV/FVZ201905)

Microorganisms can exist either as planktonic free floating cells or as three-dimensional single-species or polymicrobial communities which are embedded in a self-produced matrix. These microbial consortia called biofilms, are associated with biotic or abiotic surfaces and presented by higher resistance against antimicrobial agents. Methods as the determination of MIC (minimal inhibitory concentration) are essential conventional methods for the susceptibility testing. However, regarding the important role of microbial biofilms in the development of persistent infections, the research is nowadays more focused on MBEC (minimal biofilm eradication concentration) evaluation. The anti-biofilm agents would be more valuable in clinical practice. Regarding that, the aim of this project is to modified MBEC assay for individual bacterial strains and for multiple-species biofilms. Moreover, this method will be used together with standard MIC assay to determinate antimicrobial effect of certain agents commonly used in clinical practice.

NOSOCOMIAL INFECTIONS – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

Boštík, P., Boštková, V., Páral, J., Pejchal, J., Plodr, M., Radochová, V., Sleha, R., Mikyška, A., Čermák, P., Bogdanová, K., Houška, M.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-31765A)

The increasingly more prevalent bacterial resistance to antibiotics presents an important worldwide problem. Compounds of natural origin with a proven antibacterial effect may represent new resources in this area or serve as complementary therapies utilized together with antibiotics. Certain compounds from hops, especially beta-bitter acids and xanthohumol possess strong inhibitory effects on Gram-positive (*Staphylococcus aureus*, including resistant variants such as MRSA) and anaerobic bacteria, namely *Clostridium perfringens* and *C. difficile*. Some of the other characteristics of these compounds, including their low solubility in water, low toxicity and low level of adsorption in the gastrointestinal tract (GIT), predispose them as useful tools for local infections of skin and GIT. Formulations containing these compounds, which will be developed and evaluated in this project, can thus represent much needed tools for a local therapy of infections caused by antibiotic-resistant strains of bacteria.

TICK – Evaluation of risk of infection with tick-borne encephalitis, Lyme borreliosis and ehrlichiosis during the training of soldiers of the Czech Army in selected military areas

Polcarová, P., Smetana, J.

Supported by the Ministry of Education, Youth and Sports, 2019–2020 (Project No.: SV/FVZ201903)

The tick *Ixodes ricinus* is the most important arthropod which transmitting diseases in Central Europe. There are mainly Lyme borreliosis and tick-borne encephalitis among the diseases transmitted by this type of tick in the Czech Republic. The less known anaplasmosis (ehrlichiosis) is also transmitted by the tick to humans, but its incidence is lower. The Czech Republic is an endemic country for these three tick-borne diseases. All three tick-borne diseases are zoonoses whose etiologic agent has a reservoir especially in forest animals. Humans are a random part in the cycle of these infections. As the incidence of ticks is currently increasing, the risk of tick-borne diseases also increases. People spending a lot of time in nature, including soldiers of Czech Armed Forces, are at the highest risk of infection. Natural foci of infections could be probably located in military training areas, where soldiers regularly exercise. The aim of this study is to investigate ticks collected in four major military areas (Boletice, Březina, Hradiště, Libavá) for the presence of tick-borne encephalitis virus and bacteria *Borrelia burgdorferi* sensu lato and *Anaplasma phagaphytophila*. The result will be an assessment of the risk of infection by mentioned pathogens during military service and proposing of appropriate preventive measures.

The induction of antiviral immune response after intranasal application of nanoparticles based vaccine

Sleha, R., Boštík, P., Janovská, S., Radochová, V.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: LTAUSA19003)

The aim of this study is to develop of chitosan-nanoparticles based vaccine against cytomegalovirus for intranasal application and investigation of the immune response on model animals (mice and nonhuman primates) after application in combination with various adjuvans.

NOSOCOMIAL INFECTIONS – Factors determining the occurrence of nosocomial infections in intensive care

Brix, J., Boštíková, V., Holmquist, I.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202001)

Nosocomial infections accompany all branches of clinical medicine in various severe forms. The most serious nosocomial infections occur in intensive and resuscitation care units, operating wards and aftercare and long-term care wards. Nosocomial infections can cause very serious health complications, worsen the prognosis, prolong the patient's hospitalization, and can lead to death. The incidence of nosocomial infection multiplies the financial costs associated with treatment. The emergence of this type of disease is related to a number of factors, including in particular the severity of the patient's condition, length of hospitalization, guided therapy, as well as the hygienic-epidemiological regime of the workplace and its observance. 5 to 10% of the total number of hospitalized patients are treated in intensive care beds during the calendar year. At the same time, it is here in intensive care units that on average 25% of all nosocomial infections occur. These infections directly related to hospitalization increase the morbidity and mortality of patients and are often a terminal complication of critical conditions.

MALIGNANCY – Importance of hyperthermic intrathoracic chemotherapy with cytoreductive surgery on malignant pleural effusion

Herzinger, J., Brix, J., Lochman, P., Mališ, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202004)

Our thesis deals with multimodal treatment of mostly advanced pleural malignancies – malignant pleural mesothelioma. Our multimodal therapy combines cytoreductive surgery, which is aimed at removing macroscopic tumour, and subsequently hyperthermic intrathoracic chemotherapy, which points at the microscopic component of pleural malignancy. The main goal of this study is to evaluate the safety of the whole procedure and to assess its influence on survival of patients with this kind of malignancy. Among others, the subject of our interest is systematic effect of intracavitary application of platinum-based chemotherapy in short-term and long-term period. Multimodal treatment is considered as potentially curative in highly selected group of patients with primary and secondary pleural tumours.

INCIDENCE – Incidence and prevalence of sexually transmitted diseases in women in military

Karásek, L., Smetana, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202006)

Sexually transmitted diseases (STDs) are diseases that are spread through sexual intercourse, and in some cases through direct contact with infected blood. Eight of them contribute the most to the overall incidence of STDs. These are human papilloma viruses (HPV), HIV, hepatitis B, herpes simplex virus, syphilis, gonorrhea, chlamydia and trichomoniasis. HPV is the most common sexually transmitted disease in the world and in the Czech Republic. The military environment, which brings together a large number of different individuals of both sexes, between which it automatically creates various ties, modifies their behavior and affects their health. The aim of this study is to compare the riskiness of the military environment in the field of sexually transmitted diseases with the civilian sector and to determinate the prevalence of HPV and other common STDs in women entering the Army of the Czech Republic and in control groups. At the same time, the discovery of specific risk factors for STD infection in the Army of the Czech Republic, their analysis and the proposal of preventive measures to ensure the minimization of the risk of infection during the service of the military professionals. The project is conducted as a prospective study of the prevalence of STD in the specific time period after women entering the Army.

PNEUMONIA – Th17 immune response, myristic acid and mid-regional pro-adrenomedullin (MR-proADM) in patients with severe community acquired pneumonia (sCAP) in correlation with specific pathogens of CAP and their value in disease severity and outcome prediction

Moravec, M., Chlíbek, R., Nejtek, T.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202008)

Study of a group of patients diagnosed with severe community-acquired pneumonia (sCAP) with monitoring of selected parameters of cellular and humoral immunity and dynamics of some inflammatory biomarkers during the disease, their relation to the causing pathogen, severity, complications, prognosis and overall clinical outcome. Evaluation of the clinical significance of these parameters may have an impact on improving the results of diagnosis and treatment and is one of the ways to contribute to the application of the concept of "precision medicine" in the treatment of severe community-acquired pneumonia and sepsis. The study is designed as observational and non-interventional. The expected number of patients enrolled in the study is 50–100 subjects over 3 years.

NATURE – Potential of the natural substances in the treatment of non-healing wounds

Púdelka, L., Boštík, P., Mališ, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202009)

Chronic non-healing wounds represent a major socioeconomic and health problem around the world. The combination of increasing microbial resistance and elderly patients with multiple comorbid diseases poses a challenge to healthcare staff in their efforts to heal wounds. One of the most important goals is to control wound infection. The infection may stop the healing process or can lead to regression of wound healing. Our aim is to analyze the natural substances, which could we use to in this issue.

RISK – The risky behavior among students of the universities

Spěváková, B., Bošťíková, V., Brixí, J., Holmquist, I.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202011)

Risky behavior is such that there is a demonstrable increase in health, social, educational and other risks for individuals or society. Risky behavior is associated with unhealthy lifestyles, violations of social norms, laws, regulations and ethical values. This can lead to damage to the health of the individual, the environment in which he lives and works. A number of disciplines deal with this issue: medicine, psychology, sociology, etopedy. It focuses on the analysis of the causes that lead to the emergence of specific behavior. The most common socially undesirable phenomena in children and adolescents include bullying and violence, substance abuse, virtual drugs, truancy, crime and delinquency, eating disorders, sexual promiscuity, xenophobia and intolerance. Within risky behavior, we distinguish eight different types of behavior: behavior or substance use, addiction and gambling, aggression and bullying, violence, vandalism, truancy, sexual risk behavior, racism and xenophobia, homophobia, intolerance, anti-Semitism, extremism, negative sects, risky sports and risky behavior in transport. It is not easy to determine the causes of these phenomena, it is usually a set of causes. The problem can be the disharmonious development of the personality, the failure to satisfy the most important human needs. In school conditions, it is important to analyze these factors and apply them in primary and secondary prevention.

**DEPARTMENT OF MILITARY MEDICAL SERVICE ORGANIZATION
AND MANAGEMENT K-302**

Educational and Research Staff

BLAŽEK Pavel	pavel.blazek@unob.cz
FUSEK Josef	josef.fusek@unob.cz
HUMLÍČEK Vojtěch	vojtech.humlicek@unob.cz
JANOUC H Jindřich	jindrich.janouch@unob.cz
KUČERA Tomáš (since 01 March 2020)	tomas.kucera2@unob.cz
POTÁČ Michal (Deputy-Head) (till 30 June 2020)	michal.potac@unob.cz
RŮŽIČKA Milan (Head of the Group) (since 01 July 2020)	milan.ruzicka@unob.cz
SCHVACH Hynek (Head of the Department)	hynek.schvach@unob.cz
SMOLA Petr	petr.smola@unob.cz
SUCHÁNEK Zbyněk	zbynek.suchanek@unob.cz
ŽDÁRA Jaroslav	jaroslav.zdara@unob.cz

Administrative, Secretarial and Other Staff

MÍŠKOVÁ Leona	leona.miskova@unob.cz
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The Department of Military Medical Service Organization and Management is the primary department which offers military and professional training for the students of the Faculty of Military Health Sciences, particularly in the field of military medical management and medical support to operations. The focus of the department is multidisciplinary. Therefore, the subjects are divided into the following areas: organization and tactics of military medical service, military training, basic and humanitarian law, e-Health and medical informatics, medical and crisis management, leadership and medical psychology. The course also includes subjects such as statistics, military history, topography and others.

DEPARTMENT OF MILITARY MEDICAL SERVICE ORGANIZATION AND MANAGEMENT K-302

The Department provides follow-up education for military doctors, dentists, pharmacists and bachelors in advanced courses. Likewise, it offers specialized training for medical personnel to the extent necessary to carry out required medical duties in military operations, e.g. medical support principles and policy, medical evacuation chain, medical intelligence or crisis intervention. It participates in preparation also of non-medical personnel within the HQ and staff of the military medical units and facilities. It carries out training in medical support planning including the estimation of medical casualties.

The subject Organization and Tactics of the Medical Service makes students acquainted with terms and conditions of the medical support during military operations, identifies tasks and principles of medical support and medical C2 issues that are fundamental to comprehension and correct application of knowledge in terms of other military medical branches. It familiarizes students with the principles followed from NATO documents and standardization agreements.

The Department's primary aim is to pass the knowledge on to students, develop their habits and skills to fulfil basic tasks and duties arising from their planned command functions. It is involved in preparation of medical personnel prior to deployment. The Department provides knowledge and passes previous experience on to control authorities and executive facilities of the medical services in crisis, a war or other emergency situations as well as in humanitarian missions. It applies the knowledge of military subjects to specific environment of medical service, respecting both military principles and requirements as well as the principles of International Humanitarian Law.

The research work of the Department focuses on improving the quality and efficiency of organization and management of the medical service in accordance with military doctrine of the Czech Republic. It contributes in optimization process of the organizational structure of the medical units, departments and facilities, elaborating principles of their operations and methods of their control during a war. It provides consultations, develops materials and proposals from these areas for strategic command level, conceptual authorities of the ACR Medical Service, including NATO STANAG assessment reports in terms of their ratification and options of implementation.

RESEARCH PROJECTS

Allied future surveillance and control high level technical concepts technology readiness level assessments

Schvach, H., Bořil, J.

Supported by the NATO, 2019–2020 (Project No.: SCI-339)

The Allied Future Surveillance and Control (AFSC) project follows on to the E-3 Airborne Early Warning and Control System (AWACS). The task is to prepare the Command & Control system of systems with large cross-domain capabilities, connected to other system architectures (Ballistic Missile Defense, Air Defense, Maritime Surveillance, Ground Surveillance, ISR). Various types of sensors, diverse platforms, robust connectivity, data science and decision-support technologies should all be important components of the AFSC capability. The Human Factor, which was addressed by members of the University of Defense, will be taken into account throughout the project.

Bio-technology, human enhancement/human augmentation

Schvach, H.

Supported by the NATO, 2020–2020 (Project No.: HFM-335)

The project on the basis of Emerging and Disruptive Technologies (EDT) roadmap of NATO. The project is tasked to perform a horizon scan across the full breadth of this EDT in order to generate a high level, comprehensive overview of its topical content. It will agree on the definition of the terminology used and identify the most promising S&T work strands and their military relevance. The outcome of the RST is a concise, comprehensive, unclassified report which will form the basis for future research areas within the STO Panels. The main areas of solution were identified Warfighter Systems, Warfighter Performance, Military Medicine, Security & Compliance and Force Protection.

Development and implementation of Autonomous Transport and Medical Systems for Casualty Evacuation

Schvach, H.

Supported by the NATO, 2020–2026 (Project No.: HFM ET 167 ET)

The project topic is to explore the development of autonomous medical systems for tactical evacuation in future battlefield environments with applications in casualty transport and far forward medical logistics. The main task is to establish common NATO concepts, policy and doctrine that leverage emerging general-purpose unmanned system (UMS) platforms for medical missions to include CASEVAC, RASEVAC (the evacuation of wounded, sick and injured personnel using robotic, autonomous, and/or unmanned air, ground or maritime platforms with or without a human attendant and/or autonomous en route care systems), medical supply and re-supply.

DECONTAMINATION – Testing of decontamination mixtures efficacy against chemical warfare agents

Kučera, T., Matula, M., Žďárová Karasová, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202005)

In this project, decontamination mixtures will be designed and evaluated *in silico* and *in vitro*. Subsequently, *in vivo* testing of the decontamination efficiency of the proposed decontamination solutions on selected chemical warfare agents will take place.

DEPARTMENT OF RADIOBIOLOGY K-303

Educational and Research Staff

ANDREJSOVÁ Lenka	lenka.andrejsova@unob.cz
ČÍŽKOVÁ Jana	jana.cizkova@unob.cz
FILIPOVÁ Alžběta	alzbeta.filipova@unob.cz
MERVARTOVÁ Lenka	lenka.mervartova@unob.cz
ŠINKOROVÁ Zuzana (Head of the Department)	zuzana.sinkorova@unob.cz
TICHÝ Aleš (Deputy-Head)	ales.tichy@unob.cz
VÁVROVÁ Jiřina (Emerit. Prof.)	jirina.vavrova@unob.cz

Technicians

PRŮCHOVÁ Šárka	sarka.pruchova@unob.cz
TÓTHOVÁ Iveta	iveta.tothova@unob.cz

Administrative, Secretarial and Other Staff

ŠKODOVÁ Kateřina	katerina.skodova@unob.cz
------------------	--------------------------

Postgraduate Students

ČECHÁKOVÁ Lucie (till 30 June 2020)	lucie.cechakova@unob.cz
ČÍŽKOVÁ Jana	jana.cizkova@unob.cz
GREPL Jakub	jakub.grepl@unob.cz
CHMIL Vojtěch (since 01 October 2020)	vojtech.chmil@unob.cz
JELIČOVÁ Marcela (till 03 June 2020)	marcela.jelicova@unob.cz
KULTOVÁ Gabriela	gabriela.kultova@unob.cz

LIEROVÁ Anna (till 01 October 2020)	anna.lierova@unob.cz
NĚMCOVÁ Markéta	marketa.nemcova@unob.cz
ONDREJ Martin (till 01 October 2020)	mertin.ondrej@unob.cz
ŠTUK Jan	jan.stuk@unob.cz

The Department of Radiobiology was established at Purkyně Military Medical Research and Postgraduate Institute on September the 1st 1963. The first chief of the department became Colonel Prof. MUDr. Josef Mráz, CSc., who was in 1968 appointed the first professor of military radiobiology of Charles University. The main tasks of the department are teaching and research activities, which are closely connected.

In the field of research, the experimental work includes histology and cytology, in vitro methods, methods of proteomic analysis and methods of flow cytometry. Individual technological units allow in vitro and in vivo observation of post-radiation mechanisms on molecular, cellular, and organ levels.

Military research is focused on early diagnosis and therapy of post-radiation damage as the main objective of the department. The aim of investigation in the medium-term horizon is discovery and practical introduction of biodosimetric markers, study of molecular mechanisms of radiation-induced DNA damage repair and autophagy, development of radioprotection agents as well as continuous renewal of decontamination agents for the Army of the Czech Republic. Mutual cooperation with other CBRN research workplaces world-wide also remains an integral part of our research activities. Cooperation with civilian workplaces at the Faculty of Medicine and the University Hospital in Hradec Králové is focused on radiation oncology.

The Department of Radiobiology takes part in military medical-specialist education in the form of pre-gradual and post-gradual education mainly in doctoral studies. The main educational activity is lecturing military radiobiology. The main topics are: the nuclear weapons effects on the living organism, the possibilities of the protection and medical treatment of irradiated persons. Other specific military issues are disaster medicine, CBRN protection etc., which are taught at the Faculty of Military Health Sciences, including the topics, which are presented by the instructors of our department.

RESEARCH PROJECTS

BIOINDICATORS – Determination of DNA damage bioindicators after irradiation by electrochemical analysis

Jeličová, M., Šinkorová, Z.

Supported by the Ministry of Education, Youth and Sports, 2019–2020 (Project No.: SV/FVZ201904)

This specific research project continues the completed specific research project “Electrochemical detection of DNA damage after gamma irradiation”, which was focused on introducing and optimizing a new biodosimetric method based on the principle of electrochemical monitoring of DNA damage. The method of electrochemical detection for biodosimetry purposes has been developed at the workplace by the researcher since 2016 and the newly submitted project will continue in relation to the achieved results so far. The main aim of the research part of the project is to detect oxidative stress products as a result of damaged DNA by ionizing radiation using the already optimized electrochemical method. Part of the project will be to increase the sensitivity of the electrodes by modifying the surface to ensure the most sensitive detection of the level of oxidative stress products in the biological sample. The results of the electrochemical determination will be compared with the existing biodosimetric methods and the ELISA method. This method should then serve as a new approach to retrospective determination absorbed dose of ionizing radiation.

New approaches in diagnostics and therapy of irradiated persons

Tichý, A.

Supported by the Czech Republic Ministry of Internal Affairs, 2017–2021 (Project No.: VH20172020010)

The aim of the project is identification and quantification of proteins by mass spectrometry. Subsequent bioinformatic data analysis will select significant plasma proteins that are quantitatively different in serum samples of leukemic patients before and after whole body irradiation. The result will be a list of proteins with a demonstrable relationship to exposure to ionizing radiation. Furthermore, we aim to identify new irradiation indicators by flow cytometry. First, we aim to quantify changes in hematological parameters (leukocytes, thrombocytes, hematocrit) of an experimental mammalian model including LD50/30 as a basic indicator of the severity of an acute radiation syndrome (ARS), to classify irradiated subjects into one of the five Radiation Categories.

Furthermore, the radiosensitivity of the major lymphocyte populations and their decrease in peripheral blood will be determined as a significant indicator for determining the dose range needed to distinguish the severity of ARS development. Quantitative changes in the leukocyte cytoplasm will be analyzed for accurate sorting. The result will be a panel of biological indicators that allow, on the basis of predefined parameters, to determine whether or not an individual was exposed to ionizing radiation and to estimate ARS development depending on RC categorization. In the last part of the project we will focus on testing of new ways of ARS therapy by growth factors. The goal is to test several combinations of clinically available growth factors for more complex bone marrow stimulation in ARS. The tested factors will include: peg-G-CSF, KGF and IGF-1. In addition to the determination of experimental survival curves, the efficacy of treatment by histopathological examination of selected tissues will be assessed and we expect the treatment to be verified with the most appropriate combination of growth factors in the higher mammalian model. The results will be recommendations for the application of growth factors and the evaluation of the benefits for ARS therapy.

STRESS – Biologically active substances and their influence on the reduction of stress and radiation burden in the organism

Čížková, J., Šinkorová, Z.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202003)

The project solves radioprotective substance Juvenil (a natural complex of dietary nucleotides, peptides, amino acids and minerals, which is prepared by autoenzymatic cleavage from animal tissues in a precisely controlled technological proces). Juvenil have a confirmed positive biological effect on a living organism. The radioprotective effects of the product is measured in combination with the stress load, which significantly affects the basic metabolism of all organisms, and is an integral part of any impact on living force.

**DEPARTMENT OF TOXICOLOGY AND MILITARY PHARMACY
K-304**

Educational and Research Staff

DLABKOVÁ Alžběta	alzbeta.dlabkova@unob.cz
HEPNAROVÁ Vendula (maternity leave)	vendula.hepnarova@unob.cz
HERMAN David	david.herman@unob.cz
HRABINOVÁ Martina	martina.hrabinova@unob.cz
JOŠT Petr	petr.jost@unob.cz
JUN Daniel (Head of the Department)	daniel.jun@unob.cz
JUNOVÁ Lucie	lucie.junova@unob.cz
KASSA Jiří	jiri.kassa@unob.cz
KORÁBEČNÝ Jan	jan.korabecny@unob.cz
KUČERA Tomáš (till 29 February 2020)	tomas.kucera@unob.cz
MATULA Marek (since 1 September 2020)	marek.matula@unob.cz
MÚČKOVÁ Ľubica	lubica.muckova@unob.cz
PEJCHAL Jaroslav (Head of the Group)	jaroslav.pejchal@unob.cz
SOUKUP Ondřej	ondrej.soukup@unob.cz
SVOBODOVÁ Hana (till 20 October 2020)	hana.svobodova@unob.cz
ŽĎÁROVÁ KARASOVÁ Jana (Deputy-Head)	jana.zdarovakarasova@unob.cz

Technicians

HATLAPATKOVÁ Jana	jana.hatlapatkova@unob.cz
KADERÁVKOVÁ Iveta	iveta.kaderavkova@unob.cz

KRBÁLEK Lucie	lucie.krbalek@unob.cz
ŠKRANCOVÁ Věra	vera.skrancova@unob.cz

Administrative, Secretarial and Other Staff

MARTINCOVÁ Alena	alena.martincova@unob.cz
------------------	--------------------------

Postgraduate Students

BABKOVÁ Kateřina	katerina.babkova@unob.cz
BZONEK Petr	petr.bzonek@unob.cz
HERMAN David (till 22 September 2020)	david.herman@unob.cz
HRABINOVÁ Martina	martina.hrabinova@unob.cz
JEŘÁBKOVÁ Markéta (till 9 March 2020)	marketa.jerabkova@unob.cz
KOBRLOVÁ Tereza	tereza.kobrlava@unob.cz
KONEČNÝ Jan	jan.konecny@unob.cz
KŘENKOVÁ Zuzana	zuzana.krenkova@unob.cz
MARKOVÁ Aneta	aneta.markova@unob.cz
MATULA Marek	marek.matula@unob.cz
MÚČKOVÁ Ľubica (till 22 September 2020)	lubica.muckova@unob.cz
OPRAVIL Jakub	jakub.opravit@unob.cz
PULKRÁBKOVÁ Lenka	lenka.pulkrabkova@unob.cz
RYBKA Aleš	ales.rybka@unob.cz
SPĚVÁKOVÁ Barbora	barbora.spevakova@unob.cz
SVOBODOVÁ Barbora	barbora.svobodova@unob.cz

The Department of Toxicology was established in 1951. Since then, as an integral part of the Faculty of Military Health Sciences, it has been involved in education and scientific research work on chemical warfare agents for defensive and protective purposes only.

The Department of Toxicology and Military Pharmacy was established on the 1st September 2014 by integration of the Department of Toxicology, the Centre of Advanced Studies, and the Department of Public Health. It comprises two groups – the military pharmacy group (biochemical laboratory, laboratory of organic synthesis, analytical laboratory, decontamination laboratory) and the toxicology group (toxicological laboratory, pharmacological laboratory, neurophysiological laboratory, neurobehavioral laboratory, laboratory of cell toxicology). This structure permits a complex study of highly toxic substances including chemical warfare agents with aims to determine their action on biochemical, neurobehavioral, histochemical, pharmacological, and neurophysiological level, to study and develop antidotes, to analyze all types of samples with respect to the presence of known chemical warfare agents, to test decontamination effectiveness of developed and field decontamination kits. Present scientific research projects are focused on therapeutic, prophylactic, and protective measures against the most toxic chemical warfare agents. Special attention has been paid to the most recent and most dangerous nerve agents and mustards. Department have participated in OPCW Biomedical Proficiency Test.

The main educational activity task was to give lectures for in undergraduate and post-graduate studies dealing with problems of biological effects of real and potential chemical warfare agents, the possibilities of the medical and chemical protection against them and the approaches to medical care of for persons intoxicated with chemical warfare agents, especially nerve agents. The Department provides and guarantees the teaching master's degree program, Military Pharmacy and participates in the teaching of toxicology in Disaster Medicine.

In 2020, the Department of Toxicology and Military Pharmacy has continued in the cooperation, started by with the Armed Forces Biomedical Research Institute in Brétigny-sur-Orge (France), the Institute for Medical Research and Occupational Health in Zagreb (Croatia), WIHE in Warsaw (Poland), the Sahlgrenska Academy, the University of Goteborg (Sweden) and University of California, San Diego, Skaggs School of Pharmacy and Pharmaceutical Sciences (USA) – in the field of development of prophylactic and therapeutic means against nerve agents and organophosphorus insecticides. The cooperation has been mostly characterized by the exchange of scientific information. The cooperation with the Department of Organic Chemistry, Institute of Chemistry, P. J. Šafárik University in Košice

RESEARCH PROJECTS

AGENTS – Development of new agents with anti-inflammatory effect

Konečný, J., Korábečný, J.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201803)

Nerve agents (NAs) are highly toxic organophosphorus compounds with rapid onset of action. Their mechanism of action involves irreversible inhibition of acetylcholinesterase (AChE), this process leads to accumulation of neurotransmitter acetylcholine (ACh) with cholinergic crisis as a consequence. According to previously published studies, NAs affect not only cholinergic receptors, but also other receptors like NMDA receptors that plays a pivotal role in inflammatory responses. The multi-target-directed ligands (MTDLs) approach includes compounds that are capable to simultaneously target multiple biological systems. The aim of the project is to verify the concept of new dual-targeted compounds, designed in accordance with the MTDLs strategy, amalgamating AChE inhibitors and NMDA receptor antagonists into single molecules. Tacrine, 7-MEOTA, 6-chlorotacrine and others will be used as AChE reversible inhibitors whereas memantine or neramexane will be applied as NMDA receptor antagonists. The project aims to investigate the effect of newly developed hybrid compounds on AChE inhibition as well as their effect on NMDA receptors under in vitro conditions.

BIOFILM – Synthesis and evaluation of novel compounds based on quaternary ammonium salts for eradication of microbial bio films

Marková, A., Marek, J.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201808)

Biofilm is community of microorganisms fixed to the various surfaces (in healthcare, for example, tissues, catheters, cannula plastic implants, teeth and dental implants). Biofilm formation is much better for a number of microorganisms than staying in a planktonic form. Microorganisms are able to differentiate during the biofilm formation and produce specific biofilm phenotype. Formations of flagella and fimbria are genetic modifications enabling initiation of adhesion, however production of extracellular polysaccharide matrix is significant for biofilm protection. Due to polysaccharide matrix are biofilms more resistant against external conditions (mechanical and chemical). In general,

planktonic forms of microorganisms are more easily eliminated than their biofilms. Our main research activity will include synthesis of novel compounds based on quaternary ammonium salts and evaluating their eradication ability against pathogenic microorganisms. Minimum inhibitory concentration (MIC) will be measured for all substances, then we will focus on introducing a new MBEC-based methodology for measuring minimum biofilm eradication concentration (MBEC). Our laboratory has appropriate strains of biofilm forming microorganisms (*Pseudomonas aeruginosa*, *Staphylococcus aureus* etc.). Two or three suitable strains will be chosen and we will compare antimicrobial action of new compounds against biofilm and planktonic form. Furthermore, the effect of new compounds will be compared with standards (benzalkonium etc.) The most important outcome of this study is to show the differences in the effectiveness of disinfectants on the microorganisms in two different life forms.

ORGANOPHOSPHATES – Centrally acting antidotes for the treatment of organophosphorus poisoning

Soukup, O., Jun, D., Herman, D., Hrabínová, M., Junová, L., Pejchal, J., Radochová, L., Žďárová Karasová, J.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-32801A)

Inactivation of acetylcholinesterase (AChE) in nerve and muscle by organophosphates is the toxic mechanism common to both nerve agents and pesticides. Standard countermeasures against OP poisoning involves muscarinic inhibition and the use of oxime – a reactivator. The latter, however, is limited by a versatility of oximes and by a low penetration of reactivators into the brain. The aim of this project is to develop oxime reactivators with better penetration of the blood brain barrier (BBB). Namely, monoquaternary oximes with balanced physico-chemical properties containing selected nucleophile capable of AChE reactivation and a ligand of peripheral anionic site ensuring the binding to the enzyme. Unique reactivators will be prepared and by application of series of in vitro and in vivo tests the compounds will be evaluated and described. The best candidate of preclinical development with practical potential will be identified.

Development of polyvalent decontamination mean

Jun, D., Marek, J., Dlabková, A., Hatlapatková, J., Herman, D., Kročová, Z., Matula, M., Žďárová Karasová, J.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2018–2021 (Project No.: NV18-09-00181)

Project is aimed at the development of new combined micellar decontamination systems based on quaternary nitrogen compounds having detergent and active decontamination properties, which will cause faster hydrolysis of chemical warfare agents. In the case of biological agents, these molecules are strong disinfectants, able to destabilize pathogen membrane structures. Several decontamination mixtures will be prepared and tested both in vitro and in vivo for their decontamination and disinfection properties against selected chemical and biological agents. The expected result of the project is efficient decontamination solution for personal skin decontamination with good tolerability.

MARYSA – Research in chemical properties and methods of individual protection against the last generation of nerve agents

Florus, S., Jun, D., Hatlapatková, J., Hepnarová, V., Jošt, P., Pejchal, J., Žďárová Karasová, J., Kadlčák, J., Čapoun, T.

Supported by the Czech Republic Ministry of Internal Affairs, 2019–2022 (Project No.: VI20192022114)

Main goal of the project is physical properties and protection research against last generation of highly toxic agents with nerve effects O-ethyl-N-diethylaminoethylidenamidofluorophosphate type, signed as A-234 (group A). These agents are supposed to be used in terroristic attacks or as potential chemical weapons. The toxicity and antidotal therapy, verifying and suggestion of detection and identification methods and decontamination of these agents will be studied during the project.

PROPHYLAXIS – Development of novel prophylactic countermeasure against nerve agents based on reversible cholinesterase inhibitors

Svobodová, B., Górecki, L., Korábečný, J.

Supported by the Ministry of Education, Youth and Sports, 2019–2021 (Project No.: SV/FVZ201901)

The aim of this project is to design and prepare a new reversible inhibitors of AChE by organic synthesis methods. The project comprises the synthesis of two series of compounds which could be potentially useful as prophylactics against nerve agents.

CB[7] – Research of oxime-CB[7] complexes for central nervous system penetration of quaternary acetylcholinesterase reactivators

Žďárová Karasová, J., Lísa, M., Kassa, J., Dlabková, A., Hatlapatková, J., Herman, D., Jošt, P., Jun, D., Můčková, L., Pejchal, J.

Supported by the Czech Republic Grant Agency, 2018–2020 (Project No.: GA18-08937S)

Acetylcholinesterase (AChE; E.C. 3.1.1.7) reactivators (also known as oximes) represent class of antidotes that may be used as therapeutics in the case of pesticide or nerve agent poisoning (OPs). Their effectiveness is limited by low passage through the biological barriers. Oximes are highly hydrophilic compounds due to their quaternary nitrogens and hydrophilic oxime groups included in structure; on the other hand their preservation in structure is essential for reactivation effect. The main aim of this project is improved the oxime delivery via their encapsulation into cucurbit[7]urils (CB[7]). Oximes-CB[7] complexes should increasingly overcome the blood-brain barrier and thus diminish the OPs central effect with subsequent pathologic cascade. In our project we will comprehensively assess the impact of oximes-CB[7] complexation on in vitro and in vivo toxicity, pharmacokinetics profile (absorption, elimination and brain targeting), safety and antidotal effectiveness. These results may be subsequently used in further preclinical anti-OPs research.

SCAVENGERS – Butyrylcholinesterase reactivators for preparation of pseudo-catalytic scavengers applicable for organophosphorus intoxications

Musílek, K., Jun, D., Kuča, K., Hatlapatková, J., Hrabínová, M., Junová, L., Korábečný, J.

Supported by the Czech Republic Grant Agency, 2018–2020 (Project No.: GA18-01734S)

Organophosphorus compounds are produced as chemical warfare agents or used as insecticides and cause life endangering intoxications. The concept of pseudo-catalytic bioscavenger which could bind organophosphorus compound, detoxify it and reactivate own bioscavenging activity was defined to prevent such intoxication. The truly human butyrylcholinesterase is now available as bioscavenger via purification by affinity chromatography with specific sorbent. However, for pseudo-catalytic concept, there is lack of small molecules (butyrylcholinesterase reactivators) which could reactivate butyrylcholinesterase bioscavenging function after detoxifying of organophosphorus compound. Thus,

this project is focused on proof of concept of pseudo-catalytic bioscavenger by using human butyrylcholinesterase and its reactivators, which will be developed for this purpose.

YPERIT – Determination of mustards and their biomarkers in biological materials using chromatographic methods

Bzonek, P., Čechová, L., Motka, J., Křížková, M., Pejchal, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202002)

Blister chemical agents are highly cytotoxic substances with lethal effect. These agents were used during local military conflicts (e.g. Iran-Iraq war conflict in the 1980s). Years later these weapon agents were misused in Syria. The representative substances of blistering chemical agents are sulphur mustards and nitrogen mustards, which are listed in annex 1 of the Chemical Weapons Convention, as well as others chemical weapon agents. The Department of Toxicology and Military Pharmacy deal with research of chemical warfare agents and protection against them. Therefore, it is necessary to develop analytical methods for determination of sulphur and nitrogen mustards in biological matrices (e.g. blood, blood derivatives), with subsequent detection of possible biomarkers of poisoning. For determination of the above mentioned chemical warfare agents and their biomarkers of poisoning are mainly used high performance liquid chromatography-mass spectrometry or gas chromatography-mass spectrometry. The quality of analysis depends on the preparation of samples and their treatment. The preparation of samples during the analysis is very often limited for its price, duration, sensitivity, selectivity, robustness of analysis and even affects the long-term quality of analytical instruments. For these reasons, much attention is currently paid to sample preparation. Traditional methods based on the extraction of analytes into organic solvents, on a solid phase or just the removal of undesirable substances from the analytes are still used. Simultaneously new techniques are developed, based on similar principles, but with higher speed, simpler design, automation options, greater sensitivity, lower solvent consumption and also smaller sample volumes required for analysis. According to the available literature, during sulphur mustards intoxication, their concentrations in the blood increases, because of their possible accumulation in the erythrocyte membrane, during the first three days after intoxication. Therefore, it's necessary to implement analytical methods for binding of unchanged sulphur mustard in the blood (choosing a suitable "scavenger") and prevent of increased risk of their toxic effects in organism. In case of nitrogen mustards, it's necessary to verify their ability to accumulate in membrane of erythrocytes, which has not been yet described, and also select a possible scavenger for binding of unchanged nitrogen mustards in blood. Yperites are also alkylating agents of biomolecules (e.g.

DNA, hemoglobin, albumin etc.) and they are responsible of their biodegradation. During the binding of sulphur mustards to hemoglobin occurs the creation of adduct with N-terminal valine. This adduct can be detected with the connection of liquid or gas chromatography with mass spectrometry. For its detection it's necessary the amino acid degradation from the chain, for instance the Edman degradation [3]. However, various modifications already established that the chromatographic and extraction procedures will be required to utilize these procedures.

DECONTAMINATION – Testing of decontamination mixtures efficacy against chemical warfare agents

Kučera, T., Matula, M., Žďárová Karasová, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202005)

In this project, decontamination mixtures will be designed and evaluated in silico and in vitro. Subsequently, in vivo testing of the decontamination efficiency of the proposed decontamination solutions on selected chemical warfare agents will take place.

NEUROTOXICITY – Evaluation of neurotoxicity and neuroprotection effects of drugs by using neuronal in vitro models

Pulkrábková, L., Martínková, N., Mišík, J., Soukup, O.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202010)

The project focuses on the global problem of neurotoxicity, the possibility of its investigation and its prophylaxis. Neurotoxicity caused by organophosphate poisoning is associated with primary, acute and life-threatening problems and with secondary disorders that may persist for a long time after exposure. In this project we will focus on the development and validation of in vitro models including the mature human neurons obtained from the SH-SY5Y cell line. As a suitable model for the study of neurotoxic changes and neuroprotection against neurotoxicity. This model will be used to evaluate the level of oxidative stress and changes in mitochondrial membrane potential (MMP) induced by toxic substances causing neurotoxicity (OF, 6-hydroxydopamine, amyloid beta, etc.). The morphology of mature neurons will be validated by light microscopy and fluorescent probes will be used to evaluate the presence of specific markers, levels of oxidative stress and MMP changes (2, 3). Furthermore in this project,

we want to develop and implement an in vitro model of microglial cell-mediated neuroinflammation as another model for neurotoxicity as the neuroinflammation is often associated with a neuronal damage. The model is based on the mouse microglial cell line BV-2 (4, 5) and is able to respond to pro-inflammatory stimuli like e.g. lipopolysaccharide (LPS). A characteristic marker of the pro-inflammatory response is an increase in the expression of iNOS (inducible NO synthase), which will be verified by immunofluorescence staining or Western blot detection. Subsequently, the level of TREM-2 (Triggering receptor expressed on myeloid cells 2) will be determined in the same way in order to characterize the effects of the studied substance in terms of neuroprotection or neurotoxicity, as maintaining or increasing TREM-2 expression is intended to ensure a neuroprotective character. Following the introduction of both cell models, the protective effects of substances that could be potential drugs will be tested in those models. Namely, we will evaluate already established drugs (antioxidants, anti-inflammatory substances) and newly prepared substances (acetylcholinesterase reactivators, NMDA receptor inhibitors, etc.), which could have a neuroprotective effect and thus play a crucial role in the therapy of organophosphate poisoning.

NOSOCOMIAL INFECTIONS – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

Bošтік, P., Bošтікová, V., Páral, J., Pejchal, J., Plodr, M., Radochová, V., Sleha, R., Mikyška, A., Čermák, P., Bogdanová, K., Houška, M.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-31765A)

The increasingly more prevalent bacterial resistance to antibiotics presents an important worldwide problem. Compounds of natural origin with a proven anti-bacterial effect may represent new resources in this area or serve as complimentary therapies utilized together with antibiotics. Certain compounds from hops, especially beta-bitter acids and xanthohumol possess strong inhibitory effects on Gram-positive (*Staphylococcus aureus*, including resistant variants such as MRSA) and anaerobic bacteria, namely *Clostridium perfringens* and *C. difficile*. Some of the other characteristics of these compounds, including their low solubility in water, low toxicity and low level of adsorption in the gastrointestinal tract (GIT), predispose them as useful tools for local infections of skin and GIT. Formulations containing these compounds, which will be developed and evaluated in this project, can thus represent much needed tools for a local therapy of infections caused by antibiotic-resistant strains of bacteria.

**DEPARTMENT OF MILITARY SURGERY
K-305**

Educational and Research Staff

DUŠEK Tomáš	tomas.dusek@unob.cz
KLEIN Leo	leo.klein@unob.cz
KOČÍ Jaromír	jaromir.koci@fnhk.cz
LOCHMAN Petr (Head of the Group)	petr.lochman@unob.cz
MALÝ Ondřej	ondrej.maly@unob.cz
PÁRAL Jiří (Head of the Department)	jiri.paral@unob.cz
ŠIMEK Jan	jan.simek@unob.cz
ŠMEJKAL Karel	karel.smejkal@unob.cz

Administrative, Secretarial and Other Staff

ZAHRADNÍČKOVÁ Jana	jana.zahradnickova@unob.cz
--------------------	----------------------------

Postgraduate Students

BERKOVÁ Jana	jana.berkova@unob.cz
FLAŠAR Jan	jan.flasar@unob.cz
HERZINGER Jaroslav	jaroslav.herzinger@unob.cz
HOLEKA Pavel	pavel.holeka@unob.cz
KOTEK Jiří	jiri.kotek2@unob.cz
LEŠKO Michal	michal.lesko@unob.cz
MAJERNÍK Josef	josef.majernik@unob.cz
MALÝ Ondřej (till 04 June 2020)	ondrej.maly@unob.cz
MENCLOVÁ Kateřina	katerina.menclova@unob.cz

ODLOŽILOVÁ Šárka (since 01 October 2020)	sarka.odlozilova@unob.cz
SIROVÝ Miroslav	miroslav.sirovy@unob.cz
SOTONA Otakar	otakar.sotona@unob.cz
ŠAFRÁNEK Petr	petr.safranek@unob.cz
ŠIMEK Jan (till 03 September 2020)	jan.simek@unob.cz
TLAPÁK Jakub	jakub.tlapak@unob.cz
ZAJAK Ján (since 01 October 2020)	jan.zajak@unob.cz

Structure and main tasks of the department

Division of Traumatology and Burns Treatment

Lochman Petr – Head of the Group

Main tasks

- Undergraduate education of medical students
- Postgraduate training of military surgeons and other medical specialists
- Expertise and referential work for needs of the Czech Armed Forces
- Research in Military Surgery
- Preparation of medical health-care personnel before foreign missions of the Army of the Czech Republic

At present, **the Department of Military Surgery** consists only of one division – The Division of Traumatology and Burns Treatment. Besides working at each Division of the Department of Surgery of the Teaching Hospital in Hradec Králové, members of the Department perform both, undergraduate courses in field surgery for students of the Faculty of Military Health Sciences, and postgraduate training of military physicians for their specialization exams in surgery and general medicine. The Department also participates in teaching of the Battlefield First-Aid Courses, disaster medicine and the first aid courses, organized by the Faculty of Military Health Sciences for the Czech Army members. Members of the Department participate in several specialised NATO working groups according to their expertise. Moreover, they are consultants of Surgeon General of the Czech Armed Forces. In the last several years, the Department has played important role in education and training of personnel of field hospitals operating in foreign missions (Yugoslavia, Bosnia-Herzegovina,

Albania, Iraq, Afghanistan). Members of the Department also took part in those missions. Research and publication activities are also essential part of the Department members' work.

Participation in a foreign mission

- J. Páral – 11th Field Hospital, ISAF, Kabul, Afghanistan, 2002, 2011 (TSF)
- J. Páral – British Field Hospital, Op TELIC, Shaibah, Iraq, 2004
- P. Lochman – British Field Hospital, Op TELIC, Shaibah, Iraq, 2004
- P. Lochman – Czech Field Surgical Team, ISAF, Kabul, Afghanistan, 2008
- J. Páral – Czech Field Surgical Team, International Medical Treatment Facility (Role 3) KAIA, Kabul, Afghanistan 2012
- T. Dušek – Czech Field Surgical Team, International Medical Treatment Facility (Role 3) KAIA, Kabul, Afghanistan 2012
- J. Šimek – Czech Field Surgical Team, International Medical Treatment Facility (Role 3) KAIA, Kabul, Afghanistan 2012

National textbooks

- Small atlas of dressing techniques (Páral), 1st ed. Prague: Grada Publishing, 2008. 240 p. ISBN 978-80-247-2255-9
- Schein's Common Sense Emergency Abdominal Surgery. 1st Czech ed. Prague: Grada Publishing, 2011, 420 p. (Translated by Ferko, Klein et al.). ISBN 978-80-247-2357-0
- Acute mesenteric ischemia – Modern diagnostics and treatment of acute bowel ischemia (Páral), 1st ed. Prague: Grada Publishing 2012. 112 p. ISBN 978-80-247-3996-0
- Handbook of surgery (Šubrt), 2nd ed. Prague: Grada Publishing 2015. 512 p. ISBN 978-80-247-1005-1
- Surgical propaedeutics (Páral et al), 1st ed. Prague: Grada Publishing, 2020. 192 p. ISBN 978-80-271-1235-7
- Proximal gastrectomy (Lochman), 1st ed. Prague: Maxdorf, 2020, 104 p. ISBN 978-80-7345-575-0

International textbooks

- Gastrointestinal Stromal Tumors (Páral). In Aperelho Digestivo (Coelho), Editora Atheneau, Sao Paulo, Brasília, 2012, p. 325–336. ISBN 978-85-388-0296-9

RESEARCH PROJECTS

ADHESIONS – Prevention of postoperative intraabdominal adhesions: an experimental study

Sirový, M., Páral, J.

Supported by the Ministry of Education, Youth and Sports, 2019–2021 (Project No.: SV/FVZ201902)

The project aim is to evaluate a protective effect of intraperitoneal application of phospholipids in the form of fat emulsions on formation of intraabdominal adhesions. In the experimental study on the animal model (pig), the cecal wall and adjacent peritoneum abrasion, the small intestine abrasion and ileoileal anastomosis are performed under general anesthesia. Subsequently, 100 ml of fat emulsion on the basis of soya oil (group 1) or 100 ml of fat emulsion on the basis of fish oil (group 2) or 100 ml of physiological solution (control group 3) is applied into the abdominal cavity. Two weeks later, the second laparotomy is performed and the amount and macroscopic quality of intraperitoneal adhesions are evaluated using the Lauder scoring system. Histological processing and evaluation of the sample of tissue adhesions and the traumatized peritoneum are carried out with respect to the level of fibrosis, the amount of collagen, the inflammatory response and neovascularization. Furthermore, healing of the small intestine anastomosis is histologically assessed. Expression of TGF- β fibrinogen and α -smooth muscle actin (α -SMA) in tissues of peritoneal adhesions will be assessed using the ELISA method. Besides that, serum lipid level is evaluated in regular samplings 0th, 1st, 3rd, 6th and 14th day of the experiment as well as serum interleukin 6 level. Results of all three groups will be statistically processed (IBM SPSS Statistics) and evaluated.

NOSOCOMIAL INFECTIONS – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

Boštík, P., Boštíková, V., Páral, J., Pejchal, J., Plodr, M., Radochová, V., Sleha, R., Míkyška, A., Čermák, P., Bogdanová, K., Houška, M.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-31765A)

The increasingly more prevalent bacterial resistance to antibiotics presents an important worldwide problem. Compounds of natural origin with a proven anti-bacterial effect may represent new resources in this area or serve as complimentary therapies utilized together with antibiotics. Certain compounds

from hops, especially beta-bitter acids and xanthohumol possess strong inhibitory effects on Gram-positive (*Staphylococcus aureus*, including resistant variants such as MRSA) and anaerobic bacteria, namely *Clostridium perfringens* and *C. difficile*. Some of the other characteristics of these compounds, including their low solubility in water, low toxicity and low level of adsorption in the gastrointestinal tract (GIT), predispose them as useful tools for local infections of skin and GIT. Formulations containing these compounds, which will be developed and evaluated in this project, can thus represent much needed tools for a local therapy of infections caused by antibiotic-resistant strains of bacteria.

MALIGNITY – Importance of hypertermic intrathoracal chemotherapy with cytoreductive surgery on malignant pleural effusion

Herzinger, J., Brix, J., Lochman, P., Mališ, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202004)

Our thesis deals with multimodal treatment of mostly advanced pleural malignancies – malignant pleural mesothelioma. Our multimodal therapy combines cytoreductive surgery, which is aimed at removing macroscopic tumour, and subsequently hypertermic intrathoracal chemotherapy, which points at the microscopic component of pleural malignancy. The main goal of this study is to evaluate the safety of the whole procedure and to assess its influence on survival of patients with this kind of malignancy. Among others, the subject of our interest is systematic effect of intracavitary application of platinum-based chemotherapy in short-term and long-term period. Multimodal treatment is considered as potentially curative in highly selected group of patients with primary and secondary pleural tumours.

VOLUMOMETRY – Significance of the trunk muscles volumetry in prediction of postoperative complications in colorectal surgery

Kotek, J., Sirový, M., Leško, M., Páral, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202007)

It is known from the literature and clinical practice that patients at malnutrition have a significantly increased risk of developing early and late postoperative complications. From CT examination, which is performed preoperatively on each patient during colorectal cancer staging, the volume of muscle mass can

be measured using volumometry. The aim of the dissertation is to verify whether the volumometry of the trunk muscles can be used as a screening tool for predicting the occurrence of complications in colorectal surgery.

**DEPARTMENT OF MILITARY INTERNAL MEDICINE AND MILITARY
HYGIENE K-306**

Educational and Research Staff

BRNDIAR Miroslav (till 31 July 2020)	miroslav.brndiar@unob.cz
HORÁČEK Jan (Head of the Department)	jan.horacek@unob.cz
JAKL Martin (Head of the Group)	martin.jakl@unob.cz
JEBAVÝ Ladislav	ladislav.jebavy@unob.cz
KUPSA Tomáš	tomas.kupsa@unob.cz
KUPSOVÁ Blanka (since 01 October 2020)	blanka.kupsova@unob.cz
LAŠÁK Petr	petr.lasak@unob.cz
MATOUŠEK Radovan (since 01 January 2020)	radovan.matousek@unob.cz
PAVLÍK Vladimír (Deputy-Head)	vladimir.pavlik@unob.cz
SKOŘEPA Pavel	pavel.skorepa@unob.cz
STRÍTECKÁ Hana	hana.stritecka@unob.cz
ŠAFKA Václav	vaclav.safka@unob.cz

Technicians

PEREGRINOVÁ Jitka	jitka.peregrinova@unob.cz
-------------------	---------------------------

Administrative, Secretarial and Other Staff

MACHAČOVÁ Iva	iva.machacova@unob.cz
---------------	-----------------------

Postgraduate Students

CSOMOR Ján	jan.csomor@unob.cz
DUŠKOVÁ Klára	klara.duskova@unob.cz
GERYCH David	david.gerych@unob.cz
GREGA Tomáš	tomas.grega@uvn.cz
GRENAR Petr (since 01 October 2020)	petr.grenar@unob.cz
HAJŠL Martin (till 14 September 2020)	martin.hajsl@uvn.cz
HORÁČKOVÁ Kateřina (till 30 June 2020)	katerina.horackova@unob.cz
HŘÍBEK Petr (since 01 October 2020)	petr.hribek@unob.cz
KAŠPÁREK Ivo	ivo.kasparek@unob.cz
KMOCHOVÁ Klára	klara.kmochova@uvn.cz
KOČÍ Karolina (née BROULÍKOVÁ)	karolina.koci@uvn.cz
KRÁL Petr	petr.kral@unob.cz
KRUTIŠOVÁ Pavla	pavla.krutisova@unob.cz
KUČERKA Ondřej (since 01 October 2020)	ondrej.kucerka@unob.cz
KULICH Marek	marek.kulich@unob.cz
KUPSOVÁ Blanka	blanka.kupsova@unob.cz
KUTÁČ Dominik	dominik.kutac@uvn.cz
LAŠÁK Petr	petr.lasak@unob.cz
MELOUN Jan (till 28 February 2020)	jan.meloun@unob.cz
PRAVDOVÁ Lucie	lucie.pravdova@unob.cz
SEDLÁČKOVÁ Simona	simona.sedlackova@unob.cz
SKOŘEPA Pavel (till 14 September 2020)	pavel.skorepa@unob.cz
TUČEK David	david.tucek@unob.cz

URBAN Miroslav	urbanmiro@seznam.cz
VAŠEK Tomáš	tomas.vasek@unob.cz
VOŠKA Michal (till 27 May 2020)	michal.voska@gmail.com

The Department is divided into the group of Military Internal Medicine and the group of Military Hygiene.

Military Internal Medicine

The Department is divided into the group of Military Internal Medicine and the group of Military Hygiene. Military Internal Medicine The group of Military Internal Medicine is the clinical part of the department systematically focused on specialized part of Internal Medicine – Military Internal Medicine. Military Internal Medicine as a sub-speciality of Internal Medicine has been progressively developed into a recent shape and purpose in accordance with latest trends of military health support and modern therapeutic approaches. Military Internal Medicine provides knowledge of and practical experience with treatment of life-threatening non-surgical impairment in specific conditions of the military, especially during the armed conflicts. Nowadays, Internal Medicine is also of increasing importance in postoperative care, where multidisciplinary approach leads to improved prognosis of the most severe surgical affections. Furthermore, the knowledge of and practical experience with Military Internal Medicine are useful also in peacetime, especially in large-scale disasters – catastrophes. In fact, most of the skills obtained by Military Internal Medicine training are useful in a novel and progressive branch of medical specialization – **Disaster Medicine**.

Military Internal Medicine has been further developed into 3 basic branches: therapeutic-preventive, pedagogical-educational and research-scientific.

The therapeutic-preventive branch is the essential part of Military Internal Medicine. It provides specialized knowledge of and experience with treatment of the most severe medical affections. The group of Military Internal Medicine cooperates with internal departments of the University Hospital in Hradec Kralove, which provides its therapeutic and educational background.

Military Hygiene

The group of Military Hygiene monitors the living and working conditions of troops with the aim to develop, propose and assert measures for health protection and promotion of military professionals in order to maintain a good health state of troops and combat capability of the Army of the Czech Republic personnel in difficult conditions of military environment. In accordance with this function, the activity of the group of Military Hygiene is aimed at monitoring the impact of environmental factors on the organism, at evaluating their risk in working and living environment and at setting effective preventive measures to protect and promote health of soldiers.

Currently, the group of Military Hygiene complexly covers the basic issues of the relation between life and job environment and health of an individual.

The group can provide the analysis of selected physical and chemical factors of external environment in the conditions of the Army of the Czech Republic. It studies the possibilities of use of chemical substances for disinfection effects. The group is focused above all on response of the organism to work in protective clothing and severe climatic conditions and on evaluation of the degree of risk connected with environment contamination.

In the area of group of Military Hygiene, attention is paid namely to the incidence and prevalence of risk factors of non-infectious diseases of mass incidence, rational food, catering of troops in peacetime and wartime conditions – emergency food rations, assessment of the properly received and consumed energy.

Cooperation:

- Charles University, Faculty of Medicine in Hradec Kralove
- University Hospital in Hradec Kralove
- Military Medical Agency of the Army of the Czech Republic
- Central Military Hospital – Military University Hospital in Prague
- Military Hospital Brno
- Military Hospital Olomouc
- Health Institute in Hradec Kralove
- Hygienic Station in Liberec
- Military Health Institute in Prague
- Training Command – Military Academy in Vyškov
- Agricultural University in Nitra, Slovakia

TEACHING

Military Internal Medicine

The pedagogical-educational branch activities in Military Internal Medicine are closely related to therapeutic-preventive care. The department provides comprehensive education of Internal Medicine and Military Internal Medicine in both undergraduate and postgraduate degree programs. Almost all military medical specialists in Internal Medicine, including both Czechoslovakian and the Czech Army members, completed their postgraduate education of Internal Medicine at our department and gained specialization degree in Internal Medicine. We are proud to announce that during the history of our department, we assisted more than 1500 physicians in gaining the specialization degree in Internal Medicine.

Nowadays, the educational process involves undergraduate education in the program of Military Internal Medicine, Military Dentistry, Military Pharmacy and Military Health Assistant. The group of Military Internal Medicine participates actively in teaching in specialized courses, such as BATLS (Battlefield Advanced Trauma Life Support) and also provides medical support during specialized training operations of various units of the Army of the Czech Republic. In cooperation with the Internal Department of the Military University Hospital in Prague and internal departments of other military hospitals, the department provides necessary background for physicians in the military in order to gain the medical postgraduate certification in Internal Medicine.

Important and highly demanding assignment of the department is management and support of doctoral study program of Military Internal Medicine. This study program has been accredited since 1993. The department is also accredited for associate professor and professor degrees proceedings in the field of Military Internal Medicine.

Military Hygiene

The group of Military Hygiene takes part in undergraduate education of military hygiene and preventive medicine for all military students of the Faculty of Military Health Sciences including civilian students of the Faculty of Health Sciences in Pardubice.

The group members participate in teaching at Charles University, the Faculty of Medicine in Hradec Kralove and cover the final exam in hygiene, military hygiene and epidemiology.

The group can provide education of hygiene and preventive medicine in the doctoral study program Preventive medicine and health care.

The group is engaged in education of hygiene and preventive medicine of civilian and military doctors and nurses including training of NATO missions participants.

The group cooperates with the Military Academy in Vyskov and ensures education and special training of the employees of the Ministry of Defence in the field of occupational hygiene, occupational medicine and risk prevention.

RESEARCH

Military Internal Medicine

The scientific-research branch is the third main part of the group of Military Internal Medicine. In general, the department is focused on clinical research in internal medicine and its implementation in specific military practice. The research is aimed at covering requirements of the Army of the Czech Republic including field and foreign military operations.

The shape of our recent research activities was formed together with the development of organization structure of the department. The long history and development of our department was connected with the development of public society, the Army and both schools in Hradec Kralove, the University of Defence, the Faculty of Military Health Sciences and Charles University, the Faculty of Medicine.

Main topics are:

- New trends in transplantation of hematopoietic stem cells and supportive care
- Optimization and individualization of treatment of disorders involving bone marrow and hematopoiesis, especially research in acute leukemias as a “model disease“
- Monitoring of side effects during treatment of hematologic disorders using various novel biochemical markers, especially for evaluation of cardiac toxicity
- Cardiovascular research with focus on acute coronary syndrome and heart failure
- The role of enteral and parenteral nutrition in intensive care

- Participation in international clinical trials, especially in fields of hematology and cardiology

Cooperation in clinical research

- Hematopoietic stem cell transplantation (HSCT), transplant-related complications and supportive care, the role of cytokines, cytokine receptors and adhesion molecules in HSCT, acute leukemias and other hematologic disorders – the project has continued.
- Complex monitoring of cardiotoxicity of antitumorous treatment, mainly cardiac biomarkers – the research project has continued
- New biochemical markers of cardiac injury, complex monitoring of cardiotoxicity of antitumorous treatment – clinical and laboratory evaluation has continued.
- Analysis of transplantation activities, indications and results in the Czech Republic – the National Stem Cell Transplantation Registry – the project has continued.
- A study on application of enteral and parenteral nutrition in intensive metabolic care – the research project has continued.
- International randomized clinical trials in the field of hematocology and cardiology.
- Academic studies of the Czech Hematology Society and the Czech Leukemia Study Group – for Life.

Military Hygiene

Scientific research is focused on primary prevention of chronic diseases and relation of life and job environment and life style. Realization of intervention study and project is focused on healthy status of professional soldiers.

Main topics are:

- Epidemiological studies of non-infectious diseases
- Evaluation of nutritional and health statuses
- Evaluation of energetic and metabolic requirements
- Combat rations in different climatic conditions
- Evaluation of response of the organism to work in unfavourable environmental and working conditions
- Evaluation of working energy expenditure

- Evaluation of physiological function in protective suits
- Elaboration of proposals for working and rest regimes, energy, fluids and minerals as a prevention of diseases

RESEARCH PROJECTS

Long-term organization development plan 1011 – Clinical branches

**DEPARTMENT OF EMERGENCY MEDICINE AND MILITARY
GENERAL MEDICINE K-307**

Educational and Research Staff

DOLEŽELOVÁ Miroslava	miroslava.dolezalova@unob.cz
DUŠKOVÁ Klára	klara.duskova@unob.cz
FINK Matěj	matej.fink@unob.cz
KRUTISŠ Jan	jan.krutis@unob.cz
KRUTIŠOVÁ Pavla	pavla.krutisova@unob.cz
NOVOTNÝ Pavel	pavel.novotny2@unob.cz
PLODR Michal (Head of the Department)	michal.plodr@unob.cz
PÚDELKA L'udovít	ludovit.pudelka@unob.cz

Technicians

ŠÍSTKOVÁ Jitka	jitka.sistkova@unob.cz
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The main mission of **the Department of Emergency Medicine and General Military Medicine** is especially education of students of the Faculty of Military Health Sciences. Instructors provide lessons focused on management of wounded patients in specific military conditions for students in the Master's degree program in Military General Medicine, Military Pharmacy and in the Bachelor's degree program of Paramedic. Further, first aid for particular bodies not only inside but also outside the Ministry of Defence is taught at the department.

The department closely cooperates with the Military Medicine Division and the Military Medicine Agency as well as with all military hospitals. Training of military healthcare personnel is provided in accordance with the main goals of the Czech Armed Forces Development concept and especially in accordance with the Military Medical Service development concept

Members of department also participate in the research project focused on use of natural products in the treatment of soft tissue infections.

Currently, department has been under the process of authorization of the international course – TCCC. For foreign partners, we can offer the Field Emergency Care Course focused on ROLE 1 casualty care.

Immediate goal is to set up the Center of simulation and practical medicine. Thanks to financial support from the Ministry of Defence, a unique center for continuous education and primarily for pre-deployment training of military healthcare personnel will arise on the Faculty of Military Health Sciences premises.

RESEARCH PROJECTS

NATURE – Potential of the natural substances in the treatment of non-healing wounds

Púdelka, L., Boštík, P., Mališ, J.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: SV/FVZ202009)

Chronic non-healing wounds represent a major socioeconomic and health problem around the world. The combination of increasing microbial resistance and elderly patients with multiple comorbid diseases poses a challenge to healthcare staff in their efforts to heal wounds. One of the most important goals is to control wound infection. The infection may stop the healing process or can lead to regression of wound healing. Our aim is to analyze the natural substances, which could we use to in this issue.

NOSOCOMIAL INFECTIONS – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

Boštík, P., Boštíková, V., Páral, J., Pejchal, J., Plodr, M., Radochová, V., Sleha, R., Mikyška, A., Čermák, P., Bogdanová, K., Houška, M.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-31765A)

The increasingly more prevalent bacterial resistance to antibiotics presents an important worldwide problem. Compounds of natural origin with a proven anti-bacterial effect may represent new resources in this area or serve as complimentary therapies utilized together with antibiotics. Certain compounds from hops, especially beta-bitter acids and xanthohumol possess strong inhibitory effects on Gram-positive (*Staphylococcus aureus*, including resistant variants such as MRSA) and anaerobic bacteria, namely *Clostridium perfringens* and *C. difficile*. Some of the other characteristics of these compounds, including their low solubility in water, low toxicity and low level of adsorption in the gastrointestinal tract (GIT), predispose them as useful tools for local infections of skin and GIT. Formulations containing these compounds,

which will be developed and evaluated in this project, can thus represent much needed tools for a local therapy of infections caused by antibiotic-resistant strains of bacteria.

DEPARTMENT OF MOLECULAR PATHOLOGY AND BIOLOGY K-308

Educational and Research Staff

BALONOVÁ Lucie (maternity leave)	lucie.balonova@unob.cz
KLIMENTOVÁ Jana	jana.klimentova@unob.cz
KROČOVÁ Zuzana (Head of the Department)	zuzana.krocova@unob.cz
KUBELKOVÁ Klára	klara.kubelkova@unob.cz
LECOVÁ Lenka (since 01 September 2020)	lenka.lecova@unob.cz
LINK Marek	marek.link@unob.cz
MACELA Aleš (Emerit. Prof.)	ales.macela@unob.cz
PÁVKOVÁ Ivona	ivona.pavkova@unob.cz
POHANKA Miroslav (Deputy-Head)	miroslav.pohanka@unob.cz
PORKERTOVÁ Stanislava	stanislava.porkertova@unob.cz
ŘEHULKA Pavel (Head of the Group)	pavel.rehulka@unob.cz
STULÍK Jiří	jiri.stulik@unob.cz
ŠEŠKO Valeria	valeria.sheshko@unob.cz
ŠPIDLOVÁ Petra	petra.spidlova@unob.cz

Technicians

LUKŠÍKOVÁ Lenka	lenka.luksikova@unob.cz
ŽÁKOVÁ Jitka	jitka.zakova@unob.cz

Administrative, Secretarial and Other Staff

FORETOVÁ Zdenka	zdena.foretova@unob.cz
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Postgraduate Students

BAVLOVIČ Jan	jan.bavlovic@unob.cz
ĐURÁČOVÁ Miloslava	miloslava.duracova@unob.cz
KERESTEŠ Ondřej (since 01 September 2020)	ondrej.kerestes@unob.cz
KOPEČKOVÁ Monika (since 01 September 2020)	monika.kopeckova@unob.cz
PROKŠOVÁ Magdaléna (till 03 September 2020)	magdalena.proksova@unob.cz
RADOCHOVÁ Věra	vera.radochova@unob.cz
STOJKOVÁ Pavla (till 10 January 2020)	pavla.stojkova@unob.cz
ŠEŠKO Valeria	valeria.sheshko@unob.cz
VÁLEK Tomáš	tomas.valek@unob.cz
VOZANDYCHOVÁ Věra	vera.vozandychova@unob.cz

DEPARTMENT DESCRIPTION

The Department of Molecular Pathology and Biology is a research and educational center focused on application of advanced technologies of functional genomics in bio-medical defence research and advanced analyses in molecular pathology. Scientific work is preferably aimed at the studies of the host-pathogen interactions at the molecular level and diagnosis of pathological states including developing of new analytical approaches. The objectives of this research are divided into three main areas: bio-molecular signatures of biological agents potentially abused for the military, terrorist attacks or bio-crime acts, intracellular fate of ingested microbes and finally the modulation of host cell signaling and gene expression by ongoing infection. The favorite microbial model is the live vaccine strain of *Francisella tularensis*, a gram-negative facultative intracellular bacterial pathogen that is included in the List A CDC as the potential biological weapon. The laboratories of the Department are currently equipped with:

- the animal, tissue culture and microbiological labs for preparing samples for subsequent analyses,
- 2-D electrophoresis, liquid chromatography and mass spectrometers for realization of complete classical and shotgun proteomic analyses,

DEPARTMENT OF MOLECULAR PATHOLOGY AND BIOLOGY K-308

- PCR, RT-PCR and quantitative real-time PCR technologies for the basic search of gene expression and the mutant construction,
- light and fluorescent microscopy, ELISA, Western blot and flow cytometry for the study of bacterial or bacterial component impact on the host,
- labs for the sensors and biosensors construction.

The established technologies enable researchers, PhD., and under-graduate students to realize complex studies oriented on the analyses of living system response to external (and internal, modulatory) signals encompassing the chemicals, biologically active bio-molecules, physical influences (temperature, radiation, etc.), and microorganisms. Currently, the Department of Molecular Pathology and Biology has 16 full-time employees, 13 scientists, 2 technicians and 1 administrative worker. The Department had 9 PhD students in 2020 and, furthermore, several undergraduates have been working on their diploma thesis at the Department.

PARTICIPATION IN INTERNATIONAL PROJECTS AND NETWORKS

The Department traditionally cooperates with the research facility in Sweden (the Department of Clinical Bacteriology and the Laboratory for Molecular Infection Medicine of the Umea University) on identification of new factors of virulence of *Francisella tularensis*, molecular mechanisms of suppression of interferon beta production in host cells infected by *Francisella tularensis* and on the analysis of possible interaction between host and bacterial proteins. Further important collaborations concern the U.S. Army Medical Research Institute of Infectious Diseases (Fort Detrick, USA) on preparation and testing of bacterial proteins with immunostimulatory potential, the Department of Microbiology and Parasitology of the University of Rijeka on microscopic analysis of microbial intracellular trafficking, proteome analysis of phagosomes isolated from infected host cells, and, finally, the Aquila Bioscience Ltd. of the National University of Ireland in Galway on identification of glycan or lectin structures recognizing bacterial carbohydrate structures with the aim of new decontamination tools development. Within the frame of the Czech Republic, the Department has developed beneficial contacts with the Institute of Microbiology and the Institute of Molecular Genetics of the Czech Academy of Science in Prague, the Faculty of Science of Charles University in Prague, the Faculty of Medicine and the Faculty of Pharmacy of Charles University in Hradec Králové, the University Hospital in Hradec Králové, the Department of Pharmacology of the Faculty of Medicine in Hradec Králové, the Department of Oncological and Experimental Pathology of Masaryk Memorial Cancer Institute in Brno and the Veterinary Research Institute in Brno and Military Health Institute, Prague. The financial support for research activities performed in collaboration with the above-mentioned institutes comes from the programs and projects of the Czech Grant

Agencies, the Ministry of Education, and Youth and Sports and the Ministry of the Interior.

RESEARCH PROJECTS

EBLN – Preparation of the collection of biologically significant toxins with the support of European biodefence laboratory network

Dresler, J., Kročová, Z., Myslivcová, A., Klimentová, J., Sheshko, V., Řehulková, H., Dřevínek, M.

Supported by the Czech Republic Ministry of Internal Affairs, 2017–2020 (Project No.: VH20172020012)

The subject of the public contract is the creation of a collection of standards of difficult to obtain toxins using modern vector cultures / bacterial, insect or plant lines) that would allow the development and testing of targeted and highly specific techniques, where so far forensic analytical approaches are not available. Furthermore, the implementation and verification of procedures for working with difficult to cultivate agents / *Coxiella* spp./ whose detection and identification capabilities are not sufficient at present in most of the security units in the Czech Republic.

Colorimetric sensor for diagnosis of pesticides poisoning

Horna, A., Pohanka, M., Voříšek, V.

Supported by Technology Agency of the Czech Republic, 2018–2021 (Project No.: TH03030336)

The project is focused to construction of a colorimetric sensor for a fast diagnosis of pesticides poisoning and it will be suitable for the both human and veterinarian samples. Functional sample of the device will be verified on biological samples. Aims of the project will be reached in the of the project solving.

Development of polyvalent decontamination mean

Jun, D., Marek, J., Dlabková, A., Hatlapatková, J., Herman, D., Kročová, Z., Matula, M., Žďarová Karasová, J.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2018–2021 (Project No.: NV18-09-00181)

Project is aimed at the development of new combined micellar decontamination systems based on quaternary nitrogen compounds having detergent and active decontamination properties, which will cause faster hydrolysis of chemical warfare agents. In the case of biological agents, these molecules are strong disinfectants, able to destabilize pathogen membrane structures. Several decontamination mixtures will be prepared and tested both in vitro and in vivo for their decontamination and disinfection properties against selected chemical and biological agents. The expected result of the project is efficient decontamination solution for personal skin decontamination with good tolerability.

Proteome analysis of potential markers of dilation cardiomyopathy

Pudil, R., Stulík, J., Řehulka, P.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2019–2022 (Project No.: NV19-02-00297)

Left ventricle remodeling and its reversal are the key factors affecting the longterm survival of the patients with dilated cardiomyopathy (DCM). Therefore, the prediction of future left ventricle remodeling at initial diagnosis is of prognostic significance. Based on the results of our pilot study, where we revealed more than 50 unique proteins for DCM, we assume, that proteomic methods can identify new markers for DCM, and could have a potential to be useful for risk stratification. Hence in the proposed project we plan to employ state of art non-gel proteomic analysis in combination with bioinformatics to discover and validate new plazma protein markers, which can early distinguish patients responding or non-responding to standard therapy. Left ventricle remodeling will be evaluated with the use of established and proved methods (echocardiography) in accordance with recommended standards.

The Creation of Czech-Irish Project Cooperation for Solving the Biological Security Questions

Kubelková, K., Dřevínek, M., Macela, A., Myslivcová Fučíková, A., Stulík, J.

Supported by the Czech Republic Ministry of Internal Affairs, 2020–2022 (Project No.: VJ01030003)

The main goal of the project is to create an international working team of experts in the field of security research focused on biological crises, including local epidemics and pandemics, and targeted protection against biological agents. The implementation of the project should enable the objectification of research and project intentions on the basis of confrontation with the opinions of foreign experts on the issue and create a personnel base for creating future joint research projects with a foreign partner, using its technological, personnel and information resources and able to withstand international competition. In essence, it is a bilateral coordination of research activities focused on the so-called "New Generation Biosecurity and Biodefence" (NGBB) concept, to which other foreign partners may join in the future. This would create the NGBB's research base for the qualified solution of security research issues for a wide scientific and application sphere. Within the presentation of the project, it is necessary to mention the possibility of creating additional support for the creation of a research team with a broad knowledge and technology specialization and a unique concept in security research with significant support from promising young researchers from both universities.

INFECTION – Analysis of changes in host cell ubiquitinylation system during infection of pathogen *Francisella tularensis*

Vozandychová, V., Řehulka, P.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201802)

Ubiquitinylation of proteins is one of the most important cell processes, which is involved in degradation of proteins, cell signaling, altering function of protein substrates, changing protein activity or their subcellular localization. Deubiquitinylation enzymes (DUBs) are an important part of the system controlling the reversible process of protein ubiquitinylation, including editing and controlling of mono- and polyubiquitine chains attached to the protein substrates. DUBs can remove ubiquitin from proteins and rescue them from degradation or functional change. These enzymes can also modulate the activity of important proteins during infection process, which was already shown in case of several known pathogens and their DUBs, e.g. bacterial strains *Salmonella* and *Yersinia*. This project is focused on the identification of potential DUBs in pathogenic bacteria *Francisella tularensis* that causes tularemia zoonosis and is listed in Category A Bioterrorism agents. Further analysis will be aimed at changes of DUBs host cells during infection with *Francisella tularensis*. This is important for a further understanding of the molecular basis of the disease process.

PHOSPHINE – Phosphine and mechanism of phosphine toxicity on the organism of laboratory animal

Radochová, V., Pohanka, M.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201806)

Phosphine is a harmful chemical substance with not well-known mechanism of toxicity. It is probably caused by high phosphine reactivity and a toxic effect having impact on more sites like inhibition of enzymes on one site and damaging of soft tissues on the other site. This thesis is focused on study of phosphine toxicity and choice of markers indicating poisoning. There will be also proposed an animal laboratory model suitable for study of phosphine toxicity.

VESICLES – Study of the secretion of outer membrane vesicles in *Francisella tularensis* and their role in the host-pathogen interaction

Bavlovič, J., Klimentová, J.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201804)

The aim of the presented project is to describe at the cellular level the interaction of the outer membrane vesicles (OMVs) isolated from the *F. tularensis* bacterium with the host cell. Model host cells will be mouse bone marrow macrophages (BMDM). The host cell response will be evaluated via changes in cytokine secretion and mapping of the localization of OMVs within the cell.

VIVARIUM

Educational and Research Staff

RADOCHOVÁ Věra
(Head of the Department)

vera.radochova@unob.cz

Technicians

ETFLAIŠOVÁ Petra

petra.etflaisova@unob.cz

CHLÁDKOVÁ Martina (till 30 October 2020)

martina.chladkova@unob.cz

MILITKÝ Richard

richard.militky@unob.cz

SLAVÍK Jaroslav

jaroslav.slavik@unob.cz

TÁNCOŠOVÁ Erika

erika.tancosova@unob.cz

The Vivarium at the Faculty of Military Health Sciences of the University of Defence fulfils science, research and teaching tasks of the departments and specialized workplaces of the Faculty of Military Health Sciences. The vivarium is subordinated to the Vice-Dean for Research.

The separate vivarium for mice and sewer-rats is a part of the Department of Toxicology and Military Pharmacy.

From the point of view of the capacity the Faculty of Military Health Sciences is able to carry out experiments, place and take care of laboratory mice, sewer-rats, guinea-pigs, rabbits, pigs or mini pigs. In the area of the vivarium there are also laboratory workplaces and operating theatres, which are equipped for experiments on laboratory animals. All studies have to be allowed by the Ethical Board of the Faculty of Military Health Sciences fully in compliance with the legal standards of the protection against cruelty to animals.

The Vivarium with the operating block is intensively used above all for experiments on large experimental animals. The courses CLS (CLS, R-CLS, CLS LVO), UPP/R and UPP/FEC are held there. During the courses different model situations and cases of emergency medicine are performed for military doctors and participants of foreign mission including war injuries on dead and live experimental animals.

On December 2015, the Vivarium was accredited for use again for 5 years (till January 2021) by the Central Board for Animal Protection.

The above-mentioned range of the activities shows that it is necessary to time work and also co-ordinate it personally including permanent presence of a veterinary surgeon, veterinary technicians and breeders of laboratory animals.

RESEARCH PROJECTS

PHOSPHINE – Phosphine and mechanism of phosphine toxicity on the organism of laboratory animal

Radochová, V., Pohanka, M.

Supported by the Ministry of Education, Youth and Sports, 2018–2020 (Project No.: SV/FVZ201806)

Phosphine is a harmful chemical substance with not well-known mechanism of toxicity. It is probably caused by high phosphine reactivity and a toxic effect having impact on more sites like inhibition of enzymes on one site and damaging of soft tissues on the other site. This thesis is focused on study of phosphine toxicity and choice of markers indicating poisoning. There will be also proposed an animal laboratory model suitable for study of phosphine toxicity.

ORGANOPHOSPHATES – Centrally acting antidotes for the treatment of organophosphorus poisoning

Soukup, O., Jun, D., Herman, D., Hrabínová, M., Junová, L., Pejchal, J., Radochová, L., Žďárová Karasová, J.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-32801A)

Inactivation of acetylcholinesterase (AChE) in nerve and muscle by organophosphates is the toxic mechanism common to both nerve agents and pesticides. Standard countermeasures against OP poisoning involves muscarinic inhibition and the use of oxime – a reactivator. The latter, however, is limited by a versatility of oximes and by a low penetration of reactivators into the brain. The aim of this project is to develop oxime reactivators with better penetration of the blood brain barrier (BBB). Namely, monoquaternary oximes with balanced physico-chemical properties containing selected nucleophile capable of AChE reactivation and a ligand of peripheral anionic site ensuring the binding to the enzyme. Unique reactivators will be prepared and by application of series of in vitro and in vivo tests the compounds will be evaluated

and described. The best candidate of preclinical development with practical potential will be identified.

NOSOCOMIAL INFECTIONS – The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

Boštík, P., Boštíková, V., Páral, J., Pejchal, J., Radochová, V., Sleha, R., Mikyška, A., Čermák, P., Bogdanová, K., Houška, M.

Supported by the Internal Grant Agency of the Czech Republic Health Service, 2017–2020 (Project No.: NV17-31765A)

The increasingly more prevalent bacterial resistance to antibiotics presents an important worldwide problem. Compounds of natural origin with a proven antibacterial effect may represent new resources in this area or serve as complementary therapies utilized together with antibiotics. Certain compounds from hops, especially beta-bitter acids and xanthohumol possess strong inhibitory effects on Gram-positive (*Staphylococcus aureus*, including resistant variants such as MRSA) and anaerobic bacteria, namely *Clostridium perfringens* and *C. difficile*. Some of the other characteristics of these compounds, including their low solubility in water, low toxicity and low level of adsorption in the gastrointestinal tract (GIT), predispose them as useful tools for local infections of skin and GIT. Formulations containing these compounds, which will be developed and evaluated in this project, can thus represent much needed tools for a local therapy of infections caused by antibiotic-resistant strains of bacteria.

The induction of antiviral immune response after intranasal application of nanoparticles based vaccine

Sleha, R., Boštík, P., Janovská, S., Radochová, V.

Supported by the Ministry of Education, Youth and Sports, 2020–2022 (Project No.: LTAUSA19003)

The aim of this study is to develop of chitosan-nanoparticles based vaccine against cytomegalovirus for intranasal application and investigation of the immune response on model animals (mice and nonhuman primates) after application in combination with various adjuvans.

COMMUNICATION AND INFORMATION SYSTEMS OFFICE

Educational and Research Staff

OSIČKA Jan	jan.osicka@unob.cz
VOPLATKOVÁ Zdeňka	zdenka.voplatkova@unob.cz
ZEDNÍČEK Jiří (Head of the CISO)	jiri.zednicek@unob.cz

Technicians

RYDRYCH Jiří	jiri.rydrych@unob.cz
--------------	----------------------

Administrative, Secretarial and Other Staff

VÍCHOVÁ Eva	eva.vichova@unob.cz
ZETOCHOVÁ Dita	dita.zetochova@unob.cz
ZIKOVÁ Jitka	jitka.zikova@unob.cz

The Communication and Information Systems Office provides the top quality information service to ensure efficient scientific, research and teaching activities for teaching and research staff as well as under- and postgraduate students of our faculty.

The Communication and Information Systems Office provides the operation of the faculty network, enables access to army, specialized and public information systems and supplies the needs of the Faculty with modern information technologies. Main activity is ensuring the access to INTERNET and to specialized information systems. Management of data network, central management of software, servicing as well as specialized support of users is also provided.

Part of the Communication and Information Systems Office are also graphic services that create graphic documents and posters for presentations, make arrangements and changes of drafts for printing, make digital pictures and do other associated work. It also provides the operating and updating of the web site of the Faculty (<http://fvz.unob.cz>).

The library provides students, research and teaching staff of the Faculty of Military Health Sciences and members of the Czech Army Medical Service with scientific and information services. The main information services are provided by the library with 63 000 library units concerning medicine as well as associated branches.

Information sources in the field of military medicine, emergency medicine and disaster medicine are specificity of this library. The library enables access to various information databases (WoK, ScienceDirect, SCOPUS, SpringerLink, BiblioMedica, etc.) and provides systematic help when being used.

The library participates in teaching activities in the doctoral study programmes and scientific education (PhD) by giving lectures in Basics of Informatics focused on retrievals, processing and publication of scientific information.

VISITORS TO THE FACULTY OF MILITARY HEALTH SCIENCES

Republic of Armenia

- COL SATURYAN Armen; LTC HOVHANNISYAN Harutyun; LTC KHACHUNTS Karen; LTC VAROSYAN (Yerevan) – Field Emergency Care (FEC) Course, 17 February 2020–19 February 2020

Ukraine

- COL VOITOVYCH Anatolii; LTC MOSKALIUK Oleksander; LTC POLIAKOVA Olha; MAJ DALINGER Oleksander; MAJ SHEMCHUK Oksana; MAJ POLISCHUK Liudmyla; 2LT SUSHKO Yurii; LT TESLENKO Viktoria (Kiev) – Field Emergency Care (FEC) Course, 17 February 2020–19 February 2020

VISITS ABROAD

Qatar

- PEJCHAL, J. (OPWC COURSE „International Course on Pre-hospital Medical Assistance for the Victims of Chemical Incidents), Doha, 17 February 2020–20 February 2020)

Slovakia

- CHLÍBEK, R. (11th Slovak Vaccination Congress, Tatranská Lomnica, 06 September 2020–08 September 2020)

United Kingdom

- BAVLOVIČ, J. (Cellular Microbiology Network meeting 2020: Exploring the Host-Pathogen Interface, Sheffield, 08 February 2020–11 February 2020)
- VOZANDYCHOVÁ, V. (Cellular Microbiology Network meeting 2020: Exploring the Host-Pathogen Interface, Sheffield, 08 February 2020–11 February 2020)

United States

- Boštíková, V. (Presentation of the Faculty of Military Health Sciences of the University of Defence and his scientific results, Atlanta, 05 December 2020–17 December 2020)
- Boštíková, V. (CDC, Atlanta, 30 June 2019–11 July 2019)
- Boštíková, V. (Nursing Research Committee, Emory University Hospital Midtown, Atlanta, 05 December 2020–17 December 2020)

WORKSHOPS, COURSES, RESIDENCIES AT THE FACULTY IN 2020

Military Hygiene

- Specialized basic course – Teaching on foodstuff I, 27 January 2020–28 January 2020
- Specialised course – Nutrition state assessment, 13 January 2020–14 January 2020
- Specialized course – Prevention of non-infectious diseases of mass incidence, 09 March 2020 –10 March 2020

Radiobiology

- Specialized course – Radiation accident – protection and basic measures, 11 February 2020–12 February 2020

Language Courses

- Combined language courses – English (STANAG 2), 03 September 2018–31 May 2019, 09 September 2019–03 April 2020
- Combined language courses – English (STANAG 1), 09 September 2019–03 April 2020

Military Medical Service Organization

- Specialized course – MS PowerPoint, 27 January 2020–29 January 2020
- Specialized course for Medical operations officers – MedOps – The tenets of the use of Medical Service forces and assets, 01 June 2020–05 June 2020

Military Epidemiology

- Specialized course – Specialized course – Tropical and travel medicine, 9 March 2020–11 March 2020
- Specialized course – Highly dangerous infections, new infectious diseases, 13 January 2020–15 January 2020

General Medicine

- Specialized course – Transportation of casualties in the field, 22 June 2020–26 June 2020
- Special course – Extended first aid in the field (CLS Course), 02 March 2020–13 March 2020, 18 May 2020–29 May 2020
- Special course – Repetitory of extended first aid in field conditions (R-CLS Course), 30 November 2020–04 December 2020
- Specialized course – Field emergency care, 20 January 2020–23 January 2020, 24 February 2020–28 February 2020, 27 April 2020–29 April 2020, 01 June 2020–04 June 2020, 07 September 2020–10 September 2020, 29 September 2020–02 October 2020, 05 October 2020–08 October 2020, 09 November 2020–12 November 2020, 14 December 2020–17 December 2020
- Specialized course – Field emergency care for foreign armies (Ukraine, Republic of Armenia), 17 February 2020–19 February 2020
- Specialized course – First aid in field conditions, 13 January 2020–17 January 2020

Military Toxicology

- Specialized course – Dealing with extremely dangerous poisons, drugs and psychotropic substances, 13 January 2020–16 January 2020, 04 May 2020–07 May 2020, 25 May 2020–28 May 2020, 17 August 2020–20 August 2020, 05 October 2020–08 October 2020, 23 November 2020–26 November 2020
- Specialized course – Basis of pharmacology and self-treatment, 10 February 2020–13 February 2020
- Specialized course – Basis of phytotherapy, 01 June 2020–04 June 2020

Military Pharmacy

- Specialized course – Basis of pharmacology and self-treatment, 10 February 2020–13 February 2020

INTERNATIONAL COOPERATION

Cooperation at the military medical facility level

France	Armed Forces Biomedical Research Institute, Brétigny-sur-Orge
Germany	Institute of Microbiology of Federal Armed Forces Medical Academy, Munich
Germany	Bundeswehr Institute for Radiobiology, Munich
Italy	University of Bologna, Bologna
Poland	Military Institute of Hygiene and Epidemiology, Department of Pharmacology and Toxicology, Warsaw
Slovakia	Air Forces Hospital, Košice
Slovakia	Central Military Hospital, Ružomberok
Slovakia	Military Institute of Hygiene and Epidemiology, Bratislava

Scientific cooperation with civilian institutions abroad (on the basis of individual agreements and joint projects)

Austria	Institute of Chemical Technologies and Analytics, Vienna University of Technology, Vienna
Croatia	Department of Microbiology and Parasitology, University of Rijeka, Rijeka
Croatia	Institute for Medical Research and Occupational Health, Zagreb
France	University of Burgundy - Franche-Comté, Besançon

Portugal	University of Porto, Faculty of Pharmacy, Department of Biological Sciences, Laboratory of Biochemistry, Porto
Republic of Korea,	Medicinal Science Division, Korea Research Institute of Chemical Technology, Daejeon
Slovakia	Agricultural University in Nitra, Nitra
Slovakia	Chemical Institute, Slovak Academy of Sciences, Bratislava
Slovakia	P. J. Šafárik University, Košice
Slovakia	Slovak Medical University, Bratislava
Spain	Centre for Research of Environmental Epidemiology (CREAL), Barcelona
Spain	University of Alcalá, Environmental Sciences and Chemistry, School of Biology, Department of Organic Chemistry and Inorganic Chemistry, Alcalá de Henares, Alcalá de Henares
Sweden	University of Umea, Umea
United Kingdom	Centre for Radiation Chemical and Environmental Hazards, Public Health England, Didcot, Oxfordshire
United States	Departments of Medicine and Pathology, Perelman School of Medicine, University of Pennsylvania, Philadelphia
United States	Emory University, Atlanta
United States	MMRHVLB/CCID/CDC, Atlanta
United States	University of California San Diego, Skaggs School of Pharmacy and Pharmaceutical Sciences, San Diego

INTERNATIONAL COOPERATION

Participation in international projects and networks

NATO	NATO STO HFM-05-2020-RTG Development and Implementation of Autonomous Transport and Medical Systems for Casualty Evacuation
NATO	NATO STO HFM-335 Bio-Technology, Human Enhancement/Human Augmentation
Spain	Centre for Research of Environmental Epidemiology (CREAL), Barcelona
Sweden	European Program for Intervention Epidemiology Training, European Centre for Diseases Prevention and Control, Stockholm
United Kingdom	Public Health England – Centre for Radiation, Chemical and Environmental Hazards, Didcot
United States	U.S. Army Medical Research Institute of Infectious Disease, Fort Detrick

Other expert commissions

ANDREJSOVÁ Lenka	member of the European Radiation Research Society
BOŠTÍK Pavel	national coordinator for CBRN in Cap Tech ESM04 EDA
BOŠTÍK Pavel	member of NATO LTSS HFM 273
BOŠTÍK Pavel	council member of the European Society of Clinical Virology
BOŠTÍK Pavel	member of the Association of UICC Fellows
BOŠTÍK Pavel	member of the American Association of Immunologists (AAI)
BOŠTÍK Pavel	member of the Federation of American Societies for Experimental Biology

INTERNATIONAL COOPERATION

BOŠTÍK Pavel	member of the American Society of Microbiology
BOŠTÍK Pavel	member of Editorial board of „ <i>the Open Infectious Diseases Journal</i> “
BOŠTÍKOVÁ Vanda	member of the International Board for the Investigation and Control of Influenza and Other Epidemic Diseases
BOŠTÍKOVÁ Vanda	member of the European Society of Clinical Virology
BOŠTÍKOVÁ Vanda	member of Editorial board of „ <i>Journal of Clinical Virology</i> “
DUŠEK Tomáš	member of the European Society of Coloproctology
HORÁČEK Jan	member of the European Society for Blood and Marrow Transplantation (EBMT)
HORÁČEK Jan	member of the European Society of Hematology
CHLÍBEK Roman	European Centre for Disease Control (ECDC) – member of Potential shortages of Vaccines and treatment for rare communicable diseases in Europe Group
CHLÍBEK Roman	European Centre for Disease Control (ECDC) – member of Expert Panel Hepatitis A
CHLÍBEK Roman	member of the Global Pertussis Initiative (GPI)
CHLÍBEK Roman	supervisor of the Central European Vaccination Awareness Group (CEVAG)
CHLÍBEK Roman	member of the Central and Eastern Europe Pertussis Awareness Group
CHLÍBEK Roman	member of C.O.P.E. – Consensus on Pertussis Booster Vaccination in Europe

INTERNATIONAL COOPERATION

JAK Martin	member of the European Society of Cardiology
JANOVSKÁ Sylva	member of the Swiss Proteomics Society (SPS)
JEBAVÝ Ladislav	member of the European Group for Blood and Marrow Transplantation (EBMT)
JEBAVÝ Ladislav	member of the Multinational Association of Supportive Care in Cancer (MASCC)
JEBAVÝ Ladislav	member of the European Study Group on Nosocomial Infections (ESGI)
JUN Daniel	member of Editorial board of „ <i>Scientifica</i> “
KASSA Jiří	member of NATO CBRN Medical Working Group
KASSA Jiří	member of the European Society for Neurochemistry
KASSA Jiří	member of Editorial board of „ <i>Journal of Medical Chemical, Biological and Radiological Defence</i> “
KASSA Jiří	member of Editorial board of „ <i>Challenge Medical CBRN Defense International</i> “
KLEIN Leo	Secretary General, Committee of the International Association for Humanitarian Medicine Chisholm - Gunn (IAHM)
KLEIN Leo	Assistant Secretary General, International Committee of Military Medicine (ICMM)
KLEIN Leo	member of the European Burns Association (EBA)
KLEIN Leo	member of the International Society for Burn Injuries (ISBI)
KLEIN Leo	member of the Mediterranean Council for Burns and Fire Disasters (MBC)

INTERNATIONAL COOPERATION

KLEIN Leo	member of the Academic Council on the United Nations System (ACUNS)
KLEIN Leo	Honorary member of the United States Army Medical Department Regiment
KLEIN Leo	member of the Editorial board of <i>„Annals of Burns and Fire Disasters“</i>
KLEIN Leo	member of the Editorial board of the <i>“European Journal of Burn Care”</i>
KORÁBEČNÝ Jan	member of the Society for Neuroscience
KUBELKOVÁ Klára	member of the European Radiation Research Society
KUBELKOVÁ Klára	member of the American Microbiology Society
LOCHMAN Petr	member of the European Society of Surgical Oncology
LOCHMAN Petr	member of the European Wound Management Association
LOCHMAN Petr	member of the FACS – American College of Surgeons
PAVLÍK Vladimír	member of NATO RTO HFM-154
POHANKA Miroslav	member of Editorial board of <i>„Mini Reviews In Medicinal Chemistry“</i>
POHANKA Miroslav	member of Editorial board of <i>„Sensors“</i>
POHANKA Miroslav	member of Editorial board of <i>„Interdisciplinary Toxicology“</i>

INTERNATIONAL COOPERATION

POHANKA Miroslav	member of Editorial board of „ <i>Journal of Mellomics and Nanotechnologies</i> “
POHANKA Miroslav	member of Editorial board of „ <i>BioMed Research International</i> “
POHANKA Miroslav	member of Editorial board of „ <i>Biosensors</i> “
SCHVACH Hynek	chairman NATO Medical Information Exchange Requirements Panel
SCHVACH Hynek	principal member of the NATO STO Human Factors and Medicine Panel
SCHVACH Hynek	member of the NATO COMEDS Future Advisory Board
SCHVACH Hynek	member of the NATO COMEDS Military Medical Structures, Operations and Procedures Working Group
SCHVACH Hynek	member of the NATO COMEDS Health Information Systems and Technology Working Group
SCHVACH Hynek	member of the NATO COMEDS Telemedicine Team
SOUKUP Ondřej	member of the Society for Neuroscience
STŘÍTECKÁ Hana	member of Editorial board of „ <i>Journal of Obesity & Weight loss Therapy</i> “
STŘÍTECKÁ Hana	member of Editorial board „ <i>Journal of Food Security</i> “
STŘÍTECKÁ Hana	member of the International Association for the Study of Obesity
STŘÍTECKÁ Hana	member of the European Association for the Study of Obesity (EASO)

INTERNATIONAL COOPERATION

STŘÍTECKÁ Hana	member of the European Federation of the Associations of Dietitians (EFAD)
STULÍK Jiří	member of Editorial board of „ <i>Frontiers in Cellular and Infection Microbiology</i> “
ŠINKOROVÁ Zuzana	member of NATO CBRN Medical Working Group
ŠINKOROVÁ Zuzana	member of the NATO RTO HFM - 222
ŠINKOROVÁ Zuzana	member of the European Radiation Research Society
TICHÝ Aleš	member of the NATO HFM Panel RTG-291
TICHÝ Aleš	member of the American Society for Mass Spectrometry
TICHÝ Aleš	member of the European Society of Radiation Biology
TICHÝ Aleš	member of the European Society for Radiotherapy and Oncology (ESTRO)
TICHÝ Aleš	Guest Editor of „ <i>Frontiers in Pharmacology</i> “

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SCIENTIFIC AND RESEARCH ACTIVITIES

Completed full professorships

ŠINKOROVÁ Zuzana

Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

area of specialization: Biodosimetry

professor's lecture: Modern biodosimetry methods in the Army of the Czech Republic

HORÁKOVÁ Dagmar

Department of Public Health, Faculty of Medicine and Dentistry, Palacky University Olomouc

area of specialization: Epidemiology, Preventive Medicine and Hygiene

professor's lecture: Concept of scientific work and training in the field of Epidemiology, Preventive Medicine and Hygiene

Completed associate professorships

SNOPKOVÁ Svatava

Department of Infectious Diseases, Faculty of Medicine, Faculty Hospital Brno, Masaryk University Brno

area of specialization: Epidemiology, Preventive Medicine and Hygiene

habilitation thesis: Changes in hemostase and immunological response during the treatment of HIV infection

habilitation lecture Opportunistic infection and new immunological approaches

KURFIRST Vojtěch

Department of Cardiac and Thoracic Surgery, Hospital Ceske Budejovice

area of specialization: Military Surgery
habilitation thesis: Cardiac surgery in instructive cases reports
habilitation lecture: Surgical treatment of atrial fibrillation

POHNÁN Radek

Department of Surgery, Central Military Hospital-Military University Hospital Prague, Second Faculty of Medicine, Charles University, Prague

area of specialization: Military Surgery
habilitation thesis: History, the present and new trends in the treatment of pulmonary tuberculosis
habilitation lecture: Status of mini-invasive operations in thoracic surgery

Dissertation defences

STOJKOVÁ Pavla

Department of Molecular Pathology and Biology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Infection Biology
dissertation: Characterization of virulence factors in relation to pathogenesis of *Francisella tularensis*

SCIENTIFIC AND RESEARCH ACTIVITIES

HORÁČKOVÁ Kateřina

Department of Military Internal Medicine and Military Hygiene, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Preventive Medicine and Public Health Protection
dissertation: The impact of the Holocaust on the health and life satisfaction of survivors in a historical context

HERMAN David

Department of Toxicology and Military Pharmacy, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Toxicology
dissertation: Development of analytical methods for the determination of military important toxic substances and antidotes

MACHAČ Jan

Department of Epidemiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Epidemiology
dissertation: The importance of elastography in the monitoring of patients with chronic viral hepatitis C

POLCAROVÁ Petra

Department of Epidemiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Epidemiology
dissertation: Evaluation of the risk of tick-borne encephalitis disease in soldiers of the Czech Armed Forces and options of its prevention

MALÝ Ondřej

Department of Surgery, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Surgery

dissertation: Inhalation application of a mixture of hydrogen and oxygen as a potential antioxidant to prevent ischemic-reperfusion liver damage during major liver resection

BENKOVÁ Markéta

Department of Epidemiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Medical Microbiology

dissertation: Antimicrobial susceptibility testing of newly synthesized compounds

PROKŠOVÁ Magdaléna

Department of Molecular Pathology and Biology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Infection Biology

dissertation: Investigation of protein-protein interaction important for pathogenesis of tularemia infection

ŠIMEK Jan

Department of Surgery, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Surgery

dissertation: Operative treatment of midshaft clavicle fractures compared intramedullary and extramedullary internal fixation

SCIENTIFIC AND RESEARCH ACTIVITIES

SKOŘEPA Pavel

Department of Military Internal Medicine and Military Hygiene, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Internal Medicine

dissertation: Comparison of different amounts of glucose in parenteral nutrition in critically ill patients

HAJŠL Martin

Department of Military Internal Medicine and Military Hygiene, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Internal Medicine

dissertation: Metabolomic study of acute coronary syndrome markers

MÚČKOVÁ Ľubica

Department of Toxicology and Military Pharmacy, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Toxicology

dissertation: In vitro characterization of acetylcholinesterase modulators

LIEROVÁ Anna

Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Radiobiology

dissertation: Study of the inflammatory response of the organism after total body and partial irradiation of experimental models

ČECHÁKOVÁ Lucie

Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Radiobiology

dissertation: Radiosensitization of cancer cells: Importance of autophagy modulation

JELIČOVÁ Marcela

Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Radiobiology

dissertation: Electrochemical detection of DNA damage after gamma irradiation

VOŠKA Michal

Department of Military Internal Medicine and Military Hygiene, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Internal Medicine

dissertation: Accuracy of colon capsule endoscopy for colorectal neoplasia detection in individuals referred for a screening colonoscopy – multicenter, prospective, cross-over study

ONDREJ Martin

Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, Hradec Králové

study programs: Military Radiobiology

dissertation: Radiosensitization of cancer cells by modulation of autophagy: Phosphoproteomic analysis

**THE REVIEW OF RESEARCH PROJECTS CARRIED OUT AT THE
FACULTY OF MILITARY HEALTH SCIENCES IN 2020**

THE CZECH HEALTH RESEARCH COUNCIL

Principal investigators

• **Pavel Boštík**

(NV17-31765A) The potential of xanthohumol and beta-bitter acids in the therapy of nosocomial infections

• **Daniel Jun**

(NV18-09-00181) Development of polyvalent decontamination mean

Co-investigators

• **Daniel Jun**

(NV17-32801A) Centrally acting antidotes for the treatment of organophosphorus poisoning

• **Jiří Stulík**

(NV19-02-00297) Proteome analysis of potential markers of dilation cardiomyopathy

THE CZECH REPUBLIC MINISTRY OF INTERNAL AFFAIRS

Principal investigators

• **Aleš Tichý**

(VH20172020010) New approaches in diagnostics and therapy of irradiated persons

• **Klára Kubelková**

(VJ01030003) The Creation of Czech-Irish Project Cooperation for Solving the Biological Security Questions

Co-investigators

• **Zuzana Kročová**

(VH20172020012) Preparation of a standard collection of biologically important toxins - EBLN (European Biodefence Laboratory Network)

• **Pavel Řehulka**

(VH20172020012) Preparation of a standard collection of biologically important toxins - EBLN (European Biodefence Laboratory Network)

• **Jana Klimentová**

(VH20172020012) Preparation of a standard collection of biologically important toxins - EBLN (European Biodefence Laboratory Network)

• **Daniel Jun**

(VI20192022114) MARYSA – Research in chemical properties and methods of individual protection against the last generation of nerve agents

THE CZECH REPUBLIC GRANT AGENCY

Principal investigators

- **Jana Žďárová Karasová**

(GA18-08937S) Research of oxime-CB[7] complexes for central nervous system penetration of quaternary acetylcholinesterase reactivators

Co-investigators

- **Daniel Jun**

(GA18-01734S) SCAVENGERS – Butyrylcholinesterase reactivators for preparation of pseudo-catalytic scavengers applicable for organophosphorus intoxications

THE MINISTRY OF EDUCATION, YOUTH AND SPORTS

Principal investigators

- **Radek Sleha**

(LTAUSA19003) The induction of antiviral immune response after intranasal application of nanoparticles based vaccine

- **Jan Brix**

(SV/FVZ202001) NOSOCOMIAL INFECTIONS – Factors determining the occurrence of nosocomial infections in intensive care

- **Ivana Holmquist**

(SV/FVZ201812) BREASTFEEDING – Factors influencing initiation and

continuation of breastfeeding in the South-East United States

• **Věra Vozandychová**

(SV/FVZ201802) INFECTION – Analysis of changes in host cell ubiquitinylation system during infection of pathogen *Francisella tularensis*

• **Jan Bavlovič**

(SV/FVZ201804) VESICLES – Study of the secretion of outer membrane vesicles in *Francisella tularensis* and their role in the host-pathogen interaction

• **Věra Radochová**

(SV/FVZ201806) PHOSPHINE – Phosphine anad mechanism of phosphine toxicity on the organism of laboratory animal

• **Jan Konečný**

(SV/FVZ201803) AGENTS – Development of new agents with anti-inflammatory effect

• **Aneta Marková**

(SV/FVZ201808) BIOFILM – Synthesis and evaluation of novel compounds based on quaternary ammonium salts for eradication of microbial bio films

• **Barbora Svobodová**

(SV/FVZ201901) PROPHYLAXIS – Development of novel prophylactic countermeasure against nerve agents based on reversible cholinesterase inhibitors

• **Marcela Jeličová**

(SV/FVZ201904) BIOINDICATORS – Determination of DNA damage bioindicators after irradiation by electrochemical analysis

• **Petra Polcarová**

(SV/FVZ201903) TICK – Evaluation of risk of infection with tick-borne encephalitis, Lyme borreliosis and ehrlichiosis during the training of soldiers of the Czech Army in selected military areas

• **Michaela Hympánová**

(SV/FVZ201905) MBEC – MBEC assay: The method modification for individual bacterial strains and multiple-species biofilms

• **Miroslav Sirový**

(SV/FVZ201902) ADHESIONS – Prevention of postoperative intraabdominal adhesions: an experimental study

• **Lenka Pulkrábková**

(SV/FVZ202010) NEUROTOXICITY – Evaluation of neurotoxicity and neuroprotection effects of drugs by using neuronal in vitro models

• **Luboš Krásek**

(SV/FVZ202006) INCIDENCE – Incidence and prevalence of sexually transmitted diseases in women in military

• **Ľudovít Púdelka**

(SV/FVZ202009) NATURE – Potential of the natural substances in the treatment of non-healing wounds

• **Barbora Spěváková**

(SV/FVZ202011) RISK – The risky behavior among students of the universities

• **Petr Bzonek**

(SV/FVZ2012002) YPERIT – Determination of mustards and their biomarkers in biological materials using chromatographic methods

• **Tomáš Kučera**

(SV/FVZ202005) DECONTAMINATION – Testing of decontamination mixtures efficacy against chemical warfare agents

• **Michal Moravec**

(SV/FVZ202008) PNEUMONIA – Th17 immune response, myristic acid and mid-regional pro-adrenomedullin (MR-proADM) in patients with severe community acquired pneumonia (sCAP) in correlation with specific pathogens of CAP and their value in disease severity and outcome prediction

• **Jaroslav Herzinger**

(SV/FVZ202004) MALIGNITY – Importance of hypertermic intrathoracic chemotherapy with cytoreductive surgery on malignant pleural effusion

• **Jiří Kotek**

(SV/FVZ202007) VOLUMOMETRY – Significance of the trunk muscles volumetry in prediction of postoperative complications in colorectal surgery

• **Jana Čížková**

(SV/FVZ 202003) STRESS – Biologically active substances and their influence on the reduction of stress and radiation burden in the organism

TECHNOLOGY AGENCY OF THE CZECH REPUBLIC

Co-investigators

• **Miroslav Pohanka**

(TH03030336) Colorimetric sensor for diagnosis of pesticides poisoning

RESEARCH AIMS

Daniel Jun

A long-term organization development plan 1011 – Health problems of the weapons of mass destruction

Jiří Páral

A long-term organization development plan 1011 – Clinical fields

ARTICLES IN JOURNALS WITH IMPACT FACTOR

1. AL MAMUN, Abdullah, MAŘÍKOVÁ, Jana, HULCOVÁ, Daniela, JANOUŠEK, Jiří, ŠAFRATOVÁ, Marcela, NOVÁKOVÁ, Lucie, KUČERA, Tomáš, HRABINOVÁ, Martina, KUNEŠ, Jiří, KORÁBEČNÝ, Jan, CAHLÍKOVÁ, Lucie. Amaryllidaceae alkaloids of belladine-type from narcissus pseudonarcissus cv. Carlton as new selective inhibitors of butyrylcholinesterase. *Biomolecules*, 2020, **10**(5), 800. ISSN 2218-273X. **IF 4.082**
2. ANDRÝS, Rudolf, GÓRECKI, Lukáš, KORÁBEČNÝ, Jan, MUSÍLEK, Kamil. Reply to Comment on "Cysteine-Targeted Insecticides against *A. gambiae* Acetylcholinesterase Are Neither Selective nor Reversible Inhibitors". *ACS Medicinal Chemistry Letters*, 2020, **11**(6), 1065–1066. ISSN 1948-5875. **IF 3.975**
3. ANDRÝS, Rudolf, KLUSOŇOVÁ, Aneta, LÍSA, Miroslav, ŽDÁROVÁ KARASOVÁ, Jana. Encapsulation of oxime acetylcholinesterase reactivators: influence of physiological conditions on the stability of oxime-cucurbit[7]uril complexes. *New Journal of Chemistry*, 2020, **44**(34), 14367–14372. ISSN 1144-0546. **IF 3.288**
4. BENKOVÁ, Markéta, SOUKUP, Ondřej, MAREK, Jan. Antimicrobial susceptibility testing: currently used methods and devices and the near future in clinical practice. *Journal of Applied Microbiology*, 2020, **129**(4), 806–822. ISSN 1364-5072. **IF 3.066**
5. BOHONĚK, Miloš, KUTÁČ, Dominik, ACKER, Jason P., SEGATCHIAN, Jerard. Optimizing the supply of whole blood-derived bioproducts through the combined implementation of cryopreservation and pathogen reduction technologies and practices: An overview. *Transfusion and Apheresis Science*, 2020, **59**(2), 102754. ISSN 1473-0502. **IF 1.285**
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Contact address:

Fakulta vojenského zdravotnictví

Třebešská 1575

CZ-500 01 Hradec Králové

Tel.: +420 973 253 101

Fax: +420 973 253 100

E-mail: roman.chlibek@unob.cz

E-mail: ivana.komarkova@unob.cz

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