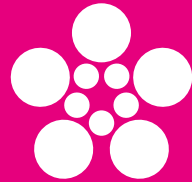


Focusing on Science: Current Research at the University of South Bohemia



Faculty of Theology



Faculty of Economics



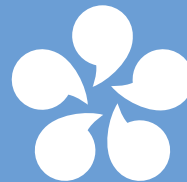
Faculty of Education



Faculty of Agriculture



Faculty of Science



Faculty of Arts



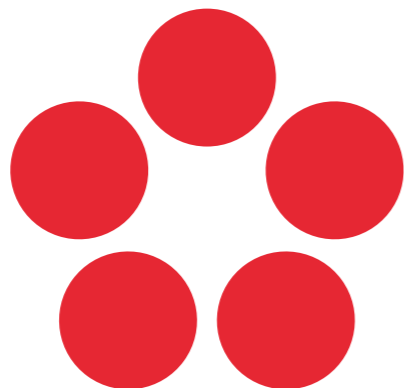
Faculty of Health and Social Sciences



Faculty of Fisheries and Protection of Waters



Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice



Dear readers,

it is our honour to present to you the science at the University of South Bohemia in České Budějovice in a popularisation form. The University of South Bohemia is among leading Czech and European scientific and educational institutions for which it has chiefly its employees to thank but also students who nurture the reputation of the University around the world.

The establishment of the University of South Bohemia was made possible by the favourable conditions after November 1989 when Czech society was opening to the world and entering new contexts. It entered them ready to succeed and with that we credit primarily the faculties, which had been in existence in České Budějovice for decades as well as the Biology Centre of the Czech Academy of Sciences, which was at the origin of another founding faculty of our University. More than three decades of development of the University of South Bohemia have been linked with intensive creative work and seeking new paths.

Circular economics, the physics of plasma, protection of biodiversity or the ethics of the operation of autonomous vehicles. Those are some of several examples that illustrate the large scope of our research activity oriented towards issues of natural and social sciences and humanities. In total, you will find 24 interviews with researchers of the University of South Bohemia – three per each faculty – in which we shall introduce not only the content of their current research but also their passion for the given topic as well as science itself.

No selection that is limited in such a way can ever fully represent the diversity of topics of research that takes place at the University of South Bohemia or its quality. A number of first-class publications in prestigious scientific journals are to be found at such a respected centre of science as is the University of South Bohemia as well as a great number of topics with significant social impact at the national and regional level and, last but not least, also the ever-increasing number of applied outputs, which – among other things – manifests itself in the increased interest of companies in obtaining corresponding licences.

We trust that you will find our publication interesting, appealing and delightful and that it will awaken an interest in you in science as well as the University of South Bohemia and that some of you become interested in studying with us. It is one of our goals to transfer our scientific results into instruction as much as possible and generate interest in science from the very start of studies. And we hope that we have been successful at that.

May the University of South Bohemia in České Budějovice live, grow and flourish!

Vivat, crescat, floreat Universitas Bohemiae Meridionalis!

prof. PhDr. Bohumil Jiroušek, Dr., Rector
doc. Ing. Luděk Berec, Dr., Vice-Rector for Science and Research

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Focusing on science: current research at the University of South Bohemia

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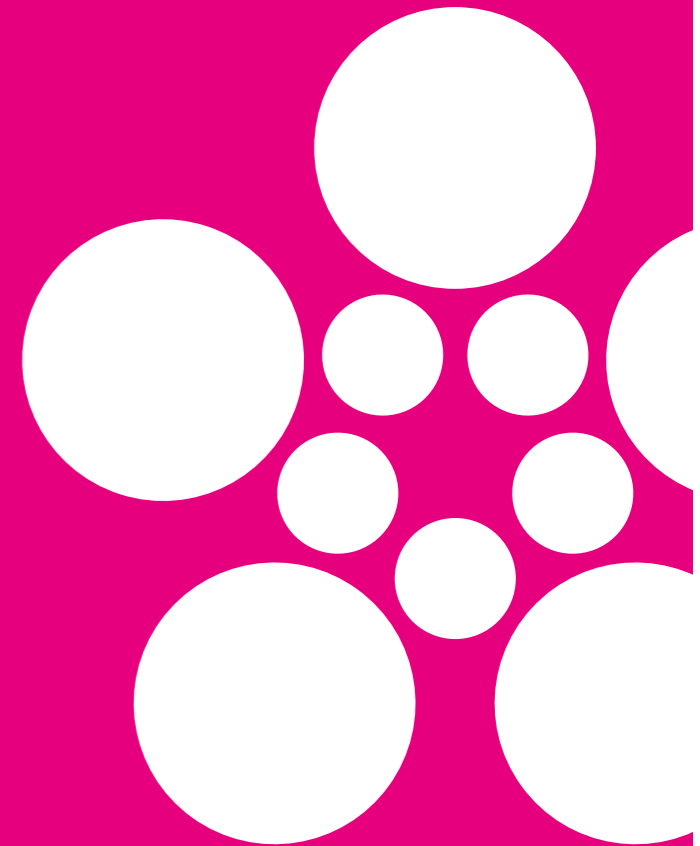
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Faculty of Economics

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Circular chains are the future. Inevitably

Professor Eva Kislingerová, Head of the Department of Applied Economics and Economy at the Faculty of Economics of the University of South Bohemia in České Budějovice, states unequivocally: 'Linear production chains cannot be sustained indefinitely. They must be replaced by circular chains.' In her view, absolutely everyone must come to that conclusion: 'And whether one is a global warming supporter or a climate change denier, whether one is a renewable energy supporter or a lover of the smell of petrol, ultimately we have to come together on this point. In the ultimate sense, there is simply no relevant raw material that is inexhaustible in the true sense of the word. But the conclusion that follows from this is that circular production chains are the only real solution.'

Try to briefly explain the two terms: linear and circular production chain.

Very simply, a linear chain is one that starts with a primary raw material the value of which is enhanced using energy from non-renewable resources. The resulting product is then used for a certain period of time, usually even shorter than its service life, to then end up as waste in one of the traditional ways, such as a landfill.

On the other hand, a fully circular chain is one only recycled and used raw materials would enter at the beginning of the cycle, which would be refined using

renewable energy, the subsequent product would be used for a long time until it is beyond repair, and then it would be 100% recycled.

It's probably clear at first glance that neither of these options exists in its pure form, right?

Yes, it is. In the real world, the former was and is only rarely the case, as it has always been the case that at least a part of the product was returned to production in one form or another. The second case is impossible for a number of physical and chemical reasons, but it can be approached to some extent.



Prof. Ing. Eva Kislingerová, CSc. (1950)

is the Head of the Department of Applied Economics and Economy at the Faculty of Economics of the University of South Bohemia in České Budějovice and a member of the Department of Strategy at the Faculty of Business Administration of the University of Economics and Business in Prague. The focus of her professional interest is on corporate economics, managerial finance, business valuation and insolvency and currently circular economy. She is permanently involved in research. She is an author (co-author) of a number of publications and her publication activity exceeded 467 publication records by the end of 2020. She was also the Deputy Mayor for Finance and Budget of Prague for four years.

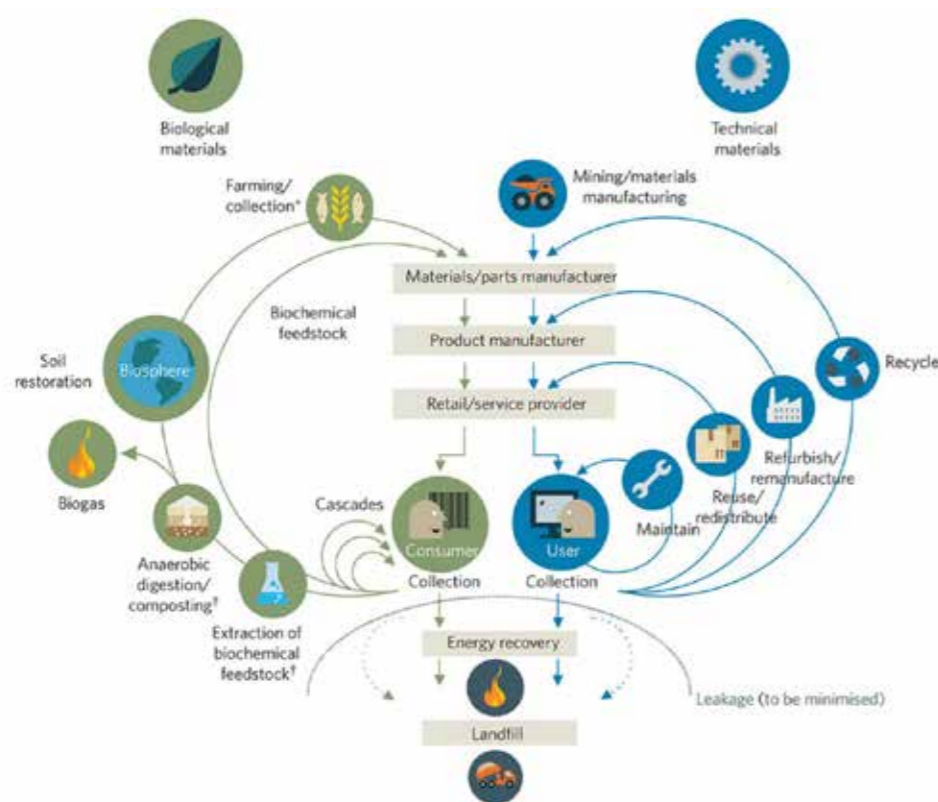
However, as far as we know, extractable oil reserves, for example, are currently the largest in history in terms of volume. So why worry about shortages?

The question strikes right at the core of the problem, where many perspectives, many levels of reality meet. Firstly, the known reserves are indeed the largest in history in terms of their extractable volume, but in terms of the timeline of consumption coverage, it is not nearly as optimistic. Secondly, this growth is due to new technological capabilities and processes. Past estimates of when each of the raw materials would run out did not properly account for human

ingenuity and innovative capacity. So, in reality, of course, in many cases of new reserves being counted in, we have in fact not found 'new oil', but we know how to, for example, re-extract in places that were 'depleted' in terms of old practices. And thirdly, again, technological ingenuity and innovation have meant that oil consumption has not been growing

nearly as dynamically as was expected, for example, in the 1980s. Although the world economy is growing relatively fast, the energy intensity is generally growing at a lower rate than earlier estimates predicted. However, it is true that oil is a rather specific case.

Circular Economy Model



Source: <https://www.innovationnewsnetwork.com/circular-economy-concept-explained/462/>

The question was mainly about whether the shortage of raw materials is a real problem. Isn't this simply a political interpretation of far more complex phenomena?

I completely understand, it's certainly something to consider. The oil example in particular seems to question the whole thesis of resources running out soon. But frankly, I would look beyond all the drilling results and reports of running out of metals needed for electronics and such. In the end, the market is always the decisive indicator. In this context, this means that the indicator is the development of commodity prices. And I think it's clear here. In the long run, if we take data going back several decades, the real inflation-adjusted commodity prices are rising, and the rise is statistically significant.

But what can we actually examine about these trends?

At our department, we are carrying out research into some of the relationships between market prices of primary raw materials, market prices of secondary raw materials and the related process of introducing circular production chains. Overall, the pressures on circularity can be divided into two types. The first one is the much-discussed, only partly market-based, essentially a directive and normative one, which is driven primarily by the desire to limit emissions. Here, political power fulfils a specific mandate from the electorate to protect nature and the planet. The second set of pressures is essentially market-based. Here, governments are showing some effort to dynamise these processes, but the prices are the main forces in this case. The scope for research here is huge and it is a really exciting area.

What about the current level of circularity, how effective is it and how much is it supported by subsidies and other instruments?

This is subject to research because it is really not easy to tell. However, even though it may seem surprising at first, it can now be said that most of the circularity achieved (in developed countries) is consequently efficient, as it is done at lower costs than what would be reported in a linear production. The other part is the result of subsidy policies, regulatory measures, standards-setting and other procedures. From a purely economic point of view, it is therefore inefficient – it reduces the profits of producers, puts pressure on public budgets and has other negative economic effects in this sense. It is important to bear in mind that circularity essentially involves not only the recycling of raw materials but also being emission-free among other things.

If we ignore the impact on the functionality of economic relations – what degree of circularity are we able to achieve?

That's a very interesting question that I cannot answer at the moment, and probably nobody can. Anyhow, purely technologically we are able to achieve a much higher level of circularity. However, the rate will vary greatly from sector to sector. But let's now speak in general terms of 'the whole economy', in which case I will give the general answer that the rate is indeed much higher technologically. The question is how much it would cost, how much more expensive it would make products from these recycled materials.

What functional test statistics can tell us

The new concept of statistical testing introduces more certainty. Today, statistical testing is an integral part of all scientific disciplines. It is a tool used to test hypotheses in the social and natural sciences. Therefore, statistical methods are an important field of study and a cornerstone of research. But even this cornerstone of research is also currently undergoing an innovation process. One of the new methods was recently introduced by a team of authors, at the centre of which is Tomáš Mrkvička, an employee of the Faculty of Economics of the University of South Bohemia. The so-called global envelope method can be used in all scientific disciplines. For simplicity, the authors demonstrate it on the example of warming.

Why did you choose warming to demonstrate your method?

We originally invented the method of global envelopes on point processes, but they are not so easy to grasp, they are harder to imagine. Point processes are, for example, trees in forests, where I record their positions, but also stars in space or the centres of tissue cells. In short, any point pattern in space. Gradually, we found that our method is widely applicable and we began to look for other uses – one of them is functional testing of trends and differences. And we chose warming because we had the needed data. In other words, I'm not making any

global conclusions about warming, I'm just showing the methodology.

What was your initial hypothesis?

We worked with the hypothesis that there has been no warming in a certain area in the last thirty years. If we want to use classical statistical testing for this hypothesis, we usually gather all the information about it and then construct one one-dimensional statistic, i.e. one number. The statistical test then declares that the value of such a one-dimensional statistic is significantly different from the values that this statistic should achieve under the validity of the



doc. RNDr. Tomáš Mrkvička, Ph.D.

studied mathematics at Charles University in Prague. In 2011 he obtained a habilitation in statistics. Since 2011 he has been working at the Department of Applied Mathematics and Informatics of the Faculty of Economics, University of South Bohemia. At the centre of his professional interest are stochastic geometry, statistics of point processes and random sets, spatial and general statistics. He is the guarantor of the Bachelor's and Consecutive programme Analysis in Economic and Financial Practice at the USB Faculty of Economics.

tested hypothesis. We then reject such a hypothesis. Or the test shows that the value of the test statistic does not differ significantly from the values that it should reach under the validity of the tested hypothesis, in which case we do not reject such a hypothesis.

However, the yes/no conclusion of the test is somewhat flat and sometimes even insufficient.

Let's imagine that we have the annual course of water reservoir temperatures for the last 30 years in our example, and let us ask in which season the warming occurs and in which it does not.

This question will generate 365 hypotheses, one for each day of the year, which we can test one by one. But then we can be almost certain that we will erroneously reject some hypothesis.

Why?

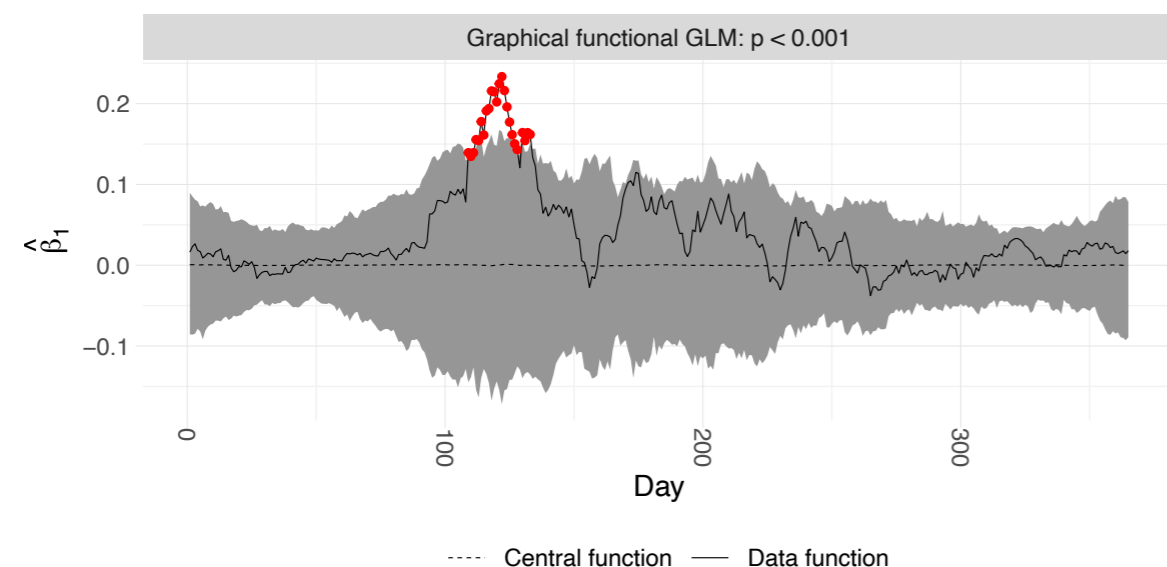
Because every statistical test usually erroneously rejects hypotheses in 5% of cases. However, for the 365 tested hypotheses, we will erroneously reject one of the hypotheses in almost 100% of cases.

I will try to explain this on the example of testing for Covid-19. Throughout the country, you do 50 000 tests a day, and each of them has an error rate of, say, 5%. Think of how many people will be wrongly identified as positive. And we don't want that.

We want to make a test that would say that I made one mistake only in 5% of 50 000 people. We simply want to limit the possibility of any error occurring.

So how is the global envelope method different?

In that it solves the problem of multiple testing if the test statistic is multidimensional (functional). In our example of warming, the test statistic is actually 365-dimensional. The envelope is constructed in such a way that the functional test statistic leaves this



The global envelope for 365 days in a year and the tested hypothesis of no global warming are shown in grey. The black line represents estimated test statistics and the red points represent test statistics in which we can reject the hypothesis of no global warming based on the global envelope.

envelope at least at one point in exactly 5% of cases, assuming the hypothesis is valid – in our example, assuming that there is no warming. In our considered example, the global envelope determines in which time periods warming occurs by the test statistic leaving the global envelope in those periods. At the same time, however, we are sure that we will make at least one erroneous rejection in only 5% of cases.

If we look at the graph, what conclusions did you reach using the method?

The global envelope for 365 days a year and the tested hypothesis of no warming are shown in grey. The estimated test statistic is shown in black and the red points are test statistic points, in which we can reject the no-warming hypothesis based on the global envelope. In addition, we know exactly when the warming took place, in this case sometime around the 120th to 140th day of the year, which is in May.

You monitored warming for one particular reservoir. Is it possible to monitor it on a global scale?

Tests for the whole planet use very similar methods. Ours could be used, but I do not have the necessary data. I would have to have a million positions on the planet and then I would observe the same, that is, in which positions the trend comes out of the envelope.

You claim that this method can be used in practically all scientific fields. Can you give an example?

We used it in economics, it can be used very well in chemistry in the study of DNA. It is very widespread in spatial statistics, where we had around a hundred citations last year. It is also used in neuroimage analysis in healthcare.

What are you currently working on?

My colleague Mari Myllymäki and I are currently using our global envelope method to detect dangerous traffic areas, specifically to identify high-risk crash locations for motorcyclists. It is a classic example of the point process I was talking about, in this case on the road network. Our data are the crash locations of bikers.

USB Faculty of Economics contributes to greater fairness in international trade by developing fair trade

Fair trade is a way of trading that gives small-scale growers, artisans and workers in the Global South (i.e. countries in Africa, Asia and Latin America) the opportunity to earn a living from their own labour under decent conditions. So if a consumer buys a fair trade product, they can be sure that it is not, for example, based on abusive child labour, inhumane working conditions or environmental devastation. In April 2013, the Faculty of Economics of the University of South Bohemia was awarded the status of Fairtrade Faculty, the first-ever faculty in the Czech Republic. It even became the first fair trade site at universities in Central Europe. The topic is being further developed in the form of lectures and research by doc. Ing. Kamil Pícha, Ph.D., MBA, from the Department of Trade, Tourism and Languages of USB Faculty of Economics.

Can you first briefly explain how the fair trade movement came about?

Its origins are essentially undated: there are several stories generally told, perhaps the most quoted being the founding of a non-profit business organisation in the USA in the 1940s. Its founder was surprised by the poverty she witnessed during her trip to Puerto Rico. This organisation began buying lace and later other

handmade products from local residents in Puerto Rico and offering them on the US market. It has gradually developed a network of similar 'suppliers' from the so-called developing countries, now referred to as the Global South, with the aim of creating market opportunities for adequate monetisation of products from developing countries and thus improving the economic position of local producers.



doc. Ing. Kamil Pícha, Ph.D., MBA

At the Faculty Economics and Management of the Czech Faculty of Agriculture in Prague, he graduated in Operations and Economics and an extension course in European Agrarian Diplomacy. During his doctoral studies, he further specialised in the field of food trade and food marketing. From 2008 to 2011 he was the head of the Department of Trade and Tourism at the USB Faculty of Economics in České Budějovice. Since 2019 he has been the Vice-Dean for International Relations. He has completed several study stays abroad. His scientific research has long been focused on consumer behaviour in the area of consumption of products and services, which also affects tourism and regional development. Its scope includes, among other things, environmentally friendly and socially responsible behaviour. He is the editor-in-chief of Deturope (The Central European Journal for Regional Development and Tourism).

Which means paying producers for their work in a way that is fair.

Yes. The initiators were driven by the knowledge that very cheaply bought goods are sold on the markets of developed countries at prices many times higher, while producers find it very difficult to provide for their own and their families' basic needs, and humanitarian aid is often provided from developed countries in that direction. The basic reasoning is that fair remuneration for their work (and therefore a fair price paid for the purchase of products) will improve their standard of living and remove their

dependence on 'handouts'. Fair trade, in short, is a trading partnership that seeks greater fairness in international trade. It offers better conditions for buying goods from producers in developing countries and also better conditions for their potential employees. Later, requirements for respect for human and labour rights and environmental friendliness were added to fair trade conditions.

How is this idea being implemented?

The advocacy and dissemination of the idea of fair trade is a social responsibility activity, the promotion of which is now considered a significant undertaking even among business entities. The World Fair Trade Organisation (WFTO) was established in 1989, and there are also national umbrella organisations. In our case, it is Fair Trade Czech Republic and Slovakia with which our faculty is in regular contact. The WFTO and its member organisations spread the idea of fair trade through various campaigns, including Fairtrade City and Fairtrade School. The first fair trade school status in the Czech Republic was granted in 2012.

Which brings us to your faculty...

My colleague, doc. Ing. Hana Doležalová, Ph.D., suggested in 2012 that the Faculty of Economics could apply for this status. Five criteria had to be met to qualify for the award: the existence of a steering group to promote fair trade at the school; official faculty support for fair trade; availability of fair trade products; courses focused on global development issues; and organisation of events to promote fair trade and media outreach efforts. We succeeded in those, and therefore we became the first fair trade faculty in the Czech Republic. Our efforts later inspired other faculties and universities in the Czech Republic. For example, we 'outperformed' the Faculty

of Tropical Agriculture of the Czech University of Agriculture in Prague, which has long focused its courses and research on developing countries. Since the Czech Republic responded to the trend of fair trade schools very quickly and our faculty joined the call immediately, it became the first fair trade institution of higher education in central Europe in 2013. Other universities or faculties obtained this status later. The USB Faculty of Economics achieved another success relatively soon afterwards when its students won the Fair Chocolate competition in the university category with a computer simulation game called For Fair Chocolate. The game is designed primarily for educational purposes, targeting primary and secondary schools, and introduces the issue of fair trade in an entertaining way.

How are you developing the topic further?

Already at the time when we were pursuing this status, issues of fair trade had been included in the curriculum for several years and it was the subject of a number of bachelor's and master's theses and small research projects. The topic is also being explored in a dissertation, which is currently in progress. The topic of fair trade is currently included in the instruction of the course entitled Trade Fundamentals and Fundamentals of Corporate Social Responsibility. A course called Fairtrade, taught by Associate Professor Doležalová, is an elective course at the faculty. Teaching is interactive, students are taught about individual commodities traded within the fair trade framework, specifics of target markets of selected countries whose consumer demand supports fair trade significantly. They perceive the position of producers, women and children in source countries for products traded under 'fair trade'.

Where is it possible to get a clear idea of what fair trade actually means?

In Hall F we have a specially designed classroom F3. On its walls, students and other visitors to the educational and conference activities can learn about the essence and basic principles of fair trade, as well as about specific examples related to trade and the formation of the selling price of selected commodities. Of course, you can refresh yourself with fair trade coffee and other products at the faculty. In 2012 we took the initiative and started selling fair trade products in Café AL in the USB Academic Library. In 2013 the offer was expanded to include a coffee vending machine at the USB Faculty of Economics and a vending machine (dry food) at the USB Faculty of Science, but it was unfortunately discontinued. Receiving the opportunity to use the fair trade Puro machine from Miko káva to offer hot or chilled drinks and snacks since March 2014 has been a great success. The vending machine, which is located on the ground floor of the main building of the Faculty of Economics, in a room that also offers short-term seating, serves primarily the staff, students and other visitors to our faculty.

The role of the school is not only to educate but also to raise awareness. How are you doing that?

For example, during the Researcher's Night and similar programmes that are intended for the public, or during events for prospective students, we include an educational programme called 'Fair Trail'. Every year our faculty also participates in the most important Czech event to promote fair trade and responsible consumption called Fairtrade Breakfast. Fair trade became one of the topics of the book Corporate social responsibility in current trends and context (2012), which focused on retailers. Last year, the book

Fair Trade: A Challenge for All, written by Associate Professor Hana Doležalová, was published by Grada.

In simple terms, I feel that fair trade opens new horizons both from the commercial perspective as well as the perspective of living conditions in other countries. It provides information and inspires reflection on the ranking of values. Figuratively, I would say that it opens wallets and hearts.

Can we say that?

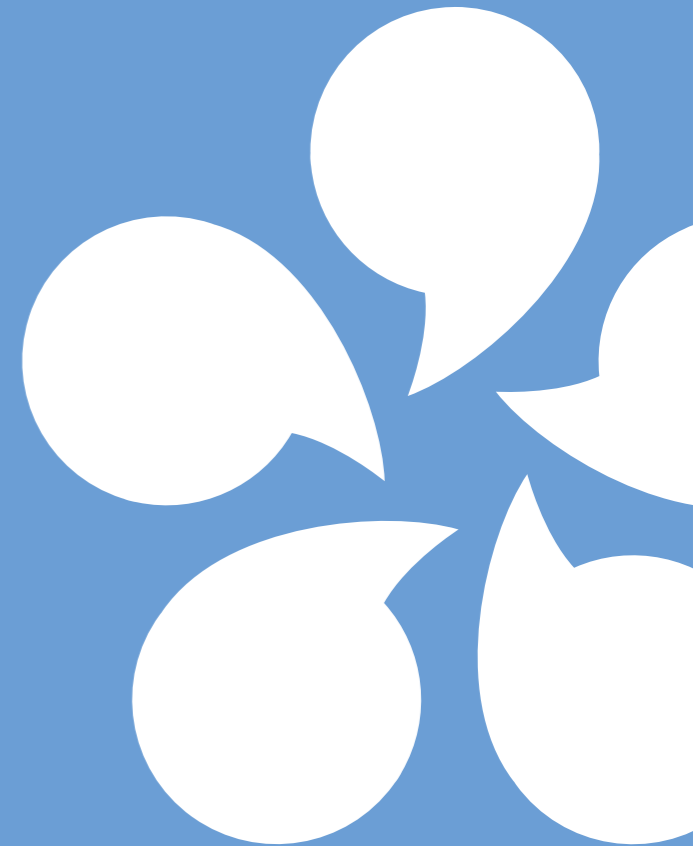
Yes, you can certainly say that. And it certainly appeals to a certain group of consumers with that mindset. On the other hand, the efforts of traders and the efforts to offer these products should be mentioned. Consumer surveys show that many consumers buy fair trade products without being aware that they are certified as such.

How has the Covid-19 pandemic affected fair trade?

At that time, there was no one to offer these products to, as students did not have access to the faculty building at all and teachers mostly worked from home. It was also not possible to take advantage of the fair trade classroom F3 because courses were only online. However, we need to continue spreading the idea and educating students, as the pandemic situation may divert attention from similar activities and projects. Moreover, it is possible that trade in fair trade products will suffer from similar problems just like international trade in general. While in most areas of international trade it is mainly the demanding countries that are harmed by the lack of inputs for their own production, in the case of fair trade, the more significant damage from the reduction of sales can come in the source countries, leading to a reduction of producers' incomes and the deterioration of their living conditions.

Faculty of Arts

www.ff.jcu.cz



Between the Middle Ages and the Renaissance. The ascent of the Habsburgs to the Bohemian throne.

The Renaissance backdrop of Český Krumlov brought Professor Václav Bůžek, a historian, first to the history of the lower and higher nobility on the threshold of the modern age, and later to his key research field at the courts of the first Habsburgs on the Bohemian throne. The Director of the Institute of History of the Faculty of Arts of the University of South Bohemia uses the methodological foundations of structural analysis and historical anthropology to study the representation of Habsburg rulers, reflecting their Catholic faith, political power and dynastic memory. Among other things, he sees the chosen path as an opportunity to deconstruct the distorted image of the Habsburg rulers in the historical consciousness of the general public. He led an international team of authors who published a comprehensive synthesis of the Habsburgs: 1526–1740. Lands of the Bohemian Crown in the Central European Monarchy (2017).

Why did you choose the early modern period in the Bohemian lands for your research?

I have been living in the Renaissance backdrop of Český Krumlov since birth, and as a student, I used to be a tour guide at the castle there. In addition, I had an excellent teacher of history at the Kaplice grammar school, Zdeněk Rohlíček, who recommended me to read popular educational books about the 16th and 17th centuries. At the

Faculty of Arts in Prague, I attended the seminar of Professor Josef Petráň, whose view of the politics and culture of the early modern period I found to be very close to my heart. Under his guidance, I chose the early modern period as my research field, initially the cultural and political history of the nobility, now the Habsburg rulers, their courts and representation (1526–1620). I have been fascinated by the early modern period for more than forty years – I see it as



a turning point when the medieval world was leaving and the Italian Renaissance was arriving, the ways of communicating were changing, people were travelling more and looking for new patterns not only in culture and politics but also in the way people thought. Unravelling the web of complex interpersonal relationships in the 16th and 17th centuries is incredibly exciting!

Do you think that this period has been sufficiently explored by Czech historiography?

The post-Soviet era brought new possibilities for research into the history of the early modern period;

prof. PhDr. Václav Bůžek, CSc.

studied history at the Faculty of Arts of Charles University in Prague and was appointed professor of Czech history at the proposal of the Scientific Council of Masaryk University in 1999. In 2004–2011 he served two terms as Rector of the University of South Bohemia in České Budějovice. He is currently the Director of the Institute of History at the Faculty of Arts of the University of South Bohemia, where he lectures on the history of the early modern period, the history of everyday life and the methodology of historical science. At the same time, he is the head of the faculty research centre Habsburgs in the Czech history of the early modern period. He is the author or co-author of two dozen monographs and two hundred scholarly studies. His international cooperation has long focused on German and Austrian universities. He has received several important awards for his work (2011 – Silver Commemorative Medal of the City of České Budějovice for outstanding merit for the development of university life in České Budějovice; 2019 – Medal of the Minister of the Interior for merit for Czech archives).

with the fall of the Iron Curtain, new methodological approaches from Western historiography began to appear in our country – the structural concept of the history of mentalities and historical anthropology. I see their intersection as a promising way to ask

new questions about topics that had previously been left out of the spotlight. It was not only Church history – the Habsburgs on the Bohemian throne were also among the blind spots. Their research in recent decades has been made possible by the study of sources stored in foreign archives, especially in Vienna, Innsbruck, Munich, Simancas and the Vatican, where Czech researchers were not allowed to go before 1989, with a few exceptions.

How did the Habsburgs actually find themselves on the Bohemian throne in 1526? Ferdinand I was the husband of Anne of Bohemia and Hungary, and therefore had a claim to the throne after the death of Louis II of Hungary, but perhaps he still could not be sure of anything?

There were indeed more people interested in the St. Wenceslas Crown. In addition to several local noblemen, among whom Zdeněk Lev of Rožmitál had a certain chance, there were the Jagiellonian prince, the Bavarian and Saxon dukes and the Archduke Ferdinand. The inheritance claims of his wife were recognized only by the estates in the neighbouring lands of the Bohemian Crown, i.e. from Moravia, Silesia, Upper and Lower Lusatia. The estates of the Kingdom of Bohemia elected him freely. Before he was crowned, he had to sign electoral capitulations in which he confirmed to the estates a number of traditional freedoms, and the Basel Compacts, which allowed Hussite priests to administer Holy Communion under both kinds. The Turkish danger was distant from Bohemia for the time being, and few nobles acknowledged its seriousness at the time.

The key issue at that time was the question of religion. Were the Czechs really a 'heretical' nation? From the point of view of the Roman Curia, they

undoubtedly were, because the Kingdom of Bohemia was the cradle of the Hussite Revolution, in principle the first European Reformation, and that was a hundred years before Martin Luther appeared with his criticism of the Catholic Church in the Roman-German Empire. At the Council of Basel in 1436, a compact was adopted allowing Holy Communion to be received under both kinds. Its validity was abolished by the Pope in 1462, but this did not end the permitted religious dualism, because the Bohemian king, unlike the Holy See, recognised the right of Catholics and Utraquists to an individual choice of faith. In 1485 the Basel Compacts confirmed the religious peace of Kutná Hora in Bohemia. But this only involved Utraquists, while in the meantime, Lutheran influences were appearing in the country and there were followers of the Unity of the Brethren, which was officially banned. When the Basel Compacts were erased from the 'land tables' in 1567, the search for a way to religious freedom for non-Catholics was put on the agenda of the states and the monarch with all urgency. But this had already exceeded the reign of Ferdinand I arriving with re-Catholicisation.

Was the period of re-Catholicisation so harsh? It probably was harsh during the time of Ferdinand I, but his son Maximilian II is even said to have established relationships with the Lutherans. In fact, he allowed the Bohemian Confession.

Under Ferdinand I, the re-Catholicisation was just beginning, it certainly was not severe by any measure at that time, there was still a majority of non-Catholics and a great degree of religious freedom. It was only after the publication of the Restored Land Constitution in 1627, which only allowed Catholicism, that the re-Catholicisation took a dramatic turn.

You are right about Maximilian II. All his life he claimed to be faithful to the Roman Church, but he was religiously undecided. There are testimonies that he was close to Lutheranism, and some people in his close circle were among the followers of the Reformation. This, of course, bothered his wife Mary, a very devoted Catholic, who checked on his deathbed that her husband indeed died a faithful Catholic, made a confession, received the Eucharist and received the sacrament of last rites. One of his courtiers remarked that Maximilian II had left the earthly world as a faithful follower of the Catholic faith, sincerely regretting all his earlier actions by which he had 'offended God', i.e. his aforementioned inner religious ambivalence. Maximilian II allowed the Bohemian Confession only verbally when he was demanding a counter-service from the Bohemian estates – which was to agree to the coronation of his son Rudolph. But then he immediately banned it.

In your last book, you are dealing with the deaths and funerals of Ferdinand I and his sons. Why this topic?

For two reasons. They were all very sick towards the end of their earthly life. I followed the testimonies of those closest to them at the time of their illness. I wondered how the disease affected their ability to make decisions and govern. I wanted to know how they themselves perceived their illness and impending death. The second set of questions I asked myself was related to the representation of faith, power and dynastic memory, which was symbolised by the social body of the deceased at the funeral; unlike his biological body, it did not end up in the coffin but permanently referred to the continuity of Christian values of the Habsburgs. Since the book was published not only in Czech but also in a German

translation by Böhlau, the topic could enter the ongoing European discussion on the representation of the monarchy in the early modern period.

What made you interested in Maximilian's brother Ferdinand of Tyrol about whom you have also written a book?

From 1547 to 1567 he was governor of the Kingdom of Bohemia, where he represented his father Ferdinand I, who was then more concerned with Hungarian politics and the Turkish danger and, therefore, he was based in Vienna. His second-born son came to Bohemia at a crucial moment, when the Middle Ages were ending and the impulses of humanist and Renaissance culture were arriving of which he made the most. It is enough to mention the construction of the Hvězda summer palace, knightly tournaments, hunts and chases. He was always surrounded by a noble society, whose leaders and their views on politics and culture interested me. When he became the ruler of Tyrol and Lower Austria, he settled in Innsbruck and Ambras, where he was visited by nobles from many European countries, including lords and knights from Bohemia. He used the famous drinking parties, chamois hunts and shooting competitions to establish links between the nobles and his court, to win them over for the goals of Habsburg policy, to strengthen the Catholic faith. The Renaissance cultural patterns, the architecture of palaces and castles, the gardens with aviaries, fountains and beds of exotic flowers came from Italy to central Europe via Innsbruck, Munich, Prague and Vienna. Rudolph II found all this in Prague when he moved there from Vienna with his court in 1583. On these foundations grew the magical universe of his residence on the border between the Renaissance and Mannerism.

From utopian heights to totalitarianism. Scholars map the history of Czech literature in a revelatory way

'There are endless ways to interpret history,' says literary historian Professor Vladimír Papoušek. The head of the Institute of Czech Studies at the Faculty of Arts reflects on the possibilities and limits of literary theory and history in his research. He is the main initiator of an ambitious project that resulted in three volumes of the History of New Modernism, which maps Czech literature between 1905 and 1947. The team of authors applies an unorthodox methodology that presents Czech literary and social reality in a revelatory way. In 2011 the team of authors led by Vladimír Papoušek received the Magnesia Litera Award in the Non-Fiction Literature category for the first volume.

The third volume of the History of the New Modernism ends in 1947. Do you have any ambitions to continue the project and cover the literary development of the second half of the 20th century?

Yes. We are preparing Volume 4, which will focus on the 1950s. We suffered quite a lot because we had to read a lot of novels on the topic of building socialism and exalted regime poetry, watch really bad films. The 1950s were unfortunate for Czech culture but interesting in terms of symbolism. The agenda was

building collectivity and monumentality. Society was to function as a perfectly tuned, giant musical instrument. Notice how often there is singing in the period films, how much choral singing and folk dancing there is. Like in *The Proud Princess*.

But there were also those who did not want to take part in the 'period dances'.

For example, Jiří Kolář, Bohumil Hrabal or Josef Škvorecký. They were not very harmonious in the



prof. PaedDr. Vladimír Papoušek, CSc.

studied Czech Language and Literature and Art Education at the Faculty of Arts of the University of Bohemia in České Budějovice. In 2006–2010 he was the director of the Institute of Czech Studies at the Faculty of Arts of the University of South Bohemia. In 2011–2019 he was the Dean of the Faculty of Arts at the University of South Bohemia, since 2019 he has been the Vice-Dean for Science and Research. He has held several residencies at Columbia University and New York University and has been publishing extensively at home and abroad. He specializes in Czech literary history and theory, Czech literature of the first half of the 20th century and the methodology of literary history. He also focuses on these topics in his teaching activities at the Faculty of Arts of the University of South Bohemia. He is the author of several important monographs on Czech exile authors, existentialists, and avant-garde research. He is the head author of the team of authors working on the History of New Modernism.

harmonic machinery. They emitted dissonant tones that eventually contributed to the unravelling of the whole ensemble. But that's talking mainly about the 1960s, which were much more attractive in terms of literary quality.

The three volumes of History bring a new perspective on the Czech literary development in the first half of the 20th century. In what way?

The main motto was to try out different alternatives to write history. The traditional notion is based on

the premise that one can write an absolute history of literature that will cover everything. That's an illusion. Always and in every period, there will be cracks, gaps as well as subjective interpretations in such a project. Each author has his own language, style, point of view and sometimes even original methodological approaches. We have, above all, abandoned the illusion of completeness and objectivity. We approach each of the books as a kind of experiment in writing literary history. For example, we approached the first part as cross-sections of literary development over the area of one year and followed these 'cuts' through the whole examined period. At the same time, we wanted it to be readable.

The first volume won the Magnesia Litera Award, so it was probably a success. What findings did you come to while researching Czech literature of the first half of the 20th century?

This is related to the poetic subtitles of the individual volumes, which also remind us of the artistic inspiration of our treatises. The subtitle of Volume 1 is 'Refractions of Verticals'.

Modernist thinking has always followed a vertical on which a new reality was to be realised. Modernists perceived the world from a utopian perspective. But this ideological vertical began to collapse at the time of the rise of totalitarianism.

The 'Age of horizons has arrived', as the subtitle of the next episode reads...

There was a period of crisis, especially during the occupation, when what had previously been directed upwards in the imagination suddenly disappeared and everything settled into a kind of horizontally immobile flat surface. Karel Čapek died, Vladislav Vančura was executed by the Nazis, Voskovec and Werich emigrated, as did Egon Hostovský and the prominent linguist and literary scholar Roman Jakobson. The era of mediocre writers who quickly filled the vacant space arrived.

New modern trends came from abroad. To what extent was the Czech cultural scene open to external influences and where did it draw inspiration from?

The degree of openness to foreign influences in the first half of the twentieth century was comparable to the present day. There was a strong inspiration from French literature in particular but also from Anglo-American literature. Translations have always been essential for Czech literature. We have a tradition of great translators. Thanks to this, Proust, Joyce and Woolf were already being translated here in the 1930s. After the events of February 1948, however, the communists came and turned the helm eastwards.

However, the familiarity with Western literature had already become too great, and the communists encountered a surviving tradition that rather sprang from Western influences.

The first half of the 20th century is a time of great names in Czech literature – there were the Čapek brothers, Nezval, Vančura, Olbracht, Hostovský. How did the then social status of a writer differ from that of today?

It's a radical transformation. The notion of an author as a creator of a work of art was established especially in the Renaissance and reached its peak in the nineteenth century and perhaps also in the early twentieth century when the author's imagination was considered to be an extraordinary gift. Writers became the spokesmen of the nation, or at least of a certain community, and represented the elite. We are currently at a point where this extraordinary evaluation of an author or work seems to be disappearing. The high and the low are being levelled out. Many literary products only pretend to be important. It is becoming increasingly difficult for readers to navigate through the flood of titles being thrown onto the market. Authors are often active rather in subcultures today and their influence in the public space is declining. Let's not complain. Cultural metamorphoses come in waves and the future is never predictable, so an unexpected turn may occur at any time.

During your research, did you discover any authors that were exceptional, but slipped through the cracks?

I have always enjoyed exploring the way canonical authors are determined. What leads to someone being declared a great writer and someone falling

into obscurity. This is not always related to an immediately recognised quality. For example, Jaroslav Hašek and Ladislav Klíma were not considered very important writers in their time. Their entry into the canon of Czech literature took place much later and rightfully so. But there are also authors who were of high quality but remained outsiders, almost nobody knows them today. This is the case, for example, of the highly controversial writer and actress Olga Barányiová or Vladimír Raffel, a pioneer of the Czech modernist short story with fantastic elements. Raffel wrote in a completely different way from the others, going against the norms of the time.

Was this also the aim of the History of the New Modernism? To reconsider the already established ideas about literature?

Even as a student in college, I had a problem with predetermined 'truths'. When the maths teacher presented the problem beginning: 'There is a straight line from point A to point B,' I asked, nonsensically in terms of school geometry: 'And by whom was the straight line given?' Such a question makes sense in philosophy. In our literary consciousness, many things are labelled and classified as if in some imaginary stagnant catalogue. The purpose of our team's work is to rid literary history of such labels so that we are able to ask new questions and find new problems to solve.



Linguistic research cannot do without computational methods

Humanities are strongly linked to the development of computer technology. In order to keep up with the times, they need to develop research that is generated using computational methods. 'They are no longer just trivial statistical programmes, but they allow us to analyse the semantic molecules of a text and model textual meanings based on that. The meaning in the text is always shaped by the surroundings,' says Associate Professor Ondřej Pešek from the Institute of Romance Studies at the Faculty of Arts. The possibility of converting texts into an electronic form and subsequently processing them by computer has opened new horizons for linguistics and significantly deepened its cooperation with artificial intelligence research. 'Artificial intelligence is trying to get as close to communication between humans as possible. However, communication between humans is complex and multi-layered. It is therefore important to learn how interpersonal communication works in natural language so that we can improve artificial intelligence models using this knowledge,' adds Ondřej Pešek.

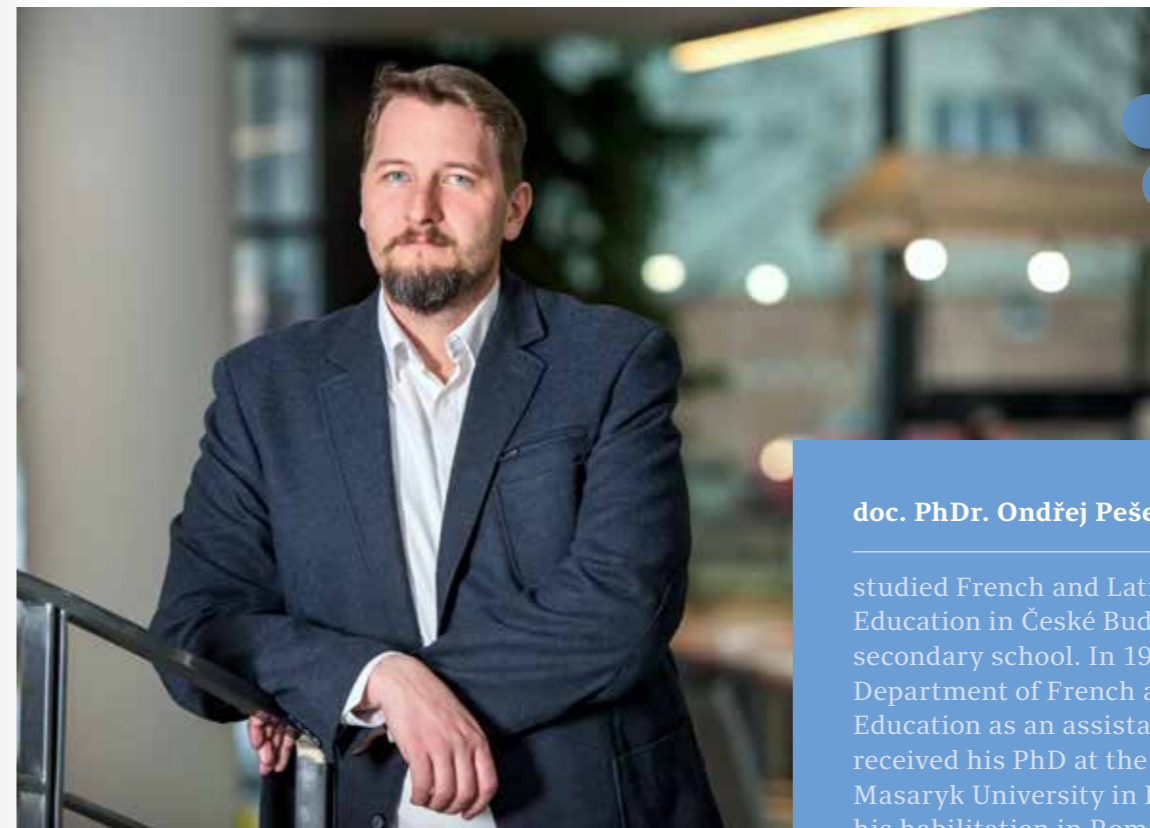
Humanities have interesting future applications, whether it is artificial intelligence, data mining or developing algorithms for text analysis. How does this translate into linguistic research?

Fundamentally. Language is the supreme manifestation of human intelligence. It implies that when developers design artificial intelligence models today, they must necessarily draw on the language and how it works. Nowadays, linguistic research is very closely linked to computer science research.

The knowledge we have about language and natural language communication is then translated by computer scientists into algorithms and computer-intelligible notations.

Why is it important to link linguistics with information technologies? What is the advantage of a computer over a human analyser?

In linguistics, the primary concern is the creation of theories and models of natural language, which is



doc. PhDr. Ondřej Pešek, Ph.D.

studied French and Latin at the Faculty of Education in České Budějovice after finishing secondary school. In 1999 he joined the Department of French at the USB Faculty of Education as an assistant; six years later he received his PhD at the Faculty of Arts of the Masaryk University in Brno. He completed his habilitation in Romance Languages at the Faculty of Arts, Charles University in Prague in 2012. At the USB Faculty of Arts, he works on French and Romance linguistics. His areas of interest include the syntax of contemporary French, diachronic French syntax, textual and general linguistics. Since 2013 he has been involved in the management of the faculty as Vice-Dean for Studies, and he has been the Dean since January 2019. He is also a Knight of the Ordre des Palmes académiques, France's award for services to education, science and culture.

essentially independent of whether a computer can understand and accept those models. At the same time, the computer can greatly help us in visualising language data, in the actual creation of models, and in the extraction of language data. A computer has several major advantages over a human analyser. It enables fast and accurate processing of large amounts of data. In a fraction of a second, it goes through millions of words, sentences and texts, and it quickly finds what we need, it doesn't make mistakes

in its search, it doesn't overlook anything, and it does not get tired. Contemporary linguistic research simply cannot do without computers.

So the manual browsing of texts which involved linguists themselves reading hundreds of lines of text and transcribing the results into paper filing cabinets, is a thing of the past?

Not entirely, the human factor is always crucial. When we consider corpus-based linguistic data mining, we have ever-larger databases of text that can be searched using corpus managers. These applications can search for different types of linguistic means and forms in a very sophisticated way. However, the researcher must always know what they are looking for in the text. Therefore, the human factor is irreplaceable.

You mentioned the term corpus, which is a fundamental element of computational linguistics. What does that mean exactly?

In the most general terms, a corpus is a collection of texts that a linguist analyses, whether he/she is using a computer or not. In computational linguistics, the term corpus most often refers to large representative corpora such as the Czech National Corpus or the British National Corpus, which contain billions of words across annotated texts of various genres and are equipped with advanced search applications. A corpus approached this way and that is ever-expanding captures a significant part of the usage and allows to verify the occurrences of a specific structure in the language easily and quickly. Owing to their breadth and representativeness, these corpora provide objective evidence on the basis of which it is possible to formulate generalised conclusions about the language system. Nowadays, it is a fundamental

resource for linguistic research, so our students are encouraged from the very beginning to work with corpora, to learn how to query them correctly and to be able to evaluate the data. We have even introduced a course in Corpus Linguistics and Computational Linguistics, which is compulsory in all philology bachelor's programmes.

But if a linguist wants to analyse the finer meanings in a text, can they make do with large corpora?

No, they cannot. Today's quantitative linguistics is increasingly using smaller sets of texts defined in terms of genre or otherwise, compiled individually for each specific analysis. While analyses of morphological structures or analyses of emerging words and phrases tend to use large representative corpora, in the case of analyses of textual meanings and textual themes it is advisable to work with smaller corpora, compiled for the purpose of a specific analysis. In practice, therefore, the selection and compilation of a corpus is always the most crucial initial task of analysis for the researcher. The next step is the selection of a computational tool, i.e. a programme whose functionalities allow to perform the required search, statistical and display tasks. Currently, the range of these tools is wide and the choice of a particular tool depends on the phenomena the researcher wants to observe and analyse.

What other advantages do computer applications have for linguistics?

Another important area of computer use consists of tools we call annotation. They can automatically process the phenomena we are interested in, sort them according to the specified parameters and then display them clearly in tables or graphs. Previously,

all linguistic phenomena were written out on cards, statistics were calculated manually and data were stored in filing cabinets. The advantages of computer tools are therefore obvious, and each such analysis takes us further, allowing us to ask more questions. At our faculty, we have responded to this trend by building a special classroom for students with the latest hardware and software equipment that allows research and instruction to be closely linked. Another advantage of computer tools is the possibility of interesting and high-quality imaging methods. The computer can present the language data in the form of clear graphs, functional images or even 3D animations.

Can you give an example of linguistic research that your teams are engaged in?

One of the interesting areas of textual structure analysis that our Romance teams are developing is research into the acquisition of textual competence in Romance languages for non-native speakers. In this context, we are building electronic learner corpora, which contain the written production of our students, i.e. students of French and Spanish at the advanced B2–C2 level. Texts produced by students are annotated, and we are constantly improving the annotation schemes.

What do you use student corpora for?

They can be used to analyse errors at the morphological, syntactic and lexical levels. We concentrate on the specifics of textual phenomena, always grasped on the basis of general text theory: we look, for example, at the choice of terms in coreferential chains, which include articles, demonstrative pronouns, lexical anaphors and others. We are also interested in the use of textual connectors,

which are various connective expressions that link utterances within a text. This includes words like 'however', 'therefore', 'anyway' and the like. Another phenomenon observed is the level of syntactic complexity of sentences and paragraphs.

What conclusions have you reached? Does research into the acquisition of textual competence of non-native speakers also have an applied dimension?

From a theoretical point of view, for example, it is very interesting that our native evaluators often evaluate phenomena related to the sequence of sentences or structural complexity of sentences as errors. This means that the text of the non-native speaker is perfectly fine morphologically, lexically and sentence-syntactically, but the impression of 'foreignness' is given by text and structure peculiarities. Similar phenomena can be observed, among other things, when evaluating the success of automatic translators. Besides its relevance for basic research in the field of textual linguistics, this research activity has an important applied dimension: its results help improve the didactic approaches of FLE/ELE.

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How can we influence the breathing stereotype?

'Breathing technique can affect the performance of an endurance exercise by reducing the total breathing work and delaying fatigue of the respiratory muscles,' says Petr Bahenský, who is the head of the Functional Stress Diagnostics Laboratory at the Department of Sports Studies of the USB Faculty of Education. He focuses on the possibility of influencing the breathing stereotype.

You say that today's civilised man cannot breathe properly and few people breathe fully. Why?

Over the last few decades, the nature of our lives has changed dramatically. There is a change in movement and thus breathing stereotypes. Our current lifestyle contributes to the fact that we do not breathe naturally. Breathing into the abdomen, into the diaphragm, is significantly reduced. People often do not realize that the respiratory muscles are involved not only in breathing but also in the posture of the body. This causes various imbalances, muscle weakening and shortening. From my experience as a coach of adolescent athletes, I can say that very few people today can be classified as health group 1. Almost every person has some kind of minor scoliosis.

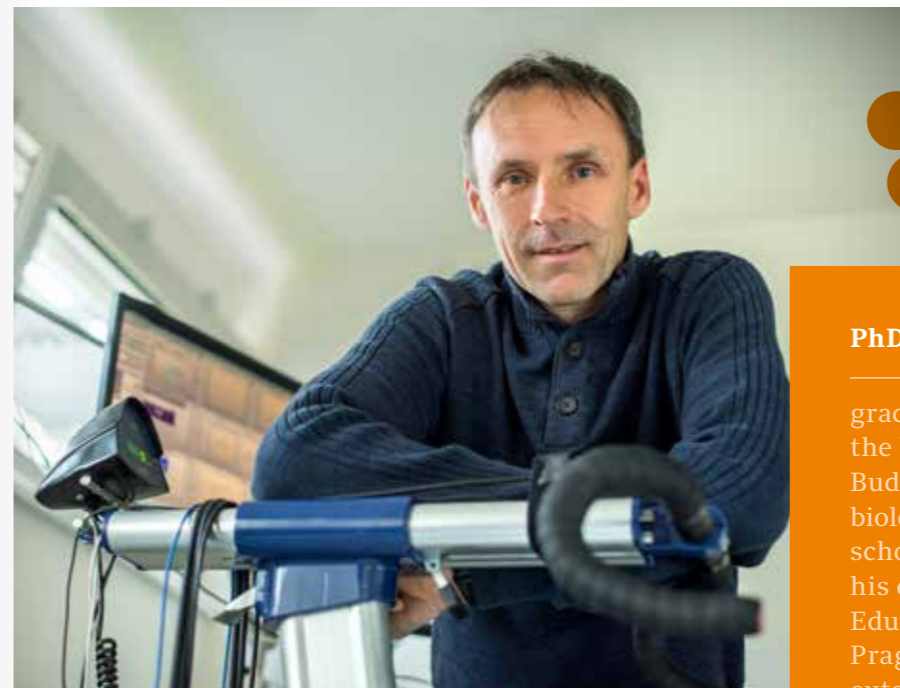
So why is it important for athletes, and not only for them, to breathe properly?

According to existing measurements, about 10% of the energy at maximum power is processed by the respiratory muscles. When we breathe badly, it can

be up to 17% of our energy. A difference of seven per cent can already play a significant role in endurance running, for example. As far as everyday life is concerned, improper breathing leads to faster fatigue of the respiratory muscles and can exacerbate these imbalances.

Many people will say that breathing is a natural thing, so what are we doing wrong?

Breathing is an involuntary activity, it is actually a basic life function. We acquire various imbalances throughout our lives, some of which may arise during pregnancy or childhood. How we breathe and move is partly genetic, partly determined by our lifestyle. If we sit inactive in a chair all day in the office, we can almost certainly expect problems, for example with our backs. We see this even in today's children, who do not have nearly as much spontaneous physical activity as they used to. The involvement of small and deep muscles is much less. All this affects the breathing stereotype.



PhDr. Petr Bahenský, Ph.D.

graduated from the Faculty of Education at the University of South Bohemia in České Budějovice (major in physical education and biology), he also graduated from a coaching school (class I athletics coach) and completed his doctoral studies at the Faculty of Physical Education and Sport at Charles University in Prague. Since 2004, he has been working as an external teacher at the Department of Sports Studies at the USB Faculty of Education, where he started working as an assistant professor in 2012. Since 2014 he has been the head of the Functional Stress Diagnostics Laboratory. His main professional interests are issues of breathing when exercising, high-altitude training of endurance athletes, training diagnostics and the possibility of influencing the training levels of athletes through modern technologies as well, e.g. through the use of the heart rate variability monitoring data, which allows the individualisation of the training load or the use of breathing exercises and restraints following Wim Hof just before exercising. This can induce a state of increased kinetics with VO₂.

In recent years, many people have been practising yoga or discovering the Wim Hof method. So are people's attitudes to breathing properly changing?

Athletes, especially endurance athletes, have long known that proper breathing promotes performance. When you breathe badly, you use extra energy. Other people are also beginning to realise the benefits of proper breathing. When we did breathing training with our students, a lot of them told me that their backs stopped hurting, for example. There are many techniques of corrective breathing, but we chose yoga because my colleague Renata Malátová deals with it didactically. She set up an exercise program and we used a breathing intervention based on the use of full breathing and sector breathing. In the future, we

want to try other methods to improve the breathing stereotype and compare their effectiveness.

There have been several studies in your lab on influencing the breathing stereotype. What came out of them?

One of the studies was carried out on students who enrolled in elective physical education with us, about 230 in total. In our functional stress diagnostics laboratory, we have a measuring device whose probes

are placed on the trunk of the probands – one probe is placed on the abdomen, the second on the chest and the third on the sternum. We found that almost three-quarters of the students tested did not use the abdominal sector during resting breathing, many of them even during deep breathing. In some of them, we subsequently tried to activate the diaphragm with a two-month intervention consisting of short exercises. After this time, we saw great progress in the next measurement.



Further testing was carried out on forty-six young elite athletes around the age of sixteen. What were the results?

We used the same intervention as in the students and tested the change of breathing stereotype at different intensities. We have shown that a 2-month daily intervention can change the breathing stereotype even at different exercise intensities, including submaximal exercise. At the same time, respiration became more efficient, which was demonstrated through changes in ventilation parameters. The result is a reduction in the energy expended on breathing. This research was published in the journal in Q1, as was a study looking at the effect of training load management in endurance runners at higher altitudes using data from daily monitoring of heart rate variability. Another paper we were able to publish at this level was looking at laterality in young footballers and finding associations between the amount of muscle mass in each limb, their strength and their preference while playing.

Are breathing exercises important for improving athletes' performance?

In another study, we investigated the effect of the Wim Hof breath-holding method on the performance of 45 young athletes. We divided the group into two parts, the first did a standardised test on the bike, the second did a standardised exercise according to Wim Hof. We cross-checked. We found that breathing exercise immediately before exercise increased the kinetics of oxygen consumption even in the peak phase of exercise. About 10% of the probands did not finish the test without breathing exercises, but with breathing exercises they did. Individuals who did breathing exercises before the physical exercise had subjectively significantly less fatigue and less objective heart rate load. So the exercises following Wim Hof are also relevant in performance sports.



Words as a mirror of personality

The relationship between language and personality has been studied in the professional psychological literature for decades. The CPACT project, whose principal investigator was Dalibor Kučera, head of the Department of Psychology at the Faculty of Education of the University of South Bohemia, also looked for links between people and words. In a study, he and his colleagues focused on how a person's personality traits are reflected in his/her use of grammatical categories of language. Dalibor Kučera also searches for the relationships between the specifics of the written text and the author's personality in another project called PoznejSe [KnowYourself] and summarises them in his book *Personality Markers in the Text*.

What linguistic categories did you focus on when looking at the relationship between language and personality in the CPACT project?

We were interested in formal analysis, that is, we were not primarily looking at meanings of words, nor did it have anything to do with graphology, which focuses on handwriting. The subject of formal linguistic analysis is mainly morphology, such as the grammatical person, number, and tense, as well as sentence structure – for example the use of punctuation or sentence length. In the project, we set almost 200 textual formal parameters. Our goal was to find relationships between these parameters in different types of communication and the personality of the speaker. To find indicators that tell us if, for example, an emotionally unstable person uses the first person singular, past tense, or longer sentences more.

What personality traits did you focus on?

On extroversion, neuroticism, openness, conscientiousness, and other similar characteristics. Participants were asked to produce six types of text in written and spoken form. They were asked to write a letter of complaint, a cover letter, a letter from vacation, a personal letter, or talk about their holiday and apply for a job. Each participant also completed psychological questionnaires so that we had something to compare the results of the formal textual analysis with.

What conclusions did you reach?

For example, the higher the speaker's neuroticism, the more he or she uses first-person pronouns, verbs, fewer indefinite numerals, and has a less rich vocabulary. For the openness parameter, the richness of vocabulary increases. But we also came



PhDr. Dalibor Kučera, Ph.D.

is a teacher and researcher in the field of general, social, and educational psychology. Since 2013, he has been working as an assistant professor and researcher at the Department of Psychology of the Faculty of Education at USB in České Budějovice, and as the head of this department since 2021. In 2016–2018, he was a researcher of a three-year research project of Czech Science Foundation (GACR), 'Computational Psycholinguistic Analysis of Czech Text', and in 2020 he was awarded a senior Fulbright-Masaryk scholarship of the J. W. Fulbright Commission for the project 'Personality Processes and Oral Communication'. He is a member of the board of the Czech-Moravian Psychological Society and the author of a number of professional publications.

to more important findings. The Project CPACT was the first comprehensive analysis of its kind in the Czech language. In contrast, many such studies have been published abroad, especially in the United States, since the second half of the 1990s. We asked ourselves whether the results related to English are also valid in Czech. And it has been shown to be so to some extent. The relationships between personality and text are often translingual in nature.

To what extent is it possible to obtain truly valuable information about the speaker's personality through formal analysis?

Related to this is another important conclusion we have reached. We thought we would find some

golden thread of parameters running through all the texts of a given speaker. That we will identify his idiolect, a kind of linguistic ‘fingerprint’. But it turns out that the links between text and personality vary tremendously depending on the type of text. One writes and speaks differently in an informal text and differently in a formal text. Or has a different conversation with a superior and a different conversation with a partner. The context, the communication situation, is important. Therefore, the most relevant data in our research were obtained from informal communications, especially spoken ones, which are more spontaneous and where the choice of formal language parameters was not influenced by the type of communication situation.

You also explored the relationship between language and depression. What have you found?

Research has shown that the levels of depression (experienced currently) are reflected in the text. Its



reliable indicator in the text is, among other things, the presence of negatively emotionally loaded words or words with the prefix ne- (negation indicator). The concreteness of the text and the number of expressions expressing the relationship to others also decrease, the first person singular predominates. Interestingly, we also find significant gender differences in verbal markers of depression.

Does this mean that gender differences play a big role in the results of the linguistic analysis? And what is the importance of, for example, the age or education of the speakers?

Gender, the age of the speaker, or their education are very important factors. Women’s texts generally contain more verbs and are more dynamic. In the case of age, the representation of prepositions increases with the age of the speaker, and the analyticity of the text decreases. Furthermore, there is a strong relationship between the conscientiousness of the speaker and the frequency of nouns. However, as I already mentioned, the effect of the individuality is not crucial to explaining variability in texts. This is the communication situation, the context.

To what extent are the intercultural differences reflected in the texts?

The differences between cultures and languages are significant – greater than we previously thought. An interesting example is the word ‘regret’. In Austronesian languages, this word is much more related to love, so it has more positive connotations than in Czech. Significant shifts in meaning can be found in words denoting actions, movement, or values. In contrast, the meanings of words that denote kinship are more universal. But it depends on the type of language. For example, Chinese is

very distant from us and difficult to reach with our research, it has a very different linguistic system.

You focus on the use of computational linguistic analysis to describe personality. How important are information technologies in psychological research?

They are becoming more and more important. The field in which I am involved has seen an incredible revolution in this regard over the past twenty years. Our research under the CPACT project also worked with a large volume of data and it would not have been possible without computers. The use of artificial intelligence, or machine learning, is becoming very important. However, the academic domain lags far behind private-sector research and is uncompetitive in comparison. Giants like Google, Facebook (Meta), and Apple have the technology, data, and money that scientists at universities can only dream of. They also have disproportionately more know-how that they guard. They use all this for commercial purposes. I also perceived this during my internship at the University of Arizona, an institution with a great reputation in the field of psychological research. But even their efforts to cooperate with Google were not successful. Perhaps because the goals of our research are different in many ways.

What makes the research different?

We are trying to find explanations of how the relationships between language and personality work and how they are related, not just to predict, for example, buying behaviour. We strive for transparent, accessible communication research, which will be the basis for further studies, but also for open applications. Unfortunately, such basic research cannot be carried out without sufficient support – especially if the subject is Slavic languages

or even the ‘marginal’ Czech. However, Czech could have an excellent position in the research. The Czech language system is unique in many ways and has been described in detail by a number of excellent linguistic projects. Czech computational linguistics is on a world-class level, and it would certainly be good if psychological research also made use of this advantage.



Examples of word clouds that were created under the JUPSYCOR project. It focused on collecting information on the behaviour and experience of people in the extraordinary situation of Covid-19 spreading in the Czech Republic; 2 552 respondents took part in the collection. The visual representation shows words that resonated in the statements of respondents the most in relation to the period of the Covid-19 epidemic in the first half of 2020 in the Czech Republic.

(Note: The word ‘rouška’ [facemask], which was the most prominent word, was removed from the overview)

Digital technologies in schools: Toys or work tools?

'Computational thinking helps children prepare for the future. It's not just for programmers. It is for everyone,' the *Imysleni.cz* website proclaims on its front page. Children bent over puzzles, pictograms of smiling robots or a video about Little Red Riding Hood who, thanks to clever decisions, does not end up in the wolf's mouth. They just need to learn the principles of computational thinking. Associate Professor Jiří Vaníček, head of the Department of Informatics at the Faculty of Education, has been introducing them to students and the public for a long time.

What is computational thinking?

It is a way of thinking that allows a person to be able to solve a problem and communicate that solution to someone else – a robot, computer, automaton or another human who automatically executes the solution. It includes a number of processes such as algorithmization, abstraction or generalization. Computer science has a range of topics and methods to develop this thinking, for example through programming, creating diagrams and data models, information systems or robotics.

Your goal is to bring computational thinking into schools. But isn't the existing subject called Information technology enough for children?

The main problem lies in the content of the course, which tends to focus on the consumption of technology. Children only learn to use MS Word or surf the Internet, but they already do that a lot in their daily lives. They lack a deeper understanding and ownership of the principles according to which digital technologies operate. Children see a computer or a mobile phone as a toy. Our goal is for them to use these technological advances as a work tool, as an aid to learning across the entire school curriculum. Another problem lies in the insufficient time allocation of the course. The small space does not allow the children to understand how computers



doc. PaedDr. Jiří Vaníček, Ph.D.

He is the head of the Department of Computer Science at the Faculty of Education of USB, where he has been working for over a quarter of a century. He has ten years of experience in primary school teaching, which has significantly shaped his professional motivation. Together with colleagues in the department, they create textbooks and teaching aids for the needs of students and teachers, in which they apply the results of their research. For the thirteenth year, he is the director of the Beaver of Informatics competition. In recent years, he has been involved in the formation of the new national curriculum in computer science and also guaranteed the strategic project PRIM, which prepared the conditions for its introduction in schools this September.

and information systems work, to explore the world around us from another perspective, and to expand the boundaries of general education.

Fortunately, that's changing now. There will be more informatics classes.

Yes. Finally, we will match the situation in Slovakia thirteen years ago. At least one hour of computer science per week will be compulsory in each grade from fourth to ninth grade. Now the new framework

programmes have been in place since September, allowing schools to roll out the new model over the next three years. And the content of the course is also changing, the emphasis is placed on the development of computational thinking.

What credit does your department have for this?

We were the main guarantors of the implementation of these innovative changes in schools through the PRIM project, one of the outputs of which is

the *Imysleni.cz* website. There, teachers can find a range of educational materials or even model school curricula. We offer certified online courses there. In addition to teachers, we also try to reach out to parents or authorities founding schools on the website.



After all, this is a society-wide issue. Many politicians talk about the need for digitalisation, about changes in the structure of the labour market towards greater automation and robotisation.

And schools should be able to prepare their pupils for these changes so that, like in the fairy tale of *Little Red Riding Hood*, they do not end up in the throes of unemployment. It's hard to predict what the job market will look like in thirty years, but it's clear that children who develop a computational mindset will have a competitive advantage in many fields.

Has Covid-19 contributed to the ability to use IT in teaching? Online learning?

Yes and no. The computer has become a communication medium, but in many cases, its didactic potential has not been exploited. Teachers have gained confidence, learned to use 'Teams' and email in their teaching, but few of them have given their students homework, such as: 'Draw geometric constructions in a web application and solve problems on axial symmetry.' In their defence, they didn't have much time to do it. It was challenging just to switch to distance learning and adapt the content of the curriculum to that. The disadvantage is that we have fallen behind on research, textbooks and educational materials that would help with the use of computers in education. No grants have been announced for this. This is sometimes related to the lack of preparation of specialists at faculties of education on how to teach using computers.

At what age is it good to start developing computational thinking?

Children naturally learn the basics of various scientific disciplines early on. They discover the behaviour of magnets, the social behaviour of animals, the rules



of number addition, balancing when constructing. In the same way, they can give commands to the robot toy where and how to go. So, children can acquire computational thinking from a very early age.

In what other ways do you promote computational thinking?

I should mention the 'child of our department', the Beaver of Computer Science competition. It is an international project, something like the Math Kangaroo. This is the 14th time we have held it. Before the Covid-19 pandemic, we had 90 000 participants

and this year we had 109 000 participants. The competition, which takes the form of a test with a number of short tasks, is open to students from fourth grade up to high school graduates. And imagine, almost fifty per cent of the participants are girls. Interest in computer science is gender-balanced.

Your robots are also of great interest. Like now, during Researchers' Night...

No doubt, children are fascinated by them. Like when a robot looks at you and recognizes whether you're a boy or a girl. But the interesting thing is that children often don't know how to treat robots because they don't know anything about how they work, that they are programmed. So instead of answering 'yes', they say 'yeah' and the robot doesn't understand them.

And aren't you afraid that robots will take over one day?

They already control us to a certain extent, for example through social networks. It is difficult to predict what direction this will take. That's why it's good to be educated in this regard because ignorance makes people easier to control.

Faculty of Science

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How cyanobacteria changed the world

Cyanobacteria, which many people hate for polluting people's water for swimming, are among the oldest organisms on earth. They are also of significant evolutionary importance and have made a major contribution to the current form of life on Earth. 'Life, as we know it today, would not exist without cyanobacteria,' says Jan Kaštovský, who studies cyanobacteria and algae at the Faculty of Science of the University of South Bohemia.

I dare say that while algae are considered by many people as a possible means of feeding the growing human population, for example, cyanobacteria have a much worse reputation. Hardly anyone is looking for something positive about the green layer in ponds and lakes. Do you?

First of all, it must be said that some cyanobacteria can be eaten, not just algae. But the importance of cyanobacteria is enormous and some of their properties fascinating. Therefore, studying them is a spectacular experience. On the other hand, even algae are not all 'good girls' – the Bible already speaks about them unkindly.

In what sense?

Today, for example, it is reasonably speculated that one of the so-called 'ten plagues of Egypt', i.e. the biblical plagues, was caused by marine

dinoflagellates. Their overpopulation may have caused all the water in the Nile to turn to blood. In reality, however, it may have been caused by overpopulated dinoflagellates that turned the polluted water red. They still do that a lot today, it is called the red tide.

Back to cyanobacteria. You said something about their evolutionary significance. What does it consist in?

Cyanobacteria, with exaggeration, invented photosynthesis, the conversion of solar energy into chemical bond energy. Billions of years ago, virtually only cyanobacteria and other bacteria lived on Earth. The atmosphere of the planet was originally very different, there was a lot of nitrogen, methane, carbon dioxide, some water vapour and so on. Cyanobacteria took CO₂ from the air, made sugars from it with the help of solar energy (that is



the principle of photosynthesis in a nutshell to this day), and as a waste product of all this, oxygen was produced. There was an awful lot of them, and they were doing it for a couple hundred million years. And that oxygen is not too good for living organisms even today, it is an aggressive gas – and it caused the first global catastrophe in the history of the Earth.

So what happened? The cyanobacteria were unknowingly killing themselves?

Yes, they produced so much oxygen on the planet that they literally poisoned the air with it. This triggered a mass demise of everything that lived here, including cyanobacteria, about two and a half billion years ago, and only a small fraction of life survived

prof. RNDr. Jan Kaštovský, Ph.D.

studies cyanobacteria and algae, their taxonomy, evolution and ecology, and he prefers to study them in various extreme habitats: hot springs, caves, wet rocks in the tropics, etc. He received his doctorate, habilitation and professorship at the Faculty of Science of the University of South Bohemia, where he is still active today, but he also collaborates with a number of institutions in Europe and beyond.

the atmospheric change. Those cyanobacteria that were able to survive in the new environment, along with some other bacteria, also provided the basis for the evolution of new life based on oxygen respiration. We, as humans, are actually the product of the change brought about by the behaviour of cyanobacteria.

Could the cyanobacteria's path to self-destruction be compared, albeit with exaggeration, to the behaviour of humanity and its impact on climate change?

If anyone is looking for a parallel, it is probably possible. If humans really did cause a planet-wide climate catastrophe, they probably would not die out as a species either, some would survive. And those who remain would adapt to the new environment.

But let's go back to today's cyanobacteria, which we usually hear about when operators of swimming pools complain about cyanobacteria-infested water in hot weather and the resulting outflow of visitors. Does your research also cover how to get rid of cyanobacteria?

First of all, it is necessary to say that 505 known species of cyanobacteria are found in the Czech Republic of which about twenty are poisonous to humans. By no means do all cyanobacteria cause problems for people. But the fundamental problem with removing the poisonous ones known from the water in the hot summer is that they are actually the product of human activity, not the other way around.

I do not understand that, can you explain it better?

If cyanobacteria are present in large numbers in a reservoir, dam, pond or lake, it is always the result of run-off from over-fertilised fields, fertilised

ponds, other agricultural activities or the fact that huge amounts of human faeces and urine, even if filtered through a sewage treatment plant, enter the water from the surrounding areas. In this way, the water becomes over-fertilised, which is a breeding ground for cyanobacteria. What I mean is that if people around a body of water want to get rid of cyanobacteria, they have to change their behaviour, including, for example, the way they farm and recreate. There is no other way to eradicate the cyanobacteria on the water surface.

Well, I am sure some mayors or water managers have asked you if it would be possible to remove the cyanobacteria in the summer with some chemical or using natural means. Is that not possible?

The idea that scientists have some powder in their hands, which they pour into the water and the cyanobacteria disappear is quite common. But that is not how it works. Of course, you can, for example, pour copper sulphate (bluestone) into the pond, as copper is poisonous to cyanobacteria. The problem is that this will not only kill the cyanobacteria, but also many other aquatic organisms. Moreover, and this is important, you would have to sprinkle the substance into the water almost constantly until the last cyanobacteria are eradicated and completely destroy aquatic life that way.

Why? I do not quite understand that.

It is like having to get antibiotics when your doctor prescribes them. If you use copper to kill only part of the cyanobacteria and not all of them, the remaining survivors will become even more resistant and will quickly infest the pond again. The chemical way of removing cyanobacteria is therefore illusory, people's behaviour towards nature and the surroundings of

watercourses and reservoirs must change. Unless we want the water to be green.

Someone may argue that for decades they had a dry toilet at the pond, the faeces went straight into the water and the water was clean, while today there is a sewage treatment plant or an overflow and the pond is full of cyanobacteria. What do you say to such arguments?

Nothing but that water has a memory just like humans. What is happening to cyanobacteria in water and water bodies today is not just the result of our current behaviour. This is a consequence of agricultural management and approach to the



landscape over the last 100 years. The visible effects are not immediate. Nutrients are stored at the bottom and released gradually over many, many years. If the water in a pond was clean 30 years ago and is now infested with cyanobacteria, it does not mean that we have suddenly polluted or over-fertilised it. The point is that the consequences of human activity from relatively ancient times are manifesting or can fully manifest only today.

That sounds rather pessimistic in terms of water protection...

It is similar to a person who has been drinking large amounts of alcohol all his life and suddenly has a diseased liver in old age. He did not ruin them with that last 'shot' either. His illness is the result of a lifetime of behaviour that simply cannot be changed back or undone. And it is so with water reservoirs. In a year you cannot expect to fix something that has been in the making for decades.

You are saying that there are things that are virtually impossible to undo. So if there are cyanobacteria in a recreational pond every summer, does that mean we will never get rid of them?

No, it does not. We can get rid of them if we change our entire landscape management. But even if we do that, we have to take into account that it will be very time-consuming to correct. Some studies conclude that if we want to completely restore a pond that has been affected by centuries of human management and over-fertilisation to its original state, we need another 100 years. It may not take as long as some experiments have shown, for example, on the Bolevec Ponds in Plzeň, with partially reduced demands on the result, but in any case, it is always a long-term affair. And a very expensive one.

Structural biochemistry describes the hidden secrets of life

The fields of experimental biology, biochemistry and biophysics are currently experiencing a boom. Their findings underpin new approaches for disease treatment, development of new technologies in agriculture, food production and exploration of new materials. They can also help to answer some elemental questions related to the origin of life. The Laboratory of Structural Chemistry of the Faculty of Science of the University of South Bohemia is one of the scientific institutions that significantly contribute to the developments in this area. 'With some exaggeration, we are looking into the nanoworld, which is undetectable even with the most powerful light microscope,' says the head of the laboratory Ivana Kutá Smatanová.

What disciplines are actually involved in the study of living organisms today?

In addition to conventional biology, there are, for example, molecular biology, structural biology, biological chemistry, chemical biology, biochemistry – these are all relatively new disciplines separated by very narrow boundaries. They focus on studying living organisms from several different perspectives, for example, studying the chemical nature of living systems, the structural and functional properties of their individual components, and the nature of their interactions. They give us insight into the secrets of

metabolic processes and their regulations in living organisms. Simply said, they study what happens in living organisms, how they work as well as how and by what means their functions can be influenced.

So what exactly does structural biochemistry deal with?

The methods of structural biochemistry allow us to gain a detailed insight into the 'interior' of living organisms down to the level of molecules and even atoms. There are numerous biophysical methods, which facilitate this study. One such



prof. Mgr. Ivana Kutá Smatanová, Ph.D.

is the head of the Laboratory of Structural Chemistry at the USB Faculty of Science. She has dedicated over 20 years to the study of protein crystallogenes and crystallography as well as collaboration with world-renowned scientists on development and testing of new crystallisation techniques. She became the principal investigator of numerous international projects, organised several global crystallographic conferences, and remains being actively involved in teaching and supervising students of all levels of higher education.

method (and the one closest to my heart) is protein crystallography, a modern field primarily concerned with the crystal structure and arrangement of atoms in substances. This is precisely what the research in our laboratory is directed at.

Can you please describe in more detail what exactly crystallography is used for?

Crystallography focuses, among other things, on the study of the relationship between the molecular structure and the properties of substances.

Findings concerning the structure can be exploited, as already mentioned, by many fields of human activity, from biology to chemistry (e.g. drug development) to physics and to development of new materials. Crystallography and related techniques are also utilised in the study of minerals (mineralogy) or in art (symmetry in art and architecture, analysis of artworks).

How specifically is the structure of substances determined by crystallography?

Very. Crystallography is able to characterise substance in a highly specific manner. For example, using the scattering of X-rays, neutrons or electrons on the crystals, the arrangement of atoms, ions or molecules in a crystalline material can be determined. In close collaboration with the interdisciplinary research consortium established within the Centre of Excellence project 'Makrokomplex', our laboratory studies the structure of biomolecules from simple peptides to large protein complexes along with nucleic acids, and nowadays frequently talked about viruses.

How can the structure of the virus be described in general terms?

In general, a virus is a genetic material contained in an organic particle, typically encapsulated in a protein shell. Inside, the hereditary information is encoded in form of nucleic acids, DNA or RNA. Because most viruses are smaller than bacteria, they cannot be visualised by a conventional microscopy making their detection very complicated.

This raises the familiar question of whether viruses are living or non-living. How do you answer this question?

Interesting question. I like the idea that viruses can help us better define what life is. Viruses have their own hereditary information like other living organisms and are able to reproduce, but they cannot do so without a living host cell. Interestingly, due to their simple structure, viruses can very easily change (mutate) to adapt to external conditions, which is also another characteristic of living organisms.

Viruses are dealt with in a number of biological or medical disciplines. How does your lab contribute to their understanding?

Our research is focused on determining detail structure and function of such substances such as viruses. It can contribute to answering the question of what happens to virus in the body. Based on these findings, effective vaccines can be developed. Drugs specifically designed to block the viral enzyme, known as virostatics, have already been developed against some viruses. In any case, the study of the viral structure can significantly advance the possibility of developing effective agents to combat viral infections.

You said yourself that your field is interdisciplinary, i.e. it includes knowledge from biology, chemistry and physics. Is it possible to say that even scientists in biochemical disciplines must therefore be (with a degree of an exaggeration) much more educated in, for example, mathematics and physics than they used to be?

Indeed, the application of experimental methods in our research requires a wide range of knowledge and



practical skills from many scientific and engineering disciplines, which can only be acquired through collaboration of a broad scientific team of experts. It is important that student education also adapts to this approach. The Faculty of Science of the University of South Bohemia has recently accredited MSc and PhD Biochemistry degree programmes, and our laboratory is directly involved in student research projects.

How? By applying what they have learned from theoretical biochemistry in practice?

Indeed, during the degree programmes, students can build on their theoretical knowledge of biochemistry, and expand their practical skills using advanced laboratory techniques including state-of-the-art automated techniques employed in research of molecules and complexes in biological systems. They will advance their knowledge of molecular mechanisms of metabolic processes occurring in solutions, biological membranes and living organisms using different types of biochemical analyses and various biophysical methods.

Considering the development of biochemistry and biophysics in general today: what kind of jobs are waiting for your students?

Graduates of the Biochemistry degree programmes will acquire knowledge and skills equivalent to those studying at well-known and established domestic and foreign universities. They will be able to work independently as researchers as well as successfully collaborate on scientific projects led by international teams.

Nanotechnology is the science field of the future

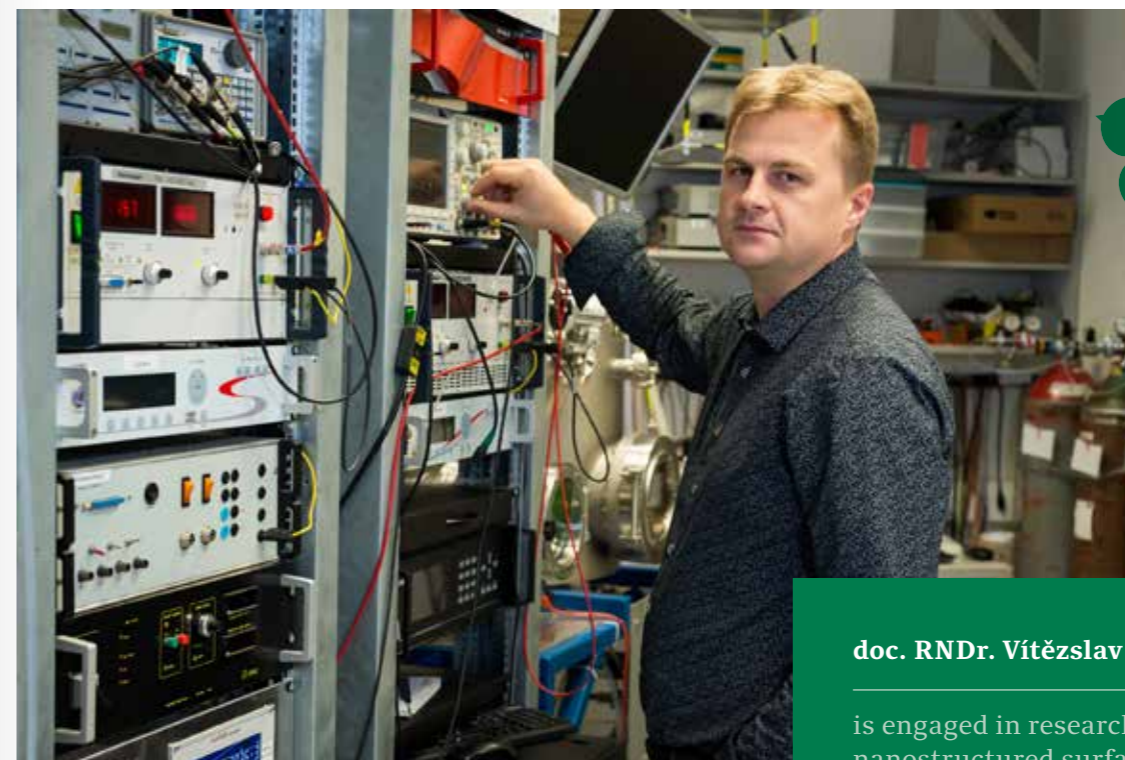
Nanotechnology works with matter at the level of atoms and molecules to create new materials with astonishing properties. At the same time, it is a discipline with extremely broad options of practical application. One of the scientific facilities successfully dealing with nanotechnology is the Laboratory of Applied Plasma Physics and Nanostructures at the Faculty of Science of the University of South Bohemia. According to the head of the laboratory, Vítězslav Straňák, this kind of scientific research can influence many fields of human activity from industry to medicine.

Could you please briefly introduce what exactly your laboratory does?

We are a laboratory focusing on the research and preparation of nanostructured thin films with application potential. The name is logically derived from the prefix 'nano', which indicates that we work with dimensions in the range of nanometres. To give you an idea, these are the dimensions that correspond to approximately one-thousandth of the thickness of a human hair.

Nanotechnology is said to work with objects in dimensions other than three dimensions. Is that right? And if so, how is that possible?

In general, one imagines a solid as a three-dimensional object. Nanotechnology shows that this may not always be the case. At the level of 'nano' dimensions, we talk about 0D, 1D, 2D and 3D structures. The so-called quantum dots are considered zero-dimensional (0D); single, semiconductor particles that are about 10 nm in size. We consider 2D layers to be so thin that their third dimension (thickness) can be neglected.



doc. RNDr. Vítězslav Straňák, Ph.D.

is engaged in research of functional, nanostructured surfaces prepared by low-temperature plasma. These include active surfaces of (bio)sensors, surfaces with immobilised molecules, antibacterial layers or coatings with potential for industrial applications. He obtained his PhD in Plasma Physics at the Faculty of Mathematics and Physics at Charles University and then worked for almost ten years at the University of Greifswald. In 2012 he was habilitated in Applied Physics and since then he has been working at the USB Faculty of Science, where he founded and is further developing the Laboratory of Plasma Physics and Nanostructures.

If the so-called 'nano-domain' is so different from our ordinary, three-dimensional world, how can we use the knowledge from its functioning in everyday life?

Scientific advances in the area of the 'nano-domain' have led us to new materials with unique properties. This is how new materials are created, and they often underpin technological developments. We can mention, for example, surfaces that can split water molecules to produce hydrogen, solar cells, structures for sensors whose surface interacts with selected molecules, and more.

Could you please be more specific?

For example, the possibilities in biomedicine are amazing. It is possible to prepare surfaces that selectively interact with selected molecules. This can be used for either diagnosis or treatment. There are plenty of nanostructured surfaces around us. They are just not as obvious at first glance. The last 25 years have seen huge advances in nanotechnology, and the progress is often incredible.

But your laboratory, as its name suggests, also deals with plasma. How does this relate to nanotechnology?

Nanostructures and nanostructured active surfaces can be prepared in different ways. And the economic aspect plays an important role. In our lab, we prepare thin films and nanostructures using low-temperature plasma, which is a weakly ionized gas produced in an electrical discharge.

Here again, I would like to ask for a more detailed explanation of how a nanostructure can be made using plasma.

The chef adds individual ingredients to the pot to make the best soup possible. We set the discharge parameters to prepare the best layer possible. We build all the equipment ourselves, adapt it to the requirements and develop the plasma deposition process. In addition, we are involved in plasma diagnostics, so we know (fairly accurately) what is happening in the discharge and how it will affect the growth of the layer.

So what layers do you prepare in the lab and what use do they have?

For example, we prepare layers that can graft pathogens of Lyme disease on their surface.

And confirm its presence by modulation of surface properties. Thus, these are sensory nano-structures. Another direction is the preparation of antibacterial and antiviral surfaces. This is a topic I have been consistently developing for more than ten years.

And what is it actually exploring? Materials that can destroy bacteria and viruses?

Yes, we prepare layers that provide an antibacterial/ antiviral effect based on the release of either metal ions from the layer or a released antibiotic that is impregnated into the layer. Our motivation is to prepare antibacterial coatings for surgical implants. In addition, of course, we also do basic physics research on nanoparticle and thin film growth. And I should not forget application research for industrial partners.

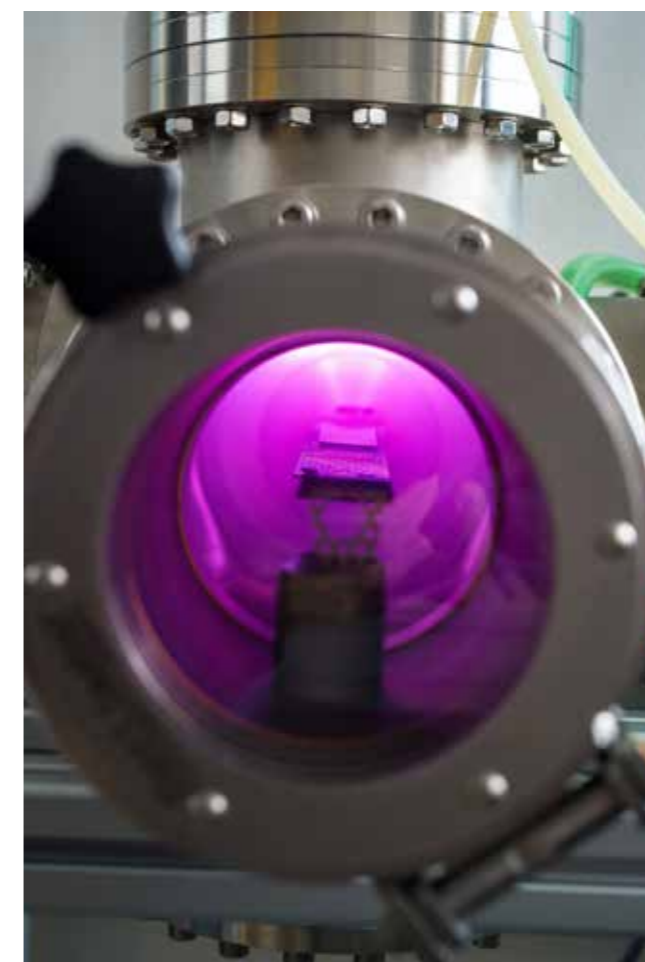
How do you work with the industrial sphere?

These are usually joint projects or contract research. Unfortunately, this form of cooperation is often bound by confidentiality. In most cases, this involves the development of thin functional layers either on production tools or on the products of our industrial partner. The spectrum of requirements is again wide, but I can mention hard, abrasion-resistant layers, self-lubricating layers, hydrophobic and oleophobic surfaces, layers with antimicrobial effect and others. The laboratory is a member of the NCK MATCA consortium, which brings together nearly two dozen academic and industrial partners.

What about selling your work, i.e. commercialising your research?

Of course, we try to sell patents, i.e. ideas, but we do not have the ambition to sell commercial products

based on our research. Because from the time our research is finished at a certain stage, it takes a long time before it is translated into specific commercial practice. Normally, this can take several years, and much longer in the case of medical applications. We, therefore, leave this technology transfer to commercial partners, but we are still involved in further development, albeit less intensively.



We already have more than 10 patents, utility and functional models in collaboration; a patent with world-level protection is pending.

What do you think is the main reason for the success of your laboratory?

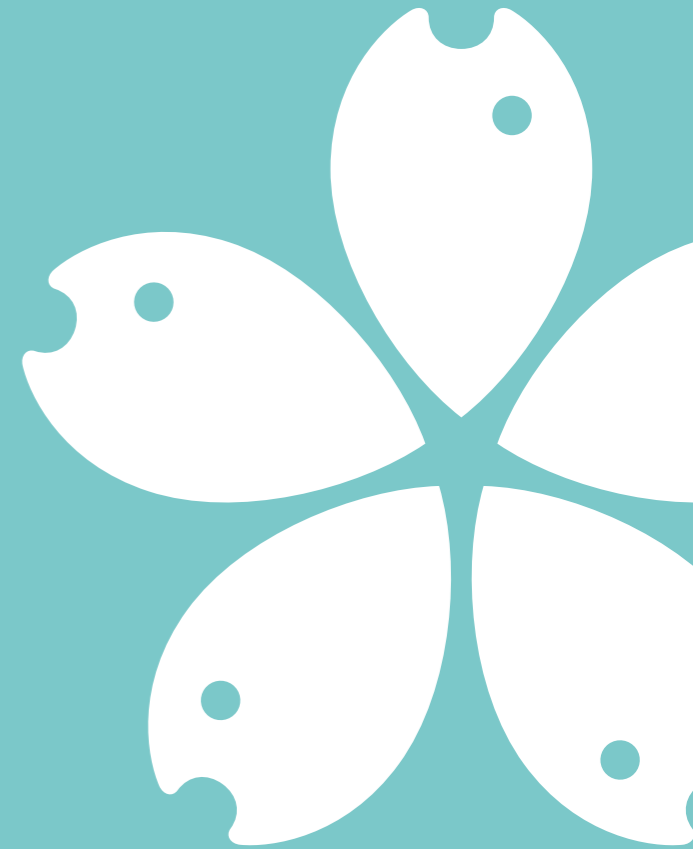
Personally, I am convinced that success in science lies in intensive collaboration between laboratories with different research focuses. And this is also the case of the USB Faculty of Science. At the faculty, I think that over time, we have managed to build imaginary bridges that connect nanostructure research with chemistry and biology. And such a connection offers great potential. Cooperation with the Institute of Physics of the Czech Academy of Sciences, which is a strategic partner for us, is also crucial.

How does the USB Faculty of Science cooperate with the Institute of Physics? What should we imagine?

Our cooperation is synergistic. Therefore, we mutually benefit from the advantages of each department, especially in the field of diagnostic methods. We also work closely with the laboratories of the Faculty of Mathematics and Physics of Charles University on the development of new nanostructures. We are studying sensor structures together with colleagues in Warsaw, Gdansk and Greifswald. As part of a NATO project, we collaborated with the California Institute of Technology (CALTECH), the University of Oulu and Ohio University. But the cornerstone of success is a lab team that can bring the idea to life and move it forward.

Faculty of Fisheries and Protection of Waters

www.frov.jcu.cz



'I perceive invasive species to be a societal problem'

Miloš Buřič is the head of the Laboratory of Freshwater Ecosystems at the Faculty of Fisheries and Protection of Waters of the University of South Bohemia in České Budějovice. He focuses on biological invasions in freshwater ecosystems, especially those of crayfish. In addition to monitoring their occurrence, he and his colleagues focus on examining their behaviour and impact on native aquatic organisms and entire ecosystems. 'Not so long ago, we thought that marbled crayfish or red swamp crayfish don't have a chance to survive in our environment. And today we already know that they do,' he comments on the abundance of changes that are taking place in our waters for various reasons.

Rivers and the water in them are a suitable medium through which new species of animals and plants can arrive. But they don't usually come on their own, they are helped by humans. In what ways?

The spread of animal species to new localities is actually a natural process. However, since the age of discovery, mankind has been the main driver of the movement and spread of animals and plants. Until about the 20th century, no one thought that this could be a problem. As far as Czech waters are concerned, it is certainly necessary to mention crayfish, fish (recently I would mention especially round gobies), amphipods and bivalves, such as the zebra mussel, the Asian clam or the Chinese pond

mussel. But of course, there are more. Some are not obvious at first glance and their influence will only become apparent over time. The causes of their spread are, for example, the import and breeding of economically important species, transport in the ballast water of vessels, unwanted or even intentional introduction by individuals or, for example, reckless releases of aquarium species. As it is also the case of the marbled crayfish.

So, what non-native species of crayfish are already demonstrably present in our territory?

Quite a lot has been said about the massive occurrence of spiny-cheek crayfish and signal crayfish.



doc. Ing. Miloš Buřič, Ph.D.

As for the marbled crayfish, its occurrence has so far been proven in the Czech Republic only in a few places. The occurrence of the red swamp crayfish has not yet been proven in our territory, but I think it is only a matter of time before this happens.

And is that a problem? Will it not just replace the original species of crayfish with non-native ones, which we will eventually begin to perceive as native?

I do not think so. I will give an example from our work on the Křesánovský creek near Vimperk. For the European crayfish, we would see a density of one, maybe two individuals per square meter. However, the density of the presence of the signal crayfish in

graduated from the Faculty of Fisheries and Protection of Waters of the University of South Bohemia in České Budějovice, where he received his habilitation in the same field in 2020. Since 2006 he has been working at the Research Institute of Fish Culture and Hydrobiology, where he has been the head of the Laboratory of Freshwater Ecosystems (formerly the Laboratory of Fish and Crayfish Ethology) since 2017. His main professional interests are biological invasions in aquatic environments, aquatic animal ethology and crayfish biology.

the creek is roughly 10 times higher. They basically exceed the holding capacity of the environment. The European crayfish is also present in the creek, but only in the upper sections or randomly in the order of units among hundreds to thousands of signal crayfish. In the past, the creek was used to obtain trout fingerlings, today it is almost impossible due to signal crayfish. The same has been experienced in the UK. The growth and maturation of invasive crayfish species are generally faster, their egg clutches are larger, and they are more resistant and aggressive.

Last but not least, they transmit crayfish plague to which they are resistant. Their negative impact on the functioning of the entire ecosystem is proven. In addition, red swamp crayfish usually dig often very deep burrows. I can imagine that if it spread massively in the Třeboň region, for example, they could significantly disrupt pond dams.

People usually only realise the problem when it has an impact on the economy, on business. In this regard, I would mention the round goby.



On the Elbe River, but also in the Great Lakes of North America, where it is abundant, it contributes to the decline of other species of fish. It eats their eggs and fry. It is very durable and adaptable. When I recently went on vacation, I saw a number of cars with yachts on my way from the south of Bohemia. Often with water still dripping out of them. Where did they come from? Some of them might have been from the Elbe River and headed for Lipno reservoir. If the round goby was able to cross the Atlantic Ocean, why couldn't it make it from the Elbe River to Lipno reservoir? Of course, this also applies to many invertebrate species.

Maybe the yacht owners didn't even realise it.

Certainly not. I don't even blame them. But it follows that education is the most effective way how to fight invasive species. Some countries are already ahead. In Ireland, for example, fishermen are required to disinfect their boots or fishing gear before entering a fishing area. In order not to carry a pathogen there, perhaps crayfish plague. Its spores can be transferred on fishing gear to new localities where populations of native crayfish species can be found. A certain preventive measure could be not to visit multiple districts for angling daily. Undesirable transmission of pathogens can also occur during fish stocking.

Can a species that is non-native to our area but cannot reproduce itself in our conditions become invasive?

It can. Let's mention, for example, the grass carp or silver carp. The grass carp, in particular, is an economically valuable fish that was imported to us in order to reduce aquatic plants. Let's leave aside the fact that other non-native, now invasive species have been introduced along with their imports. With the

increasing ambient temperature, these species may be able to reproduce in our country and may begin to spread uncontrollably and disrupt the ecosystem. A non-native species becomes an invasive species. Just look at videos from North America to see what such a move to an invasive group looks like. The silver carp is a capable jumper and its leaping schools look spectacular, but I'm not sure if we would like to see that spectacle here.

Can a more effective use of legislation be a solution in the fight against invasive species?

The European Union has a strategy in the fight against invasive species, but what is important is its implementation in individual countries. Unfortunately, many things are addressed from the table, making sure that everything is correct according to the generally valid rules, without deviation. In reality, however, it is necessary to use common sense at the same time. Insensitive revitalisation can endanger or even destroy the protected native species that are present. Elsewhere, fish ladders built in inappropriate locations may allow the spread of invasive species. It is necessary to know the specific situation, communicate, discuss, inform, clarify. Because invasive species are not just a topic addressed by some biologists in the laboratory. It is a problem of the whole society, which unfortunately is only noticeable when it is too late. Therefore, it is necessary to teach society and bring it back to nature.

Unintended psychotherapy in rivers

Almost anyone realizes that swallowing a pill for sore throat, headaches, or depression affects the environment. Once eliminated from the body, these substances find their way into the environment through wastewater treatment plants, where they can harm aquatic organisms. What are the consequences when drugs are used massively by the entire society? Kateřina Grabicová from the Laboratory of Environmental Chemistry and Biochemistry at the Faculty of Fisheries and Protection of Waters investigates micropollutants, which, in addition to pharmaceuticals, include everyday personal care products.

Recently, a report about trout addicted to methamphetamine has circulated in the Czech and international media. Could you give us an idea about this issue?

This study presented the results of an experiment on which our laboratory collaborated with scientists from the Czech University of Life Sciences. We showed that trout exposed to methamphetamine for a long time began to show signs of addiction and withdrawal symptoms after its source was removed. Methamphetamine is a prevalent 'hard' drug in the Czech Republic. After use, methamphetamine enters the sewage system together with its metabolite amphetamine. Most sewage treatment plants cannot sufficiently remove these substances, so they are found in surface water. The concentrations

of methamphetamine to which trout were exposed in our laboratory experiment are consistent with concentrations found in many locations in Czech streams.

Does that mean our streams and rivers are full of drugs?

Certainly not. That applies to places where 'treated' municipal wastewater flows. The degree of dilution also has a significant influence. For example, wastewater flowing from the Prague sewage treatment plant into the Vltava River is not a problem due to its high dilution. The situation is worse in cases where the treated wastewater constitutes a significant part of the total flow of the receiving stream, as in the case of the Živný brook in Prachatic. There, we already



Ing. Bc. Kateřina Grabicová, Ph.D.

graduated from the Academic Grammar School in Štěpánská Street in Prague and studied General and Applied Biochemistry with a focus on Biomedical Engineering at the University of Chemistry and Technology in Prague. Later she obtained her PhD at the Faculty of Fisheries and Protection of Water at the University of South Bohemia. She is currently working at the same faculty in the Laboratory of Environmental Chemistry and Biochemistry. She mainly engages in the topic of the occurrence of drugs and their metabolites in the aquatic environment.

found pharmaceuticals and other selected foreign substances in fish and aquatic invertebrates.

What groups of foreign substances do you focus on in the laboratory?

In addition to pharmaceuticals and daily care products, our team has recently been dealing with bisphenols, pesticides, and perfluorinated substances, for example. As far as medicines are concerned, we currently work on a project focusing on psychoactive substances, as their consumption in society has been increasing recently. It includes antidepressants, opioids, and illegal drugs and their effect on the behavior of aquatic organisms.

In what ways can these substances affect aquatic organisms?

The brain is the target organ affected by psychoactive substances. These drugs also tend to bioaccumulate. Behavioral changes then occur in exposed individuals. In the case of exposure to the antidepressant sertraline, feeding was affected in the exposed fish compared to the control. After exposure to tramadol, a painkiller, the fish were less daring, spent more time in a shelter, and generally, a break-up in the schooling behavior occurred. These substances also affected the behavior of crayfish – changes in movement speed, time spent a shelter, or distance traveled were observed. Exposure to citalopram (an antidepressant) or tramadol reduced feeding rates in dragonfly larvae, whereas exposure to treated wastewater had the opposite effect.

What does this imply?

Obviously, there can be a big difference between laboratory and field research results. While in laboratory conditions, we study the effect of one or at most a few drugs; in the aquatic environment, these substances act as a mixture, or if you prefer, a cocktail, which may contain a whole range of them. Foreign substances dissolved in it can have a synergistic but also antagonistic effect.

Let's go back to the methamphetamine-addicted trout. If a person eats fish like that for lunch, does it affect them?

We are talking about very low concentrations in nanograms per gram (ng/g), and the target organs of these substances are not the muscle we consume. Pharmaceuticals bioaccumulate mainly in the kidneys and liver. Psychoactive substances have also been found in the brain. In the individual organs

of trout coming from the receiving waters where the treated wastewater flows, twenty-five of the seventy analyzed drugs were found. The highest total concentration (500 ng/g) was found in the kidneys, while in the liver, the second most contaminated tissue, contained only up to 100 ng/g. Only four substances were found in the muscle at background concentrations (less than 5 ng/g). Thus, there is nothing to worry about regarding the consumption of such fish.

Are there any solutions how to clean the water of these foreign substances?

Indeed, the development of new treatment technologies can improve their removal. For example, I would mention a drinking water treatment plant that takes water from a river. In the upper reaches of this river, the concentrations of foreign substances, mainly pharmaceuticals and pesticides, are at low levels. However, passing settled landscape, the concentration of these substances in the river water increases. The existing drinking water treatment technology was insufficient, so it had to be upgraded by new technologies such as ozonation and activated carbon filtration.

I don't think it's a cheap solution.

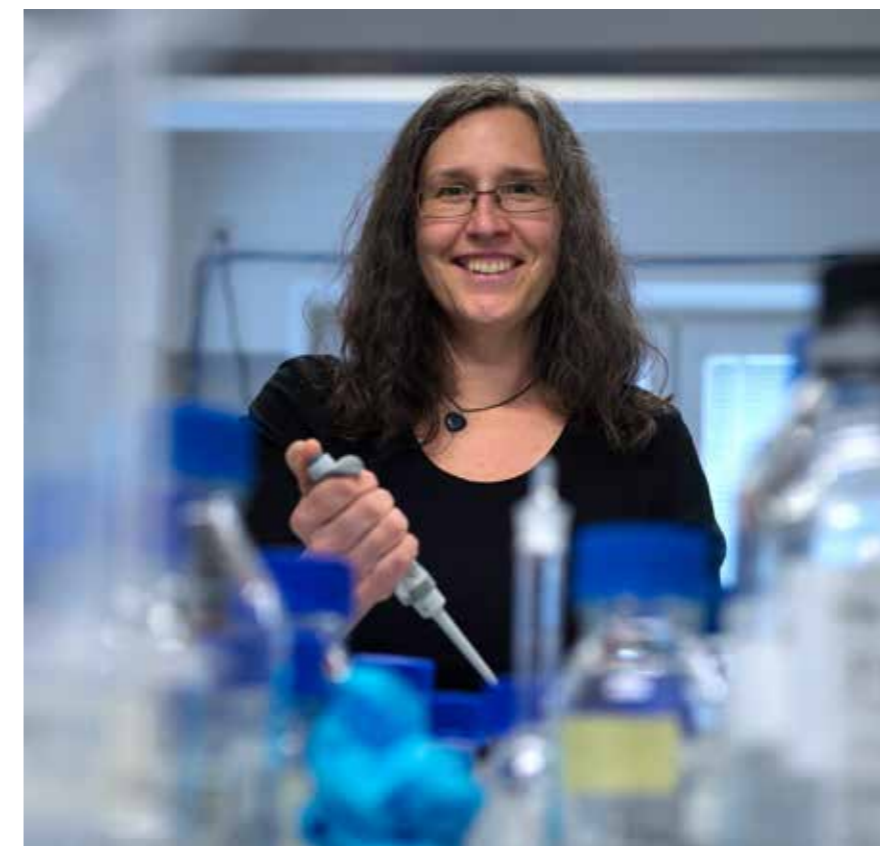
Absolutely not. However, research and development of treatment technologies are at a very high level and undoubtedly not stagnating. Nevertheless, the important thing is to understand the importance of clean water. That is why Israel is said to be a leading country in this respect. They live in areas where water is scarce, and they purify seawater up to drinking water. Scarcity has taught them to value this natural resource.

How important is international cooperation in the area you focus on?

It is essential for us. We collaborate with colleagues from laboratories in Sweden, Norway, Portugal, the UK, Slovakia, and Texas. Moreover, since 2011, we have been involved in an international project to detect illegal drugs from inflow water coming to wastewater treatment plants. The research is carried out in selected cities once a year during one week when water samples are taken, and drugs are monitored.

What have you found out?

While in central Europe, including the Czech Republic and Slovakia, methamphetamine dominates, in western Europe, for example, in Amsterdam or other port cities, cocaine 'wins.' That is related to the socio-economic level of the population in these countries.



Aquaculture of the future: circular and sustainable

Bioeconomy is the part of the economy that uses renewable natural resources. It has huge potential and is one of the ways to achieve sustainable development. In addition to agriculture, forestry, and other sectors, it also includes aquaculture, i.e., the farming of aquatic fauna and flora. Koushik Roy, a Ph.D. student in the Laboratory of Nutrition of the Faculty of Fisheries and Protection of Waters, is working on the issues of efficient and sustainable fish farming. The main focus of his research is the development of sustainable and circular aquaculture, which seeks to maximize the use of waste and nutrients.

Why is it so important to introduce circular aquaculture today?

The UN predicts that about 9.7 billion people will live on the planet by 2050, and food consumption will soar along with it. But the way we produce food today is unsustainable. In terms of greenhouse gas emissions, water consumption, and other requirements, the biggest problem is the production of red meat, beef, and pork. An organic alternative to red meat is fish. But as the world's oceans are overfished, aquaculture is coming to the fore. It is now the fastest-growing sector of livestock production. There is talk of a blue revolution.

The Green Deal is also spoken about as the European Union's strategy for a sustainable future. What role does aquaculture play in it?

A big one. We have recently returned from Paris, where we were awarded the status of a key partner in a major project called HORIZON. This makes us, together with several other research institutes, European leaders in the search for circular aquaculture. This is a priority for the European Commission. Making aquaculture 'cleaner' is a prerequisite for meeting climate commitments. One of the challenges we are working on at the faculty is the treatment and utilization of waste and nutrients



Koushik Roy, MSc.

is a fisheries and aquaculture graduate. He completed his bachelor's degree from Calcutta University and his master's degree from Indira Gandhi Agricultural University. He is pursuing his doctoral studies at the USB Faculty of Fisheries and Protection of Waters. His journey in this industry began 13 years ago, in 2008. He is a biologist focusing on circular and sustainable aquaculture, with interests in fish nutrition and excretion, nutrient use in aquaculture systems, the impact of climate change on aquaculture, freshwater ecology, and the quality of aquaculture products.

from intensive fish farming, but also from other sources. It is estimated that about one-third of food in Europe is thrown away. But actually, the value of a part of the waste could be efficiently recovered in aquaculture.

What technologies can circular aquaculture use?

These are various recirculation systems that simulate what happens naturally in nature. Very interesting but also attractive is aquaponics, which is a food

production system that combines fish farming and growing plants without soil. Fish waste products serve as nutrients for plants. In our aquaponic greenhouse, we are trying to make this system more efficient. For example, we test some natural insecticides and monitor their effect on fish and bacterial cultures. We also focus on finding the ideal balance between the fish food that enters the system and the quantity and quality of the plant food obtained. Compared to conventional field farming, aquaponics is ten times

less water-demanding. It produces neither waste nor greenhouse gases, and it solves today's very topical problems of lack of quality land. It does not use synthetic pesticides, which contaminate surface and groundwater, and it addresses some nutrient deficiencies. We also use wastewater from fish farming to produce a microbial protein or high-quality vermicompost and earthworms.

What are other activities of your laboratory oriented in this direction?

We are investigating different essential oils that could replace antibiotics used in fish farming. I also see the promotion of the consumption of fish products obtained from aquaculture among people as important. The team of my colleague Jan Kašpar is dedicated to creating valuable fish dishes that are also appealing to people. It is also worth mentioning the project of my colleague Jan Mráz who is developing new fish products for preschool children, such as fish balls, hams, or fish burgers, and who is trying to change the perception of fish consumption among the younger generation. However, we can also find many interesting projects in other laboratories at our faculty. For example, my colleagues at the Laboratory of Intensive Aquaculture are developing a circular system that uses agro-industrial residues to cultivate microalgae that serve as food for rotifers, tiny zooplankton, that is then fed to economically valuable fish species.

You also deal with various aspects of pond management. How are the South Bohemian ponds doing?

Eating South Bohemian carp in a restaurant is the ideal solution in terms of environmental impact.

Extensive fish farming in ponds is by far the most environmentally friendly way of obtaining food out of all animal farming sectors. Moreover, fishermen provide an irreplaceable service to the Czech landscape by looking after the ponds and fulfilling their non-productive functions, such as stabilizing the local climate or increasing biodiversity. The problem is that the rules that fishermen often follow in their management often no longer work in the changing climatic conditions, and this is reflected in the deteriorating water quality in the ponds. We need to adapt to changes. New opportunities lie in the use of alternative food sources for fish instead of cereals. These include residues from processing agricultural crops such as rapeseed, lupins, and beans, which are rich in protein. And here we are, back to waste recovery and recycling.

It costs a lot of money to put different technologies into practice and make them attractive to the private sector. Moreover, the idea of the Green Deal does not enjoy much enthusiasm in the Czech Republic.

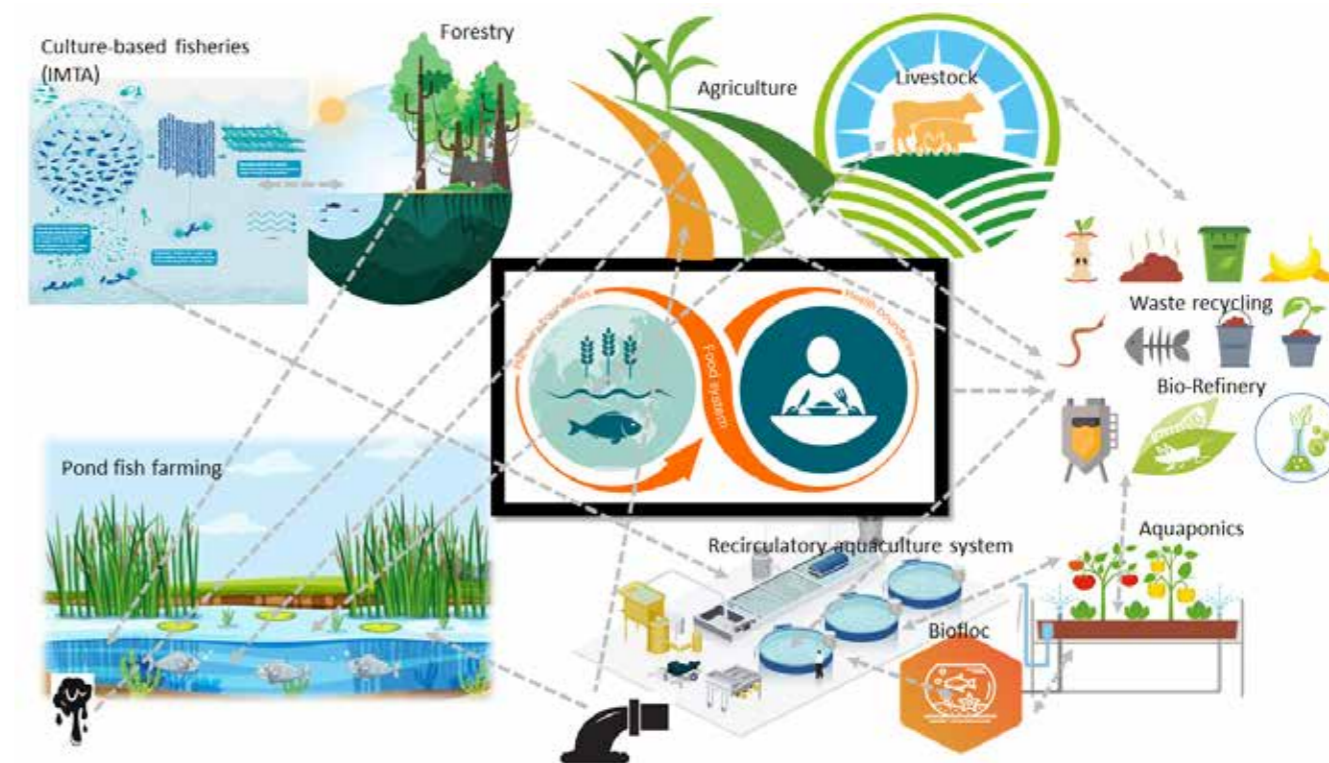
These changes cannot be introduced immediately. They need to be introduced step by step, gradually. In some European countries, aquaponic systems that work on the roofs of houses are being developed quite successfully. Personally, I think the issue of money and the will of the people is important but solvable. I see 'biosecurity' or security as a bigger problem. Working with waste, especially in the livestock industry, poses a threat in terms of various diseases, epidemics such as mad cow disease or Spanish flu, and requires great demands on safety. In this respect, aquaculture is much safer than other livestock farming.

You are from India; does that influence your way of thinking about these issues?

India is not as environmentally conscious as Europe. For example, water quality issues are not covered by nearly as much legislation. On the local level, however, there are many inspiring moments. For example, in very poor villages where people do

not have enough money, circular farming has been practiced since time immemorial. Manure is used by the local people to grow crops; they use all the waste from the kitchen, etc. A circular bioeconomy is, therefore, above all a return to nature.

Diagram of the use of nutrients in circular bioeconomics of the future



Source: Roy, K. Circular and sustainable fish nutrition Ph.D. thesis, University of South Bohemia in Ceske Budejovice (2022).

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Virtual reality immerses seniors in the action

We usually associate virtual reality with leisure and entertainment. However, its application is much broader. For example, it can improve the lives of the elderly by enabling them to stay, at least for a while, in an environment in which they can no longer move around on their own through virtual glasses. How to do this and what to look out for so that such 'trips' are actually beneficial to seniors is being explored by the project 'Virtual Reality in Keeping the Elderly Active' (VIREAS) that started in 2019 with funding from TA CR under the Ěta programme. Dr. Věra Suchomelová from the Faculty of Theology of the University of South Bohemia leads the research team. The partners of the project are the Czech Institute of Informatics, Robotics and Cybernetics, the Czech Technical University and the Association of Virtual and Augmented Reality.

Thanks to your project, seniors have already been to different environments. Which one of them has had the most success with them?

When we asked seniors in several homes at the beginning of the project where they would like to go in virtual reality (we used the expression 'magic glasses'), they overwhelmingly chose an 'ordinary' walk in nature. That's why we have created a forest where there is life – water gurgling, leaves rustling in the wind, anthills swarming... Of course, if I could magically arrange it, I could physically transport them all to the forest, but unfortunately, that's not possible. With the help of virtual goggles, in which reality does not end with the

frames but continues in all directions, even people who can no longer move on their own and are bedridden most of the time find themselves in the forest. In addition to nature, the seniors wanted to travel, to return to the places where they grew up, where they went with their families, or where they could not go. The next experience we have created is therefore focused on travel. Seniors can go on various themed trips around the Czech Republic and Europe, or take a stroll through the city centre. The walks in Prague, České Budějovice or Pilsen, for example, are fully interactive, so seniors can choose their route, check out the shops and cultural sights, or just observe the



Mgr. Věra Suchomelová, Th.D.

works as an assistant professor at the Department of Education at the Faculty of Theology of the University of South Bohemia in České Budějovice. She teaches theoretical and practical courses on the psycho-spiritual needs and leisure of the elderly and gives lectures in courses of the University of the Third Age and the University for Grandparents and Grandchildren. She has long been involved in the topic of spirituality in old age and the spiritual accompaniment of the elderly. She has been the principal executor of the interdisciplinary project supported by TACR called 'Virtual Reality in Keeping the Elderly Active' (VIREAS) since 2019.

people around them. Experiences of this type include 360° photos, so the illusion of reality is almost perfect.

The new technological possibilities are fascinating. They are mainly developed by young people – have you encountered differences in the perception of the world of the elderly?

Yes, and it has brought many surprises. The forest or the station I mentioned earlier are created by computer graphics. Our developers have tried to make the environment as visually appealing as possible. But it turned out that seniors do not want any 'foreign', albeit attractive, elements. The winner for them is

clearly the scene corresponding to what they know from their own lives. In the first version of the virtual forest, we showed them, they discovered alien plants, and missed mushrooms and ferns. We later made use of this attentiveness and in the final version, we planted a small palm tree among the pine trees as part of the memory exercise. The memory of a palm tree in the Czech forest amused one lady even a week after. Mostly she was happy that she had discovered it and 'wasn't fooled'.

Is your goal even to make an old lady laugh?

Of course, such reactions encourage us that we are

moving in the right direction. We see virtual reality as a way of conveying new experiences to the elderly person, and to broach topics that can be talked about both during and after the experience. The purpose is to evoke positive emotions that will motivate people to talk, reminisce or train their memory. We don't think that virtual reality is the only and best way to motivate seniors and must suit everyone. But this technology is booming, many companies are offering it in retirement homes, and we want to make sure that its potential is really used.

This suggests an idea of creating what could be described as a 'happy Matrix' environment in the homes – seniors get glasses to keep them occupied and staff get a break from them.

In order to prevent this from happening, we are creating a methodology for activation workers in parallel with the virtual experiences. It shows the staff of homes for the elderly how to work with this technology and, most importantly, how to use these experiences in the 'real world' of the elderly.



Virtual reality should always support the contact of the elderly with their surroundings. The technical solution we are developing allows the connection of the goggles and an additional computer on which the activation worker can see where the senior is in virtual reality. This way, seniors are not closed in the virtual world but can share their experiences directly. The activation worker carries an auxiliary control and can help the senior unobtrusively if, for example, he or she has problems with hand coordination. They can also prepare them for 'adrenaline' views, such as the view from the Černá věž [Black Tower] in České Budějovice. Not everyone likes heights, so you need to warn them about the change in advance and ask them. At the same time, the activation worker continuously talks to the client about where they are and what they see. Sometimes the senior knows the place better and can enjoy the role of a guide. The virtual reality experience usually lasts 10 to 15 minutes and then comes the equally important phase. Space and time to discuss what one has seen with other people around them. If several seniors share the same experience, they can form a group to practice their memory. Or they talk about their recollections. When a person tells others about what he has seen, personal memories come back to him. These are what we are all about. Someone talks about where he lived, where he went on trips or to the spa, or why he couldn't travel under the previous regime.

How did you come up with the idea that modern technology can be used in this way?

A few years ago, I visited a festival with my children organised by the Virtual and Augmented Reality Association. It was my first encounter with virtual reality, which I had been rather sceptical about until then.

I was intrigued by a group of seniors trying out a virtual flight on a flying carpet. I watched their reactions and thought about them in terms of my focus, which is the psycho-spiritual needs of seniors. We later agreed with the festival organisers that virtual reality has great potential, especially for use by seniors who have mobility difficulties or live in stimulus-poor environments. We agreed to create a joint project and apply for the Czech Technology Agency's ÉTA programme. The first year we failed in the competition, but the very next year, when we invited colleagues from the Czech Technical University, our project proposal was accepted with a very good evaluation. For me, who is not at all technically oriented, this is a big challenge. Our team is a mix of technical and non-technical professions and different generational approaches, and sometimes it's not easy to get on the same page. On the other hand, it is this diversity that allows us to reconcile both the technological possibilities and the needs of the target groups for whom we create the software, i.e. seniors and activation workers.

You say that in the choice of themes, an authentic representation of reality wins out, not embellished and epic fiction. What environments do seniors most often want to see?

Apart from the aforementioned ordinary forest, these are places they knew personally. Qualitative testing took place in the Dobrá Voda Retirement Home near České Budějovice and when seniors had a choice of where to go in virtual reality, they were mainly interested in a walk through the centre of České Budějovice. Only those who had actually been to other towns and areas before wanted to visit these. Another important finding from the study is the fact that seniors need to have people in the scene. Preferably in

some action, on a bike, they want to see young people having fun... When there was no life in the pictures, they pointed it out to us right away.

I noticed in the video that the older lady even waved at someone...

Yes, this is an example of how virtual reality works. Although these are still images, the person in the centre of the 360° space has the feeling of live action. That's why people comment that someone is passing by on a bicycle, or spontaneously wave at waving children. They perceive that they are 'among people'. The scene also motivates physical reactions: the person raises his hands, moves around on the chair in different ways, turns his head in all directions and exercises his body in a non-violent way. Even a person with mild dementia can enjoy the experience, but it is always necessary to be assessed by activation workers who know the individual senior well.

What reactions do you enjoy the most?

We are happy when a virtual experience evokes wonder, laughter, joy, admiration, emotion – in short, anything that uplifts a person. Seniors often express gratitude that they live in a world where there are so many beautiful places, that they have been able to revisit the places they love. Gratitude is an important key to psychosocial health – psychosomatics works, people feel better, which is reflected in their physical health. Gratitude makes people not focus on what they can no longer do but remember the many things they can give thanks for. For example, that they have witnessed great progress, that they have been given much to live through and achieve a long age, that they have overcome hardships, been able to be in this world at all... Each person has a unique life story and we are grateful for being able to help build and mirror that story.

On theology and natural science and on reason and nature

Theology and the natural sciences – for some, perhaps a bizarre phrase, even a contradiction in terms. But both bring an interpretation of the world of its own kind. 'While theology strives for a holistic interpretation, the sciences come up with partial interpretations, which people tend to absolutise,' says Lucie Kolářová from the Department of Theological Disciplines at the USB Faculty of Theology. In her book *Creation or Nature?* she traces the process of the formation of early modern natural science and natural science methodology against the background of the hermeneutics of the contemporary theology of creation.

Why do some people see theology and the natural sciences as mutually exclusive?

This is probably related to historical development. It started in the modern era and climaxed in the 19th century – as shown, for example, by the furore over Darwin's then-published *On the Origin of Species*. Two interpretations of the world collide here: either the world is created by God, or the theory of evolution is right. But this is a false dilemma. It is not possible to insert our modern epistemological intentions into the three-thousand-year-old biblical texts that speak of creation. The people of those times did not explore the world in a scientific way, they asked about the origin of the world, i.e. where something so magnificent and beautiful came from. Why it is here at all. The natural sciences, by contrast, follow a different track – the 'how' and the 'which

way' and the 'how much'. It is clear that the question of 'why' cannot be investigated using the natural scientific methodology. But that does not devalue it as meaningless. Or do we want to accept, in the spirit of positivism and scientism, the language of hard arguments as the only valid one and declare everything else irrational and subjective?

Maybe that is it. People tend to regard theology as something irrational, whereas they trust the natural sciences without restraint.

I understand that the object with which theology operates is difficult to objectify, it is indirectly attainable, it cannot be quantified. This does not mean that theology cannot be legitimate professional thinking. It possesses developed methods appropriate to its subject. And it is also true that



Mgr. Lucie Kolářová, Dr.theol.

studied theology at the USB Faculty of Theology in České Budějovice and received her doctorate from the Catholic University of Linz. Since 2010 she has been an assistant professor at the Department of Theological Disciplines of the USB Faculty of Theology. Her main interests are theological anthropology and theology of creation, and she also translates literature from German and Dutch. In 2015–2018 she was a member of the Excellence team, where she worked on creation in early modern Europe (monograph *Creation or nature? On the hermeneutical potential of creationist thought in relation to natural science in the early modern period* (2018).

the humanities, in general, cannot be subordinated to the demands of natural scientific record-keeping – probably along the lines of: 'please justify your uselessness, and, of course, scientifically'. Moreover, theology is often suspected of being ideological. Of course, theology can be ideological, but this is also true of science as such.

Being both a theologian and a naturalist is not mutually exclusive. Let us remember, for example, the ecologist and priest Josef Petr Ondok, after whom the library of the USB Faculty of Theology is named.

Yes. The natural sciences operate in a mode of so-called methodological atheism, where the

category of 'god' cannot programmatically be part of their procedure, and that is fine. The scientist's personal creed is independent of this. At the same time, today the theory of science itself knows that objectivity in the sense of absolute subjectlessness is not attainable in the world of humankind – so, for example, the pre-understanding with which a scientist sits down to a particular analytical work is not only about the knowledge they have acquired up to that moment, but also about the values they have somehow put together for themselves. And they did not stay outside the door. The problem in the science-belief relationship arises when methodological atheism imperceptibly turns into principled atheism and even wants to think that this

is what the evidence suggests. It does not – and at the moment of confusion, the (natural) scientist is no longer standing on the ground of a certain scientific hypothesis or theory, but on the ground of metaphysics.

So what is the substantive connection between theology and natural science?

Natural science tries to observe, describe, explain the world, theology tries to understand it. Simply put: analysis versus synthesis. Both bring interpretations that relate in content to the cosmos, nature, the phenomenon of life, human thought, the position of humankind in the world, and so on. All big and important things. While theology and philosophy aspire to a holistic interpretation, science offers partial interpretations. While theology anticipates and is speculative to some degree (and therefore lacks empirical rationality), natural science is by definition reductive. Because in order to get accurate results, for methodological reasons, it has to displace and ignore a lot of things. This is not a condemnation, just a warning that its results should be accepted as objective and valid only within the given section, which – for that matter – it sets itself. Normally, we tend to see these results as the final word on the world. But science does not answer the great existential questions that people ask themselves. They must answer them for themselves – and theology is a rational reflection of how answers to these great questions are offered by religion, which is the institutionalisation of the human search for their own existential place.

You think theology can contribute to a greater self-understanding of the natural sciences. How?

Theology shows natural science where its limits are.

It questions the obviousness with which natural science can approach nature. It leads it to its own roots by untangling the whole chain backwards: from technology to natural science, from natural science to human interests, from human interests to fundamental values and beliefs. And from there, finally, to the very beginning of humankind's essential certainty of meaning.

Looking back to archaic history, what was the relationship between theology and nature?

The roots of so-called natural theology go back to mythical times. The first and fundamental space in which the numinous, the sacred and ultimately the divine are made accessible to archaic man is the experience of nature. Nature, humankind and the dimension of divinity were being somewhat merged at that time. Even if we were to imagine, purely hypothetically, that it would have been possible to study nature in the archaic world in the scientific way of today, it would have to fail immediately. Not only on the cognitive unpreparedness and technical unpreparedness of the world's inhabitants at the time but first and foremost on how their perceptions were set. Nature is not conceivable here as an object; humankind itself is fully part of it and cannot distance itself from it.

How did the ancient rational approach change the perception of nature?

It comes with a conscious claim to know the world by the power of human reason. Today's science owes the very discovery of rationality to Greek philosophy. However, Judeo-Christian monotheism also contributed greatly to the study of nature. In it, the world becomes the world, man becomes man, nature becomes nature, and everything together becomes

divine creation. And God is somehow naturally knowable from nature, from God's creation. In such a setting, one can quite well imagine a person as one who explores nature. Religious beliefs do not prevent this, since nature is de facto a 'secular' matter at man's disposal.

The great turning point in the relationship between theology and the natural sciences was probably the Enlightenment...

We have jumped ahead a lot. Already at the beginning of the modern period, René Descartes distinguishes the thinking subject from the rest that extends around it. In this dualism, the world easily becomes a material, a passive matter, a prey, and humankind the creative and sovereignly acting element. In the beginning, it was still with respect for God's creation, but gradually it evolves, and, in the Enlightenment, humans are already heading towards a utilitarian and overbearing relationship with nature. You asked about the relationship between theology and the natural sciences at that stage: the Enlightenment questions the explanatory value of the Christian revelation, and theology comes under pressure from positivist evidentialism. Its reaction was not exactly a fortunate one.

So, the rational approach to nature meaning that it has become a material that we can study is actually the beginning of its plundering?

The combination of Greek rationality and the monotheistic system resulted in a rational approach to nature understood as something autonomous, which could and should be investigated. As an object. There was a small catch though. As long as nature was comprehended as a creation it was tied to its originator even in its autonomy and remained, at

least in theory, an object of love. But if nature could be relegated to an 'area for the collection of raw materials' in the post-Enlightenment industrial era, then this is also a question for natural science. In the service of whom does it stand? Knowledge for knowledge's sake? Knowledge for monetisation? For progress? What kind of progress more precisely?

What do you address in your book, Creation or Nature?

The book is a probe into the intellectual history of European culture in the interpretation of nature between the 15th and 17th centuries. The first part deals with the process of autonomisation of nature, the second with the problem of thinking about creation. The third part presents the so-called physical theology and includes an analysis of six authorial approaches that, with respect to the concept of creation and the new function of science, illustrate the diversity and methodological inconsistency of early modern thought. For example, the entomologist Jan Swammerdam is worth mentioning. His work combines a passion for empiricism with a passion for religion. I quote from his Report necessary for the reader seeking the truth: 'Before we proceed, careful reader, to speak of our findings, we respectfully request that we may not be taken amiss if we everywhere in the following work rely upon our own experience as an unshaken ground: on condition that we neither step outside the experience named nor over-apply the same to others which we have not yet ascertained. Otherwise, since nature is quite inexhaustible, the truth easily falls into great danger; and we ourselves are the cause that matters which are clearly apparent from the nature of things become obscure, even indecipherable, to us.'

Autonomous vehicles as a test of ethics. Computers will be making life-and-death decisions

Autonomous (self-driving) vehicles should one day be the future of transport. Several types of driverless vehicles are already in use in some places on the globe. However, expanding the operation of these vehicles on a mass scale is not only a technical issue but also an ethical and social one. Among the experts who are trying to address such questions is Daniel Novotný from the Faculty of Theology at the University of South Bohemia. The Vice Dean for International Relations is, among other things, a member of the scientific team of the project Ethics of Autonomous Vehicle Operation and also a member of the Ethics Committee for the assessment of issues related to the operation of automated and autonomous vehicles in the Czech Republic.

What is actually the main reason for the development of autonomous vehicles? What should be their main advantage over human-driven cars?

At the beginning of the development of self-driving cars, there was a desire to improve the safety of automobile traffic. Around 600 people die on the roads every year in the Czech Republic alone, and more than a million people worldwide. The vast majority of fatal traffic accidents are caused by human error. Autonomous vehicles should reduce the number of deaths in passenger car transport to a minimum.

But safety is probably not the only reason for the development of self-driving cars. What are the other reasons?

As time goes on, it is becoming increasingly clear that autonomous vehicles could fit well into the new concept of developing shared and more environmentally friendly transport, especially in agglomerations. But it's not just an environmental issue, it's also the simple fact that cars just can't fit in cities in such large numbers anymore. Owning a vehicle that is not used 90% of the time and just takes up space in the city is difficult to sustain in its current form.



Daniel D. Novotný, Ph.D.

deals with the history of philosophy, applied ethics, metaphysics, philosophical anthropology, comparative philosophy, and occasionally other philosophical disciplines. He holds a Ph.D. in philosophy from the State University of New York at Buffalo and is a research fellow in philosophy at the University of South Bohemia in České Budějovice. The research of Dr. Novotný has so far been mainly in the Aristotelian and scholastic traditions, but he is currently also working in the field of philosophy of technology and applied ethics (e.g. philosophy of autonomous vehicles and philosophy of epidemics). He is the Vice-Dean for International Relations of the USB Faculty of Theology.

And how exactly should self-driving cars solve the problem of crowded urban transport?

Maybe in the future, we will actually see an app where you can summon a vehicle to your house for a certain hour and minute the next day, it will take you on a trip and when you return it will serve someone else. And it's completely driverless. For now, of course, it is a utopia, but development is moving so fast in this direction that it may become a reality in the not-too-distant future.

But you are addressing the question of the ethics of operating autonomous vehicles. What does that actually mean?

If the car is not driven by a human, but by a computer, the computer must of course react to sudden events that happen on the road, just like a human. Imagine, for example, a teacher and her entire kindergarten class suddenly and unexpectedly stepping in front of a car carrying a family with their children. So the computer has to evaluate what is the best solution at that moment. Save the crew at all costs, regardless of the fact that people on the road will die in the process? Or should the car behave in such a way that as few people as possible die in an accident? Should children be given priority over adults in rescues? There are many complex issues and we are really addressing them.

In what sense? What are you specifically addressing?

For example, through questionnaire surveys, we are finding out which way of dealing with various situations on the road by an autonomous vehicle would be most acceptable to people. Certain models of vehicle responses to crisis situations are established, from the so-called tank model to the so-called counter to the so-called knights. While the tank would save the crew at all costs, the counter would assess the potential number of casualties and the knight would not intervene and would prioritise saving bystanders over the crew. The answers show how extremely difficult it is to find an ideal or universally acceptable solution.

Again, please give me a specific example...

The vast majority of respondents in our survey (over 60%) would allow the counter type when voting. Only 20% of respondents would raise their hand for a tank

protecting the crew at all costs, and even fewer for a knight. However, when people had to decide which vehicle they would buy themselves if it were not possible to tell at a glance what type of vehicle it was, the order of vehicles was quite different. Most people would buy a tank. If respondents were to buy a vehicle for their offspring, tanks would be purchased by as many as 60% of respondents, roughly twice as many as vehicles of the counter type. And only 10% would opt for knights.

What does that mean? That we are selfish and hypocritical?

It shows that our preferences can be significantly different from how we want to look to others. Most people would prefer tanks, but they don't want to be called selfish. It is important for us to signal virtues, e.g. altruism.

Okay, but is it even possible to arrive at an ideal solution for autonomous vehicle safety software? In layman's terms, it seems to me that there is simply no ideal solution...

You are right, it is probably not possible to find a solution that everyone is happy with. The point is to arrive at something that is at least acceptable to most people, even if there are people who disagree with it. And that the solution we arrive at is set in the wider context of the well-being of individuals and society.

What does that mean?

The cases of self-driving vehicle accidents that we are talking about should represent only a fraction of the fatalities caused by human error in terms of the risk to people and the number of casualties. So if there is a situation where even a self-driving

vehicle causes an accident with a human casualty, it does not mean that autonomous vehicles kill people. This means that although self-driving cars are many times safer than conventional cars, a fatal accident simply cannot be ruled out. Good communication is therefore important to avoid the misconception that self-driving cars are more dangerous than human-driven cars.

But I still find the idea of roads on which driverless vehicles will be driven en masse utopian. Do you really believe that this idea will come true?

It is almost certain that autonomous vehicles may soon become a normal part of traffic. Even the people in charge of the car companies can see for themselves that the current way of car transport and vehicle ownership is not sustainable in the long term. Self-driving cars have to be seen as part of the absolutely necessary changes in human transport and mobility, which will have many other socio-economic consequences. On the other hand, I am convinced that the transition to autonomous vehicles will not be completely global and its exact course is difficult to predict.

What do you mean? That there will be different autonomous vehicles in the Czech Republic than in China?

Yes, but not only that. The answers in the questionnaire we presented to Czech respondents regarding the operation of self-driving cars are not the same all over the world, and sometimes they even differ significantly. However, the approach to private car ownership in the US, Europe and Asia differs as well. And this is likely to be reflected in the laws governing the operation of autonomous vehicles. So I assume that the rules of this traffic will definitely

not be uniform worldwide. Different countries are likely to take their own approach to autonomous vehicles. While these solutions will or should be coordinated within an international or supranational framework, they should also grow out of the values and arrangements of individual cultures and religions and be adapted to the history and context of local social traditions.

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Nurses play a big role in prevention as well so that people adhere to a healthy lifestyle

The position of nurses in the nursing process, but also their role in disease prevention issues, mirrors the development of society. Nurses are an indispensable part of the healthcare team and the demands on their autonomy are increasing – it is no longer their job to simply follow the doctor's instructions. Among other things, they disseminate information about healthy lifestyles: research even shows that patients are more likely to take a nurse's recommendations to heart rather than the doctor's. Of course, this is also linked to the level of education needed for general, practical, paediatric and other nurses, and the opportunities to apply it. A number of topics that are being investigated by the Faculty of Health and Social Sciences of the University of South Bohemia are related to the competencies of nurses.

Let's start with the current situation because the Covid pandemic has significantly raised the prestige of healthcare professions and shown how demanding – and also irreplaceable – they are. Has this been reflected in the behaviour of the patients?

Lenka Šedová: Yes, we see this clearly, for example, at the Centre for Prevention of Lifestyle Diseases, which our faculty has on Nerudova Street. It offers, among other things, various counselling services focused on a healthy lifestyle – we have already noticed that there has been an increased interest in information and advice on obesity, nutrition and

exercise counselling. Apparently, it is in the context of Covid-19 that people have become more aware that obesity is also a risk factor in this case.

This is a specific example that demonstrates the importance of prevention. Television footage from Covid units in hospitals is usually dramatic. No one is eager to get there. Is this also an important argument for prevention?

Lenka Šedová: It certainly is – and, of course, it is not the only one. This is where the role of the nurse is irreplaceable. We demonstrate this in our research



as well as in practice. A nurse is not just a person who gives injections, measures blood pressure, administers medication or treats patients at the bedside. She has much broader competencies and can do a great deal of work in the area of prevention. Often even more than the doctor, because she is in closer contact with the patients than the doctor. She spends more time with them and can establish a more personal relationship with them. A whole range of research shows that patients have so much trust in nurses that they confide in them more often than in doctors and even trust their advice and recommendations more. It is of course very individual and cannot be generalised. However, many doctors confirm that the nurse has the role of educator and

Mgr. Ivana Chloubová, Ph.D.

Since February 2019, she has been the Dean of the USB Faculty of Health and Social Sciences, where she previously served as the Vice-Dean for Student and Social Affairs for eight years. After graduation, she worked as a nurse in the neurosurgical department of the České Budějovice Hospital, then graduated in Teaching – Nursing at the Faculty of Arts of Charles University in Prague. She has taught specialised subjects at the Secondary Medical School and Higher Medical School in České Budějovice. She has been working at the USB Faculty of Health and Social Sciences since 2004, teaching courses such as Theoretical Fundamentals of Nursing and Nursing Care in Surgical Disciplines.

Mgr. Lenka Šedová, Ph.D.

She works as a university educator at the Faculty of Health and Social Sciences of the University of South Bohemia, at the Institute of Nursing, Midwifery and Emergency Care, where she focuses on health education, educational and preventive activities in non-medical health fields. Since 2006 she has been managing practical training facilities. She focuses on issues of a healthy lifestyle in the prevention of lifestyle diseases. In addition, she works as a general nurse in clinical practice.



is a key person in health education. In America, England and the Scandinavian countries, for example, these competencies are being put to good use: nurses go out into different communities to teach people to live a healthy lifestyle. They are paid for that by the state health insurance. In the Czech Republic, however, we forget the educational role of the nurse.

But there are exceptions – for example, Michaela Šuplerová, a graduate of our faculty, comes to mind. She has been actively providing education in the remote corners of the Nové Hradky region for a few years now.

Lenka Šedová: I can confirm this from my own experience because we regularly collaborate on events that this graduate organises. She organises a lot of educational activities and focuses mainly on the health literacy of people, which is a topic that our faculty pays a lot of attention to.

What topics of scientific research that our faculty addresses are related to the competency of nurses?

Ivana Chloubová: All scientific research activities oriented towards the nursing profession are in some

way related to the provision of nursing care and related competencies. Two years ago, we completed a project that looked at the competencies of nurses in preventive cardiology and how to educate the public in the prevention of cardiovascular disease. Another of our projects, 'The role and care of the nurse in a pandemic', which we commissioned this May, responds to the current situation and its results should be of benefit to both healthcare professionals and the public. Our other projects also focus on the safe administration of medications by nurses or on the comprehensive care for a patient after a stroke. All of these research projects address current topics and are highly beneficial for clinical practice.

Dean Chloubová, you yourself first worked as a nurse in the neurosurgery department of the České Budějovice Hospital. Given this personal experience, how do you perceive the development in competencies of nurses?

Ivana Chloubová: It is interesting to observe the development of nursing competencies, which is influenced by a number of external factors: the modernisation of technical equipment in healthcare facilities and the related increased demands on nurses' knowledge and skills, the care for patients from diverse cultures, the computerisation of healthcare information systems, the orientation of care towards the promotion and maintenance of public health, and many other influences. The nursing profession requires greater responsibility, independence in decision-making, but also, as before, diligence, reliability and empathy. Naturally, educational institutions must also respond to the increasing demands placed on nurses by continuously updating the syllabus of individual courses. Of course, the newly built simulation centre also

significantly helps us train the skills of our students with precision.

We live in very fast times, so we also want to handle health problems in such a way that we get rid of them as soon as possible. What about prevention?

Lenka Šedová: Unfortunately, prevention is more of a Cinderella in our country because unlike conventional treatment, which often works immediately and the patient feels the results, the effect of prevention can only be seen in the long term. It is much less expensive to invest in prevention than to pay for treatment... But this is hard to explain to people who are focused on fast performance. Before 1990, a number of prevention programmes worked well in our country, but then lifestyles changed and many of those programmes disappeared. In doing so, factors that contribute to many diseases have developed: in particular, sedentary work, unhealthy diet and stress. This is mainly due to the development of new technologies, which, on the one hand, save us time and effort, but at the same time bring new tasks – there is more to do at work, so there are more tasks to do, and the possibilities for entertainment and sources of information have also expanded. This, of course, creates additional stress. Cooking at home can easily be replaced by buying something ready-made, and sweets or sugary drinks, for example, are now cheaper than fruit and vegetables in the shops. Not to mention the lack of exercise.

What predictions does your research into current lifestyles suggest?

Lenka Šedová: In the 21st century, the human lifespan will continue to increase, which, of course, also means that civilisation diseases will continue to increase. Moreover, the increased number of chronically ill

people will increasingly affect younger age groups. We are already seeing an increase in obesity and people who are overweight, which are precisely the consequences of unhealthy living today – all those conveniences that make life easier and seemingly save time, but constantly reduce our physical load including the amount of exercise the body needs.

Holistic care is characterised by a holistic view of the patient, i.e. in addition to the body, it also focuses on the patient's soul and the conditions in which he or she lives. What would help nurses make the most of their work?

Ivana Chloubová: We try to guide our students to see each person as a bio-psycho-social and spiritual being. It is important to understand how much the psychological state can affect the physical side of a person and vice versa. And it is not only patients who are holistic beings – nurses also need their biological and psychological well-being to be in balance. Even nurses are people who have needs. Their work is physically and mentally very demanding and they have to be able to relax and 'make their dreams come true'. Then, they are able to provide their patients with responsive and proactive nursing care. This does not always have to mean using the latest tools and procedures, but it can be a kind word, giving their hand a stroke and a smile on the nurse's face. Nurses should know that society appreciates their dedication and can show them appreciation. Not only during the current Covid-19 pandemic, but also many times before, nurses have been able to set aside their private lives and devote themselves to their patients. They have often shown courage, diligence and dedication. And we do our best to prepare our students for this beautiful but extremely demanding profession as responsibly as possible.

Assisted reproduction is turning into a business with immeasurable consequences and, above all, ethical dilemmas

Over the period of almost thirty years that she has been dealing with issues of surrogacy and various aspects and risks of assisted reproduction, doc. PhDr. Ing. Hana Konečná has witnessed a revolutionary development. This is mainly due to the enormous development of technology, but also due to lifestyle changes that lead to postponing parenthood to a later date. Progress brings many dilemmas in the psychosocial, legal and ethical spheres – and also many new questions. A team of experts is now addressing these issues under a project called Quality and Sustainability of Body Part Donation Programmes in the Czech Republic. The Ministry of Health of the Czech Republic is the application guarantor of the three-year project launched in 2020, which has received financial support from the Technology Agency of the Czech Republic.

What exactly do we mean by body part donation programmes?

Modern medicine is increasingly dependent on body part donation, both from deceased donors and living ones. The basic ethical principles are that the procedure must be for the benefit of the patient and that no one can profit from the donation. Donors are only entitled to compensation for their

expenses. Our project focuses exclusively on living donors such as donors of blood, plasma, bone marrow, sperm and eggs. One of the outputs will be a proposal to compensate donors for their expenses in a way that corresponds to the complexity of the donation procedure from the donor's point of view (time, transport, preparation for donation). The topic is also related to issues of awareness,



Doc. PhDr. Ing. Hana Konečná, Ph.D.

graduated in Electrical Engineering (Faculty of Electrical Engineering of the Technical University) and Psychology (Faculty of Arts of Masaryk University) in Brno. She teaches psychology at the USB Faculty of Health and Social Sciences and her main professional topic is psychosocial and ethical aspects of dealing with involuntary childlessness. She is one of two representatives of the Czech Republic in the Committee on Bioethics of the Council of Europe, a member of the Ethics Commission of the Ministry of Health of the Czech Republic and the Commission for Reproductive Medicine of the Ministry of Health, an expert member of the Union of Family Lawyers, etc. She is the author of a number of books and was also the principal executor of two projects of the Grant Agency of the Czech Republic at the USB Faculty of Health and Social Sciences, namely Gamete donation in assisted reproduction: psychosocial and ethical aspects, and Surrogacy in the Czech Republic: psychosocial, legal and ethical aspects.

psychosocial and criminal issues, etc. So other objectives are to propose strategies for donor recruitment, to formulate recommendations for the informed consent of donors and recipients, and to make recommendations for the work of medical, psychosocial and legal professionals. The Faculty of Social Studies at the University of Ostrava, the Motol University Hospital in Prague and the University Hospital in Plzeň, as well as the České Budějovice Hospital are cooperating with us on the project.

What led you to this research?

Especially the developments in assisted reproduction (ART), which I have been involved in for a very long

time. It was originally developed to help couples who cannot conceive a child. Thirty years ago, adhesions on the fallopian tubes were a big problem and ART managed to circumvent this obstacle. That was a huge success. However ART is now used much more often for other reasons, mainly because of the higher age of family planning and the acceptance of other

family formations. This, of course, means going beyond biological limits.

What are the rules for assisted reproduction in our country?

Assisted reproduction can be carried out on a woman of childbearing age, provided that her age has not exceeded 49 years. However, this age limit does not reflect biological reality, as women over 40 have little chance of getting pregnant spontaneously, in the vast majority of cases they need a donated egg. Assisted reproduction as specified in our legislation can be performed on the basis of a written request of a woman and a man who intend to undergo this medical service together. They do not have to be married – the original ‘married couple’ requirement has been dropped. So it can happen that a woman and a man who are not really together, who have no intention of raising the child together come to the centre. In addition, our law states that the treatment provider is required to ensure that the mutual anonymity of the anonymous donor and the infertile couple and the anonymity of the anonymous donor and the child born from ART is maintained. However, the free movement of patients has brought people travelling the world, often just for ART. All this brings a lot of ethical, legal and psychosocial problems.

So what is the situation in the world?

The number of treatment cycles with own eggs and sperm has been stagnating for years, while the number of treatment cycles with donated eggs, sperm and embryos is growing enormously. If ART were only used to treat heterosexual couples of reproductive age, which is what it was created for, only a fraction of the number of sperm and egg donations would be needed. These are now mainly

used for women outside the reproductive age, for single people and for homosexual couples. For example, data from one global sperm bank show that only 15% of donor sperm is used for assisted reproduction of heterosexual couples, the rest goes to single women and lesbian couples. In the Czech Republic, a woman and a man must come to the centre together. For now. But the Czech Republic is a place where couples who want a child from all over the world come for egg donation procedures because we have enough donors, probably thanks to attractive compensations. Almost 90% of donated eggs are taken from the Czech Republic by foreign women, mostly over 40 years old. The oldest woman who underwent assisted reproduction – not in our country – was 74 years old at the time of delivery. This was one of the impetuses for our research. Is body part donation still a help in times of need as originally intended? Does it lead us to view humans as a source of spare parts? Is the society divided into the poor who sell and the rich who can afford to buy body parts?

And are the children’s interests taken into account?

Children’s interests are very difficult to define and measure. Some time ago, we did research on children’s preferences for parental age. We asked children and young people aged from eleven to university students if and how they would change the age of their parents if they had a magic wand. The results showed that ninety per cent of them wanted their mum to give birth before 30 and their dad to be under 35 – in short, they wanted active parents who were at an age to play sports and have fun with them and who would not be afraid of imminent illness or death. I have been advocating for years for a ban on the use of donated eggs for women over 40. In

addition to lowering the requirements for the number of donated eggs and taking into account children’s preferences, this has a medical basis. The problem called premature ovarian failure is limited by the age of 40. It is not premature after that.

You are the Czech Republic’s representative on the Committee on Bioethics of the Council of Europe.

What is the purpose of this committee?

It is responsible for the interpretation and development of the Convention on Human Rights and Biomedicine, a fundamental international document that sets out ethical principles for medicine: for example, informed consent, the acceptability of gene manipulation and the aforementioned body part donation. The Committee on Bioethics cooperates with other commissions and institutes of the Council of Europe, including those focused on the interests of children. Some time ago, for example, we commented on the proposal to abolish anonymity for egg and sperm donation in Europe. This was justified by the rights of children. The rights of children born from donated sperm or eggs are treated differently in each country. In the Czech Republic, we have donor anonymity, which means that a child born thanks to donor ART will not find out who its genetic parent is. But since we are part of the EU and many people from abroad come here for assisted reproduction with donated eggs, this situation will probably not last long and it may change in a very short time.

What do you think might happen then?

In some countries, the child already has the right to know the identity of the donor at the age of 18. They ask the registry and the registry provides them with the contacts. For example, they can find out the following: the sperm was provided by a man

from Chile, the egg was provided by a woman from the Czech Republic, it was carried by a surrogate mother from Ukraine, one parent, i.e. the applicant for assisted reproduction, is from Brazil and the other from Norway... So at the age of 18, a young person gets several names, but what should they do with them? They may be offered the help of counsellors and psychologists, but is that the solution? Are the best interests of the child synonymous with the right to information? It is also problematic for the donor – if someone donates anonymously and then the regime is discontinued and everything is disclosed, they may start to worry that their genetic descendants will seek them out after many years and even blackmail them. Or the biological parent can be the blackmailer. Despite the fact that an army of experts will be assisting with the contact.

To what extremes can this development still go?

I was shocked, for example, by a catalogue of egg donors I discovered in Vienna at a conference of the European Society for Human Reproduction. It looked like a fashion magazine, pretty girls photographed from all sides with links to the internet where they also offer a 3D view of their bodies. In addition, a description of what they have studied, what their hobbies are, that they have healthy parents and maybe even one healthy child... Plus contacts where you can order their eggs... And what about artificial gametes (eggs and sperm)? Scientists are already working on that, too! If they are successful, in the future the man will theoretically use his sperm to create an egg from his skin cells, will be transplanted a uterus and will give birth to a child to whom he himself will be both father and mother. I believe that this is an extremely exciting challenge for researchers, but I hope that it is not just me who is scared.

Culturally competent care – part of modern healthcare

The idea of culturally tailored nursing care originated in the 1950s in the United States, while the Czech Republic began to develop this topic after the opening of its borders in the 1990s. At that time, it introduced the subject of Fundamentals of Multicultural Care into nursing education and since 2001, when the European rules have been fully applied in teaching, this topic has had an important place in the curriculum. Prof. PhDr. Valérie Tóthová, Ph.D., intensively deals with this topic at the Faculty of Health and Social Sciences of the University of South Bohemia.

What do we mean by culturally competent care?

Culturally competent care means providing care to all patients in a way that respects their cultural habits, needs and expectations. This is a very current issue because we live in a globalised world and nurses and other healthcare professionals that we train for their professions are increasingly encountering people from other cultures in hospitals and other healthcare facilities. These cultures have their own particularities that need to be known and respected when providing care – whether in the examination or in relation to meals. This issue is not only about immigrants, but also about employees of various multinational companies that bring groups of people from other countries to our country.

How do you prepare students to provide culturally competent care at the USB Faculty of Health and Social Sciences?

In the second year of the Bachelor's degree programme Nursing, students undergo a one-semester transcultural nursing course called Theoretical Foundations of Nursing. The course deals with individual national and religious groups living in the Czech Republic. We focus on the differences that affect the behaviour and actions of individuals in times of health and illness. We guide students to respect cultural differences and idiosyncrasies when planning care. In the consecutive master's degree programme, we develop the knowledge and skills of students that they acquired during their bachelor's studies. We focus on the theoretical and philosophical underpinnings of transculturality, emphasising the importance of



prof. PhDr. Valérie Tóthová, Ph.D.

Since 1999, she has been working at the Faculty of Health and Social Sciences, first as the head of the department, and a year later she became the Vice-Dean for Studies, a position she held until 2011. She was the Dean of the faculty from 2011 to 2019. She is currently the Vice-Dean for Science and Research and also the Director of the Institute of Nursing, Midwifery and Emergency Care. She received all types of education in nursing and has been a professor of nursing since 2008. She actively participated in the transformation of education of nurses in the Czech Republic. For these activities in 2004, she also received special recognition from the Minister of Health. In 2013, she was at the birth of the Association of University Educators of Non-medical Health Professions in the Czech Republic, which she chaired until autumn 2021.

At the USB Faculty of Health and Social Sciences, she prepared the Bachelor's, Master's, and Doctoral degree programmes in Nursing for accreditation. She has a rich research and publication activity. She has published more than 250 scientific papers in domestic or foreign peer-reviewed journals (34 of them in the last five years in impacted journals). She is the author and co-author of several monographs or chapters in monographs.

anthropology, history, philosophy and ethics for transcultural nursing. We guide students in the use of conceptual models in cultural assessments that should be part of the nursing history. The course content is designed to provide students with the knowledge and skills to provide professional health care that is culturally sensitive, culturally appropriate, and culturally competent.

I teach this topic along with other colleagues who have also been involved in this field for a long time. They are colleagues who, under my supervision, focused on research activities in transcultural nursing as part of their doctoral program. Since our department has



been intensively involved in transcultural nursing since 2005, as evidenced by a number of research projects, students have the opportunity to explore this issue in depth during the writing of their graduation theses.

What led you to focus your research on transcultural nursing?

The socio-political changes that took place in our country in 1989 also triggered changes in the national, cultural and ethnic structure of the population – these changes also placed certain demands on health professionals. At that time, we realized that we would increasingly encounter patients who, although not very different from us in external features, differed in certain invisible ways because they come from a different culture. We usually only realise this when we don't understand each other and find that our

communication style has clashed with another individual's communication style, or we find that the individual has a different value pattern of behaviour. These differences that influence our behaviour and actions arise because we come from different places in the world, have different cultures, different ethnic backgrounds, different beliefs, different experiences, ideas and desires, and our expectations in specific situations are also different. These facts led me to start to focus on this issue in my research activities. I knew that in order to provide culturally competent care, we needed to know certain differences, specifics, and expectations of individuals from different cultures. In our research projects, we have dealt with individual national and religious minorities living in the Czech Republic. We have been lucky and successful in obtaining financial support from individual research agencies to implement our projects. We have had several CEP projects, several team projects funded by GA USB, and even an international project with colleagues from Turkey, Hungary, Belgium, Spain and Slovenia starting in 2019 in which we are focusing on students' cultural competencies. From the results of all projects, we have prepared several monographs, which are intended for nurses, students and all professionals and those interested in contemporary national minorities and religious groups living in the Czech Republic.

Do you have another research project in which you are working on transcultural nursing?

Yes. In January 2021, we started a team project called Cultural Competence of Nurses in Clinical and Community Nursing, which we are working on with PhD students and master's students. Under this project, we are focusing on the cultural competencies of nurses in different care settings, and one part

of the research even focuses on identifying and comparing the cultural competencies of nurses in five EU countries. Based on the results of the research, a certificate course for nurses will be developed and offered as part of continuing education.

What do cultural competencies of nurses mean?

A cultural competency is the ability to provide effective health care, taking into account people's cultural beliefs, behaviours and needs. Professor Irena Papadopoulou and her colleagues have argued that a cultural competency is both a process and an outcome, resulting from the synthesis of the knowledge and skills we acquire in our personal and professional lives to which we continually add more. The path to acquiring a cultural competency is not easy, first, we have to gain cultural awareness, we have to have cultural knowledge and we have to gain cultural sensitivity. Throughout our professional lives, we develop and use culturally generic competencies that are applicable across cultural groups, which help us to develop culturally specific competencies that are specific to particular cultural groups. Of course, it is not possible for healthcare workers to know everything about numerous cultural groups, but with the help of culturally general competencies, one can gather relevant culturally specific information needed for patient care.

You mentioned Irena Papadopoulou – is this the same person who was at our faculty?

Yes, she is the president of the European Transcultural Nursing Association (ETNA) and in 2019 the ETNA conference was held in České Budějovice. I represent the Czech Republic in this association. Professor Papadopoulou and other prominent figures in transcultural nursing attended the conference at the

time – the conference was a great opportunity to exchange our experience with experts from twenty countries, and at our faculty. The goal was to compare how curricula are set up in different states to ensure that students acquire the knowledge and skills needed to provide culturally competent care. As part of ETNA, we have been continuously conducting research investigations on various aspects of transcultural nursing since 2014 and publishing the results in journals with impact factor. It is very interesting to compare results that focus on perceptions of compassion in different cultures, the view of robotisation in cultural care, differences in cultural competencies, etc., from 18 and sometimes more countries.

What would you like to add in conclusion?

I am very pleased that we have been able to develop transcultural nursing at our faculty based on the results of research projects and apply the results to the teaching of students not only in nursing but also in other health disciplines. The knowledge that our faculty has gained with research on the Romani, Vietnamese, Chinese, Mongolian, Ukrainian, and Russian ethnic minorities, as well as religious minorities such as Islam, Christianity, Buddhism, Judaism, Mormonism, and the Church of Scientology, will contribute to the provision of fully culturally competent care in our healthcare facilities. This is an issue that requires continuous attention as cultures continue to evolve in space and time, and evolution brings with it changes that can affect the behaviour, expectations and needs of individuals in health and illness.

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How to use artificial intelligence methods in agriculture?

Today's industry and agricultural production are gradually transforming and entering a new phase, which is referred to as Agriculture 4.0 (or Industry 4.0 or Society 4.0). 'This revolutionary change is the result of advances in computer science and electronics that make it possible to create cyber-physical systems. Simply put, devices using these principles are able to perform some activities and make decisions similar to humans,' says Associate Professor Petr Bartoš, Dean of the USB Faculty of Agriculture. Although the first principles of artificial intelligence were formulated more than fifty years ago, its more significant use in practice can be observed only in the past few years. However, the number of applications will grow significantly in the next decade, in all areas of human activity.

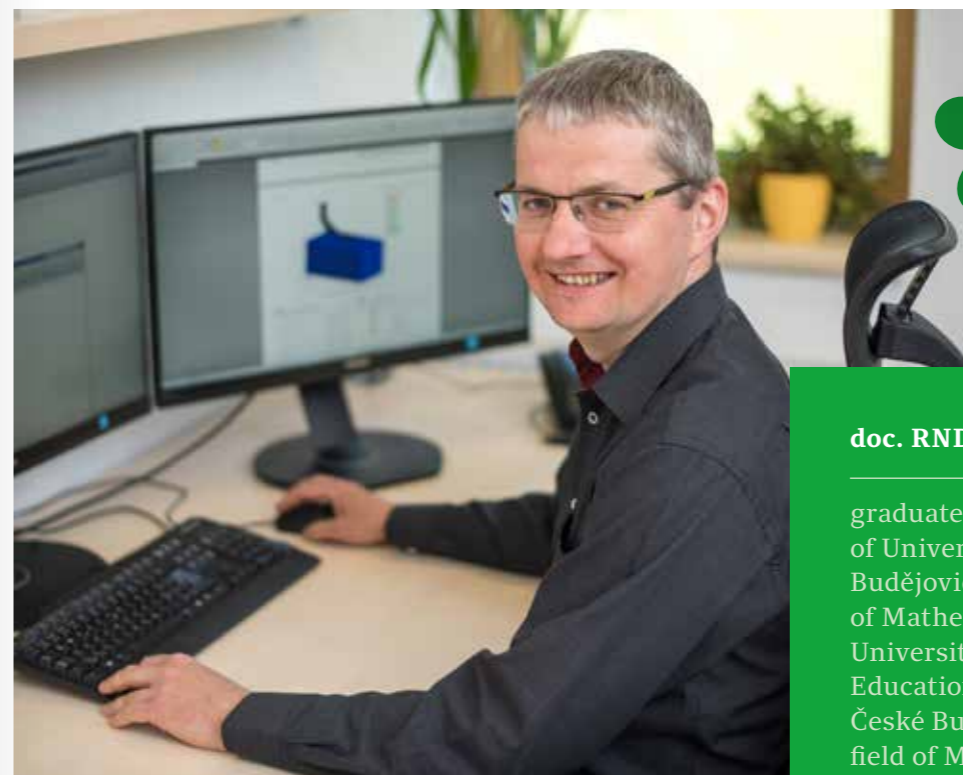
Artificial intelligence covers a number of interesting areas. Which of them are you pursuing at your faculty?

We are pursuing the application of algorithms from the field of neural networks, machine learning, data mining and expert systems. In one ongoing project, for example, we are developing software that selects animals with health problems from a group of dairy cows – all without intervention from the operator, based only on observations using cameras installed in the stables and available zootechnical data. The use of such systems in practice has significant economic

benefits for businesses, contributes to improved working conditions for people and a better quality of life for livestock. Putting smart technologies into practice will enable businesses to address current issues such as labour shortages.

There is a fear among people that modern technology will put them out of work. Is this concern justified?

The reality is rather the opposite. Modern technology will cover jobs for which it has long been difficult to find suitable employees. A typical example is the position of dairy milkmaids at cattle farms. Farms are



doc. RNDr. Petr Bartoš, Ph.D.

graduated from the Faculty of Education of University of South Bohemia in České Budějovice and then from the Faculty of Mathematics and Physics of Charles University; he also taught at the Faculty of Education of University of South Bohemia in České Budějovice. In 2013 he habilitated in the field of Materials Science and Engineering at the Faculty of Mechanical Engineering of the Czech Technical University and began working at the USB Faculty of Agriculture, where he headed the Department of Agricultural, Transport and Handling Technology. For three years he was the Vice-Dean for Quality. Since April 2020 he has been the Dean of the USB Faculty of Agriculture, to be renamed the Faculty of Agriculture and Technology in 2022. He is professionally involved in the use of modern computational methods in industry and agriculture and the development of the best available technologies for intensive livestock breeding.

presently struggling to find such workers because it is low-paid routine work in difficult conditions. However, the intelligent robots being developed today can do most of the tasks associated with milking well – they perform teat hygiene automatically, the milking robot arm applies teat handles on the udder and milks the cow. At the same time, sophisticated algorithms assess the milk quality and cow health in real time and mine the obtained data to offer zootechnicians an optimised and unique approach to each animal using expert systems. These technologies make it possible to significantly increase the economics of

farming. An important benefit for consumers is the improvement in the quality of agricultural products, which we all appreciate.

In industry, the use of robots is already quite common; for example, everyone can think of a car production line where one robot works alongside another. How challenging is the use of robots in agriculture?

The use of robotic systems in livestock production is undoubtedly more challenging. In car manufacturing, the position of individual parts is known in advance and the machine can be programmed accordingly. On the other hand, when working with live animals, it is necessary to react interactively to the movement of the animal or other situations, such as finding the appropriate trajectory for the movement of the robotic arm between the animal's limbs, which is different each time and changes over time. Situations where the animal is stressed or even injured must be avoided.



Can the software handle unexpected situations that may arise?

The software must be programmed to behave correctly in any situation. Operationally, it deals with various unexpected events, such as the robotic arm coming into contact with an obstacle, a change in the position of the cow's limbs, incorrect milking cluster deployment or its being kicked away by the animal. Hence the concept of machine learning – we want to 'teach' the robotic arm to make independent decisions in these moments based only on the available data and without the need for operator intervention. The development of a robotic system for agricultural applications is therefore significantly more challenging than in industrial applications. Without artificial intelligence, the development of such systems would not be possible.

And how do you manage to involve students in research projects?

We are currently working on several research projects aimed at developing suitable solutions especially for the needs of Czech breeding. However, other complex solutions applied by leading manufacturers of milking robots, such as deLaval – with which we also cooperate at the faculty – are also interesting. We have managed to establish an International Education and Training Centre of this company on the premises of the USB Faculty of Agriculture. Thus, we will offer students the latest technologies from the world's leading manufacturer. We try to involve our students in these research activities as much as possible and prepare them in advance for the significant changes that are taking place in agriculture. The profile of graduates is changing significantly – it is no longer sufficient to be a specialist in traditional agricultural fields such as crop production and agricultural production, but

it is necessary to equip students with comprehensive knowledge and skills in many other areas.

In November 2020, a new state-of-the-art laboratory for Agriculture 4.0 was opened at your faculty. What new possibilities does it bring?

The new laboratory and the possibility of cooperation with USB is very interesting for the business community and it can be expected that the commercial license for the software will allow our faculty to carry out applied and contract research in areas where this has not been possible so far. Thanks to this cooperation, academics will find it easier to find partners for their projects and representatives of the business community will be able to participate in teaching activities, which will certainly be appreciated by students. Since the beginning of its operation, we have registered interest in the use of the laboratory from companies in the agricultural sector and food industry. Some projects are already in the works, for example with AGROSOFT Tábor, s.r.o., and others.

Where else can artificial intelligence methods be used?

These are very interesting and progressive directions in the field of research and development, which will be translated into specific technological solutions in the next few years and will be key to maintaining the competitiveness of agricultural and industrial enterprises. They can be successfully deployed in a wide range of activities. At the faculty, they will be used, for example, by working groups dealing with topics such as the use of drones in agriculture, the evaluation of remote sensing imagery of the Earth's surface, or the assessment of crop health in crop production. Very interesting is the use of

artificial intelligence for the automated diagnosis and prediction of agricultural machinery failures, which I consider a very beneficial topic.

The research and development of the systems we are discussing require considerable financial resources.

Do you manage to get them through grants?

All the projects we are working on at the department have been selected for financial support under grants. We have succeeded, for example, in grant competitions of the TRIO programme of the Ministry of Industry and Trade or in the TREND – 'Technology Leaders' programme of the Technology Agency of the Czech Republic, in the challenging competition of such experienced players as companies focused on the production of components for the automotive industry. The projects are being carried out in cooperation with companies that have committed to incorporating the results into their product portfolio. At the same time, they pay part of the research costs from their own resources. I am very happy that the work we do on the solution will find a specific practical application and will not end up in a drawer somewhere.

Are researchers from abroad also involved in the development of intelligent systems?

Yes, within the framework of the Technology Agency of the Czech Republic project supported by the Delta 2 programme, we are carrying out interesting research using neural networks to evaluate the images obtained by means of a thermal camera installed in the stables. Our aim is to detect incipient udder or hoof infections in cattle farms and thus prevent unwanted losses in milk production or the cost of veterinary care for the affected animal. The project is not due to be completed until 2023, but the current results already look very promising.

Molecular biology methods shorten the breeding cycle

Agricultural biotechnology is one of the fastest-growing areas in research and development. 'In a broader sense, biotechnology is anything that uses a living organism. We are specifically interested in the application of molecular biology methods in plant breeding,' explains Professor Vladislav Čurn, head of the Department of Genetics and Agrobiotechnology at the USB Faculty of Agriculture. Thanks to technologies based on the analysis of genetic information, breeders can obtain molecular selection markers and thus select the most suitable plants from a large population. For example, ones that can better withstand cold, drought or pests in times of climate change.

How do these molecular methods overcome the limits of conventional breeding methods?

Conventional breeding is a long-term process. You need a large number of plants for it, which you have to take care of for a long time. The benefit of molecular biology is that it allows scientists to select target plants more accurately and more quickly, and it saves breeders time. I will give you an example. Our department is working closely with the University of York, which is much more deeply looking into the genomics of rape. Our colleagues in England managed to obtain a new variety with a completely changed fatty acid composition within four years. This would take at least fifteen years using conventional breeding methods. So if we know the genome, we

can actually define what active genes a plant should have. And if we have selection markers for them, then we can actually select purposefully from the large breeding population. However, initial genome analysis and marker development are extremely expensive.

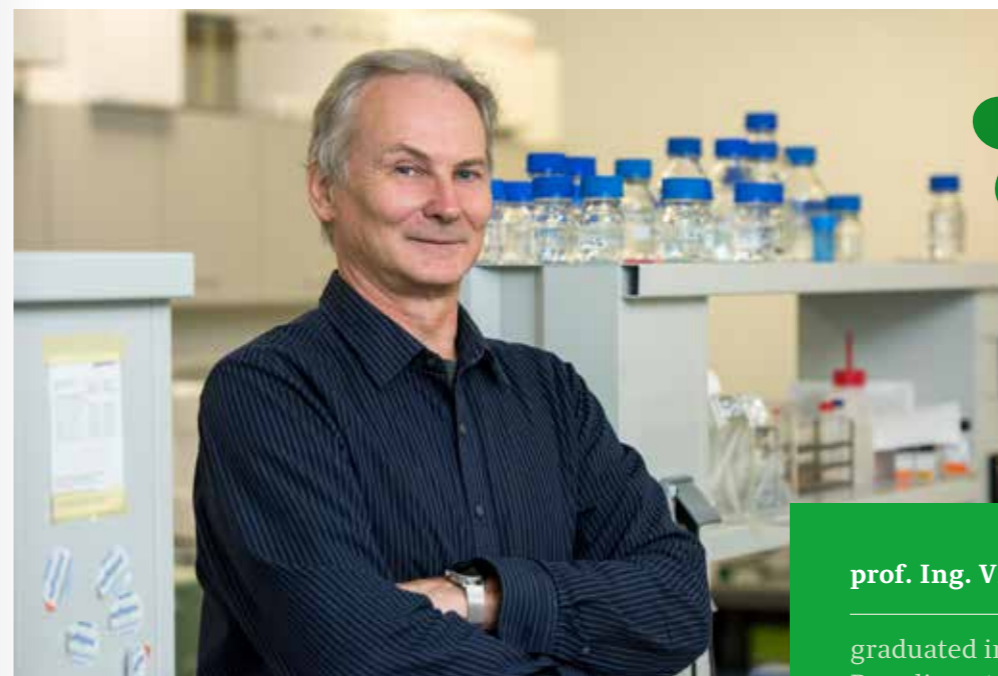
Even though biotechnology and molecular biology methods are interesting for breeders, are they financially worthwhile?

Of course, research in a molecular or biotechnology laboratory is expensive, and you need high-end instruments and scientists to do it. Nevertheless, in the end, the conventional breeding procedure will cost more than the combination of breeding and molecular biology. Precisely because breeding is

a lengthy process and human labour is expensive. It means that in practice, we pass the methods we have developed at our laboratory for both rape genotyping and molecular selection markers on to breeders who test their breeding material and use these markers to select suitable plants.

We have mentioned that biotechnology is one of the fastest-growing fields with a huge potential for innovation. Does this mean that contemporary agriculture cannot do without them?

I am convinced that it cannot. Biotechnology is not only molecular biology and breeding, but also tissue cultures for plant propagation and production of virus-free plants, or the production of



prof. Ing. Vladislav Čurn, Ph.D.

graduated in Genetic Engineering and Plant Breeding at the Faculty of Agronomy of the University of Agriculture in České Budějovice. In 2008 he was appointed professor of Plant Breeding and Seed Science. Since 1991 he has been managing the laboratory of the Biotechnology Centre of the USB Faculty of Agriculture and he has been the head of the Department of Genetics and Agrobiotechnology since 2009. His professional interests include genomics and transcriptomics of rape, molecular markers and their use in plant breeding and in the study of the genetic structure of populations of wild and invasive plant species. He is the guarantor of the Bachelor's, Master's and Doctoral degree programmes in Agricultural Biotechnology at the USB Faculty of Agriculture.

microbial biopesticides. Conventional biotechnology includes, for example, fermentation processes in the processing of primary raw materials. But biotechnology also includes genetically modified organisms. In Europe, these technologies face a huge legislative barrier. The use of genetically modified plants can lead to a reduction in pesticide consumption because resistant plants are able to better resist pathogens. If you look at the main directions of global breeding, the first thing is resistance to drought, disease and pests, and only then comes breeding for yield and quality. So in fact it is the exact opposite of what it has been for the last three decades. In the past, the yield was always the most important, then the other features.

So why is the cultivation of GMO plants still perceived as a bogeyman?

I would say it is more a political and economic question than a biological one. Currently, many biotechnological companies that produced GMO plants for use in the food industry are moving away from this direction. A new trend is emerging – molecular farming – where the aim of growing GMO plants is to gain substances for the pharmaceutical industry. This is what is referred to as green biotechnology. A typical example of a substance obtained from GMO plants is human insulin.

It is interesting that Europe, although it practically does not grow GMO plants itself, is one of the biggest consumers.

It is true. After the BSE affair (mad cow disease, ed.), a substitute for meat and bone meal for cattle feed was sought. And genetically modified soy became such a substitute. It is imported mainly from South America, which is a large producer of GMO crops.

I believe that if we are to overcome the limitations of current breeding, gene technology can take us significantly forward. Whether it is genome editing or the production of transgenic plants.

Does genetic modification not also change crop characteristics that may be desirable?

Through the controlled switching of genes on and off, we have the option to switch off a certain metabolic pathway, for example of antinutrients, but it must not be a vital pathway. The old varieties of rape had one huge disadvantage – a high content of glucosinolates, which are troublesome in animal nutrition. But the plant uses these substances as a natural biopesticide, a defence mechanism against diseases and pests. If we want to get a variety without these substances and remove them, the plant is much more susceptible to diseases and pests. So we have to use pesticides. However, once we block the protein that mediates the transfer of these metabolites to the seeds, we get a plant that has a large amount of glucosinolates in its biomass, so it will be sufficiently resistant. At the same time, the undesirable substances will not be deposited in the seeds. Therefore, the grower will also be satisfied because these substances will not be present in the target product.

You mentioned that plant breeding against climate change is at the top of the agenda these days. Is it possible to maintain a balance that preserves the nutritional value and, of course, yield?

For the time being, it is not possible to register a variety that is poor in yield or quality. Yield, quality and resistance are three traits that often go against each other. A high-yielding variety tends to be of lower quality and less resistant.

So there is a trade-off to be made. The problem is that cereals have been intensively bred for some one hundred and fifty years, and one hundred years of that time was spent by breeding them for yield. The gene pool of cultivated wheat has lost the traits of the wild character, i.e. resistance. In the case of the current intensive varieties, it is the traits that relate to resistance, whether to diseases, pests, drought or frost. The aim of current breeding is to make the plant acquire this resistance.

Can we breed fast enough? Even given the rate of change in the pathogen spectrum or rapid changes in the climate?

If we only use conventional breeding methods, then the answer is no. The changes are now very fast, whether due to warming and longer periods of drought, or the spread of a large number of pathogens and pests for which these conditions are suitable. Conventional breeding takes a long time, with wheat you have a new variety registered only after fifteen years. Any shortening of the breeding process is therefore interesting. So I see the benefit of molecular biology and biotechnology in shortening the breeding cycle so that we can respond to rapidly changing conditions.

What exactly are you looking at in your research?

We focus on molecular biology methods and the development of molecular selection markers in rape breeding. Rape has been a mainstay crop for us since the early 1990s when we started molecular biology here at the Faculty of Agriculture. Initially, these were methods for selecting incompatible plants, i.e. those that are not capable of pollination by their own pollen. This trait is recessive, meaning that it is lost after cross-breeding and only appears in the next



generation. Using molecular techniques, we are able to select plants that carry the trait before it is fully expressed. In addition to incompatibility, cytoplasmic sterility is also used for hybrid breeding of rape, and molecular techniques allow us to distinguish between 'normal' plants that are uninteresting from the breeder's point of view, plants that are sterile and plants that can recover fertility. The third area of concern for oilseed rape is resistance to Plasmodiophora and also to drought and cold. We are looking for functional genes that are expressed under these stress conditions. These methods are among the 'finer' issues of molecular biology. By analysing the transcriptome and finding functional genes, we can directly target the genes that control the trait. This research is very timely because Plasmodiophora is a major spreading pathogen against which there is no chemical protection. Our team has found a method to identify individual genes and discovered another set of candidate genes that control resistance. In the future, we want to provide breeders with markers for selecting resistant plants.

Food quality parameters include health safety and sensory characteristics

The quality of food is determined by the sum of many parameters, from sensory to nutritional, hygienic, and microbiological, which are influenced throughout the food chain. From this perspective, it is very important to monitor the quality of products from the primary production and to know the factors that influence this quality. 'Our research focuses on the quality of selected agricultural products. We are interested in the composition of food, quality parameters, including health safety. We also focus on the enrichment of products with compounds that increase the nutritional value', says Associate Professor Eva Samková from the Department of Food Biotechnology and Agricultural Products Quality at the USB Faculty of Agriculture.

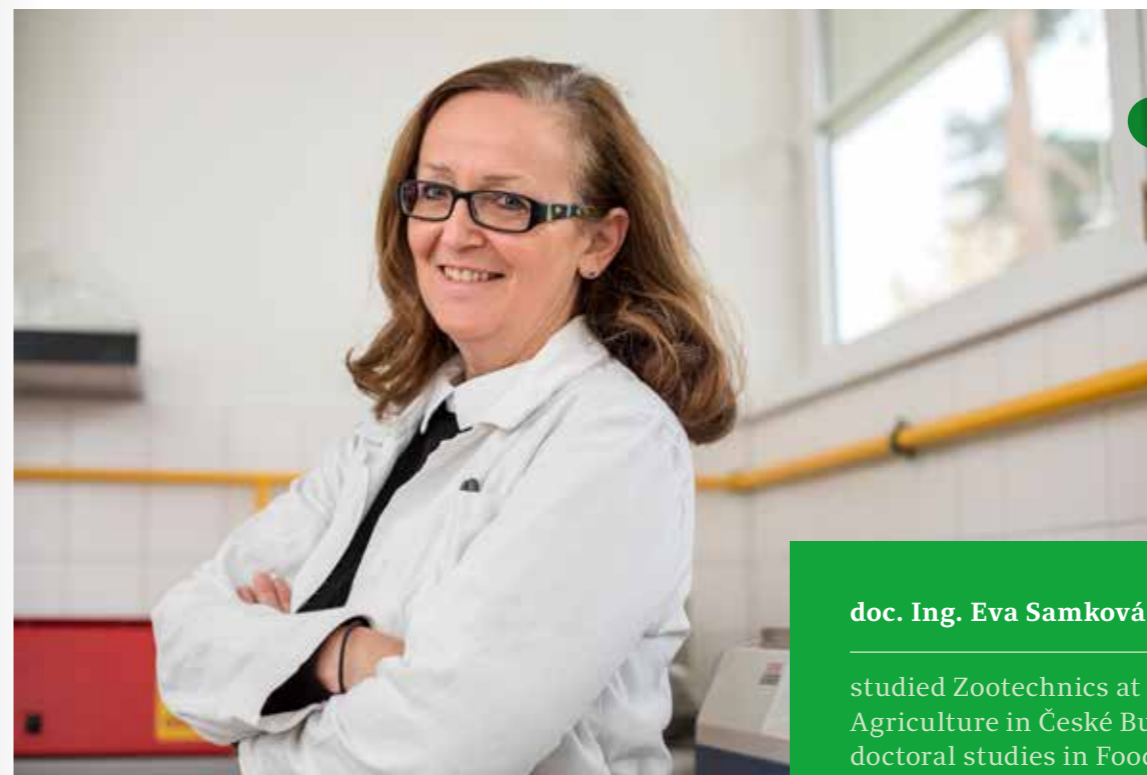
What is the consumption of milk and dairy products in the Czech Republic?

In Europe, we are rather average, with the annual consumption of drinking milk being around 60 kilograms in the long term. The so-called milk equivalent shows the consumption of milk and dairy products, except butter, which shows consumption of 262.5 kg per person last year. For cheese and curd, the trend is changing a bit, with consumption increasing. For years it has been between 15 and 17 kilograms per person, and last year we reached 19.1 kilograms. On the other hand, in processed cheese,

where we were the European record holders, the trend is slowly declining, and we are now below 2 kg per person per year.

Does an adult actually need to consume milk? There are often conflicting views on this.

I am an advocate of milk consumption. Milk is a complex food that contains all the necessary amino acids, a wide range of vitamins and minerals in addition to the basic nutrients. No plant product can replace calcium, and a half-litre of milk or 100 grams of hard cheese will provide a significant portion



doc. Ing. Eva Samková, Ph.D.

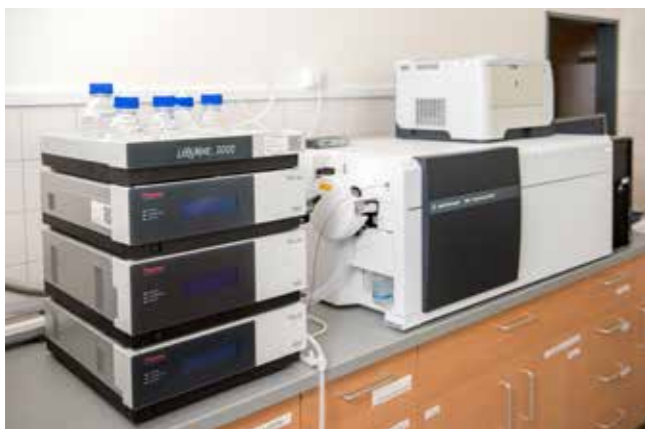
studied Zootechnics at the University of Agriculture in České Budějovice and completed doctoral studies in Food Technology from MENDELU in Brno. In 2012 she was appointed associate professor at the USB Faculty of Agriculture in the field of zoohygiene and prevention of livestock diseases. She has been consistently working on topics related to the quality, evaluation, and processing of agricultural products since 1999 and has long been focusing on the quality of milk and dairy products, the composition of milk fat, and the factors affecting nutritional, technological and sensory properties. She is the guarantor of the Consecutive master's degree programme Quality and Processing of Agricultural Products at the USB Faculty of Agriculture.

of the body's daily calcium requirements. There is a reason why dairy products are at the top of the food pyramid, and the FAO recommends consuming at least three dairy products a day. On the other hand, milk contains higher levels of saturated fatty acids and cholesterol, which are just some of the many risk factors associated with the development of cardiovascular diseases. As a result, people tend to prefer lower-fat dairy products. As for me, I say on the contrary: prefer less, but with fat. Only a small proportion of the population with a cow's milk protein allergy has a problem with milk consumption.

Conversely, people with lactose intolerance, a metabolic disorder of lactose breakdown, can consume fermented products or cheese without much difficulty. Today, lactose-free products are also a trend.

What do we mean by the quality of agricultural products?

Quality is not only the composition of the product, where we count the content of fat, proteins, and other compounds, but also other important quality parameters. One of them is the occurrence of contaminants and microorganisms, especially pathogens, which means health safety. Possible pathogens in milk are destroyed by pasteurization. I once read in a serious newspaper that people prefer to buy milk from a milk vending machine rather than the 'chemically treated' milk from the market network. This is utter nonsense and ignorance on the part of both journalists and consumers. The basic steps in milk processing – pasteurization, standardization, homogenization – are all purely physical operations. By law, nothing can be added to



milk, not even water or, for example, additives known to consumers as 'Es'.

Milk, by the way, is one of the most frequently and strictly controlled food products.

It is true. European legislation states three fundamental indicators – the total bacteria count, the somatic cells count, and residues of inhibitory substances, i.e. mainly veterinary drugs such as antibiotics. These are checked every day or whenever the milk is pumped from the tanker to the dairy plant. The problem with milk is that antibiotic residues can cause resistance and also have bactericidal or bacteriostatic effects so that the dairy cultures used in milk fermentation do not work properly. That is why sick and therefore treated dairy cows must be milked separately, and milk is only collected from them after a protection period of five days or more. However, in addition to the basic indicators prescribed by European legislation, Czech dairy farmers also monitor other parameters (e.g. fat content, protein content, sensory properties) and the requirements for basic indicators set by the Czech guild standard or the so-called Q CZ regime are even more stringent than European ones.

What areas do you focus on in your research at the department?

In the field of agricultural product quality, we are engaged in three lines of research. Firstly, we are interested in the composition of plant and animal products, quality parameters, including health safety, but issues of enriching food with substances that improve their nutritional properties are no less important to us. We have also long been concerned with the composition of fatty acids in milk fat, which can be altered to some extent thanks to the

knowledge of internal (genetic, animal) and external (feed, management) factors. The spectrum of fatty acids affects, among other things, the spreadability of butter. The consumer today seeks convenience and welcomes being able to use the butter immediately after removing it from the refrigerator. This can be achieved by adjusting the feed ration or changing the technology of butter production. Starting this year, we are working on a new project, the main objective of which is to offer measures to further eliminate the residues of inhibitory substances in milk. We want to focus on the issue of their excretion from the organism of dairy cows or on suitable ways of their detection. Research at the department is, of course, interconnected with other departments at the Faculty of Agriculture. It can no longer be done without mutual cooperation. Even grant agencies now favour comprehensive research. We cooperate closely with, among others, the Dairy Research Institute, the Food Research Institute, the Veterinary University in Brno, Mendel University in Brno, food companies and other institutions.

As a result of the research, a patent has been filed for a method of preparing black garlic with antioxidant activity.

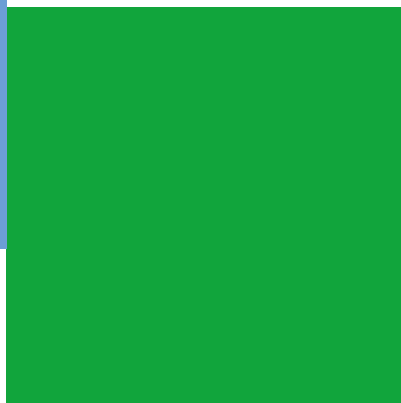
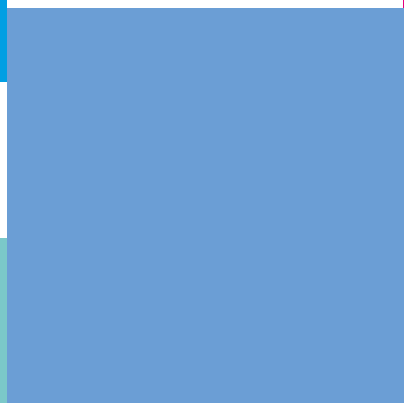
The project focused on traditional and less common sources of antioxidants and their use in food enrichment. It is well known that plant products are rich in antioxidants. We worked with different forms of processed onion skins first; then, we focused on the preparation of black garlic. It is produced from fresh white garlic in a relatively long technological process called 'ageing', which uses only higher temperature (60–90°C) and humidity without the use of other raw materials or added substances. We have simplified and, most importantly, made cheaper the

commonly used method of ageing. Black garlic has a specific taste and smell, it supports the immune system much more than fresh garlic, and it does not have the typical burning taste caused by sulphur compounds.

What role does sensory evaluation play in food quality?

Sensory properties are an important quality parameter. Nowadays, the consumer is guaranteed to know the exact composition of the food, its quality and safety, so what does he choose by? Usually by taste or appearance. Sensory evaluation is therefore always an essential part of the food enrichment process. We are interested in the amount of the enriching ingredient that the consumer is still able to tolerate in order to make the product acceptable from the sensory perspective. The instruments may detect a high antioxidant activity of the enriched product or food being tested, but what good is it if the person does not like the result? In the future, we will also be interested in researching how our enriched products with specific nutritional properties affect the health of consumers.





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