

BIOTECHNOLOGY AND BIOMEDICINE

Specific subthemes of the area of research specialisation:

Part I BIOTECHNOLOGY

Part II BIOMEDICINE

Part I: BIOTECHNOLOGY

Biotechnology has become the key component of some economic sectors within the EU: in the areas of industrial processing and primary production / agricultural and food industry, as well as in healthcare and pharmaceutical industry. Modern biotechnology currently makes up approx. 2% of the EU's gross added value. Applied biotechnology using enzymes, micro-organisms and plants focuses on the production of chemicals, pharmaceutically active substances, pharmaceuticals and new energy carriers. Biotechnological processes also focus on the elimination of pollutants and reduction of the environmental burden of technological processes. Biotechnology contributes to the development of a sustainable "bioeconomy" as the basis of the European Technology Platform for Sustainable Chemistry – SusChem.

1. KEY WORDS – industrial biotechnology, environmental biotechnology, agrobiotechnology, pharmaceutical biotechnology, advanced materials, enzymes, bioplastics, chemical precursors, biomedical engineering, zero waste technology, phytomass, bioethanol, waste processing, bioactive substances, bioremediation technology, energy carriers, environment-friendly technology, fermentation, antibiotics, vitamins.

2. CLOSER DESCRIPTION OF THE RESEARCH AND DEVELOPMENT AREAS

Subtitle: Industrial biotechnology

- Research of microbial metabolites which can be utilised in chemical, pharmaceutical and food industry;
- Biotechnological use of renewable resources for products with a high added value;
- Research of advanced materials (biodegradable plastics, biocompatible implants, biodegradable surfactants);
- Reduction of the energy efficiency of production technology through the application of biotechnological processes;
- Nanobiotechnology (biosensors for diagnostics and continuous monitoring of technological processes);
- Research of energy carriers (biotechnological production of hydrogen, methane, biodiesel and bioethanol from agricultural waste);

Subtitle: Environmental biotechnology

- New remediation technology, use of biotechnology in the disposal of waste and hazardous substances;
- Study of microbial decontamination of soil with high content of aromatic hydrocarbons and their chlorinated derivatives;
- Use of biotechnological processes in combating pests in agriculture;
- Production of enzymes for new technology; preparation of new biocatalysts for environmental use;
- Biotechnological production of attractants for application in forestry;
- Research on the possibilities of use of recombinant technology to improve the properties of micro-organisms and plants for environmental technologies;

Subtitle: Agrobiotechnology

- Callus cultures for biotechnological production of pharmaceutically usable plant metabolites;
- Immobilisation of plant cells, continualisation of production and productivity increase;
- Biotechnological preparation of vaccines and antibodies for veterinary use;
- New types of fertilisers based on nitrogen-fixing bacteria;
- Biotechnological production of phytoalexins, study of plant resistance by applying inactivated microbial plant pathogens;
- Breeding and genetic engineering of animals;
- Complex phytomass processing into products with a higher added value.

Subtitle: Pharmaceutical biotechnology

- Biotechnological production of antibiotics and vitamins;
- Biotransformation of steroids;
- Biotechnological production of immunomodulators;
- Study of recombinant biologically active proteins and polypeptides;
- Preparation of polyclonal and monoclonal antibodies;
- Biotechnology of production and use of stem cells in human and veterinary medicine;
- Development of the methodology of transport of pharmaceuticals to target tissues.

3. LINKS/RELATIONSHIPS BETWEEN THE LONG-TERM STRATEGIC RESEARCH PROGRAMME AND THE ADDRESSING OF SOME/SEVERAL DEVELOPMENT TRENDS ON THE BASIS OF AVAILABLE R&I CAPACITIES (short description of the links, if such exist with respect to specific areas):

Available R&I capacities in the field of biotechnology can be used in the following development trends:

- Smart technologies with a focus on special chemical and pharmaceutical substances;
- R&I of biodegradable plastics and new recyclable materials reducing the environmental burden;
- Increasing the value of the domestic raw materials base;
- R&I technology for complex biomass processing into products with a high added value;
- R&I in bioenergetics;
- Conversion of agricultural waste and biomass into energy carriers;
- Development of innovative solutions enabling rational resource management in agriculture and forestry and reducing the environmental burden, such as modern fertilising systems and chemical substances used in these sectors;
- New remediation technology for environment decontamination;
- R&I in the field of biotechnological over-production of biologically active metabolites applicable in human and veterinary medicine.

4. EXPECTED OUTPUTS AND THE POTENTIAL OF THEIR APPLICATION AND USE IN ECONOMIC AND SOCIAL PRACTICE (examples of outputs in indents)

Increasing the domestic added value of products mainly through an effective transfer of technologies and R&D results into the production process:

- Biotechnological processes reducing the costs of production of chemical and pharmaceutical products;
- Reducing energy efficiency and intensification of manufacturing processes by applying biotechnological processes;
- Advanced materials applicable in pharmacy and medicine – bioactive substances and polymers, biopolymers, biosurfactants.

Development of production processes in industry aimed at a better use of available resources, more recycling and use of environment-friendly materials using scientific and technological development and innovation:

- Biotechnological production of bioethanol, biobutanol, biogas, methane and hydrogen from agricultural waste, 1st and 2nd generation biofuel, bioenergetics;
- Use of living organisms and their metabolites in the biological and biotechnological fight against pests in agriculture;
- New remediation technologies, use of biotechnologies in waste disposal and in soil and water decontamination.

5. QUALITY OBJECTIVES TO WHICH THE SUPPORT OF LONG-TERM STRATEGIC PROGRAMME IS EXPECTED TO CONTRIBUTE under the RIS3 SK objectives, including the addressing of issues of nationwide concern identified in the RIS3 SK – short description of the objectives and of the ways of achieving them:

“Bioeconomy” has the potential to contribute to the achievement of EU’s key political objectives and to the addressing of new problems related to health, energy supplies, global warming and population ageing. Europe disposes of knowledge and skills which enable the use of this potential both within its borders and at the global level, for example, in relations with development countries. Biotechnology is an important means to support growth, jobs and competitiveness within the EU.

Quality objectives in the long term:

- Replacement of chemical technologies with biotechnologies – energy aspect;
- Advanced materials, biocomposites and biopolymers – environmental aspect;
- New bioactive substances applicable in medicine and veterinary medicine – health aspect;
- Innovation in machine production by focusing on machines and equipment for biotechnology development (production of biochemicals and biopolymers) – innovation aspect;
- New impulses for the development of bioelectronics, biochips and biocomputers – innovation aspect;
- Production of biofuels and bioenergetics – environmental aspect;
- Increased demands for workers’ training and qualification, building regional research centres – education, employment and regional development;
- Links between education, research, production, services and consumption – stronger links – science – innovation – production;
- New possibilities for the development of regions, higher employment in regions – cohesion and employment;
- Better quality of the environment – environmental aspect;
- Given the current state of development and support of biotechnologies in Slovakia, it is recommended, as a key step, to take a cross-sectoral approach to biotechnology with a thorough analysis of the existing biotechnological industry and related research and development as the basis for strategic support. The specific measures proposed include the preparation of a state concept on biotechnology development.

6. LINKS TO THE FOCUS OF RESEARCH WITHIN THE EU

- Horizon 2020 (Nanotechnologies, Advanced Materials, Biotechnology and Production, other call H2020-NMBP-2016-2017);
- Supporting excellent science;
- Promoting the leading position of industry in the following fields: Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology;
- Emphasising social needs in EU priority areas: Research and Innovation, Food Safety, Health, Environment.

Part II: BIOMEDICINE

Biomedical research is essential for improving success in combating diseases that increasingly affect the population of the EU and Slovakia and the solution of which is becoming economically unviable. The top priority is health, which is reflected in Horizon 2020. The economic burden on all developed countries caused by diseases, including civilisation ones, is on the rise. Industry, which commercially applies the results of biomedical research, is one of the most dynamic and economically most prosperous sectors, and there is the need to create conditions for its development also in Slovakia. In the context of health sciences, the EU has set targets which, among other things, respect the needs of biomedical sciences in our country, namely: better understanding of mechanisms supporting health, ensuring healthy ageing; understanding the mechanisms of emergence and development of diseases; improving the possibilities of health monitoring, diagnosing, treatment and disease management; promoting active and healthy ageing; and developing new means and opportunities for health promotion and provision of health care. Slovakia identifies itself with the trends within the EU and concentrates its biomedical research predominantly on diagnostics, prevention and treatment of diseases representing a huge social and economic burden – oncological and cardiovascular diseases, CNS diseases, infectious and metabolic diseases; and supporting the development of the most advanced methods enabling the regeneration and transplant of organs, tissues and cells.

SUBTOPICS:

- a. ONCOLOGICAL DISEASES
- b. CARDIOVASCULAR DISEASES
- c. DISEASES OF THE CENTRAL NERVOUS SYSTEM
- d. REGENERATIVE AND TRANSPLANTATION MEDICINE
- e. INFECTIOUS DISEASES
- f. ENDOCRINAL AND METABOLIC DISEASES

1. KEY WORDS – oncological, cardiovascular, respiratory, infectious, metabolic diseases, CNS diseases, diagnostics, prevention, treatment, natural healing sources, quality of life, study of etiopathogenesis, regenerative medicine, transplantation, personalised medicine, healthy ageing, bioethics.

2. CLOSER DESCRIPTION OF THE RESEARCH AND DEVELOPMENT FIELDS

Subtopic A: ONCOLOGICAL DISEASES

Short description of the subtopic:

Oncological diseases have seen a huge increase in Slovakia. The research of the factors of occurrence and development of oncological diseases and of the mechanisms of their resistance against treatment represent, along with the extremely high occurrence and constant growth of incidence of oncological diseases in Slovakia, a serious scientific, medical and societal problem which is largely manifested in the economy of the society. The key oncology issues include the preparation and implementation of effective nationwide preventative programmes, early laboratory and clinical diagnostics, availability of modern personalised methods of treatment, and uncontrolled development of resistance against chemotherapeutic agents. Given the gravity and mortality of diseases, oncological research constitutes the priority focus of biomedical research trends, and its scientific implementation is expected to help the preparation of modern preventative, diagnostic and treatment processes and nationwide programmes for combating cancer both on the individual and societal level. The aim of this priority is to extend, in particular, the personal and also some more demanding technological research capacities from the period 2007–13 and to organise them into thematically and methodologically complex research units with comprehensive and critically

sufficient number of high-quality scientific personal and technological capacities closely linked in their work to clinical facilities.

Closer description of the research and development areas A – ONCOLOGICAL DISEASES

- Research of the mechanisms of emergence and development of oncological diseases;
- Study of the mechanisms of emergence of resistance of tumour cells;
- Research of tumour stem cells;
- Research of etiopathogenesis of oncological diseases with respect to other diseases;
- Development of new processes in early laboratory and clinical diagnostics;
- Development of advanced processes in cancer treatment at the immunological, pharmacological and surgical levels;
- Identification of new molecular targets for personalised anti-tumour therapy;
- Development and verification of the effectiveness of new diagnostic and therapeutic approaches;
- Research of oncological diseases using state-of-the-art imaging diagnostic methods, omic methods and better use of ICT;
- Research of the effects of selective and low-level electromagnetic field on the inhibition of the growth of tumours;
- Creation of a bank of tumour tissues and cells;
- Use of modern technologies, computer production and data analysis to improve research, diagnostics and treatment;
- Development of innovative approaches to the analysis of large-volume data using ICT.

Subtopic B: CARDIOVASCULAR DISEASES

Closer description of the subtopic:

Cardiovascular diseases and cerebrovascular accidents are the main cause of death worldwide. Every year they take the lives of 17.3 million people, and in the absence of rapid and effective measures based on scientific knowledge it is expected that this number will rise up to 23 million by 2030. The socio-economic impacts of diseases of the circulatory system are extremely serious, in particular because of the high cost of long-term treatment. The main purpose of cardiovascular research is the reduction of the incidence of the most serious cardiovascular diseases and subsequent reduction of morbidity and mortality rates with respect to the most serious cardiovascular diseases, such as ischemic heart disease, chronic heart failure, sudden cardiac death, and peripheral artery diseases. The emergence and development of cardiovascular diseases is closely linked to the metabolic syndrome. Its main components include hypertension, diabetes, overweight/obesity, and dyslipidemia, as well as new risk factors, such as endothelial dysfunction, procoagulant state, chronic inflammation, and also ageing. As the complex of these pathogenetic factors increases the risk of coronary artery diseases and myocardial infarction, recent debates are about the so-called cardiometabolic syndrome. The neuroendocrine system and its humoral mediators are not only important factors maintaining the homeostasis of an organism, but are directly involved in the pathogenesis of the cardiometabolic syndrome and its consequences. Knowledge of the pathophysiological mechanisms of damage to the cardiovascular system and the identification of individual genetic, epigenetic, behavioural and social risk factors represent an opportunity for targeted prevention, treatment and elimination of cardiovascular diseases, which would directly translate into improved quality of life of citizens and better economy and prosperity of the whole society.

Closer description of the fields of research and development B – CARDIOVASCULAR DISEASES

a) Molecular mechanisms of damage to heart and blood vessels for targeted prevention and treatment

- Identification of pathophysiological mechanisms of damage for targeted prevention and treatment of cardiovascular diseases;

- Endothelium dysfunction as a risk factor of hypertension, atherosclerosis and ischaemia;
 - Research of atrial fibrillation and heart failures;
 - Cardiometabolic syndrome – prevention and incidence reduction;
 - Neuroendocrine, genetic and psychosocial factors and new therapeutic processes in the case of hypertension, endothelium dysfunction and insulin resistance;
 - Prevention of cardiovascular diseases as a consequence of ageing;
 - Improved coordination of preventative, diagnostic and treatment strategies in patients with increased risk of atherosclerosis and related complications.
- b) *Omic technologies for cardiovascular diseases*
- Proteomic analysis and identification of proteins changed or produced during cardiovascular diseases;
 - Genomics, proteomics and metabolomics of cardiovascular diseases;
 - Proteomic research of thrombin-activated thrombocytes upon the emergence of cardiovascular diseases, including apoplectic strokes and cerebral infarction;
- c) *Cardiorespiratory relations – new processes in the diagnosing and treatment of respiratory failures;*
- d) *Development of methods for computer modelling of hemodynamic blood parameters in the vascular system;*
- e) *Detection and processing of ECG ad EEG signals with the aim to increase their information value;*
- f) *Research and development of wearables for the purposes of monitoring, diagnostics, prevention and research of cardiovascular diseases and for use in telemedicine.*

Subtopic C: DISEASES OF THE CENTRAL NERVOUS SYSTEM

Short description of the subtopic:

The treatment of diseases of the central nervous system (CNS) represents an absolute priority of the European Union and of the World Health Organisation (WHO). In 2010, the direct cost of healthcare related to cerebral diseases attained 24% of the total Union costs allocated to healthcare, and 3% of GDP in Slovakia. The most common brain and spinal cord diseases include neurodegenerative diseases, encephalitis, epilepsy, stroke, multiple sclerosis, neurodevelopmental (e.g. autism) and traumatic diseases. One of the RIS3 social and thematic priorities is population ageing and quality of life with a particular focus on active ageing and healthcare to senior citizens, including assistance in the field of mental health. Slovakia's prospective areas of specialisation in terms of development trends therefore include technologies and services for active life and ageing, healthcare and early diagnostics of serious diseases in older age. The absence of diagnostic tests, lack of causal therapy and the ageing of the European population lead to a sharp increase in the number of patients and subsequent healthcare expenses. Despite the population decline in Slovakia, the number of pensioners will grow by one million by 2050. The aim is to further develop and integrate the platform of excellent research and clinical departments, which will result in the creation of a comprehensive national programme for CNS and spinal cord, ensuring continuity and sustainability of research, development of diagnostics, development of new therapeutic approaches, their preclinical and clinical testing, standardisation of patient care, and reduction of medical costs.

Closer description of the fields of research and development C – DISEASES OF THE CENTRAL NERVOUS SYSTEM

- Research, development and testing of new therapeutic processes and biomaterials for neurodegenerative diseases and traumatic damages to the CNS;
- Development of new methods of the prevention of CNS diseases and protection of mental health;
- Development and clinical application of electronic and digital technologies for maintaining and improving mental health and condition and diagnosing of changes in brain activity;
- Research, development and testing of new approaches to the treatment of depressive states, autism, motoric activity disorders and cognitive failures;
- Improving the quality of life during ageing through advanced diagnostic technologies and non-

pharmacological cognitive approaches, and building of a national network of services for the activation of senior people;

- Research and application of analytical bioinformation processes for CNS data processing;
- Research and development of ICT applications, including virtual reality for the study of neurodegenerative diseases and traumatic damages to the CNS.

Subtopic D: REGENERATIVE AND TRANSPLANTATION MEDICINE

Short description of the subtopic:

Regenerative medicine aims to restore the function of damaged tissues and organs by transplantation of cells or activation of endogenous cells. The study of the molecular background of the effects of cellular therapy determines the future treatment of many diseases which cannot be treated by means of present-day medicine. Therapy using cells forms part of personalised medicine, which is an important part of European research. The research results offer already today possibilities for the initiation of testing with adult stem cells and induced stem cells (iPSC) for post-traumatic, cardiovascular, autoimmune, metabolic, orthopaedic, neurodegenerative and eye diseases, as well as other diseases, and for the treatment of post-traumatic conditions, conditions after the transplantation of organs and haematopoietic cells, etc. It is necessary to complete the human and technological base and to build the institutional background for ensuring the sustainability of research in the regenerative and transplantation medicine which would enable efficiency and standardisation of the most demanding generally required methods for experimental research, preclinical studies, as well as translational research. The ongoing development of interdisciplinary technologies, such as 3D bioprinting, development of biomaterials, bioimplants, nanomaterials, biotechnology and the use of other technical and material possibilities, including ICT for the preparation of artificial tissues, requires interdisciplinary collaboration across several specialisations. Given the work related to stem cells and the development of artificial organs, communication with social and bioethical sciences will also be necessary. Transplant research and research in the field of regenerative medicine and stem cells is a highly interdisciplinary field of medicine, which is currently one of the priorities of the RIS3 SK strategy and HORIZON 2020.

Closer description of the fields of research and development D – REGENERATIVE AND TRANSPLANTATION MEDICINE

Biomedicine and biotechnologies with a focus on new diagnostic and treatment processes in socially serious diseases

- Research of the potential of cell therapy for the treatment of diseases and injuries to the tissues of the skeleton, CNS, heart, vessels, infectious, autoimmune, oncological, haematological and other diseases;
- Translational research to check the therapeutic effect and safety of cell therapy for the treatment of diseases and injuries to the tissues of the skeleton, CNS, diabetes mellitus, cardiovascular, infectious, autoimmune, oncological and haematological diseases;
- Research and development of innovation in the transplantation of organs, tissues and cells;
- Development of new progressive forms of tissue transplants and replacements, cell carriers, 3D technologies, additive technologies and supporting organ systems using ICT;
- Know-how transfer from advanced world laboratories into the research and translation practice in Slovakia;
- Completion of the personal and technological infrastructure for research in regenerative and translation medicine.

Research and drafting of new legislation on the basis of a social survey on the acceptance of advanced medicine methods in Slovakia and creation of new ethical legal standards for experimental and clinical research in progressive medicine

- Analysis of the ethical and legal aspects related to research and the use of human embryonic and adult stem cells, biotechnological and biomedical processes and products in economy and

medical practice;

- Quantitative and qualitative analysis of the acceptance of modern research and development in biomedicine based on a representative empirical and qualitative public opinion poll;
- Facilitation and subsequent analysis of deliberative discussions among actors in the field of biomedicine and biotechnologies between R&D institutions, commercial firms, the mass media, law makers and the general public;
- Completion of the personal and methodological infrastructure of teams able to conduct such research at the international level.

Subtopic E: INFECTIOUS DISEASES OF VIRAL AND BACTERIAL ORIGIN

Short description of the subtopic:

Despite progress in the control of infectious diseases transmissible pathogens continue to pose a serious threat to human and animal health. The ecological and evolutionary dynamics of infections is diverse in terms of space and time, and some pathogens spread directly in the human population, while others are transferred between different host species and can survive in natural reservoirs. The situation is complicated by increasing incidence of resistance to antibiotics and antiviral agents, changes in human behaviour, including industrial interventions in nature and increased mobility. We are currently witnessing an outbreak of epidemics, the emergence of new viruses, as well as the return of 'old' pathogens with altered properties. It is therefore necessary to obtain as much knowledge as possible about the occurrence and spread of infectious pathogens in Slovakia, on the internal sources and the possibilities of their control, as well as effective prevention, diagnostics and treatment of infections.

Detailed description of the fields of research and development E: INFECTIOUS DISEASES OF VIRAL AND BACTERIAL ORIGIN

- Research in the epidemiology, pathogenesis and molecular biology of emerging and re-emerging infectious agents, study of non-specific and specific immune defence against infectious agents, study of the pathogen/host relationship, study of virulence factors;
- Research in new methods of diagnosing viral and bacterial infections (e.g. pathogens, antibodies and mediators of immune response);
- New ways of control of microbial contamination of food, and prevention of epidemics caused by contaminated food;
- New and fast methods of detection of zoonoses and animal infectious agents;
- Research and development of new pharmaceuticals and preventative means against the spread of infectious diseases (antimicrobial substances, vaccines and immunostimulatory agents);
- Research of the mechanisms of resistance to antiviral substances and antibiotics;
- Building of personal and institutional infrastructures capable of effectively handling the spread of pandemics in crisis situations;
- Building and ensuring the sustainability of biobanks of infectious agents, infected cells and tissues and biological samples of patients suffering from infectious diseases;
- Development of innovative approaches to the analysis of large-volume data using ICT.

Subtopic F: ENDOCRINE AND METABOLIC DISORDERS

Short description of the subtopic:

Modern diagnostics of various socially serious civilisation diseases and less common hereditary diseases allows, compared to the past, unprecedented early detection, accurate molecular diagnostics, and highly effective treatment in diabetology, endocrinology and in the field of metabolic disorders. Emphasis will be placed on advanced diagnostics, risk stratification, personalised treatment of diabetes, obesity, endocrine and metabolic disorders, including rare genetically determined forms of these diseases. A key role in the treatment of chronic inflammatory diseases is currently played by conventional pharmacological, biological, as well as non-

pharmacological treatment, including physiotherapy. Complex therapy must be personalised in the context of other system factors, such as neuroendocrine system or stress response. Despite complex treatment, complete remission of the disease is reported in a considerable part of patients. The current trend is therefore to seek additional treatment options using modified immune cells as such and their constituents or progenitors.

Closer description of the fields of research and development F – ENDOCRINE AND METABOLIC DISORDERS

- Research in molecular diagnostics and personalised treatment of diabetes, obesity, endocrine and metabolic disorders, including their consequences, complications and mechanisms of these diseases in line with the personalised medicine implementation strategy;
- Mechanisms of emergence of autoimmunity, diagnostics and personalised pharmacological and non-pharmacological treatment of autoimmune disorders, including development of advanced therapies defined within the group of advanced therapy medicinal products;
- Innovation of diagnostics of metabolic disorders in farm animals and their impacts on the quality of products and food.

3. LINKS/RELATIONSHIPS BETWEEN THE LONG-TERM STRATEGIC RESEARCH PROGRAMME AND THE ADDRESSING OF SOME/SEVERAL DEVELOPMENT TRENDS ON THE BASIS OF AVAILABLE R&I CAPACITIES (short description of the links, if such exist with respect to specific areas):

Available R&I capacities in the field of biomedical research can be used in the following development trends:

- Technologies and services supporting health, active life, healthcare, diagnostics, treatment and healthy life of the population;
- New opportunities for young people in changing conditions;
- Supporting the health and quality of life of the ageing population;
- Research, development and implementation of new technologies in research, development and practice;
- Transfer of state-of-the-art technologies and know-how from abroad to Slovakia;
- Smart technologies with a focus on special medical procedures and chemical and pharmaceutical substances.

4. EXPECTED OUTPUTS AND THE POTENTIAL OF THEIR APPLICATION AND USE IN ECONOMIC AND SOCIAL PRACTICE (examples of outputs in indents)

- Improved diagnostics, prevention and treatment of socially serious diseases;
- Innovation of laboratory and clinical diagnostics methods;
- New preventative programmes for the creation and protection of population health;
- Improving early detection of new diseases;
- Improving the effectiveness of the diagnosing and treatment process;
- Creating bases for innovative medicine;
- Reducing the costs of healthcare;
- Increasing the effectiveness of prevention, diagnostics and treatment of serious diseases;
- Better links between the R&D sector and the healthcare practice;
- Involvement in the European Research Area;
- New preventative programmes for the protection of the population and livestock against infections;
- Introducing progressive medicine methods and innovative treatment methods into practice;
- Innovative methods of laboratory and clinical diagnostics;
- Better early detection of emerging diseases;
- Improving the effectiveness of the diagnostic and treatment process;

- Innovative methods of detection of microbial contamination of food;
- Better links to the European Research Area;
- More effective monitoring and protection of the country against infections.

5. QUALITY OBJECTIVES TO WHICH THE SUPPORT OF LONG-TERM STRATEGIC PROGRAMME IS EXPECTED TO CONTRIBUTE UNDER THE RIS3 SK OBJECTIVES, INCLUDING THE ADDRESSING OF ISSUES OF NATIONWIDE CONCERN IDENTIFIED IN THE RIS3 SK – SHORT DESCRIPTION OF THE OBJECTIVES AND OF THE WAYS OF ACHIEVING THEM:

Biomedical research aims to support health creation, detect demographic changes and improve the health of the Slovak population, which represents a huge societal challenge. Better health for all in Slovakia responds to the EU-wide challenge. The main objectives include the promotion of healthy and active ageing, promotion of the market growth of products with a high added value, and the creation of new areas and jobs in healthcare. The challenges related to these objectives stem from the ageing of the Slovak population and its lifestyle, which, unless actively managed throughout a person's life, result in increasing the societal burden on existing health and health care systems and on society in the form of chronic diseases. This will also result in increased public expenditure on labour and lost productivity. Additional funding for projects in the field of biomedicine, financed under the first programming period, will ensure continuity and sustainability of the launched solutions to serious topics of nationwide concern relating to top priority – health of the Slovak population.

The principal quality objectives include:

- Promoting the effectiveness of knowledge transfer from research into practice, which will be manifested in better healthcare mainly with respect to socially serious diseases;
- Better knowledge transfer from research into practice;
- Development of translational biomedical research in Slovakia;
- Development of personal and technological capacities in biomedical research and development to reach the European level;
- Improving the quality of healthcare, reducing the morbidity rate in the main socially serious categories of diseases – oncological, cardiovascular, CNS, metabolic diseases, etc. and, hence, gradual reduction of the financial demands of healthcare;
- Increasing the success of treatment by improving the quality of detection of diseases at their early stages.

6. LINKS TO RESEARCH TRENDS WITHIN THE EU

- Horizon 2020 Work Programme 2016–2017, 8. Health, Demographic Change and Well-being;
- Supporting excellent science;
- Emphasis on the social needs in EU's priority areas: Research and Innovation, Food Safety, Health, Environment;
- EU strategy "Together for Health", project ERA-NET NEURON, Horizon 2020 – SC 1 "Health, Demographic Change and Well-being". Europe 2020 strategy: "THE THIRD HEALTH PROGRAMME 2014–2020 - FUNDING HEALTH INITIATIVES", Thematic priority 1: Promote health, prevent diseases and foster supportive environments for healthy lifestyles (1.4 Chronic diseases including cancer, age-related diseases and neurodegenerative diseases, and 1.6 Health information and knowledge system to contribute to evidence-based decision-making), and Thematic priority 3: Contribute to innovative, efficient and sustainable health systems.
- In 2009, the EU initiated the set-up of the largest international R&D platform for the identification of causes, the development of pharmaceuticals and suitable methods of care for patients suffering from Alzheimer disease and other neurodegenerative diseases ("Joint Programme – Neurodegenerative Disease Research – JPNDR"). Slovakia, represented by the MoESRS, is co-founder of this platform, and was involved in the preparation of the Action Plan (2012, Brussels), which defined the research focus in Europe for the next 20 years. The COST programme (BM1004)

is the leader in the implementation of research on early autism – ESSEA interdisciplinary network. “United Nations Convention on the Rights of Persons with Disabilities”: for the implementation of this convention, the EU created the EU Disability Strategy 2010-2020, including an action plan to ensure equality, inclusive approach to education, healthcare and the application of one’s own skills.

The mutual relationships and links between the long-term strategic research programme from the point of view of available R&I capacities and the development trends of economic specialisation and prospective areas of specialisation are shown in the table below.

DEVELOPMENT TRENDS FOR THE AREAS OF ECONOMIC SPECIALISATION	BIOTECHNOLOGY				BIOMEDICINE					
	I	II	III	IV	I	II	III	IV	V	VI
AREAS OF ECONOMIC SPECIALISATION										
Automotive and mechanical engineering industries	y	y								
Consumer electronics and electrical equipment	p	p	p	p	p	p	p	p	p	p
ICT products and services	y	y	y	y	y	y	y	y	y	y
Production and processing of iron and steel										
DEVELOPMENT TRENDS IN THE AREAS OF SPECIALISATION OF THE ECONOMY										
Increasing domestic value-added products, particularly through the effective transfer of technology and R&D results into the production process	y	y	y	y	y	y	y	y	y	y
Development of production processes in industry focusing on better use of available resources, greater use of recycling materials and environment-friendly materials through scientific and technological development and innovation	y	y	y	y				y		
The use, placement and replacement of previously used materials for advanced materials with a new and more complex performance, including technological processing (machining, forming, binding)	y	y	y	y				y		
Development of technological investment units, particularly in the field of metallurgy,	y	y								

engineering, energy and integrated industrial equipment, with respect to the application and use of light metals and advanced materials in the manufacture of transport and construction facility to reduce overall weight and contribute to the green economy, development and application usage of composite materials										
Development of technological investment units, particularly in the energy and industrial facilities, with respect to internationalisation activities and the development of “emerging countries”										
Increasing the effectiveness of production and logistics processes										
Use of ICT and robotics in production processes								y		
Involvement in supply chains and internationalisation - “the purchase of cooperation is a purchase, too”										
Know-how transfer from large to small subjects and vice versa in the framework of cooperation	y	y	y	y	y	y	y	y	y	y
Energy efficiency and renewable energy	y		y							
PROSPECTIVE AREAS OF SPECIALISATION										
Automation, robotics and digital technology	y	y	y	y						
Processing and increasing the value of light metals and their alloys										
Production and processing of polymers and advanced chemical substances	y		y	y				y		
Creative industry										
Increasing the value of domestic raw material base	y	y	y	y						
Supporting smart technologies in the processing of raw materials and waste in the region of their occurrence	y	y	y							
DEVELOPMENT TRENDS IN PROSPECTIVE AREAS OF										

SPECIALISATION										
New technologies allowing the transmission, processing and storage of data	y	y	y	y	y	y	y	y	y	y
Smart production systems	y	y	y	y	y	y	y	y	y	y
Smart and industrial transport										
Technologies for intelligent consumption management										
Progressive chemical technologies for the production of modern fertilisers	y	y	y							
Technologies and services for active life and ageing, i.e. health care, diagnostics and wellness				y	y	y	y	y	y	y
Supporting smart technologies in the processing of raw materials and waste in the region of their occurrence										

Explanatory notes:

y – yes, p – partially

Biotechnology: I (Industrial biotechnology) II (Environmental biotechnology) III (Agrobiotechnology) IV (Pharmaceutical biotechnology)

Biomedicine: I (Oncological diseases) II (Cardiovascular diseases) III (Diseases of the central nervous system) IV (Regenerative and transplantation medicine) V (Infectious diseases) VI (Endocrine and metabolic diseases)